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Rapid Mini Appraisal of Irrigation Development Options and Investment Strategies

TANZANIA

USAID

WATER MANAGEMENT SYNTHESIS PROJECT
WMS REPORT 23

RAPID MINI APPRAISAL
OF
IRRIGATION DEVELOPMENT OPTIONS
AND INVESTMENT STRATEGIES
FOR
TANZANIA/USAID

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PREFACE

This study was conducted as part of the Water Management Synthesis-II Project, a program funded and assisted by the United States Agency for International Development through the Consortium for International Development. Utah State University, Colorado State University and Cornell University serve as co-lead universities for the Project.

The key objective is to provide services in irrigated regions of the world for improving water management practices in the design and operation of existing and future irrigation projects and give guidance to USAID for selecting and implementing development options and investment strategies.

For more information about the Project and any of its services, contact the Water Management Synthesis-II Project.

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FOREWORD

This mini-irrigation survey was completed within a three-week period beginning on November 18, 1983. During the same time the Review Team also evaluated USAID's Rift Valley Rice Project. This sector survey does not provide a complete guideline for irrigated agricultural development in Tanzania; rather, it can serve as a point of departure for pinpointing some interesting possibilities for assisting and aiding in the more effective development of irrigated agriculture in the country.

This irrigation sector review is limited in scope because the Team was not charged by its terms of reference to visit sites in the western and southern areas of the country. It is apparent, however, from regional differences in agroclimatic condiitons that irrigation investment and development policies should likely vary across the country. For example, rainfed agriculture is more viable in some regions than in others and overall seems to offer substantial potential for increasing agricultural production.

In some regions such as the Rift Valley in the more central area low natural rainfall and limited surface and underground water resources suggest a minimal potential for agricultural development with or without irrigation facilities. Here collection of limited runoff water on heavy clay soils and the diversions from seasonal streams and rivers can provide a type of supplemental irrigated agriculture. Lack of power -- man, animal and mechanical -- in addition to water shortage severely restricts production in these same areas. Given these and other constraints (lack of roads, proven husbandry practices, minimal extension service and demonstration plots, etc.) irrigation investment decisions can only be made in the broader context of a comprehensive agricultural development program.

The Team was extremely fortunate to have had the opportunity to work with and learn from the Irrigation Officer of the Government of Tanzania, Mr. C. K. Chiza, who served as a special consultant to the Team and was an invaluable resource. His insights and wisdom helped keep us grounded in the realities of the Tanzanian environment. The Team, however, is responsible for any errors in judgment which have been committed.

Mr. Kurt Lonsway, USAID project engineer assigned to the Team, was especially appreciated. His openness and willingness to discuss and explore his experiences helped motivate thinking in important ways.

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Kilimanjaro Agricultural Development Center, Kilimanjaro Region

Ngabobo Small Scale Irrigation Scheme

Ngarenanyuki Small Scale Irrigation Scheme

EXECUTIVE SUMMARY

General Observations

The Government of Tanzania (GOT) appears to be now focusing somewhat more heavily on the agricultural sector as a critical component in the development process. It is important to establish the role, if any, that irrigation might play in the agricultural sector. Not only is it necessary to establish the potential contribution of irrigation, but it is necessary to see that potential in the appropriate timepath of development. This calls for a greater maturity and sophistication than is often present in the "shopping list" approach to resource allocation. The Tanzania Government may well have sufficient experience and wisdom to avoid the massive misallocations that can occur from relying too heavily on an ad-hoc development sequence.

There seems to be a general feeling in the GOT that the effects of droughts, which among other causes have been responsible for recent production shortfalls, can be eliminated with irrigation and that irrigated agricultural development holds the key to stabilizing and increasing production. In response, the Review Team points out that irrigation water supplies from direct stream diversion are also sensitive to drought. These are the irrigation water supplies which can be most easily and readily developed using local currency and self-help. This leaves very capital intensive large projects with reservoir storage and systems which depend on pumping from groundwater or lakes as being those which would be immune from droughts. These types of projects are typically ten or twenty years to maturity. In addition, when the drought periods are only occasional, as in the Tanzanian case, such projects often are not justifiable purely on economic grounds. Furthermore, if pumping is required foreign exchange shortages and lack of a supportive infrastructure create fuel shortages and great difficulty in maintaining machinery in operating condition.

In summary, given shortages of foreign exchange to purchase pumping plants and spare parts to keep them running, a lack of a tested agricultural program, a lack of supportive institutions and the existence of other opportunities to increase agricultural production, we have very

serious reservations concerning the wisdom of attempting to achieve food security mainly through irrigated agriculture. (See page 3 and the Appendix for a further discussion of this point.)

Recommendations

1. The GOT is now focusing on small, simple irrigation projects as opposed to large complicated ones.[1] We endorse this focus; however, as mentioned previously, we have reservations concerning any systems, small and large alike, which depend on pumping water. Not only is there a fuel and spare parts problem caused among other things by a foreign exchange shortage, but such systems also require a complicated supporting infrastructure for supplying fuel and maintenance services. The operation of such an infrastructure may be as complicated as operating large canal systems.

2. We have noted long-range planning efforts and statements suggesting that all irrigation development (including those by the beneficiaries themselves) be in accordance with well refined and developed masterplans. The Team recommends incremental planning rather than costly long-range master planning. Our principal objection to long-range (up to 20 years) master agro-hydraulic planning is not only that it is expensive, but it is based on incomplete information and also irrigation technology is rapidly changing in ways which will affect development plans. Furthermore, the planning and efforts to adhere to the plans may actually retard development.

For incremental planning purposes we recommend that a country-wide agro-hydraulic resource inventory be made. A good start on this is already available in the recent FAO "Agroclimatic and Land Suitbility Study."[2]. In addition, an inventory of pre-annual and semi pre-annual

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[1]Herein we define small projects as being those which when completed can be managed, operated and maintained by the beneficiaries. Some assistance and training may be required at the onset but they do not require an external agency to carry out the management, operation and maintenance functions except for periodic reviews and occasional assistance with maintance.

[2]D.P.J. Van de Vyvere and the Early Warning System Crop Monitoring Project, "Agro-climatic and Land Suitability Study," Working Paper No. 10, National Food Strategy Project in Tanzania, FAO, Aug.-Oct. 1981.

streamflows and the current effective irrigated acreage from them should be made on a region-to-reion basis.

Using the above information, first priority should be given to simple small-scale irrigation schemes which have a reasonable potential to increase production with both limited foreign exchange and limited critical local commodity inputs. Technical, heavy machine work, commodity and credit assistance should be given to both mini private projects and small-scale commumity projects.

3. The Team has observed public and private irrigation schemes that are not fully operational, and we have been informed that there are a number of such schemes throughout the country. These investments undoubtedly represent a significant underutilized economic and physical resource. In view of this, the Team recommends that an inventory be made of the irrigation systems which are now in place. Such an inventory, to be useful, should include multidisciplinary diagnoses of the more promising systems to identify the socioeconomic as well as the engineering and agronomic problems which have retarded system utilization.

Based on such a region-to-region inventory a strategy of incremental planning can be initiated to complete or rehabilitate systems based on the economics of the necessary new investments compared to expected production increases. Obviously, added investments should only be made where the socioeconomic factors indicate that they have a relatively high potential for success.

4. During the review the Team noted that there are a number of water management and research/demonstration activities underway throughout Tanzania. However, these are all independent efforts and there is little or no coordination between them or effort to synthesize the experience and lessons learned. In view of this, the Team recommends that the Irrigation Division of the Ministry of Agriculture take on the task of developing an information coordination network between the various foreign assisted irrigation projects, local research stations and the division of extension (see page 5).

5. Realizing that competition for dependable water flows will intensify, the Team recommends that the system of water rights and laws

which has been developed be supported with provisions to enforce the law and regulate the diversions in accordance with a reasonable scheme of priorities. We do not recommend extending the legal system past the diversion points as we feel the allocation of water within each system can best be handled by the beneficiaries themselves through water users' associations.

6. One of the lessons learned on the USAID Rift Valley Rice Project was that there is a large amount of construction equipment and agricultural machinery in Tanzania which is not functioning due to relatively minor mechanical difficulties. Furthermore, the Rift Valley Project was able to rehabilitate an impressive amount of construction equipment (over one million dollars at original cost) with project-trained local mechanics using field tool kits to install less than $20,000 of needed parts. Most of the machines had only been operated for a relatively few hours and can be operated for many times longer before requiring major overhaul. In view of this impressive performance the Team recommends that priority be given to a construction equipment and agricultural machinery rehabilitation program.

The next step will be to utilize the rehabilitated machinery effectively. This will require training machinery operators (as the Rift Valley Project has done) to do routine maintenance; furthermore, diesel, lubricants, spare parts and mechanical services must also be available to keep the machinery in operation. By benefiting from this existing capital (in a form of rehabilitated machines), considerable agro-hydrological development can be undertaken at greatly reduced cost.

7. The Irrigation Division of the MOA is short of trained professional staff for the design, construction and development of water management packages for carrying out even a modest program in small-scale irrigation, not to mention medium or large irrigation projects. With a view toward incremental building of the capacity of the division, the Team recommends that each of the six zones be provided with a zone irrigation officer and assistant officer who are irrigation engineers and trained in the design and management of small- and medium-scale projects.

In addition to the above, the irrigation agronomic aspects of the Division should be built up with an irrigation agronomist in each zone

who can obtain information gained from the networking activities described earlier.

Since there are few professional irrigation engineers and agronomists in the country, the development of this talent will require some special training. In view of this, the Team recommends that professionals with compatible trainng be selected and given special short course programs in irrigation. One possibility for achieving much of the needed training would be to solicit assistance from the Water Management Synthesis-II Project. By using the Project's diagnostic analysis or the International Irrigation Center training programs it would be possible to provide rather intensive and useful training for engineers, agronomists, economists and sociologists associated with the multidisciplinary diagnosis and management, rehabilitation or design of irrigation systems.

8. The Review Team has been asked to address the subject of appropriate pumping plants for irrigation in Tanzania. Unfortunately, we are not optimistic about any of the solar schemes and recommend that they be tried and proven elsewhere before being brought to Tanzania. Furthermore, animal power is only used on a local basis and is not generally available. This leaves various hand pumps and wind power for stock water and small garden plot irrigation. For larger schemes hydroelectric power is preferable where the power is available and the pumpsets are large enough and/or closely spaced. For more remote individual pumps, diesel engines afford the most practical power source.

It is important to point out that electrical/diesel pumping requires a relatively complex infrastructure of support services (for fuel, lubricants, parts and maintenance). Because of the difficulties of operating and maintaining machinery in Tanzania, gravity fed (or greatly pressured) systems are preferred even where they may appear to be more costly than pumped systems.

9. There is undoubtedly significant potential for applying new irrigation innovations on certain high value export cash crops such as cashew, tea, coffee and sugar cane. Precision trickle, surface or sprinkle irrigation along with special agronomic packages often greatly increase production per unit of land as well as per unit of water applied. Such techniques can also render sites in unique agroclimatic

zones for a given commodity, but with poor topography or soils or limted water resources, very productive. With this view in mind, the Team recommends the possibilities for improving production of the more promising export cash crops by using new irrigation technologies be investigated.

10. The Team has been asked to make recommendations for further studies concerning the need for a more complete sector review. As mentioned in the introduction, we realize our study is of limited scope, having only visited a small part of the potential irrigation areas of the country and not having read all the many studies which have been conducted by various donors and governmental agencies throughout the years. However, believing in incremental planing, we have reservations as to whether a detailed study is warranted at this time. We feel it is a given that there are vast untapped irrigation resources, but are quite certain that these will be expensive and complicated to develop.

Developing complex, expensive irrigation potential is beyond the current Tanzanian capacity for designing, financing, managing and farming the completed projects. Therefore, for the time being this potential should be held for future growth. In the meantime, we believe the next order of business in irrigation is to continue developing small-scale systems and to complete the development of, and rehabilitation of, existing irrigation systems.

At the same time, attention should be given to improving Tanzanian technical and managerial capacity in the irrigated sector. The recommendations given herein should assist in this regard.

In addition, the Team recommends the following in the area of irrigation-related reviews:

a. A team consisting of two Ph.D. candidates, an economist and an agricultural engineer should spend at least one year drawing together, summarizing and synthesizing the many project planning documents and studies relevant to irrigation which have already been developed in Tanzania.

b. A similar team should conduct an economic analysis of current irrigation activities on large-scale, small-scale and private projects for important crops.

c. The Water Management Synthesis-II Project should be called on to conduct a diagnostic analysis training course on one large-scale and one small-scale project in Tanzania. The training course should provide the needed training and background for future diagnostic activities in the country while at the same time providing an interdisciplinary diagnosis of the systems which are studies.

Some Criteria for the Expenditure of PL 480 Funds in Tanzania

1. Expenditures on small-scale irrigation systems which will increase production are much preferred to those which are solely for the convenience of the cultivator. For example, it would be more effective to pay a farmer to dig a new canal than to replace temporary diversion structures with permanent masonry works.

2. The lining of main canals from perennial springs and small streams is probably cost-effective through water savings which can be used to expand total irrigated acreage. This is not likely the case for canals associated with seasonal flowing rivers and streams with only single cropping and supplemental irrigatin potential.

3. There are opportunities to rehabilitate small systems at likely low cost, such as the virtually unused system close to the agricultural college at Morogoro.

4. Expenditures on incremental planning are much preferred to large-scale, long-range planning exercises.

5. Any expenditure on improving the system of consolidating and providing access to past research in agriculturel and on measurements of physical resources such as meteorological data is probably well worthwhile.

6. PL 480 funds might well be utilized to support the development of an irrigated agriculture/project network for donor-assisted projects and GOT activities associated with irrigated agriculture. A further description of this activity is given elsewhere in this report.

7. Support for the development of a professional society of irrigation engineers and irrigation agronomists would be a worthwhile

activity. Such societies are commonplace around the world and contribute in very positive ways to professional development.

8. Support might be provided to carry out hydrologic inventories and for diagnostic analyses of existing irrigation projects.

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OF
IRRIGATION DEVELOPMENT OPTIONS
AND INVESTMENT STRATEGIES
FOR
TANZANIA/INDIA

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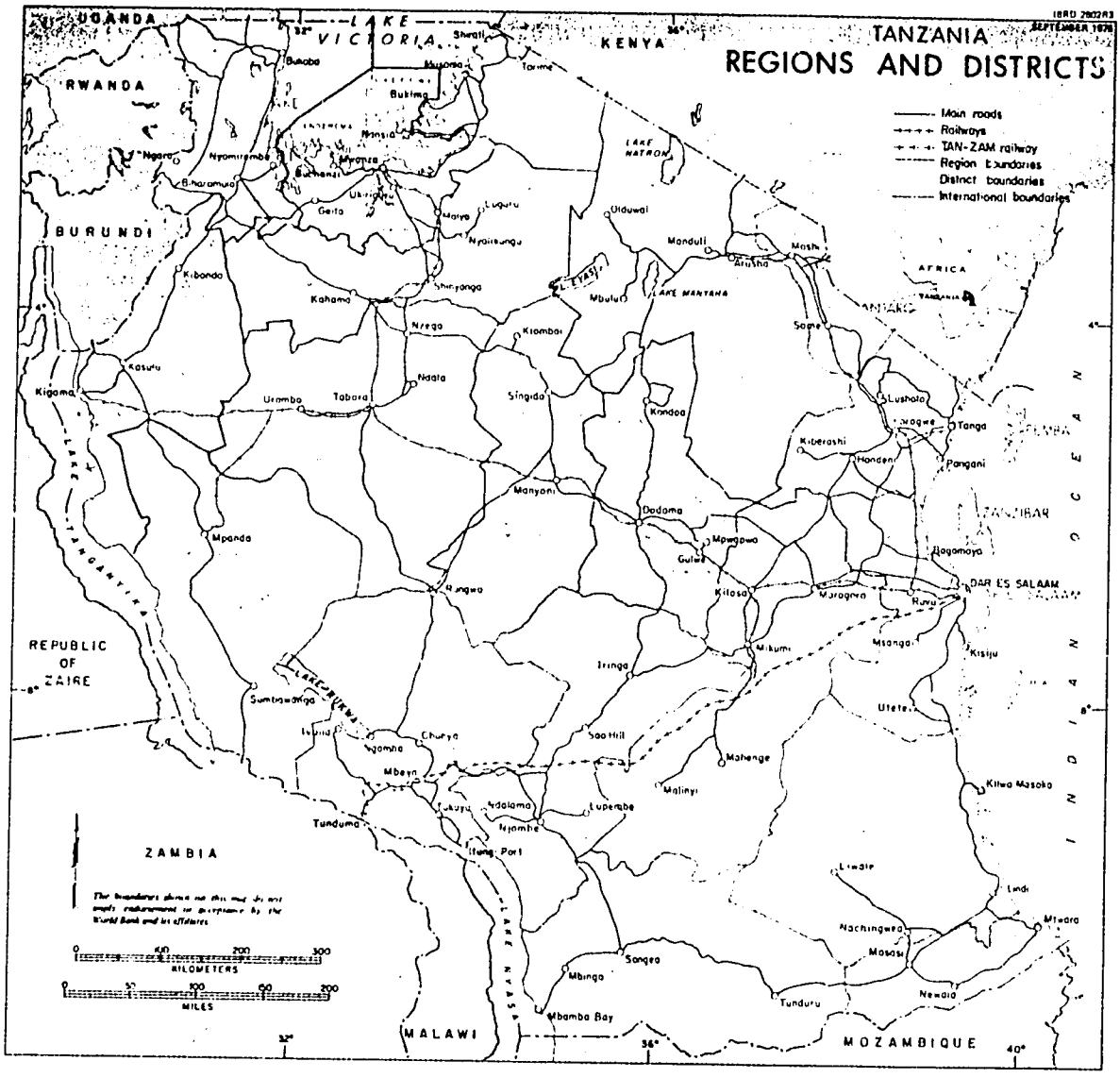
TANZANIA
REGIONS AND DISTRICTS
Main roads
Railways
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Region boundaries
District boundaries
International boundaries
UGANDA
KENYA
RWANDA
BURUNDI
REPUBLIC OF ZAIRE
ZAMBIA
MALAWI
MOZAMBIQUE
LAKE VICTORIA
LAKE TANGANYIKA
LAKE NYASA
LAKE NATRON
LAKE MANYARA
DAR ES SALAAM
ZANZIBAR
INDIAN OCEAN
KILOMETERS
MILES

GENERAL BACKGROUND AND DISCUSSION

A recent (1983) World Bank agriculture sector study provides the following description of the current level of irrigation development in Tanzania.

> Only an estimated 3 percent of cultivated areas in Tanzania is under irrigation. In 1981 there were 114,378 ha under traditional small-scale farmer irrigation and 25,260 ha under large-scale operations. The major large-scale schemes are on sugar estates, and two state-owned rice farms (Mbarali and Dakawa). Among the smaller scale schemes are some village-owned communal schemes up to 200 ha each. Capital allocations for increasing acreage under irrigation have yet to reflect the Government's ambitions. Excluding NAFCO farms, irrigation investment has constituted only TShs. 200 million, 3 percent of total planned capital investment in the agricultural sector at current prices over this period. However, there was a sharp increase in planned investment in 1980/81 and 1981/82 in both Ministerial and regional development budgets, and irrigation receives considerble attention in the new Five-year Plan for 1981/82-1985/86. The Government proposes that more of the small-scale traditional irrigation should be organized into "better regulated village irrigation projects" despite the acknowledged failure of all but one of this type of communal village project to date.[1]

It is extremely difficult at present to determine the economic potential of irrigation development in Tanzania. Over the past ten years a variety of opinions have been offered. In the late 1950s a World Bank Mission placed considerable emphasis on irrigation agriculture. By the early 1970s the record of irrigation development was spotty at best. An FAO study at the time[2] suggested a go-slow policy primarily on the opinion that there were lower cost methods in dryland farming, especially for maize, for increasing total food output. The recent World Bank agriculture sector study argues the rainfed agriculture case on the basis

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[1] World Bank, "Tanzania Agricultural Sector Report," Report No. 405-TA, August 19, 1983.

[2] FAO, The Economics and Planning of Irrigation Report to the Government of Tanzania, UNDP No. TA 3095, Rome, 1972.

of the recent FAO study of agro-climatic conditions[3] and on observations on yield potential in the areas least likely to experience drought. They point out, in addition, that inadequate rainfall is "occasional, regional and usually not severe." Other observers suggest that as much as 4 million hectares could be irrigated in some way with the water resources[4] available. This is almost equivalent to the total acreage now under cultivation. These authorities see 16 million tillable acres within the national boundaries. However, these same authorities can shed no light on the economic potential of such development except to suggest that with current regulated price relationships irrigated paddy production is more economically viable than is that of irrigated maize. This type of casual rule of thumb for resource allocation totally ignores the role of supply and demand in factor allocation in both socialist and capitalist economies alike.

Other observers, long familiar with the Tanzanian agricultural economy, point to the successful experience with rice cultivations at Mbarali as an indication of potential. The Team does not have access to detailed costs and returns data from these schemes so as to place this reported success story within the overall context of irrigation development within the country. The casual evidence suggests that the development has been very costly. Numerous river basins, especially in the southern reaches of the country, have been identified as worthy of additional irrigation feasibility studies. Much more must be known before the economic realities of these sites can be considered.

All observers to date do seem to agree, regardless of their assessment of potential, that the institutions necessary to support a modern irrigated agriculture in Tanzania are not in place. These include sufficient research on all aspects of crop production, an irrigation authority of sufficient breadth and depth, an extension staff trained in irrigated agricultural techniques and a maintenance and repair capacity.

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[3] D.P.J. Van de Vyvere and Early Warning System and Crop Monitoring Project, "Agro Climatic and Land Suitability Study," Working Paper No. 10, National Food Strategy Project in Tanzania, FAO, AIG.-Oct. 1981.

[4] International Labour Organization, "Basic Needs in Danger," ILO Officer Roles and Programme for Africa, Addis Ababa, 1982.

In addition, the comparative return of investment in irrigation compared to other alternatives in the agricultural sector are not known. As noted by the World Bank, there are compelling arguments that a program of emphasis on rainfed food grain production would have much more favorable short-run impacts than equivalent attention to irrigation.

In short, even the most optimistic accounts of the potential for irrigated agriculture within the country follow immediately with a menu of institutional constraints to rapid development of the resource. Heavy investment in irrigation schemes at this time in Tanzania would, in the opinion of the Team, be made in the same climate of uncertainty as to the physical, biological and economic realities that existed during the period of investment by the British Colonial authorities on the Indian subcontinent before the turn of the century. These schemes were many decades in reaching maturity.

This Review Team believes that there is potentially a role for irrigation in Tanzanian agriculture on both food grain and perennial crops. There is very strong evidence, however, that irrigation is not a necessary condition either for food self-sufficiency or for protection against drought. In our opinion there is a logical pattern of irrigation development moving from small, relatively simple systems to more complex, higher technology application. This pattern is determined by the realities of the present economic situation and the state of the institutions necessary to support a modern agriculture.

The Review Team cautions against drawing conclusions too quickly on the cost effectiveness of irrigation under Tanzania conditions; for example, the average per acre cost at the Dakawa Project has been estimated at 10,000 U.S. $ per hectare. On the one hand part of this high cost must be attributed to an extreme overdesign of the pumping station. Six pumps have been installed and the capacity of the rest of the system could not handle the output from three of them. This is due in part to an underdesign of the transition stilling basin to the main canal. On the other hand, given this latter situation and likely underestimated infiltration rates -- at least on the lighter soils in the upper sections of the Project -- the Project may never irrigate more than half of the designed acreage and per acre development costs may be even

higher. Hopefully, conclusions can eventually be drawn on design and construction conditions which approximate the state-of-the-art.

It is worth noting that in Tanzania some authorities continue to view irrigation as a necessary condition for protection against drought. As noted elsewhere in this report and by numerous other authorities, too often irrigation systems installed as protection against drought are themselves short of water in the years when water is needed most because the catchment areas for the systems are the same as those for the irrigated area.

Many of the failures of the early irrigation systems installed on the Indian subcontinent established this fact in a dramatic manner. Only expensive and substantial reservoir supply carried between seasons, water transported from unaffected regions or rechargeable groundwater supplies can offer real drought protection, and even then -- in coastal areas at least -- excessive pumping in drought years has been known to create unpleasant problems with saltwater intrusion. The economics for such systems which provide only supplemental water during a rainy season are usually quite unfavorable, especially if there is no package of modern agricultural practices.

CONCLUSIONS: IRRIGATION STRATEGY OPTIONS

Irrigated Agriculture Coordination Center (IACC)

The need to begin now on a long-term commitment to develop agricultural support services for the country has been strongly emphasized by recent commentators (Tanzania Agricultural Sector Report No. 4052-TA, World Bank Document). Very important among these are research and extension institutions which will serve the needs of the various producing sectors.

It has been frequently noted that there is no program in the country to develop agricultural packages (new varieties, fertilizer, pest and disease control, crop husbandry, water management and so on). Our observations strongly confirmed this observation.

At the present time there is a proliferation of projects supported by foreign donors in which crop and water management trials are an integral part of project activities. For example, the North Koreans at Dakawa are carrying our varietal trials on paddy and other crops and at the Kilimanjaro Agricultural Development Center in Moshi the Japanese have laid out an extensive network of field plots for varietal and fertilizer trials on paddy and maize and are even growing watermelons. Similar efforts are reportedly being carried out by the Chinese at Mbarali, the British at Mtwara and Germans at Manya and Mambo, FAO in Zanzibar, the Government Research Station at Ifakara and USAID in the Rift River Valley. Other donors may well be involved. As far as the Team was able to determine, there is no coordination and information exchange between the principals of the numerous projects. It is very important that the information and experience being gained on these projects be captured and integrated into the knowledge of agricultural practices in the country. Also, it is most likely that interaction between the various projects would have a synergistic effect as is common within a vital scientific community.

One of the very common observations in developing countries is that irrigation engineers have no knowledge of crop husbandry and agriculture and thus are not able, or unconcerned with managing water beyond the farm

outlet. In the Tanzania system the Irrigation Division is under the Ministry of Agriculture. This thoughtful placement puts the Irrigation Division in a unique position to develop a network within and between GOT and donor-assisted irrigated agriculture projects (perhaps by cropping system types). Such a network would exchange in-country information and experiences on such matters as varietal and fertility trials, water management practice, water requirements and pest control -- including insects, disease and varments.

For example, the irrigation duty as a function of soil types is important for project design and operation. The Japanese note in their project document that they found infiltration rates to be 2 to 5 mil/day on trial plots which were thought to have a rate of 1 to 2 mil/day. They are assuming that the higher than expected rate is because the soil is newly cultivated and has not yet settled. They expect (hope) that the longer cultivated soils in the actual project zone will have the lower infiltration rate assumed in the design. This may indeed be the case. On the other hand, since the typical Tanzanian paddy husbandry system does not include a puddling operation even with transplanted paddy, settling may be quite minimal and very long-term. It may be in the project area that infiltration rates are at the higher rate, or perhaps are quite variable over the project areas. The area which will finally be irrigated when the project reaches maturity will depend to a considerable extent upon which conditions actually exist. Clearly, transferring this experience as it occurs to and between other projects would be a useful exercise.

Network activities would include carrying out workshops and conducting seminars. This could be part of the continuing training component of at least the irrigation agronmists assigned to each of the Irrigation Zones.

Another possible activity of the network could be to develop on-site documentary materials using half-inch video tapes. These tapes could be used to transfer information between scientists, to develop materials for agronomists such as information obtained from field trials on farm water management and to prepare extension materials. The viability of the suggestion depends upon the capability to provide repair service, the

availability of foreign exchange and so on. It is noteworthy that programs such as these are being developed in West Africa and in some developing countries in South America. Being locally produced, they seem to be powerful mechanisms for transferring relevant information useful to the agricultural community.

Another network function would be to serve as a conduit within the Ministry of Agriculture from the irrigation/foreign assistance projects to the Division of Extension, research stations and training institutions. By serving in this role the Irrigation Division would play a more integrated role in the total agricultural development effort.

Staff Development and Training

Given the very young status of the Irrigation Division, it is not surprising that there are some real manpower problems. There is no design division and this task falls on the Division Chiefs. This puts unreasonable demands on the Chiefs and limits capacity. There are too few people and too little experience to carry out any major design programs. Another problem is that the Division lacks funds and equipment for the construction of hardware.

In the Team's opinion, a modest design program consistent with an incremental irrigation program would require the influx of approximately six additional Irrigation Engineers to serve as assistants to the Zonal Irrigation Officers. The diploma holders now being trained at Nyegezi Agriculture Institute could be used to do the small-scale design work and supervise construction.

One way to meet the requirement for Irrigation Engineers would be to give short-term training to Civil Engineers. Training could likely also be given to a small cadre of state farm personnel. Such training could be provided by the Water Management Synthesis-II Project's diagnostic analysis workshop or through the International Irrigation Center.

A model for a more extensive long-term training program which appears basically sound is given in the 1972 FAO Document TA 3096, The Economics and Planning of Irrigation, pages 23 through 39.

Recommendation for a Rehabilitation Program for Heavy Construction Equipment

During the conduct of the Rift Valley Pilot Project, USAIDpersonnel observed a minimum of over 100 idle but by no means dilapidated pieces of heavy equipment scattered around the country. This could in no way be considered a complete enumeration, but the replacement value of just this number alone must exceed $15,000,000 U.S. Closer investigations determined that more often than not heavy equipment is imported for use on a specific project with little attention paid to establishing effective field support, stocking of necessary spares and training Tanzanians in both use and maintenance.

Most heavy plant falls under the Ministry of Works (Ujenzi). They have great difficulties in maintaining and supervising the use of heavy plant. Other government departments also have various quantities of heavy plant. However, there is surprising lack of interdepartmental cooperation to utilize all heavy equipment to the maximum advantage.

The Rift Valley Rice Project has shown that many of these barriers can be overcome with the cooperation of all departments involved and full utilization of the few spares available.

Considering the severe economic constraints and the necessity of utilizing foreign exchange and aid in more desparate sectors of the economy, the Review Team recommends that the government embark upon an extensive heavy equipment rehabilitation program to satisfy many heavy plant requirements rather than indiscriminate continued importation.

The following guidelines and recommendations may be useful in organizing such a program.

1. Countrywide inventory of all heavy equipment and operational status.
2. Countrywide inventory of all existing heavy equipment spares.
3. Devise a more effective system for interdepartmental loan, lease or sale of heavy equipment and/or spare parts.
4. Organize a training program to instruct heavy machinery mechanics in repair of heavy plant on a "field level."
5. Organize training programs to instruct operators in preventive and routine maintenance.

6. Establish well-equipped mobile workshop stations staffed by competent, resourceful mechanics.

These suggestions do not attempt to address the problem of shortages of fuel, lubricants, spare parts, etc., but offer constructive suggestions on how to better utilize already existing heavy plant and personnel. The Government should also investigate a strategy of standardizing import of heavy plant in order to simplify the repair and maintenance required.

APPENDIX

FOOD SECURITY THROUGH IRRIGATED AGRICULTURE

APPENDIX

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Background

It may be technically feasible to develop large-scale irrigation systems with reservoir or lake water storage capacity to provide real protection against drought. Experience has shown that economic feasibility can never be taken for granted. The global record on such investments gives no cause for optimism. A very large number of these projects have ultimately been justified because of their questionable distributional impact after expected productivity gains have not been realized.

Another important consideration with large-scale irrigation projects is the considerable time period between project identification, design, construction and full utilization of irrigation potential. Five, even ten years would be a crash program. More typically, 15 to 20 years elapse until the project is fully operational. The present value of such benefit streams is not very attractive when compared with much more immediate returns which might be realized from the development of rainfed agriculture.

Irrigation, especially large-scale irrigation, is often considered to be a necessary condition for national food and feed grain self-sufficiency, irregardless of climatic conditions. The record suggests otherwise. For example, Table 1 shows the percentage of irrigated acreage of the important food and feed grains in U.S. agriculture. Dependent upon the data source, estimates of the total irrigated acreage in U.S. agriculture in 1978 vary from 60.7 to 50.8 million out of a total of 546.9 million acres in agricultural production.

It is difficult to determine with great precision the contribution to total output from this irrigated acreage. This is because we do not know what yields would be without irrigation for many of the irrigated areas. It is very apparent from Table 1, however, that not more than 15 to 17 percent of total U.S. corn for grain and silage and 6 or 7 percent of the wheat crop can be attributed to irrigated agriculture. Table 2, which shows a yield comparison between irrigated crops in the western states and rainfed yields, reveals even more dramatically the contributon of rainfed agricultural to the U.S. total agricultural economy.

Clearly, for corn, yields under irrigation on western acreage are higher than on the rainfed acres in the east or west, but the rainfed acreage contributes the far greater portion of the total crop. This is also true for wheat and here there is scant difference between average yields in the rainfed east and the irrigated west. If one adds to this the reality of the high rate of government subsidization of western irrigated agriculture compared to the value of the grains from

irrigation, there is not a very strong case for the contribution of irrigation to the food and feed grain sector of the U.S. agricultural economy. If the U.S. agricultural food and feed grain sector were being developed today, clearly a team of experts would recommend an initial heavy concentration on the development of rainfed agriculture. Security against occasional drought could more efficiently be achieved through a grain or credit storage policy than through the construction of reservoirs and canals in the western states.

On the other hand, irrigation appears to have made a very significant contribution in U.S. agriculture in the production of high valued perishable and industrial crops (see Table 3). This further emphasizes the importance of an economic evaluation of investment in irrigation.

TABLE 1

IRRIGATED ACREAGE FOR MAJOR U.S.

FOOD AND FEED GRAINS

Crop	Total Acreage Harvested	% Irrigated
Corn for seed or grain	70,734,094	12.4
Wheat for grain	54,457,876	5.5
Soybeans for beans	61,832,897	2.1
Oats for grain	10,240,993	2.3
Corn for silage or chop	8,343,904	15.8
Total Silage and Hay	69,900,000	74.9

Source: Census of Agriculture, 1978. Irrigation. U.S. Dept. of Commerce Bureau of Census, February 1982, Vol. IV.

TABLE 2

COMPARISON OF YIELDS ON IRRIGATED AND

RAINFED AGRICULTURE

	Acreage Harvested	Yield (bu./acre)
Corn		
Irrigated West	8,838,000	115.2
Rainfed East	56,596,000	88.6
Rainfed West	4,572,000	48.3
Wheat		
Irrigated West	3,899,000	39.4
Rainfed West	49,387,000	27.1
Rainfed East	12,930,000	38.4

Source: U.S.D.A., Agricultural Statistics, 1978 (Washington, D.C., G.P.O., 1978).

TABLE 3

IRRIGATED ACREAGE OF U.S. PERENNIAL,

INDUSTRIAL AND PERISHABLE CROPS

Crop	Total Acreage Harvested	% Irrigated
Cotton	12,737,497	36.8
Sugar Cane	766,071	49.5
Vegetables	3,569,304	58.2
Orchards	4,546,138	66.5
Strawberries	45,568	71.2
Tobacco	1,004,696	13.1

Source: Census of Agriculture, 1978. Irrigation. U.S. Dept. of Commerce Bureau of Census, February 1982, Vol. IV.

ANNEX I

NARRATIVE FIELD TRIP REPORT (LOG)
FOR
TANZANIA - RIFT VALLEY IRRIGATION
PROJECT REVIEW AND MINI IRRIGATION SECTOR STUDY
November 18, 1983 to December 5, 1983

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Friday, November 18, 1983

Keller and Weaver arrived in Dar es Salaam. We met with Ken Lyvers at AID along with Hess and Lonsway. We discussed the Team's statement of work and plan for doing it. In general, the statement of work was acceptable to the Team; however, we pointed out that we could not do detailed studies in the time frame and with the resources at hand.

In the afternoon we visited with Mr. Nkuba, Acting Director of the Irrigation Department of the Ministry of Agriculture (MOA) and Mr. Chiza, who is the Irrigation Department Zone Chief stationed in Tabora. Mr. Chiza was deputized as special consultant to the Evaluation and Review Team at our request. Mr. Nkuba had two quesions he wished us to address:

1. What are the Team's ideas on small-scale community irrigation versus large-scale?

2. Where should the irrigation be centered: in MOA or in a special ministry? He is not comfortable with it in MOA because the ministry is not set up or accustomed to handling capital expenditures.

Mr. Nkuba pointed out the following restraints to his Division:

1. Lack of manpower (only have ten professional Irrigation Engineers in the country).

2. Lack of capital support.

3. Inadequate design section -- have insufficient hydrological, climatological, topographic and soils data to work with.

4. No maintenance cadre for pumpsets and projects.

The Team then met with Director Handley who outlined what the Mission hopes to obtain from the Rift Valley Irrigation Project Review and the Mini Irrigation Sector Study.

Saturday and Sunday, November 19 and 20

The Team spent the weekend planning and preparing for the one week

field trip, reviewing appropriate literature and outlining the reports to be done.

Monday, November 21

The Team headed to Dodoma and made the first stop at the Ruvu Rice Project which is a state farm operated under the National Ag. Food Corp. (NAFCO). Some salient features are:

1. The farm was started by the Chinese in 1965 and turned over to NAFCO in 1974.

2. They only irrigate 725 ha of paddy out of a potential of 2000 ha! The water supply is never limiting.

3. They employ 115 permanent workers and 500 to 600 casual laborers for weeding and bird watching as needed. It takes about ten person days/ha for weeding.

4. They have a problem with red rice (which is a weed) and only obtain 3 to 4 T/ha of paddy from one crop per year.

5. The reason they only raise one crop is because of continual rains and bird migrations. The farm is fully mechanized.

All in all, the performance at Ruvu is quite poor. Hopefully, red rice seed is not getting spread from the farm to other locations.

The next step was at the Morogoro campus of Dar es Salaam University. The Team visited with Dr. Brad Gifford and was informed that their continuing education program is going well. Part of the Team then visited the Agricultural Engineering faculty and reviewed the curriculum and programs for the irrigation (soil and water) option and made the following observations.

1. Students spend their first two years in a general pre-engineering curriculum at the main campus at Dar es Salaam.

2. Then they come to Morogoro for the last two years of the B.S. program. There is also an M.S. and a Ph.D. program on the books at Morogoro.

3. The soil and water option program curriculum and course descriptions look good.

4. However, there are no students in them and no professors who specialize in irrigation.

5. In all, there are only six undergraduates and three graduate students in all the Ag. Engineering option programs at Morogoro!

The National Bean Experiment Station is also at Morogoro. Part of the Team visited the experimental areas and found very little activity considering that this is the National center for such an important commodity.

At Morogoro we noticed an almost unused irrigation system with water flowing, although the area looked very dry. Upon inquiring about this, the Zone Irrigation Engineer told us that this was because there is confusion as to which agency or who controls the system.

Our next stop was at the Dakawa Rice Farm. This is also a State Project. This project is being assisted by the Koreans. From our brief visit with the manager and a tour around the farm we found the following:

1. The project irrigates 750 ha of paddy but has the potential to irrigate 2000 ha!

2. The pump station is fitted with six electric driven pumps, each capable of delivering 1.0 m^3/s, but has no desilting works at the inlet and the stilling basin and transition to the canal is improperly designed so that only two pumps can be operated at a time.

3. The main canal seems to have silting problems and the field channels already appear fragile.

4. The rice paddies look fair but stands are uneven and fields are not level. The farming is totally mechanized and the ramp from the banks to the fields take up considerable space in the paddies.

5. There may be a red rice problem.

6. Some of the paddies on what appeared to be lighter textured soils appear to be abandoned.

7. The Koreans appear to be doing some varietal and possibly fertilizer trials. They are also experimenting with upland crops.

We did not get a very complete picture of the project because when we returned from the field visit at 3:00 p.m. the manager was no longer there because it was after quitting time.

Tuesday and Wednesday, November 22 and 23

After spending the night at Dodoma the Team spent the next two days reviewing and visiting the various facilities and lands developed by the USAID assisted Rift Valley Rice Irrigation Pilot Project. Details of the Team's activities and specific findings are contained in the Rice Project

Evaluation Report. We were generally impressed with the project's performance and outputs. The newly developed irrigated areas were effectively designed and constructed. The heavy construction machinery maintenance and rehabilitation output is most outstanding. And, the training of mechanics, equipment operators, parts clerk and irrigation agronomists and surveyors was impressive. We are concerned that shortages of farm labor at critical periods during planting and harvesting of the paddies will limit the development potential of the area at an early point and should be carefully monitored.

Thursday, November 24 (Thanksgiving)

We left Dodoma heading for Manyara. En route we visited a small-scale project at Mnenia. This project consisted of the lining of about 3 km of canal to convey about 65 lps from a perennial spring to potentially irrigate 72 ha. (Mr. Chiza was the Irrigation Department Officer who was involved with the project during the initial construction phase.) We had discussions with the local managers and some irrigators and learned the following:

1. The association of water users manage the system. They only allow as much land to be under irrigation as they feel there is sufficient water for, so there is no serious competition for water once a farmer is allowed into the association. Of course, there are prospective users who are denied access.

2. The canal is lined with stone masonry and is very effective. It appears that the lining is very cost-effective and the Team suspects that more lining is in order. This is because the spring has a rather constant flow during the dry season and farmers are able to irrigate at least two crops with assured supplies.

3. We visited and talked to farmers who were doing a very good job of irrigating onions. One farmer had 200 small (1+ m by 5 m) mini basins with onions and said he grossed TShs 600 per plot! His neighbors were helping him irrigate and it was interesting to note that this careful high value irrigation was at the extreme (distal) end of the system, perhaps 3 km from the spring.

4. Farmers said they irrigate at night during the dry season since there is no active storage on the system. Possible overnight storage would be a worthwhile consideration because they also said irrigation is difficult in the darkness and quite inefficient.

As with pumped irrigation water, canal lining is undoubtedly cost-effective where flows are assured from perennial streams and springs in water-short areas. It would be quite useful to develop a decision

tree for determining when to line channels. Important parameters would be: flow, land, dependable flows, lining cost, produce values, etc. (Perhaps this could be undertaken in a general sense by the Water Management Synthesis-II Project; it would make an M.S. level study.) A decision tree could also be worked up for overnight storage.

Friday, November 25

After spending the night in Manyara, the Team visited small traditional irrigation activities near the Gibbs Coffee Estate as well as the sprinkler systems on the Estate, while en route from a delightful visit to Ngorongoro Game Park. The gravity pressured sprinkle system at the Gibbs Estate (75 ha?) was not operating because their sprinklers were malfunctioning. They couldn't get new springs and parts to fix the sprinklers because of foreign currency limitatins, although the rainfall is only about 900 mm and coffee in this area needs about 1800 mm for maximum production! Furthermore, coffee is a major export crop (earner of foreign exchange). It was interesting to note that an adjacent foreign owned coffee estate was sprinkler irrigating because they had been allowed to bring in a batch of new equipment. The unirrigated coffee looked quite desiccated.

Small holders were irrigating from the same stream which supplied the coffee estates. The farmers had constructed crude stick and mud diversion dams to raise the water 1 m or so to reach small plots adjacent to the stream. Depending on the perennial nature of flows and the existing demand for water, these small holdings may be good candidates for a small project consisting of a more substantial diversion structure and canal. Water management on the small plots seemed to be fair and the farmers had obviously gone to a gret deal of trouble (and labor) to use the water beneficially for mixed grain and vegetable cropping. They point out the well known fact that where water is dependable and irrigatin is economically viable, farmers will try to use the water as well as possible, given their limited resources.

After leaving the highlands we stopped in Manyara to visit the rather large small-holder project(s) there. Unfortunately, we were unable to visit any sites because it was too close to 2:30 p.m. when the Government agencies close; furthermore, they had not been officially informed of our visit from the Regional Headquarters in Arusha. We did observe irrigation in passing along the main road. Crops looked good and there was a mixture of them.

Saturday, November 26

After spending the night in Arusha, the Team traveled to Moshi where we visited with the Regional Planning Office. Japanese financial consultants have made an elaborate master agro-hydraulic plan for the Kilimanjaro Region -- undoubtedly very costly, taking two or three years

to complete and utilizing a consulting staff of up to 14 expatriate professionals (so we were told). Their plans seemed to be quite carefully executed and thorough. However, the Team was surprised to see such elaborate planning in view of the very limited capacity of the Tanzanian Government to follow through. It would seem that incremental planning would be more appropriate. The resources spent in the planning could probably be better spent on productive works.

We passed through the Japanese designed (and to be constructed soon) Moshi Project Area en route to the Kilimanjaro Agricultural Development Center (KADC). In reading the Project documents we noted typical over-optimism in terms of expected irrigation efficiencies, irrigated areas and crop yields. The Project calls for land consolidation with uniform sized plots. The project is mostly for paddy and it appears to the Team that the Project diversion (which is to be upstream of a number of traditional diversions) will deprive the older water users of their water during drought period! This points up to the need to better administer and enforce the Tanzanian water law. One obvious difficulty the Japanese consulting team had in designing the Project was the shortage of reiliable streamflow data.

The KADC has been built by the Japanese. It is a very elaborate facility with small modern rice and corn handling mills, a machinery shop, classroom space, living quarters, offices and demonstration/research fields. During our visit we did not get a clear picture of what the mission of the Center is! Some interesting comments concerning the Center:

1. The Center has elaborate rice drying and milling equipment -- not for training but only to process pilot farm and demonstration farm rice. Same for corn (complete with kerosene dryers).

2. They have many different types and makes of walk-behind tractors and implements. Maybe 10 to 20 tillers with numerous powered implements. This will probably confuse the farmers in the area even if it doesn't confuse the experts!

3. Expatriate experts in rice, corn, machinery and agronomy are assigned to the Center. As might be expected they have begun varietal and fertilizer trials. The experiments looked interesting. They include four rice variants (two local and two improved) crossed with three fertilizer treatments. There were also planting density trials and several upland crops were being grown and studied.

After leaving the KADC we visited the Tanganyika Planting Company, a large sugar plantation nearby. It is half sprinkled and half flooded. Crops looked good from a quick pass-through. Apparently, the original Danish-English management team is still in place even though the plantation has been nationalized. We were told that they produce 50,000

T/year of sugar on 7,000 ha or about 7 T/year/ha of refined sugar. Water supply may be a problem in the future, especially with increased irrigation development upstream (Moshi Project).

Sunday, November 27

After spending a second night in Arusha the Team visited two projects in the Ngarenanyuki area. We spent most of our time on the Ngabobo Project which potentially irrigates 250 ha. The system was put in place by earlier settlers (ranchers) and was more or less abandoned when they left in the early 60's. Within the last few years local villagers have worked together (with some technical assistance) and brought the system back into operation.

The village-build diversion structure is constructed of boulders, logs and earth and must be replaced each year. The Chairman of Ngabobo Village said this takes about 30 men three days to do, or about 100 man days/year. The Irrigation Department is in the process of constructing permanent masonry headworks complete with steel gate at an estimated cost of over TShs 200,000 (at parallel market prices for the cement and steel the price would probably be more nearly TShs 500,000).

The Team questions the expenditure if it only makes the project more convenient for the farmers. Even with a labor cost (somewhat above market) of Tsh 50/day, the annual maintenance cost of the indigenous structure is Tsh 5,000/year; hardly large enough to justify building the permanent masonry structure. To better justify the construction cost of Tsh 200,000, it must also improve crop production.

We visited with farmers on the system. They seemed to be doing a good job of irrigation on a variety of grain and vegetable crops. We noted minor nutrient deficiencies and disease problems and suggested that what may be needed more than the diversion structures is assistance with improved cropping packages.

One farmer had 4 ac of irrigated cropland. There were nine members in his family and all worked on the farm every day. He had tried commercial fertilizer but liked animal manure better?! He said he would like assistance with promoting higher value crops which can be more cost-effectively transported out of this somewhat difficult to reach area (about two hours on rough roads to Arusha). Candidate crops might be hot peppers and possibly berries.

The Team also visited a permanent diversion structure built by the Government in 1978-79. It was a few miles upstream from the one discussed above. We were impressed that it was still in excellent condition, so it can be assumed that the planned-for Ngabobo structure should also hold up quite well.

A good study would be to compare diversions between the two systems

(as they now stand) to determine if the added convenience of a permanent structure is inducement to more timely beginning of the irrigation season, more efficient use of water, and/or less silting and damage to the canal sysem during flood periods (because the controlled diversion can more easily be shut off).

The Team returned to Dar es Salaam by airplane.

Monday through Saturday, November 28 to December 3

The Team spent the final week reviewing documents, in discussions with Government and AID officials and completing a draft report for the Rift Valley Rice Project Evaluation and the Mini Irrigation Sector Review.

The Team had a joint debriefing wth the Ministry of Agriculture and USAID officials on Thursday afternoon, December 1. The discussions lasted about two hours with the Acting Director of Irrigation from the MOA engaged throughout. The team felt the inputs from the Acting Director, Mr. Nkuba, were very valuable.

Points covered in the debriefing included:

1. Small versus large projects;

2. Long-range versus incremental planning;

3. Water regulations;

4. Diagnostics and inventory of existing irrigation;

5. Potential for machinery rehabilitation;

6. Networking of present water management related research and demonstration activities;

7. Training needs;

8. Appropriate technologies for pumping water and applying irrigation;

9. Desirability for a full sector study;

10. The follow-up program for the Rift Valley; and

11. Promising AID projects using PL 480 local currency funds with no foreign exchange inputs.

ANNEX II

A RAINFALL ADEQUACY STUDY FOR TANZANIA

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Introduction

The following material was taken from a report developed under AGREEMENT NO. 58-319R-2-429, PROJECT 52, WORK PLAN NO. 302 6100 4003 between Utah State University and the Office of International Cooperation and Development, USDA. The project name is "Climatic Tables for Project Planning in Selected Countries of Africa and the Near East." Fifteen countries, including Tanzania, were selected. The study was conducted by George H. Hargreaves and Z. A. Samani in 1983.

Methods and Procedure

The study was carried out in two stages. Tanzanian data available from the National Oceanic and Atmospheric Administration (NOAA), originally from the World Meteorological Organization (WMO), were analyzed to produce tables of precipitation probabilities, climatic data, potential evapotranspiration and a moisture availability index. The following is presented:

PROB = The probability of rainfall occurrence amounts in mm, the 95, 75, 50 and 5 percent probabilities are given (75 percent probability is that amount equalled or exceeded three-fourths of the time);

PM = Mean monthly precipitation in mm;

TEMC = Mean monthly temperature in degrees Celsius;

ETP = Mean monthly potential evapotranspiration in mm; and

MAI = A moisture availability index equal to the 75 percent probability of rainfall amount divided by ETP.

ETP was calculated from mean air temperature in degrees Fahrenheit, T°F, and incoming solar radiation, RS, in equivalent mm of water evaporation per month. The equation is:

$$ETP = 0.0075 \times RS \times T°F \qquad (1)$$

in which ETP and RS are in the same units.

Incident solar radiation is usually recorded and reported in

Langleys per day (cal/cm /day). Langleys are converted to equivalent mm of water evaporation by dividing by 59.59 - 0.055 x T°C, in which T°C is mean air temperature in degrees Celsius.

The results of analyses of the data from NOAA were used to evaluate the relationships between mean monthly rainfall, PM, and the 75 percent probability, PD, and also between PM and the 5 percent probability, P_{05}. The relationships between mean annual precipitation, PMA, and the 75 percent anual probability, PDA, were also determined. The equations can be written:

$$PD = a + b \times PM \quad (2)$$

$$P_{05} = a + b \times PM \quad (3)$$

$$PDA = a + b \times PMA \quad (4)$$

The values of a and b in Tanzania are:

PD from PM		P_{05} from PM		PDA from PMA	
a	b	a	b	a	b
-10	0.68	80	1.60	0	0.84

Equations (2) and (4) were used with mean precipitation and mean air temperature given by Wernstedt[1] in order to produce additional analyses. The principal source of solar radiation data used for the tables in Lof, Duffie and Smith.[2] The tables developed from the mean climatic data present the following values:

PREC = Mean monthly precipitation in mm;

TEM = Mean monthly temperature in degrees Celsius;

RS = Mean monthly incoming solar radiation in Langleys per day ($cal/cm^2/day$)

PD = The 75 percent probability of rainfall occurrence in mm from equations (2) and (4);

ETP = Mean monthly potential evapotranspiration in mm from equation (1); and

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[1]Fredrich L. Wernstedt, World Climatic Data, (Lemont, PA: Climatic Data Press, 1972), 523 p.

[2]George O.G. Lof, John A. Duffie and Clayton O. Smith, "World Distribution of Solar Radiation," Report No. 21, Solar Energy Laboratory, The University of Wisconsin, 1966. 59 p. plus maps.

MAI = Moisture availability index as defined above.

Rainfall Intensities

Information is often needed on depth-duration and depth-frequency rainfall amounts in order to plan and design storm drainage sysems or agricultural drainage. Reasonable estimates are also useful in estimating the probility of flood damage to irrigation systems and facilities.

For time periods (duration), t, of from 0.5 to 96 or more hours and return periods, T, of from 5 to 100 years, the depth-duration-frequency amounts can be approximated by the equation:

$$D = K(t x T)^{0.25} \tag{5}$$

Equation (5) has produced good results when compared with the log-normal probability distribution of rainfall at various locations.

Analyses of data from Tanzania indicate the 10-year return period 24-hour rainfall amounts ($P_{10,24}$) can be approximated from the 5 percent rainfall probability amount, P_{05} (the monthly precipitation amount equaled or exceeded 5 percent of the time). The equation for $P_{10,24}$ in mm can be written:

$$P_{10,24} = 26 + 0.32 \times P_{05} \tag{6}$$

Values of K can be obtained by combining equations (5) and (6) resulting in the equation:

$$K = \frac{26 + 0.32 \times P_{05}}{3.94} \tag{7}$$

Equation (3) was evaluated for Tanzania. Equations (3) and (6) can be combined to produce an equation that can be written:

$$P_{10,24} = a + b \times PM \tag{8}$$

Values of a and b for use in equation (8) are as follows:

a. 52 b. 0.83

Equation (6) was derived from data from several countries in the Americas and has not been confirmed for Tanzania. However, it seems probable that equation (6) is fairly universal in its applicability. Additional evaluation of the above relationships is therefore recommended. Until such evaluation is made, the equations given above are suggested to provide reasonable estimates of rainfall intensities for use in planning, design and project operation.

Limitations

Conclusions resulting from the analyses of monthly data are not as complete and detailed as desirable for some purposes. If there is no rain for 15 days and then excessive rain for 15 days, the monthly analysis might appear very favorable. Actual conditions would not be at all favorable for crop production. In areas where rainfed agriculture predominates and where irrigation is supplemental to rainfall, planning and management can be greatly improved by summarizing daily data and producing tables similar to those in this report giving the values for 10 to 15 days sums and relationships.

Procedures have been recently developed for making reliable estimates of incoming solar radiation from measurements of maximum and minimum air temperatures. With daily rainfall and temperature record a good analysis can be made of crop water requirements, rainfall dependability, probability of short period droughts and probable rainfall depth-duration amounts. The periods selected for analyses can coincide with prevailing soil moisture retention or with the more common irrigation rotations.

For the above reasons it is strongly recommended that additional effort be made to compile and publish and also place on computer tape the daily rainfall and temperature records for those areas considered to be of importance for agricultural production.

TANZANIA

STATION DAR ES SALAAM LAT 6 30 S LONG 39 18 E ELEV 58.0 M 47 YEARS

PROB	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
95.	7.	4.	39.	139.	50.	1.	4.	1.	2.	7.	2.	10.	666.
75.	27.	20.	78.	210.	103.	8.	13.	6.	9.	20.	18.	37.	886.
50.	56.	46.	117.	272.	158.	20.	27.	16.	21.	38.	57.	76.	1066.
5.	203.	181.	263.	471.	363.	97.	95.	87.	89.	115.	329.	264.	1602.
PM	74.	63.	129.	284.	176.	31.	35.	27.	30.	46.	97.	98.	1091.
TEMC	27.	28.	27.	26.	25.	24.	23.	23.	24.	25.	26.	27.	26.
ETP	151.	151.	140.	99.	113.	112.	119.	123.	122.	141.	167.	160.	1605.
MAI	0.18	0.14	0.55	2.13	0.91	0.07	0.11	0.05	0.07	0.14	0.11	0.22	0.55

STATION KISAUNI LAT 6 12 S LONG 39 12 E ELEV 18.0 M 68 YEARS

PROB	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
95.	2.	2.	44.	104.	67.	2.	1.	6.	12.	13.	58.	26.	963.
75.	16.	14.	80.	205.	146.	14.	8.	17.	26.	38.	115.	69.	1235.
50.	44.	40.	136.	307.	230.	36.	25.	31.	41.	69.	171.	119.	1452.
5.	215.	206.	311.	686.	557.	169.	142.	92.	100.	210.	380.	330.	2084.
PM	68.	64.	152.	340.	261.	54.	42.	37.	47.	85.	189.	141.	1479.
TEMC	28.	28.	28.	27.	26.	25.	25.	25.	25.	25.	27.	28.	27.
ETP	134.	144.	137.	113.	126.	123.	119.	134.	137.	152.	129.	144.	1592.
MAI	0.12	0.10	0.66	1.82	1.16	0.11	0.07	0.13	0.19	0.25	0.89	0.48	0.78

STATION SONGEA LAT 10 42 S LONG 35 36 E ELEV 1067.0 M 27 YEARS

PROB	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
95.	113.	104.	136.	36.	0.	0.	0.	0.	0.	0.	0.	31.	805.
75.	176.	168.	195.	69.	1.	0.	0.	0.	0.	0.	4.	89.	993.
50.	231.	225.	244.	102.	5.	0.	0.	0.	0.	1.	22.	162.	1124.
5.	411.	417.	399.	221.	58.	4.	17.	2.	12.	24.	231.	482.	1443.
PM	242.	238.	253.	112.	14.	1.	3.	0.	2.	5.	57.	197.	1124.
TEMC	23.	23.	22.	21.	20.	17.	17.	19.	20.	23.	24.	23.	21.
ETP	106.	100.	99.	92.	88.	73.	80.	85.	98.	113.	114.	110.	1157.
MAI	1.66	1.69	1.97	0.75	0.01	0.00	0.00	0.00	0.00	0.00	0.03	0.82	0.86

STATION TABORA LAT 5 6 S LONG 32 54 E ELEV 1190.0 M 47 YEARS

PROB	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
95.	61.	58.	60.	36.	0.	0.	0.	0.	0.	0.	18.	89.	661.
75.	98.	93.	110.	77.	2.	0.	0.	0.	0.	1.	49.	137.	818.
50.	132.	125.	159.	119.	12.	0.	0.	0.	1.	8.	87.	178.	926.
5.	246.	229.	335.	280.	127.	10.	3.	3.	21.	71.	251.	314.	1191.
PM	140.	132.	173.	134.	31.	2.	1.	1.	4.	18.	104.	187.	926.
TEMC	22.	23.	22.	22.	22.	22.	21.	23.	24.	25.	24.	23.	23.
ETP	141.	141.	146.	134.	142.	136.	130.	153.	153.	162.	146.	136.	1720.
MAI	0.70	0.66	0.75	0.58	0.01	0.00	0.00	0.00	0.00	0.01	0.34	1.00	0.48

TANZANIA

STATION AMANI LAT 5.06S LONG 38.38E ELEV 911. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	80.	77.	171.	347.	322.	111.	100.	99.	105.	161.	163.	168.	1904.
TEM	23.	23.	23.	22.	20.	19.	18.	18.	19.	20.	21.	22.	21.
RS	381.	457.	390.	339.	359.	370.	340.	382.	412.	433.	388.	410.	388.
PO	44.	42.	106.	226.	209.	65.	58.	57.	61.	100.	101.	104.	1599.
ETP	111.	125.	114.	93.	98.	94.	87.	98.	104.	117.	106.	118.	1265.
MAI	0.40	0.34	0.93	2.43	2.13	0.69	0.66	0.59	0.59	0.85	0.95	0.89	1.26

STATION ARUSHA LAT 3.23S 36.41E ELEV 1373. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	81.	70.	76.	238.	81.	9.	10.	7.	3.	16.	113.	105.	809.
TEM	20.	21.	21.	20.	19.	18.	16.	17.	18.	20.	20.	20.	19.
RS	489.	520.	507.	480.	498.	501.	465.	528.	522.	522.	497.	470.	500.
PO	45.	38.	42.	152.	45.	0.	0.	0.	0.	1.	67.	61.	680.
ETP	133.	134.	140.	126.	129.	123.	113.	131.	130.	139.	130.	127.	1556.
MAI	0.34	0.28	0.30	1.21	0.35	0.00	0.00	0.00	0.00	0.01	0.51	0.48	0.44

STATION BAGAMOYO LAT 6.25S LONG 38.55E ELEV 9. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	82.	68.	103.	238.	191.	37.	31.	34.	25.	47.	86.	109.	1051.
TEM	28.	28.	28.	27.	27.	25.	24.	24.	25.	26.	27.	28.	26.
RS	464.	494.	433.	322.	367.	386.	402.	415.	421.	457.	543.	518.	435.
PO	46.	36.	50.	152.	120.	15.	11.	13.	7.	22.	49.	64.	883.
ETP	154.	154.	143.	101.	117.	116.	122.	125.	124.	143.	170.	171.	1640.
MAI	0.30	0.24	0.42	1.50	1.02	0.13	0.09	0.10	0.06	0.15	0.29	0.37	0.54

STATION BANAGI LAT 2.20S LONG 34.55E ELEV 1293. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	81.	76.	116.	119.	63.	31.	23.	42.	37.	33.	75.	88.	784.
TEM	23.	23.	23.	23.	22.	21.	21.	23.	24.	25.	25.	23.	23.
RS	489.	520.	507.	460.	498.	501.	465.	528.	522.	522.	497.	470.	500.
PO	45.	42.	69.	71.	33.	11.	6.	18.	15.	12.	41.	50.	659.
ETP	141.	142.	147.	134.	142.	136.	130.	153.	153.	162.	147.	137.	1725.
MAI	0.32	0.29	0.47	0.53	0.23	0.08	0.04	0.12	0.10	0.08	0.28	0.36	0.38

STATION BIHARAMULO LAT 2.38S LONG 31.19E ELEV 1479. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	93.	105.	149.	196.	85.	10.	4.	21.	33.	65.	97.	114.	972.
TEM	21.	20.	19.	20.	20.	20.	20.	19.	21.	21.	20.	20.	20.
RS	489.	520.	507.	480.	498.	501.	465.	528.	522.	522.	497.	470.	500.
PO	53.	61.	91.	123.	48.	0.	0.	4.	12.	34.	56.	68.	817.
ETP	134.	132.	133.	127.	136.	133.	125.	139.	142.	143.	130.	128.	1601.
MAI	0.40	0.47	0.69	0.97	0.35	0.00	0.00	0.03	0.09	0.24	0.43	0.53	0.51

TANZANIA

STATION BUKOBA LAT 1.20S LONG 31.49E ELEV 1137. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	149.	157.	246.	363.	316.	85.	51.	81.	108.	134.	161.	189.	2040.
TEM	21.	21.	21.	21.	21.	21.	21.	21.	21.	21.	21.	21.	21.
RS	556.	579.	530.	441.	400.	343.	315.	348.	446.	494.	459.	508.	452.
PO	91.	97.	157.	237.	205.	48.	25.	45.	63.	81.	100.	119.	1714.
ETP	156.	152.	149.	120.	112.	92.	86.	95.	120.	138.	124.	142.	1487.
MAI	0.59	0.63	1.06	1.98	1.83	0.52	0.29	0.47	0.53	0.59	0.80	0.83	1.15

STATION CHALA LAT 7.35S LONG 31.16E ELEV 1769. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	195.	212.	167.	89.	27.	1.	0.	3.	5.	13.	112.	189.	1013.
TEM	29.	29.	27.	28.	27.	26.	25.	26.	26.	27.	29.	29.	27.
RS	464.	494.	433.	322.	367.	386.	402.	415.	421.	457.	543.	518.	435.
PO	123.	134.	103.	50.	8.	0.	0.	0.	0.	0.	66.	119.	851.
ETP	155.	155.	141.	102.	118.	118.	123.	129.	129.	149.	176.	174.	1668.
MAI	0.79	0.87	0.73	0.49	0.07	0.00	0.00	0.00	0.00	0.00	0.38	0.68	0.51

STATION CHUNYA LAT 8.32S LONG 33.25E ELEV 1405. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	212.	153.	163.	54.	6.	0.	1.	1.	1.	7.	48.	165.	812.
TEM	21.	21.	21.	21.	20.	19.	19.	20.	21.	23.	24.	22.	21.
RS	303.	319.	293.	278.	252.	221.	230.	244.	296.	323.	343.	314.	284.
PO	134.	94.	101.	27.	0.	0.	0.	0.	0.	0.	23.	102.	682.
ETP	85.	83.	79.	75.	69.	56.	60.	66.	80.	94.	98.	91.	936.
MAI	1.59	1.13	1.27	0.36	0.00	0.00	0.00	0.00	0.00	0.00	0.23	1.13	0.73

STATION CHWAKA LAT 6.15S LONG 39.13E ELEV 19. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	58.	64.	144.	312.	285.	52.	27.	31.	40.	67.	166.	135.	1381.
TEM	28.	29.	29.	28.	26.	25.	25.	25.	26.	26.	28.	28.	27.
RS	381.	457.	390.	339.	359.	370.	340.	382.	412.	433.	388.	410.	388.
PO	29.	34.	88.	202.	184.	25.	8.	11.	17.	36.	103.	82.	1160.
ETP	127.	144.	131.	107.	114.	112.	105.	118.	124.	138.	123.	135.	1476.
MAI	0.23	0.23	0.67	1.89	1.61	0.23	0.08	0.09	0.14	0.25	0.84	0.61	0.79

STATION DAR ES SALAAM LAT 6.50S LONG 39.18E ELEV 14. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	49.	75.	114.	289.	216.	25.	27.	24.	37.	63.	73.	83.	1075.
TEM	28.	28.	27.	27.	26.	25.	24.	24.	24.	25.	26.	27.	26.
RS	464.	494.	433.	322.	367.	386.	402.	415.	421.	457.	543.	518.	435.
PO	23.	41.	68.	187.	137.	7.	8.	6.	15.	33.	40.	46.	903.
ETP	152.	152.	141.	100.	115.	113.	120.	124.	122.	140.	166.	168.	1613.
MAI	0.15	0.27	0.48	1.87	1.19	0.06	0.07	0.05	0.12	0.23	0.24	0.28	0.56

TANZANIA

STATION DODOMA LAT 6.10S LONG 35.46E ELEV 1120. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	151.	115.	123.	51.	5.	1.	0.	0.	1.	5.	20.	106.	578.
TEM	24.	24.	24.	23.	22.	21.	20.	21.	22.	24.	25.	25.	23.
RS	464.	494.	433.	322.	367.	386.	402.	415.	421.	457.	543.	518.	435.
PD	93.	68.	74.	25.	0.	0.	0.	0.	0.	0.	4.	62.	486.
ETP	138.	138.	128.	91.	105.	102.	108.	114.	117.	135.	161.	158.	1495.
MAI	0.67	0.50	0.57	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.39	0.32

STATION FARKWA LAT 5.24S LONG 35.36E ELEV 1220. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	144.	77.	91.	112.	26.	6.	0.	0.	0.	37.	33.	95.	622.
TEM	23.	23.	24.	23.	23.	22.	22.	23.	25.	26.	25.	24.	24.
RS	489.	520.	507.	480.	498.	501.	465.	528.	522.	522.	497.	470.	500.
PD	88.	42.	52.	66.	8.	0.	0.	0.	0.	15.	12.	55.	523.
ETP	142.	141.	151.	137.	146.	139.	133.	156.	156.	166.	149.	140.	1755.
MAI	0.62	0.30	0.34	0.48	0.05	0.00	0.0	0.00	0.00	0.09	0.08	0.39	0.30

STATION GEITA LAT 2.52S LONG 32.10E ELEV 1293. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	71.	97.	135.	166.	80.	13.	2.	18.	45.	77.	130.	136.	972.
TEM	23.	23.	23.	23.	22.	21.	21.	23.	24.	26.	25.	23.	23.
RS	489.	520.	507.	480.	498.	501.	465.	528.	522.	522.	497.	470.	500.
PD	38.	56.	82.	104.	44.	0.	0.	2.	21.	42.	78.	82.	816.
ETP	141.	142.	147.	134.	142.	136.	130.	153.	153.	162.	147.	137.	1725.
MAI	0.27	0.40	0.55	0.78	0.31	0.00	0.00	0.01	0.13	0.26	0.53	0.60	0.47

STATION GUA LAT 7.49S LONG 32.26E ELEV 1165. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	191.	147.	199.	132.	20.	0.	0.	0.	1.	22.	69.	191.	992.
TEM	22.	23.	22.	21.	20.	18.	17.	19.	21.	22.	24.	23.	21.
RS	464.	494.	433.	322.	367.	386.	402.	415.	421.	457.	543.	518.	435.
PD	120.	90.	125.	80.	4.	0.	0.	0.	0.	5.	50.	120.	833.
ETP	134.	136.	124.	87.	98.	95.	101.	108.	112.	132.	156.	151.	1432.
MAI	0.90	0.66	1.01	0.92	0.04	0.00	0.00	0.00	0.00	0.04	0.32	0.80	0.58

STATION GULA LAT 3.29S LONG 34.00E ELEV 1220. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	102.	93.	116.	86.	44.	1.	0.	0.	8.	14.	46.	115.	625.
TEM	23.	23.	24.	23.	23.	22.	22.	23.	25.	26.	25.	24.	24.
RS	489.	520.	507.	480.	498.	501.	465.	528.	522.	522.	497.	470.	500.
PD	65.	57.	77.	51.	14.	0.	0.	0.	0.	0.	15.	76.	535.
ETP	142.	141.	151.	137.	146.	139.	133.	156.	156.	166.	149.	140.	1755.
MAI	0.46	0.40	0.51	0.37	0.09	0.00	0.00	0.00	0.00	0.00	0.10	0.55	0.30

TANZANIA

STATION MANDENI LAT 5.26S LONG 38.02E ELEV 677. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	88.	87.	135.	158.	118.	26.	16.	21.	29.	52.	58.	86.	874.
TEM	25.	25.	25.	24.	23.	22.	21.	22.	23.	25.	24.	24.	24.
RS	381.	457.	390.	339.	359.	370.	340.	382.	412.	433.	388.	410.	388.
PD	52.	52.	94.	114.	79.	0.	0.	0.	0.	21.	26.	51.	764.
ETP	117.	131.	119.	98.	105.	101.	95.	109.	116.	132.	113.	124.	1350.
MAI	0.45	0.39	0.79	1.16	0.75	0.00	0.00	0.00	0.00	0.16	0.23	0.41	0.56

STATION IFAKARA LAT 8.09S LONG 36.39E ELEV 275. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	185.	159.	281.	338.	115.	18.	9.	5.	7.	15.	51.	122.	1305.
TEM	26.	26.	26.	25.	24.	22.	21.	22.	24.	26.	27.	27.	25.
RS	303.	319.	283.	278.	252.	221.	230.	244.	296.	323.	343.	314.	294.
PD	138.	115.	222.	273.	76.	0.	0.	0.	0.	0.	20.	82.	1161.
ETP	96.	94.	89.	83.	75.	61.	65.	70.	86.	101.	107.	101.	1027.
MAI	1.44	1.22	2.51	3.29	1.01	0.00	0.00	0.00	0.00	0.00	0.19	0.82	1.13

STATION IFINGA LAT 9.30S LONG 35.29E ELEV 793. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	298.	258.	331.	362.	81.	7.	5.	5.	13.	29.	113.	220.	1713.
TEM	25.	26.	25.	24.	23.	21.	21.	21.	22.	24.	25.	25.	23.
RS	303.	319.	283.	278.	252.	221.	230.	244.	296.	323.	343.	314.	234.
PD	186.	165.	215.	236.	45.	0.	0.	0.	0.	10.	67.	140.	1439.
ETP	94.	93.	88.	81.	73.	60.	63.	68.	82.	96.	101.	96.	996.
MAI	1.98	1.78	2.44	2.91	0.62	0.00	0.00	0.00	0.00	0.10	0.66	1.45	1.44

STATION IGABIRO LAT 1.48S LONG 31.33E ELEV 1525. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	94.	107.	161.	196.	116.	20.	10.	25.	60.	90.	108.	120.	1107.
TEM	21.	21.	21.	21.	19.	19.	18.	19.	20.	21.	22.	24.	21.
RS	556.	579.	530.	441.	400.	343.	315.	348.	446.	494.	459.	508.	452.
PD	54.	63.	100.	123.	69.	4.	0.	7.	31.	51.	63.	72.	930.
ETP	156.	151.	148.	119.	106.	87.	81.	90.	117.	138.	128.	153.	1473.
MAI	0.35	0.42	0.67	1.04	0.65	0.04	0.00	0.08	0.26	0.37	0.50	0.47	0.63

STATION IKIZU LAT 1.56S LONG 34.03E ELEV 1525. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	79.	92.	134.	150.	90.	37.	10.	33.	52.	67.	136.	125.	1005.
TEM	21.	21.	21.	21.	19.	19.	18.	19.	20.	21.	22.	24.	21.
RS	556.	579.	530.	441.	400.	343.	315.	348.	446.	494.	459.	508.	452.
PD	44.	53.	81.	92.	51.	15.	0.	12.	25.	36.	82.	75.	844.
ETP	156.	151.	148.	119.	106.	87.	81.	90.	117.	138.	128.	153.	1473.
MAI	0.28	0.35	0.55	0.78	0.48	0.18	0.00	0.14	0.22	0.26	0.64	0.49	0.57

TANZANIA

STATION KAREMA LAT 6.48S LONG 30.26E ELEV 824. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	187.	154.	145.	138.	18.	0.	0.	0.	5.	22.	131.	168.	969.
TEM	25.	26.	26.	24.	23.	21.	21.	21.	22.	24.	25.	25.	23.
RS	464.	494.	433.	322.	367.	386.	402.	415.	421.	457.	543.	518.	435.
PO	117.	95.	88.	84.	2.	0.	0.	0.	0.	5.	79.	104.	814.
ETP	144.	144.	135.	94.	106.	105.	111.	116.	117.	136.	161.	158.	1526.
MAI	0.82	0.66	0.66	0.89	0.02	0.00	0.00	0.00	0.00	0.04	0.49	0.66	0.53

STATION KIBAYA LAT 5.17S LONG 35.34E ELEV 1458. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	90.	72.	120.	91.	46.	3.	1.	1.	2.	12.	39.	92.	568.
TEM	21.	20.	19.	20.	20.	20.	20.	19.	21.	21.	20.	20.	20.
RS	489.	520.	507.	480.	498.	501.	465.	528.	522.	522.	497.	470.	500.
PO	51.	39.	72.	52.	21.	0.	0.	0.	0.	0.	17.	53.	477.
ETP	134.	132.	133.	127.	136.	133.	125.	139.	142.	143.	130.	128.	1601.
MAI	0.38	0.30	0.54	0.41	0.16	0.00	0.00	0.00	0.00	0.00	0.13	0.41	0.30

STATION KIBITI LAT 7.42S LONG 33.55E ELEV 153. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	107.	112.	189.	256.	94.	19.	11.	10.	24.	29.	74.	112.	1037.
TEM	27.	27.	27.	26.	25.	24.	23.	23.	24.	25.	26.	27.	25.
RS	464.	494.	433.	322.	367.	386.	402.	415.	421.	457.	543.	518.	435.
PO	63.	66.	119.	164.	54.	3.	0.	0.	6.	10.	40.	66.	871.
ETP	150.	150.	141.	98.	112.	111.	117.	122.	121.	139.	164.	166.	1591.
MAI	0.42	0.44	0.84	1.67	0.48	0.03	0.00	0.00	0.05	0.07	0.24	0.40	0.55

STATION KIBONDO LAT 3.35S LONG 30.42E ELEV 1519. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	129.	139.	174.	191.	76.	6.	2.	8.	26.	69.	140.	163.	1123.
TEM	21.	21.	21.	21.	19.	19.	18.	19.	20.	21.	22.	24.	21.
RS	489.	520.	507.	480.	498.	501.	465.	528.	522.	522.	497.	470.	500.
PO	73.	84.	108.	120.	42.	0.	0.	0.	8.	37.	85.	101.	943.
ETP	137.	136.	142.	129.	132.	127.	119.	137.	137.	146.	139.	142.	1621.
MAI	0.57	0.62	0.76	0.93	0.32	0.00	0.00	0.00	0.06	0.25	0.61	0.71	0.58

STATION KIBWELE LAT 8.35S LONG 35.20E ELEV 1861. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	204.	197.	227.	374.	183.	29.	17.	12.	9.	9.	64.	159.	1484.
TEM	18.	18.	18.	17.	16.	14.	13.	14.	16.	17.	19.	18.	16.
RS	303.	319.	283.	278.	252.	221.	230.	244.	296.	323.	343.	324.	284.
PO	129.	124.	144.	244.	114.	10.	2.	0.	0.	0.	34.	98.	1246.
ETP	77.	76.	72.	67.	60.	48.	51.	55.	68.	80.	86.	81.	821.
MAI	1.67	1.64	2.01	3.65	1.31	0.20	0.03	0.00	0.00	0.00	0.39	1.21	1.52

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STATION KIDETE LAT 6.39S LONG 36.43E ELEV 677. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	85.	83.	94.	73.	18.	3.	1.	1.	0.	6.	25.	60.	449.
TEM	25.	25.	25.	24.	23.	22.	21.	22.	23.	25.	24.	24.	24.
RS	464.	494.	433.	322.	367.	386.	402.	415.	421.	457.	543.	518.	435.
PO	48.	46.	54.	40.	2.	0.	0.	0.	0.	0.	7.	31.	377.
ETP	142.	142.	132.	93.	107.	105.	112.	119.	119.	139.	159.	157.	1526.
MAI	0.34	0.33	0.41	0.42	0.02	0.00	0.00	0.00	0.00	0.00	0.04	0.20	0.25

STATION KIGOMA LAT 4.53S LONG 29.38E ELEV 885. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	134.	118.	155.	151.	51.	6.	2.	3.	15.	61.	130.	151.	977.
TEM	23.	24.	24.	24.	24.	23.	23.	24.	25.	25.	23.	23.	24.
RS	489.	520.	507.	480.	498.	501.	465.	528.	522.	522.	497.	470.	500.
PO	81.	70.	95.	93.	25.	0.	0.	0.	0.	31.	78.	93.	821.
ETP	144.	144.	150.	138.	148.	142.	135.	157.	154.	159.	142.	137.	1751.
MAI	0.56	0.49	0.63	0.67	0.17	0.00	0.00	0.00	0.00	0.20	0.55	0.68	0.47

STATION KIGONSERA LAT 10.49S LONG 35.04E ELEV 1220. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	237.	218.	274.	116.	14.	1.	0.	1.	2.	16.	53.	171.	1103.
TEM	22.	23.	22.	21.	20.	18.	17.	19.	21.	22.	24.	23.	21.
RS	303.	319.	283.	278.	252.	221.	230.	244.	296.	323.	343.	314.	284.
PO	151.	138.	176.	69.	0.	0.	0.	0.	0.	1.	26.	106.	927.
ETP	87.	88.	81.	75.	67.	54.	58.	63.	78.	93.	98.	91.	935.
MAI	1.73	1.57	2.18	0.92	0.00	0.00	0.00	0.00	0.00	0.01	0.27	1.16	0.99

STATION KIKALE LAT 7.50S LONG 39.13E ELEV 3. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	112.	115.	141.	304.	152.	18.	24.	21.	15.	45.	92.	118.	1157.
TEM	28.	28.	28.	27.	26.	25.	25.	25.	26.	26.	27.	28.	26.
RS	464.	494.	433.	322.	367.	386.	402.	415.	421.	457.	543.	518.	435.
PO	66.	68.	86.	197.	93.	2.	6.	4.	0.	21.	53.	70.	972.
ETP	153.	152.	143.	100.	115.	116.	122.	127.	127.	146.	169.	170.	1639.
MAI	0.43	0.45	0.60	1.97	0.80	0.02	0.05	0.03	0.00	0.14	0.31	0.41	0.59

STATION KIKWETU LAT 9.51S LONG 39.44E ELEV 61. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	164.	126.	166.	144.	34.	7.	4.	5.	11.	18.	48.	134.	862.
TEM	27.	27.	27.	27.	26.	25.	24.	25.	25.	26.	27.	28.	26.
RS	303.	319.	283.	278.	252.	221.	230.	244.	296.	323.	343.	314.	284.
PO	102.	76.	103.	88.	13.	0.	0.	0.	0.	2.	23.	81.	724.
ETP	98.	97.	92.	87.	79.	65.	69.	74.	88.	101.	107.	102.	1060.
MAI	1.03	0.78	1.12	1.02	0.17	0.00	0.00	0.00	0.00	0.02	0.21	0.79	0.68

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STATION KILINDONI LAT 7.55S LONG 39.40E ELEV 21. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	155.	125.	241.	578.	291.	79.	53.	27.	16.	40.	134.	179.	1918.
TEM	28.	28.	28.	27.	26.	25.	24.	25.	25.	26.	27.	27.	26.
RS	464.	494.	433.	322.	367.	386.	402.	415.	421.	457.	543.	518.	435.
PO	95.	75.	154.	383.	188.	44.	26.	8.	1.	17.	81.	112.	1611.
ETP	152.	151.	142.	99.	115.	115.	121.	126.	126.	144.	168.	169.	1628.
MAI	0.63	0.50	1.09	3.85	1.63	0.38	0.21	0.07	0.01	0.12	0.48	0.66	0.99

STATION KILOSA LAT 6.50S LONG 37.00E ELEV 491. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	123.	124.	176.	209.	78.	13.	6.	13.	15.	32.	90.	132.	1011.
TEM	26.	26.	26.	25.	23.	22.	22.	23.	24.	26.	27.	27.	25.
RS	464.	494.	433.	322.	367.	386.	402.	415.	421.	457.	543.	518.	435.
PO	74.	74.	110.	132.	43.	0.	0.	0.	0.	12.	51.	80.	849.
ETP	146.	144.	135.	95.	108.	107.	114.	121.	123.	142.	168.	167.	1570.
MAI	0.50	0.52	0.81	1.39	0.40	0.00	0.00	0.00	0.00	0.08	0.30	0.48	0.54

STATION KILWA LAT 8.56S LONG 39.31E ELEV 12. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	106.	139.	132.	253.	59.	10.	7.	12.	13.	23.	65.	144.	979.
TEM	28.	28.	28.	27.	27.	26.	25.	26.	26.	27.	28.	28.	27.
RS	303.	319.	283.	273.	252.	221.	230.	244.	296.	323.	343.	314.	284.
PO	62.	84.	80.	169.	30.	0.	0.	0.	3.	6.	34.	88.	822.
ETP	99.	99.	93.	87.	81.	67.	71.	76.	90.	104.	110.	104.	1082.
MAI	0.62	0.86	0.86	1.93	0.37	0.00	0.00	0.00	0.03	0.05	0.31	0.84	0.76

STATION KILWA KIVINJE LAT 8.45S LONG 39.25E ELEV 9. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	123.	103.	176.	209.	71.	12.	8.	11.	15.	18.	51.	109.	907.
TEM	28.	28.	28.	27.	27.	26.	25.	26.	26.	27.	28.	28.	27.
RS	303.	319.	283.	278.	252.	221.	230.	244.	296.	323.	343.	314.	284.
PO	74.	60.	110.	132.	38.	0.	0.	0.	1.	2.	25.	64.	762.
ETP	99.	99.	93.	87.	81.	67.	71.	76.	90.	104.	110.	104.	1082.
MAI	0.74	0.61	1.18	1.52	0.47	0.00	0.00	0.00	0.01	0.02	0.22	0.61	0.70

STATION KIMANDE LAT 7.22S LONG 35.31E ELEV 885. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	84.	72.	69.	38.	4.	0.	0.	0.	1.	9.	15.	73.	365.
TEM	23.	23.	23.	22.	20.	19.	18.	18.	19.	20.	21.	22.	21.
RS	381.	457.	390.	339.	359.	370.	340.	382.	412.	433.	388.	410.	388.
PO	47.	39.	37.	16.	0.	0.	0.	0.	0.	0.	0.	40.	307.
ETP	111.	125.	114.	93.	98.	94.	87.	98.	104.	117.	106.	118.	1265.
MAI	0.43	0.31	0.32	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.34	0.24

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STATION KINAMPANDA LAT 4.22S LONG 34.31E ELEV 1525. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	122.	115.	129.	93.	26.	5.	0.	0.	3.	17.	56.	111.	677.
TEM	21.	21.	21.	21.	19.	19.	18.	19.	20.	21.	22.	24.	21.
RS	489.	520.	507.	480.	498.	501.	465.	528.	522.	522.	497.	470.	500.
PD	73.	68.	78.	53.	8.	0.	0.	0.	0.	2.	28.	65.	569.
ETP	137.	136.	142.	129.	132.	127.	119.	137.	137.	146.	139.	142.	1621.
MAI	0.53	0.50	0.55	0.41	0.06	0.00	0.00	0.00	0.00	0.01	0.20	0.46	0.35

STATION KIRANDO LAT 7.25S LONG 30.36E ELEV 824. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	120.	122.	141.	77.	16.	0.	0.	0.	1.	20.	128.	217.	842.
TEM	25.	26.	26.	24.	23.	21.	21.	21.	22.	24.	25.	25.	23.
RS	489.	520.	507.	480.	498.	501.	465.	528.	522.	522.	497.	470.	500.
PD	72.	73.	86.	42.	1.	0.	0.	0.	0.	4.	77.	138.	707.
ETP	151.	151.	158.	140.	144.	136.	128.	147.	145.	156.	147.	144.	1747.
MAI	0.47	0.48	0.54	0.30	0.01	0.00	0.00	0.00	0.00	0.02	0.52	0.96	0.40

STATION KISAUNI AIRFIELD LAT 6.13S LONG 39.13E ELEV 18. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	87.	86.	127.	403.	249.	54.	48.	37.	33.	105.	187.	145.	1561.
TEM	27.	27.	28.	27.	26.	25.	25.	24.	25.	25.	26.	27.	26.
RS	381.	457.	390.	339.	359.	370.	340.	382.	412.	433.	388.	410.	388.
PD	49.	49.	76.	254.	159.	27.	23.	15.	12.	61.	117.	89.	1312.
ETP	124.	139.	127.	106.	113.	111.	103.	115.	121.	134.	118.	132.	1443.
MAI	0.40	0.35	0.60	2.50	1.40	0.24	0.22	0.13	0.10	0.46	0.99	0.67	0.91

STATION KITANGARI LAT 10.40S LONG 39.21E ELEV 397. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	135.	220.	215.	144.	26.	2.	3.	5.	10.	14.	44.	128.	948.
TEM	26.	26.	26.	25.	23.	22.	22.	23.	24.	26.	27.	27.	25.
RS	303.	319.	283.	278.	252.	221.	230.	244.	296.	323.	343.	314.	284.
PD	62.	140.	136.	88.	8.	0.	0.	0.	0.	0.	20.	77.	796.
ETP	95.	93.	88.	82.	74.	61.	65.	71.	86.	101.	106.	101.	1024.
MAI	0.85	1.51	1.55	1.07	0.10	0.00	0.00	0.00	0.00	0.00	0.19	0.76	0.78

STATION KITUNDA LAT 6.48S LONG 33.13E ELEV 1373. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	158.	135.	163.	107.	11.	0.	0.	1.	1.	10.	71.	178.	835.
TEM	23.	23.	22.	22.	20.	19.	18.	19.	21.	22.	23.	23.	21.
RS	489.	520.	507.	480.	498.	501.	465.	528.	522.	522.	497.	470.	500.
PD	97.	82.	101.	63.	0.	0.	0.	0.	0.	0.	38.	111.	701.
ETP	142.	141.	145.	131.	136.	128.	120.	139.	140.	149.	142.	138.	1650.
MAI	0.69	0.58	0.70	0.48	0.00	0.00	0.00	0.00	0.00	0.00	0.27	0.80	0.43

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STATION KONDOA LAT 4.55S LONG 35.47E ELEV 1387. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	126.	108.	132.	95.	36.	3.	0.	0.	1.	7.	28.	98.	634.
TEM	23.	23.	22.	22.	20.	19.	18.	19.	21.	22.	23.	23.	21.
RS	489.	520.	507.	480.	498.	501.	465.	528.	522.	522.	497.	470.	500.
PO	75.	63.	80.	55.	14.	0.	0.	0.	0.	0.	9.	56.	532.
ETP	142.	141.	145.	131.	136.	128.	120.	139.	140.	149.	142.	138.	1650.
MAI	0.53	0.45	0.55	0.42	0.10	0.00	0.00	0.00	0.00	0.00	0.06	0.41	0.32

STATION KONGWA LAT 6.12S LONG 36.25E ELEV 1021. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	131.	112.	93.	62.	6.	0.	1.	1.	1.	1.	18.	118.	544.
TEM	23.	23.	23.	22.	21.	20.	19.	20.	21.	23.	25.	24.	22.
RS	361.	457.	390.	339.	359.	370.	340.	382.	412.	433.	388.	410.	388.
PO	79.	66.	53.	32.	0.	0.	0.	0.	0.	0.	2.	70.	457.
ETP	113.	125.	115.	94.	100.	96.	90.	103.	112.	127.	114.	124.	1313.
MAI	0.70	0.53	0.46	0.34	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.57	0.35

STATION KYELA LAT 9.35S LONG 33.51E ELEV 549. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	196.	159.	451.	931.	544.	180.	33.	33.	8.	10.	91.	189.	2880.
TEM	26.	25.	26.	25.	24.	22.	21.	22.	23.	25.	26.	26.	24.
RS	303.	319.	283.	278.	252.	221.	230.	244.	296.	323.	343.	314.	284.
PO	123.	98.	297.	623.	360.	112.	50.	12.	0.	0.	52.	119.	2419.
ETP	96.	95.	89.	83.	75.	60.	64.	70.	84.	98.	104.	100.	1018.
MAI	1.28	1.04	3.32	7.53	4.82	1.86	0.78	0.18	0.00	0.00	0.50	1.18	2.38

STATION KYERWA LAT 1.23S LONG 30.48E ELEV 1403. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	64.	62.	91.	143.	91.	15.	6.	18.	74.	107.	106.	83.	860.
TEM	20.	21.	21.	20.	19.	18.	16.	17.	18.	20.	20.	20.	19.
RS	556.	579.	530.	441.	400.	343.	315.	348.	446.	494.	459.	508.	452.
PO	34.	32.	52.	87.	52.	0.	0.	2.	40.	63.	62.	46.	722.
ETP	151.	149.	146.	115.	104.	84.	76.	87.	111.	132.	120.	138.	1414.
MAI	0.22	0.22	0.35	0.76	0.50	0.00	0.00	0.03	0.36	0.48	0.52	0.34	0.51

STATION LIMBANI LAT 5.04S LONG 39.44E ELEV 31. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	42.	48.	152.	491.	548.	100.	88.	56.	45.	117.	219.	139.	2046.
TEM	29.	28.	28.	27.	26.	25.	24.	24.	25.	26.	27.	28.	26.
RS	331.	457.	390.	339.	359.	370.	340.	382.	412.	433.	338.	410.	388.
PO	19.	23.	94.	324.	362.	58.	50.	28.	21.	69.	139.	85.	1719.
ETP	125.	141.	130.	106.	113.	110.	102.	115.	121.	135.	120.	134.	1454.
MAI	0.15	0.16	0.72	3.05	3.21	0.53	0.49	0.24	0.17	0.51	1.16	0.63	1.18

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STATION LINDI LAT 10.00S LONG 39.42E ELEV 41. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	143.	137.	175.	180.	35.	10.	9.	6.	13.	17.	54.	147.	926.
TEM	27.	27.	27.	27.	26.	25.	24.	25.	25.	26.	27.	28.	26.
RS	303.	319.	283.	278.	252.	221.	230.	244.	296.	323.	343.	314.	284.
PO	87.	83.	109.	112.	14.	0.	0.	0.	0.	2.	27.	90.	778.
ETP	98.	97.	92.	87.	79.	65.	69.	74.	88.	101.	107.	102.	1060.
MAI	0.89	0.86	1.19	1.30	0.17	0.00	0.00	0.00	0.00	0.02	0.25	0.88	0.73

STATION LIPARAMBA LAT 11.21S LONG 35.03E ELEV 1007. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	320.	297.	377.	198.	26.	5.	5.	4.	3.	18.	65.	221.	1549.
TEM	24.	23.	23.	23.	21.	21.	20.	21.	21.	22.	23.	23.	22.
RS	303.	319.	283.	278.	252.	221.	230.	244.	296.	323.	343.	314.	284.
PO	208.	192.	246.	125.	15.	0.	0.	0.	0.	2.	34.	140.	1301.
ETP	90.	88.	83.	78.	69.	59.	61.	67.	80.	92.	97.	92.	958.
MAI	2.31	2.17	2.96	1.59	0.21	0.00	0.00	0.00	0.00	0.02	0.35	1.53	1.36

STATION LITEMBO LAT 10.57S LONG 34.50E ELEV 1434. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	275.	236.	248.	109.	22.	4.	2.	1.	1.	10.	63.	212.	1183.
TEM	21.	21.	21.	21.	20.	19.	19.	20.	21.	23.	24.	22.	21.
RS	303.	319.	283.	278.	252.	221.	230.	244.	296.	323.	343.	314.	284.
PO	177.	150.	159.	64.	5.	0.	0.	0.	0.	0.	33.	134.	994.
ETP	85.	83.	79.	75.	69.	56.	60.	66.	80.	94.	98.	91.	936.
MAI	2.09	1.80	2.00	0.06	0.07	0.00	0.00	0.00	0.00	0.00	0.33	1.48	1.06

STATION LITUHI LAT 10.34S LONG 34.36E ELEV 519. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	287.	267.	259.	158.	37.	7.	4.	2.	1.	7.	44.	163.	1236.
TEM	26.	26.	25.	25.	25.	22.	22.	24.	25.	27.	28.	28.	25.
RS	303.	319.	283.	278.	252.	221.	230.	244.	296.	323.	343.	314.	284.
PO	185.	172.	166.	97.	15.	0.	0.	0.	0.	0.	20.	101.	1039.
ETP	97.	95.	87.	82	77.	61.	66.	73.	88.	103.	109.	102.	1040.
MAI	1.92	1.81	1.90	1.[illegible]	0.20	0.00	0.00	0.00	0.00	0.00	0.18	0.98	1.00

STATION LIWALE LAT 9.47S LONG LONG 37.58E ELEV 458. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	191.	151.	196.	103.	25.	3.	1.	3.	6.	9.	41.	127.	857.
TEM	26.	26.	25.	25.	25.	22.	22.	24.	25.	27.	28.	28.	25.
RS	303.	319.	283.	278.	252.	221.	230.	244.	296.	323.	343.	314.	284.
PO	120.	93.	123.	60.	7.	0.	0.	0.	0.	0.	18.	77.	720.
ETP	97.	95.	87.	82.	77.	61.	66.	73.	88.	103.	109.	102.	1040.
MAI	1.24	0.98	1.41	0.74	0.09	0.00	0.00	0.00	0.00	0.00	0.16	0.75	0.69

TANZANIA

STATION LOHOMBERO LAT 9.03S LONG 36.46E ELEV 549. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	205.	189.	247.	231.	63.	4.	2.	4.	2.	11.	45.	159.	1162.
TEM	26.	26.	26.	25.	24.	22.	21.	22.	23.	25.	26.	26.	24.
RS	303.	319.	283.	278.	252.	221.	230.	244.	296.	323.	343.	314.	284.
PO	129.	119.	158.	147.	33.	0.	0.	0.	0.	0.	21.	98.	976.
ETP	96.	95.	89.	83.	75.	60.	64.	70.	84.	98.	104.	100.	1018.
MAI	1.35	1.25	1.77	1.78	0.44	0.00	0.00	0.00	0.00	0.00	0.20	0.98	0.96

STATION LOLIONDO LAT 2.03S LONG 35.37E ELEV 2135. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	89.	101.	132.	190.	115.	21.	6.	13.	9.	26.	79.	115.	896.
TEM	17.	18.	17.	17.	15.	14.	13.	14.	16.	18.	18.	18.	16.
RS	556.	579.	530.	441.	400.	343.	315.	348.	446.	494.	459.	508.	452.
PO	50.	59.	80.	119.	68.	4.	0.	0.	0.	8.	44.	68.	753.
ETP	140.	138.	133.	105.	94.	74.	69.	79.	103.	124.	114.	129.	1302.
MAI	0.36	0.43	0.60	1.13	0.72	0.06	0.00	0.00	0.00	0.06	0.38	0.53	0.58

STATION LONGIDO LAT 2.43S LONG 36.40E ELEV 1525. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	34.	52.	110.	161.	35.	5.	0.	2.	3.	10.	58.	80.	550.
TEM	21.	21.	21.	21.	19.	19.	18.	19.	20.	21.	22.	24.	21.
RS	555.	579.	530.	441.	400.	343.	315.	348.	446.	494.	459.	508.	452.
PO	13.	26.	65.	100.	14.	0.	0.	0.	0.	0.	29.	44.	462.
ETP	156.	151.	148.	119.	106.	87.	81.	90.	117.	138.	128.	153.	1473.
MAI	0.08	0.17	0.44	0.84	0.13	0.00	0.00	0.00	0.00	0.00	0.23	0.29	0.31

STATION LUSHOTO LAT 4.47S LONG 38.17E ELEV 1397. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	81.	75.	137.	216.	179.	50.	38.	22.	16.	37.	101.	107.	1059.
TEM	19.	20.	19.	18.	17.	15.	14.	14.	15.	17.	18.	19.	17.
RS	500.	506.	489.	450.	404.	391.	395.	446.	466.	496.	517.	518.	465.
PO	45.	41.	83.	137.	112.	24.	16.	5.	1.	15.	59.	63.	890.
ETP	132.	128.	127.	111.	99.	89.	90.	102.	107.	122.	127.	135.	1368.
MAI	0.34	0.32	0.65	1.23	1.13	0.27	0.18	0.05	0.01	0.12	0.46	0.47	0.65

STATION LYAMUNGU LAT 3.14S LONG 37.15E ELEV 1250. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	43.	66.	108.	530.	474.	118.	62.	36.	33.	38.	93.	78.	1679.
TEM	21.	22.	21.	21.	19.	18.	17.	17.	18.	20.	21.	21.	20.
RS	556.	579.	530.	441.	400.	343.	315.	348.	446.	494.	459.	508.	452.
PO	19.	35.	63.	350.	312.	70.	32.	15.	12.	16.	53.	43.	1411.
ETP	156.	153.	149.	117.	105.	84.	78.	87.	112.	132.	122.	141.	1435.
MAI	0.12	0.23	0.43	3.00	2.99	0.84	0.41	0.17	0.11	0.12	0.43	0.31	0.98

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STATION MADIBIRA LAT 8.14S LONG 34.49E ELEV 1159. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	135.	111.	126.	87.	13.	1.	0.	0.	2.	7.	37.	111.	630.
TEM	22.	23.	22.	21.	20.	18.	17.	19.	21.	22.	24.	23.	21.
RS	303.	319.	283.	278.	252.	221.	230.	244.	296.	323.	343.	314.	284.
PO	82.	65.	76.	49.	0.	0.	0.	0.	0.	0.	15.	65.	529.
ETP	87.	88.	81.	75.	67.	54.	58.	63.	78.	93.	98.	91.	935.
MAI	0.94	0.74	0.93	0.65	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.72	0.57

STATION MAOUNDA LAT 9.52S LONG 34.28E ELEV 1373. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	272.	255.	260.	154.	43.	6.	0.	3.	0.	11.	95.	223.	1322.
TEM	23.	23.	22.	22.	20.	19.	18.	19.	21.	22.	23.	23.	21.
RS	303.	319.	283.	278.	252.	221.	230.	244.	296.	323.	343.	314.	284.
PO	175.	163.	167.	95.	19.	0.	0.	0.	0.	0.	55.	142.	1111.
ETP	88.	86.	81.	76.	69.	56.	59.	64.	79.	93.	98.	93.	941.
MAI	1.99	1.90	2.06	1.25	0.28	0.00	0.00	0.00	0.00	0.00	0.56	1.53	1.18

STATION MAFIA LAT 7.55S LONG 39.40E ELEV 21. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	155.	125.	241.	578.	291.	79.	53.	27.	16.	40.	134.	179.	1913.
TEM	28.	28.	28.	27.	26.	25.	25.	25.	26.	26.	27.	28.	26.
RS	464.	494.	433.	322.	367.	386.	402.	415.	421.	457.	543.	518.	435.
PO	95.	75.	154.	383.	183.	44.	26.	8.	1.	17.	81.	112.	1611.
ETP	153.	152.	143.	100.	116.	116.	122.	127.	127.	146.	169.	170.	1639.
MAI	0.62	0.49	1.08	3.84	1.62	0.38	0.21	0.07	0.01	0.12	0.48	0.66	0.98

STATION MAHANJE LAT 9.55S LONG 35.22E ELEV 1068. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	253.	218.	302.	253.	63.	5.	2.	3.	3.	9.	63.	167.	1351.
TEM	24.	24.	24.	23.	22.	21.	20.	21.	22.	24.	25.	25.	23.
RS	303.	319.	283.	278.	252.	221.	230.	244.	296.	323.	343.	314.	284.
PO	162.	133.	195.	169.	33.	0.	0.	0.	0.	0.	33.	103.	1135.
ETP	90.	89.	84.	79.	72.	59.	62.	67.	82.	96.	102.	96.	976.
MAI	1.79	1.55	2.33	2.14	0.46	0.00	0.00	0.00	0.00	0.00	0.32	1.08	1.16

STATION MAHENGE LAT 8.41S LONG 36.43E ELEV 1107. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	327.	240.	414.	343.	113.	22.	13.	14.	19.	34.	75.	238.	1851.
TEM	24.	24.	24.	23.	22.	21.	20.	21.	22.	24.	25.	25.	23.
RS	303.	319.	283.	278.	252.	221.	230.	244.	296.	323.	343.	314.	284.
PO	212.	153.	272.	223.	67.	5.	0.	0.	3.	13.	41.	152.	1555.
ETP	90.	89.	84.	79.	72.	59.	62.	67.	82.	96.	102.	96.	976.
MAI	2.35	1.72	3.24	2.83	0.93	0.08	0.00	0.00	0.03	0.14	0.40	1.59	1.59

TANZANIA

STATION MALAGRASI LAT 5.07S LONG 30.51E ELEV 1061. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	134.	136.	150.	185.	32.	1.	0.	0.	6.	14.	109.	181.	947.
TEM	23.	23.	23.	23.	23.	21.	21.	23.	25.	26.	25.	23.	23.
RS	489.	520.	507.	480.	498.	501.	465.	528.	522.	522.	497.	470.	500.
PO	81.	82.	92.	116.	12.	0.	0.	0.	0.	0.	64.	113.	795.
ETP	143.	143.	149.	136.	145.	136.	130.	155.	155.	163.	148.	138.	1741.
MAI	0.57	0.53	0.62	0.85	0.08	0.00	0.00	0.00	0.00	0.00	0.43	0.82	0.46

STATION MALANGALI LAT 8.34S LONG 34.55E ELEV 1525. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	167.	170.	195.	56.	6.	0.	0.	1.	1.	6.	49.	168.	819.
TEM	21.	21.	21.	21.	19.	19.	18.	19.	20.	21.	22.	24.	21.
RS	303.	319.	283.	278.	252.	221.	230.	244.	296.	323.	343.	314.	284.
PO	103.	106.	123.	28.	0.	0.	0.	0.	0.	0.	23.	104.	688.
ETP	85.	83.	79.	75.	67.	56.	59.	63.	77.	90.	96.	95.	925.
MAI	1.22	1.27	1.55	0.37	0.00	0.00	0.00	0.00	0.00	0.00	0.24	1.10	0.74

STATION MANDA LAT 10.28S LONG 34.35E ELEV 519. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	228.	202.	230.	118.	35.	3.	2.	1.	1.	8.	31.	122.	982.
TEM	26.	26.	25.	25.	23.	22.	22.	23.	24.	26.	27.	27.	25.
RS	303.	319.	283.	278.	252.	221.	230.	244.	296.	323.	343.	314.	284.
PO	145.	127.	146.	70.	14.	0.	0.	0.	0.	0.	11.	73.	825.
ETP	95.	93.	88.	82.	74.	61.	65.	71.	86.	101.	106.	101.	1024.
MAI	1.52	1.37	1.66	0.85	0.18	0.00	0.00	0.00	0.00	0.00	0.10	0.73	0.80

STATION MANDERA LAT 6.13S LONG 38.23E ELEV 214. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	88.	93.	134.	212.	149.	29.	22.	23.	27.	70.	94.	77.	1023.
TEM	27.	27.	27.	26.	25.	24.	23.	23.	24.	25.	26.	27.	25.
RS	381.	457.	390.	339.	359.	370.	340.	382.	412.	433.	388.	410.	388.
PO	50.	53.	81.	134.	91.	10.	5.	9.	8.	38.	54.	42.	859.
ETP	123.	139.	127.	104.	110.	107.	99.	112.	118.	132.	117.	131.	1418.
MAI	0.40	0.38	0.64	1.30	0.83	0.09	0.05	0.08	0.07	0.29	0.46	0.32	0.61

STATION MANYONI LAT 5.44S LONG 34.5[illegible] ELEV 1251. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	145.	97.	137.	79.	11.	1.	0.	0.	2.	5.	46.	119.	642.
TEM	23.	23.	23.	23.	22.	21.	21.	23.	24.	26.	25.	23.	23.
RS	489.	520.	507.	480.	498.	501.	465.	528.	522.	522.	497.	470.	500.
PO	89.	56.	83.	44.	0.	0.	0.	0.	0.	0.	21.	71.	539.
ETP	141.	142.	147.	134.	142.	136.	130.	153.	153.	162.	147.	137.	1725.
MAI	0.63	0.40	0.56	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.52	0.31

TANZANIA

STATION MASASI LAT 10.42S LONG 38.49E ELEV 458. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	186.	193.	186.	121.	21.	2.	1.	2.	5.	11.	47.	115.	990.
TEM	26.	26.	25.	25.	25.	22.	22.	24.	25.	27.	28.	28.	25.
RS	303.	319.	283.	278.	252.	221.	230.	244.	296.	323.	343.	314.	284.
PO	116.	121.	116.	72.	4.	0.	0.	0.	0.	0.	22.	68.	748.
ETP	97.	95.	87.	82.	77.	61.	66.	73.	88.	103.	109.	102.	1040.
MAI	1.21	1.28	1.33	0.88	0.06	0.00	0.00	0.00	0.00	0.00	0.20	0.67	0.72

STATION MATANGATWANI LAT 4.58S LONG 39.44E ELEV 40. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	39.	49.	170.	420.	475.	106.	93.	73.	49.	107.	203.	116.	1900.
TEM	28.	28.	28.	27.	26.	25.	24.	24.	25.	26.	27.	28.	26.
RS	500.	506.	489.	450.	404.	391.	395.	446.	466.	496.	517.	518.	465.
PO	16.	23.	106.	275.	313.	62.	54.	40.	23.	63.	128.	69.	1596.
ETP	164.	157.	163.	141.	127.	117.	119.	134.	137.	154.	160.	170.	1743.
MAI	0.10	0.15	0.65	1.96	2.47	0.53	0.45	0.30	0.17	0.41	0.80	0.41	0.92

STATION MBAMBA LAT 11.18S LONG 34.46E ELEV 488. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	274.	233.	255.	207.	59.	19.	23.	10.	3.	5.	71.	209.	1368.
TEM	26.	26.	25.	25.	25.	22.	22.	24.	25.	27.	28.	28.	25.
RS	303.	319.	283.	278.	252.	221.	230.	244.	296.	323.	343.	314.	284.
PO	176.	148.	163.	131.	30.	3.	6.	0.	0.	0.	38.	132.	1149.
ETP	97.	95.	87.	82.	77.	61.	66.	73.	88.	103.	109.	102.	1040.
MAI	1.83	1.57	1.87	1.60	0.39	0.05	0.09	0.00	0.00	0.00	0.35	1.29	1.10

STATION MBEYA LAT 8.56S LONG 33.28E ELEV 1737. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	199.	165.	161.	116.	17.	1.	1.	1.	3.	15.	52.	152.	883.
TEM	19.	19.	18.	18.	17.	15.	15.	16.	18.	20.	20.	19.	18.
RS	303.	319.	283.	278.	252.	221.	230.	244.	296.	323.	343.	314.	284.
PO	125.	102.	100.	69.	2.	0.	0.	0.	0.	0.	25.	93.	742.
ETP	79.	77.	73.	68.	62.	50.	53.	58.	73.	86.	90.	83.	852.
MAI	1.59	1.32	1.36	1.01	0.03	0.00	0.00	0.00	0.00	0.00	0.28	1.13	0.87

STATION MBOSI LAT 9.04S LONG 32.58E ELEV 1525. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	238.	213.	239.	190.	35.	3.	0.	1.	6.	42.	88.	219.	1274.
TEM	21.	21.	21.	21.	19.	19.	18.	19.	20.	21.	22.	24.	21.
RS	303.	319.	283.	278.	252.	221.	230.	244.	296.	323.	343.	314.	284.
PO	152.	135.	153.	119.	14.	0.	0.	0.	0.	18.	50.	139.	1070.
ETP	85.	83.	79.	75.	67.	56.	59.	63.	77.	90.	96.	95.	925.
MAI	1.79	1.62	1.93	1.59	0.21	0.00	0.00	0.00	0.00	0.21	0.52	1.47	1.16

TANZANIA

STATION MBULU LAT 3.52S LONG 35.33E ELEV 1739. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	104.	87.	150.	164.	65.	4.	1.	2.	4.	25.	81.	122.	810.
TEM	19.	19.	19.	20.	17.	16.	15.	16.	18.	19.	19.	19.	18.
RS	489.	520.	507.	480.	498.	501.	465.	528.	522.	522.	497.	470.	500.
PO	61.	49.	92.	102.	34.	0.	0.	0.	0.	3.	45.	73.	681.
ETP	128.	128.	135.	125.	124.	117.	108.	126.	128.	135.	127.	124.	1506.
MAI	0.47	0.38	0.68	0.82	0.28	0.00	0.00	0.00	0.00	0.06	0.35	0.59	0.45

STATION MKAJUNI LAT 5.53S LONG 39.17E ELEV 50. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	53.	35.	165.	357.	300.	71.	72.	80.	61.	53.	102.	122.	1470.
TEM	28.	28.	28.	27.	26.	25.	24.	24.	25.	26.	27.	28.	25.
RS	381.	457.	390.	339.	359.	370.	340.	382.	412.	433.	388.	410.	388.
PO	26.	14.	102.	233.	194.	38.	39.	44.	32.	26.	59.	73.	1235.
ETP	125.	141.	130.	106.	113.	110.	102.	115.	121.	135.	120.	134.	1454.
MAI	0.21	0.10	0.79	2.19	1.72	0.34	0.38	0.38	0.26	0.19	0.49	0.54	0.85

STATION MNERO LAT 10.11S LONG 38.38E ELEV 458. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	191.	182.	161.	141.	26.	1.	1.	3.	4.	13.	50.	116.	889.
TEM	26.	26.	26.	25.	23.	22.	22.	23.	24.	26.	27.	27.	25.
RS	303.	319.	283.	278.	252.	221.	230.	244.	296.	323.	343.	314.	284.
PO	120.	114.	100.	85.	8.	0.	0.	0.	0.	0.	24.	69.	747.
ETP	95.	93.	88.	82.	74.	61.	65.	71.	86.	101.	106.	101.	1024.
MAI	1.26	1.23	1.13	1.04	0.10	0.00	0.00	0.00	0.00	0.00	0.23	0.68	0.73

STATION MCHORO LAT 7.03S LONG 39.11E ELEV 9. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	118.	112.	166.	285.	116.	13.	7.	15.	14.	43.	103.	154.	1147.
TEM	28.	23.	28.	27.	26.	25.	24.	25.	25.	26.	27.	27.	26.
RS	464.	494.	433.	322.	367.	386.	402.	415.	421.	457.	543.	518.	435.
PO	70.	66.	103.	184.	69.	0.	0.	1.	0.	19.	60.	95.	964.
ETP	152.	151.	142.	99.	115.	115.	121.	126.	125.	144.	158.	169.	1623.
MAI	0.46	0.44	0.73	1.35	0.60	0.00	0.00	0.01	0.00	0.13	0.36	0.56	0.59

STATION MOROGORO LAT 6.51S LONG 37.40E ELEV 579. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	94.	104.	167.	208.	96.	27.	15.	10.	17.	27.	54.	73.	892.
TEM	26.	26.	26.	25.	24.	22.	21.	22.	23.	25.	26.	27.	24.
RS	464.	494.	433.	322.	367.	386.	402.	415.	421.	457.	543.	518.	435.
PO	54.	61.	103.	131.	55.	8.	0.	0.	2.	8.	27.	40.	749.
ETP	147.	147.	137.	96.	109.	105.	112.	119.	120.	139.	164.	166.	1560.
MAI	0.37	0.41	0.76	1.37	0.51	0.08	0.00	0.00	0.01	0.06	0.16	0.24	0.48

TANZANIA

STATION MOSHI LAT 3.21S LONG 37.20E ELEV 831. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	40.	41.	116.	293.	164.	30.	13.	13.	13.	35.	53.	48.	859.
TEM	25.	26.	26.	24.	23.	21.	21.	21.	22.	24.	25.	25.	23.
RS	556.	579.	530.	441.	400.	343.	315.	348.	446.	494.	459.	508.	452.
PD	17.	18.	69.	189.	102.	10.	0.	0.	0.	14.	26.	23.	722.
ETP	172.	169.	165.	129.	116.	93.	87.	97.	124.	147.	136.	155.	1589.
MAI	0.10	0.11	0.42	1.47	0.88	0.11	0.00	0.00	0.00	0.09	0.19	0.15	0.45

STATION MPANDA LAT 6.23S LONG 31.04E ELEV 1098. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	135.	141.	154.	127.	31.	1.	0.	1.	4.	27.	128.	195.	943.
TEM	24.	24.	24.	23.	22.	21.	20.	21.	22.	24.	25.	25.	23.
RS	489.	520.	507.	480.	498.	501.	465.	528.	522.	522.	497.	470.	500.
PD	82.	86.	95.	76.	11.	0.	0.	0.	0.	8.	77.	123.	792.
ETP	146.	145.	150.	136.	142.	133.	125.	145.	144.	155.	147.	143.	1712.
MAI	0.56	0.59	0.63	0.56	0.08	0.00	0.00	0.00	0.00	0.05	0.52	0.86	0.46

STATION MPWAPWA LAT 6.21S LONG 36.30E ELEV 1000. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	153.	129.	134.	64.	20.	1.	1.	0.	1.	6.	33.	115.	657.
TEM	24.	23.	23.	23.	21.	21.	20.	21.	21.	22.	23.	23.	22.
RS	381.	457.	390.	339.	359.	370.	340.	382.	412.	433.	388.	410.	388.
PD	94.	78.	81.	34.	4.	0.	0.	0.	0.	0.	12.	68.	552.
ETP	113.	127.	115.	95.	99.	99.	91.	105.	112.	123.	110.	120.	1308.
MAI	0.83	0.61	0.71	0.35	0.04	0.00	0.00	0.00	0.00	0.00	0.11	0.57	0.42

STATION MTWARA LAT 10.16S LONG 40.11E ELEV 113. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	218.	191.	195.	197.	51.	11.	15.	11.	65.	24.	33.	218.	1159.
TEM	27.	27.	27.	27.	26.	25.	24.	24.	25.	26.	27.	27.	25.
RS	303.	319.	283.	278.	252.	221.	230.	244.	295.	323.	343.	314.	284.
PD	138.	93.	102.	124.	25.	0.	0.	0.	34.	6.	12.	138.	973.
ETP	98.	96.	91.	87.	79.	65.	69.	74.	87.	101.	107.	102.	1056.
MAI	1.41	0.96	1.12	1.43	0.31	0.00	0.00	0.00	0.39	0.06	0.12	1.36	0.92

STATION MULERA LAT 4.26S LONG 29.57E ELEV 1418. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	171.	167.	195.	214.	69.	9.	1.	6.	37.	85.	162.	210.	1326.
TEM	23.	23.	22.	22.	20.	19.	18.	19.	21.	22.	23.	23.	21.
RS	489.	520.	507.	460.	498.	501.	465.	528.	522.	522.	497.	470.	500.
PD	106.	103.	123.	136.	37.	0.	0.	0.	15.	48.	100.	133.	1114.
ETP	142.	141.	145.	131.	136.	128.	120.	139.	140.	149.	142.	138.	1650.
MAI	0.75	0.74	0.85	1.03	0.27	0.00	0.00	0.00	0.11	0.32	0.71	0.96	0.68

TANZANIA

STATION MUSOMA LAT 1.30S LONG 33.48E ELEV 1147. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	62.	67.	118.	173.	110.	25.	22.	19.	27.	39.	81.	69.	812.
TEM	23.	24.	24.	23.	23.	23.	22.	23.	23.	24.	23.	23.	23.
RS	556.	579.	530.	441.	400.	343.	315.	348.	446.	494.	459.	508.	452.
PD	32.	36.	70.	108.	65.	7.	5.	3.	8.	17.	45.	37.	682.
ETP	164.	161.	157.	125.	117.	96.	90.	101.	127.	147.	131.	149.	1566.
MAI	0.20	0.22	0.45	0.86	0.55	0.07	0.06	0.03	0.07	0.11	0.34	0.25	0.44

STATION MWANHALA LAT 4.24S LONG 33.09E ELEV 1251. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	141.	107.	134.	121.	32.	3.	0.	1.	6.	18.	84.	154.	801.
TEM	23.	23.	23.	23.	22.	21.	21.	23.	24.	25.	25.	23.	23.
RS	489.	520.	507.	480.	498.	501.	465.	528.	522.	522.	497.	470.	500.
PD	86.	63.	81.	72.	12.	0.	0.	0.	0.	2.	47.	95.	673.
ETP	141.	142.	147.	134.	142.	136.	130.	153.	153.	162.	147.	137.	1725.
MAI	0.61	0.44	0.55	0.54	0.08	0.00	0.00	0.00	0.00	0.01	0.32	0.69	0.39

STATION MWANZA LAT 2.28S LONG 32.55E ELEV 1140. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	95.	79.	150.	170.	81.	11.	17.	25.	29.	74.	120.	150.	1002.
TEM	23.	23.	23.	23.	23.	22.	22.	22.	23.	23.	23.	23.	23.
RS	556.	579.	530.	441.	400.	343.	315.	348.	446.	494.	459.	508.	452.
PD	55.	44.	92.	106.	45.	0.	2.	8.	10.	40.	72.	92.	841.
ETP	162.	1[illegible].	156.	125.	115.	95.	89.	100.	127.	146.	131.	148.	1551.
MAI	0.34	0.28	0.59	0.85	0.39	0.00	0.02	0.08	0.08	0.28	0.55	0.62	0.54

STATION MWAZYE LAT 8.27S LONG 31.44E ELEV 1830. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	193.	151.	175.	110.	20.	0.	0.	0.	2.	18.	97.	172.	938.
TEM	13.	18.	18.	17.	16.	14.	13.	14.	16.	17.	19.	18.	16.
RS	303.	319.	283.	278.	252.	221.	230.	244.	296.	323.	343.	314.	284.
PD	121.	93.	109.	65.	4.	0.	0.	0.	0.	2.	56.	107.	788.
ETP	77.	76.	72.	67.	60.	48.	51.	55.	68.	80.	86.	81.	821.
MAI	1.57	1.22	1.52	0.97	0.06	0.00	0.00	0.00	0.00	0.03	0.65	1.32	0.96

STATION MWERA LAT 6.09S LONG 39.16E ELEV 244. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	62.	59.	195.	422.	321.	68.	67.	65.	67.	157.	206.	154.	1844.
TEM	27.	27.	27.	26.	25.	24.	23.	23.	24.	25.	26.	27.	25.
RS	381.	457.	390.	339.	359.	370.	340.	382.	412.	433.	388.	410.	388.
PD	32.	30.	122.	277.	208.	36.	35.	34.	35.	97.	130.	95.	1549.
ETP	123.	139.	127.	104.	110.	107.	99.	112.	118.	132.	117.	131.	1418.
MAI	0.26	0.22	0.96	2.67	1.90	0.34	0.36	0.31	0.30	0.73	1.11	0.72	1.09

TANZANIA

STATION MWITA LAT 10.17S LONG 40.05E ELEV 49. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	207.	133.	163.	141.	42.	10.	7.	6.	16.	21.	36.	130.	912.
TEM	27.	27.	27.	27.	26.	25.	24.	25.	25.	26.	27.	28.	26.
RS	303.	319.	283.	278.	252.	221.	230.	244.	296.	323.	343.	314.	284.
PO	131.	81.	101.	86.	18.	0.	0.	0.	1.	4.	15.	78.	766.
ETP	98.	97.	92.	87.	79.	65.	69.	74.	88.	101.	107.	102.	1060.
MAI	1.33	0.83	1.10	0.99	0.23	0.00	0.00	0.00	0.01	0.04	0.14	0.77	0.72

STATION NABERERA LAT 4.13S LONG 36.56E ELEV 1525. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	76.	61.	97.	103.	21.	3.	1.	2.	1.	6.	30.	69.	470.
TEM	21.	20.	19.	20.	20.	20.	20.	19.	21.	21.	20.	20.	20.
RS	500.	506.	489.	450.	404.	391.	395.	446.	466.	496.	517.	518.	465.
PO	42.	31.	56.	60.	4.	0.	0.	0.	0.	0.	10.	37.	395.
ETP	137.	128.	129.	119.	110.	104.	106.	117.	127.	136.	135.	141.	1488.
MAI	0.30	0.25	0.44	0.51	0.04	0.00	0.00	0.00	0.00	0.00	0.08	0.26	0.27

STATION MACHINGWEA LAT 10.21S LONG 38.45E ELEV 465. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	177.	186.	181.	155.	24.	3.	4.	1.	4.	7.	68.	116.	926.
TEM	26.	26.	26.	25.	23.	22.	22.	23.	24.	26.	27.	27.	25.
RS	303.	319.	283.	278.	252.	221.	230.	244.	296.	323.	343.	314.	284.
PO	110.	116.	113.	95.	6.	0.	0.	0.	0.	0.	36.	69.	778.
ETP	95.	93.	88.	82.	74.	61.	65.	71.	86.	101.	106.	101.	1024.
MAI	1.16	1.25	1.28	1.16	0.08	0.00	0.00	0.00	0.00	0.00	0.34	0.68	0.76

STATION NDAMAKAI LAT 3.23S LONG 35.28E ELEV 1769. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	132.	98.	158.	212.	124.	13.	4.	4.	5.	17.	61.	113.	941.
TEM	19.	19.	19.	20.	17.	16.	15.	16.	18.	19.	19.	19.	18.
RS	489.	520.	507.	480.	498.	501.	465.	528.	522.	522.	497.	470.	500.
PO	80.	57.	97.	134.	74.	0.	0.	0.	0.	2.	31.	67.	791.
ETP	128.	128.	135.	125.	124.	117.	108.	126.	128.	135.	127.	124.	1506.
MAI	0.62	0.44	0.72	1.08	0.60	0.00	0.00	0.00	0.00	0.01	0.25	0.54	0.53

STATION NGARA LAT 2.28S LONG 30.38E ELEV 1800. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	100.	106.	118.	181.	100.	12.	5.	19.	65.	75.	118.	113.	1012.
TEM	19.	19.	19.	20.	17.	16.	15.	16.	18.	19.	19.	19.	18.
RS	489.	520.	507.	480.	498.	501.	465.	528.	522.	522.	497.	470.	500.
PO	58.	62.	70.	113.	58.	0.	0.	3.	34.	41.	70.	67.	850.
ETP	128.	128.	135.	125.	124.	117.	108.	126.	128.	135.	127.	124.	1506.
MAI	0.45	0.48	0.52	0.91	0.47	0.00	0.00	0.02	0.27	0.30	0.55	0.54	0.56

TANZANIA

STATION NGASUMET LAT 4.28S LONG 37.09E ELEV 1525. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	86.	91.	91.	125.	62.	8.	5.	9.	5.	15.	58.	75.	630.
TEM	21.	20.	19.	20.	20.	20.	20.	19.	21.	21.	20.	20.	20.
RS	500.	506.	489.	450.	404.	391.	395.	446.	466.	496.	517.	518.	465.
PD	49.	52.	52.	75.	32.	0.	0.	0.	0.	0.	29.	41.	529.
ETP	137.	128.	128.	119.	110.	104.	106.	117.	127.	136.	135.	141.	1488.
MAI	0.35	0.40	0.40	0.63	0.29	0.00	0.00	0.00	0.00	0.00	0.22	0.29	0.36

STATION GONJA LAT 4.18S LONG 38.02E ELEV 549. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	55.	45.	136.	134.	58.	11.	6.	8.	18.	59.	131.	164.	826.
TEM	26.	26.	26.	25.	24.	22.	21.	22.	23.	25.	26.	26.	24.
RS	500.	506.	489.	450.	404.	391.	395.	446.	466.	496.	517.	518.	465.
PD	28.	21.	83.	81.	29.	0.	0.	0.	2.	30.	79.	102.	694.
ETP	159.	150.	154.	134.	120.	107.	110.	128.	133.	151.	157.	165.	1667.
MAI	0.17	0.14	0.53	0.61	0.25	0.00	0.00	0.00	0.02	0.20	0.51	0.62	0.42

STATION NGOMENI LAT 5.09S LONG 38.54E ELEV 183. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	45.	34.	110.	201.	219.	51.	49.	57.	72.	138.	115.	88.	1179.
TEM	27.	27.	27.	26.	25.	24.	23.	23.	24.	25.	26.	27.	25.
RS	500.	506.	489.	450.	404.	391.	395.	446.	466.	496.	517.	518.	465.
PD	21.	13.	65.	127.	139.	25.	23.	29.	39.	84.	68.	50.	990.
ETP	161.	153.	159.	138.	123.	113.	115.	131.	134.	151.	157.	166.	1700.
MAI	0.13	0.09	0.41	0.92	1.13	0.22	0.20	0.22	0.29	0.56	0.44	0.30	0.58

STATION NGUDU LAT 2.57S LONG 33.21E ELEV 1220. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	87.	93.	134.	151.	65.	9.	3.	4.	13.	30.	101.	129.	820.
TEM	23.	23.	24.	23.	23.	22.	22.	23.	24.	26.	24.	24.	24.
RS	556.	579.	530.	441.	400.	343.	315.	348.	446.	494.	459.	508.	452.
PD	49.	53.	81.	93.	35.	0.	0.	0.	0.	10.	59.	78.	689.
ETP	165.	160.	157.	126.	117.	96.	90.	102.	131.	154.	133.	152.	1583.
MAI	0.30	0.33	0.52	0.74	0.30	0.00	0.00	0.00	0.00	0.07	0.44	0.51	0.44

STATION NEWELA LAT 10.57S LONG 39.18E ELEV 793. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	235.	173.	189.	88.	29.	4.	3.	3.	4.	10.	33.	167.	938.
TEM	25.	25.	25.	24.	23.	22.	21.	22.	23.	25.	24.	24.	24.
RS	303.	319.	283.	278.	252.	221.	230.	244.	296.	323.	343.	314.	284.
PD	150.	108.	119.	50.	10.	0.	0.	0.	0.	0.	12.	103.	788.
ETP	93.	91.	86.	81.	74.	60.	64.	70.	84.	99.	100.	95.	996.
MAI	1.61	1.18	1.37	0.62	0.14	0.00	0.00	0.00	0.00	0.00	0.12	1.09	0.79

TANZANIA

STATION NJOMBE LAT 9.25S LONG 34.45E ELEV 1891. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	223.	224.	264.	165.	23.	2.	1.	1.	3.	15.	45.	189.	1155.
TEM	18.	18.	18.	17.	16.	14.	13.	14.	16.	17.	19.	18.	16.
RS	303.	319.	283.	278.	252.	221.	230.	244.	296.	323.	343.	314.	284.
PD	142.	142.	169.	102.	6.	0.	0.	0.	0.	0.	21.	119.	970.
ETP	77.	76.	72.	67.	60.	48.	51.	55.	68.	80.	86.	81.	821.
MAI	1.84	1.88	2.36	1.53	0.10	0.00	0.00	0.00	0.00	0.00	0.24	1.47	1.18

STATION NYAMTUMBO LAT 10.30S LONG 36.05E ELEV 824. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	212.	249.	284.	171.	28.	1.	0.	2.	2.	8.	44.	176.	1175.
TEM	25.	26.	26.	24.	23.	21.	21.	21.	22.	24.	25.	25.	23.
RS	303.	319.	283.	278.	252.	221.	230.	244.	296.	323.	343.	314.	284.
PD	134.	159.	183.	106.	9.	0.	0.	0.	0.	0.	20.	110.	988.
ETP	94.	93.	88.	81.	73.	60.	63.	68.	82.	96.	101.	96.	996.
MAI	1.43	1.71	2.08	1.30	0.12	0.00	0.00	0.00	0.00	0.00	0.20	1.14	0.99

STATION NYARWONGA LAT 3.01S LONG 30.52E ELEV 1586. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	101.	91.	141.	153.	72.	3.	2.	10.	34.	54.	121.	125.	907.
TEM	20.	20.	20.	20.	19.	17.	17.	17.	19.	20.	21.	20.	19.
RS	489.	520.	507.	480.	498.	501.	465.	528.	522.	522.	497.	470.	500.
PD	59.	52.	86.	94.	39.	0.	0.	0.	13.	27.	72.	75.	762.
ETP	131.	131.	136.	124.	130.	121.	114.	132.	132.	142.	134.	128.	1556.
MAI	0.45	0.40	0.63	0.75	0.30	0.00	0.00	0.00	0.10	0.19	0.54	0.59	0.49

STATION NZEGA LAT 4.13S LONG 33.11E ELEV 1220. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	119.	103.	137.	143.	25.	2.	2.	1.	9.	22.	85.	150.	798.
TEM	23.	23.	24.	23.	23.	22.	22.	23.	24.	26.	24.	24.	24.
RS	489.	520.	507.	480.	498.	501.	465.	528.	522.	522.	497.	470.	500.
PD	71.	60.	83.	87.	7.	0.	0.	0.	0.	5.	48.	92.	670.
ETP	145.	144.	151.	137.	146.	140.	133.	154.	153.	163.	144.	140.	1750.
MAI	0.49	0.42	0.55	0.54	0.05	0.00	0.00	0.00	0.00	0.03	0.33	0.66	0.38

STATION OLALA LAT 2.32S LONG 35.35E ELEV 1373. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	91.	85.	85.	99.	61.	9.	6.	4.	4.	16.	46.	84.	590.
TEM	20.	21.	21.	20.	19.	18.	16	17.	18.	20.	20.	20.	19.
RS	556.	579.	530.	441.	400.	343.	315.	348.	446.	494.	459.	508.	452.
PD	52.	48.	48.	57.	31.	0.	0.	0.	0.	1.	21.	47.	496.
ETP	151.	149.	146.	115.	104.	84.	76.	87.	111.	132.	120.	138.	1414.
MAI	0.34	0.32	0.33	0.50	0.30	0.00	0.00	0.00	0.00	0.01	0.18	0.34	0.35

TANZANIA

STATION OLD SHINYANGA LAT 3.33S LONG 33.24E ELEV 1220. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	127.	103.	135.	133.	47.	4.	1.	1.	6.	26.	64.	133.	780.
TEM	23.	23.	24.	23.	23.	22.	22.	23.	24.	26.	24.	24.	24.
RS	489.	520.	507.	480.	498.	501.	465.	528.	522.	522.	497.	470.	500.
PO	76.	60.	82.	81.	22.	0.	0.	0.	0.	8.	34.	81.	655.
ETP	145.	144.	151.	137.	146.	140.	133.	154.	153.	163.	144.	140.	1750.
MAI	0.53	0.42	0.54	0.59	0.15	0.00	0.00	0.00	0.00	0.05	0.23	0.57	0.37

STATION PERAMIHO LAT 10.34S LONG 35.28E ELEV 1159. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	259.	237.	262.	104.	19.	1.	1.	1.	1.	7.	53.	186.	1131.
TEM	22.	23.	22.	21.	20.	18.	17.	19.	21.	22.	24.	23.	21.
RS	303.	319.	283.	278.	252.	221.	230.	244.	296.	323.	343.	314.	234.
PO	166.	151.	168.	61.	3.	0.	0.	0.	0.	0.	26.	116.	950.
ETP	87.	88.	81.	75.	67.	54.	58.	63.	78.	93.	98.	91.	935.
MAI	1.90	1.72	2.08	0.81	0.04	0.00	0.00	0.00	0.00	0.00	0.27	1.27	1.02

STATION RUAHA LAT 8.54S LONG 36.44E ELEV 427. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	312.	232.	361.	312.	90.	11.	6.	15.	9.	21.	53.	238.	1664.
TEM	26.	26.	26.	25.	23.	22.	22.	23.	24.	26.	27.	27.	25.
RS	303.	319.	283.	278.	252.	221.	230.	244.	296.	323.	343.	314.	284.
PO	202.	148.	235.	202.	51.	0.	0.	0.	0.	4.	29.	152.	1398.
ETP	95.	93.	88.	82.	74.	61.	65.	71.	86.	101.	106.	101.	1024.
MAI	2.12	1.59	2.67	2.46	0.69	0.00	0.00	0.00	0.00	0.04	0.28	1.50	1.36

STATION RUYU LAT 6.48S LONG 38.43E ELEV 37. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	77.	75.	134.	213.	119.	21.	15.	18.	34.	61.	98.	77.	942.
TEM	28.	28.	27.	27.	26.	25.	24.	24.	24.	25.	26.	27.	26.
RS	464.	494.	433.	322.	367.	386.	402.	415.	421.	457.	543.	518.	435.
PO	42.	41.	81.	135.	71.	4.	0.	2.	13.	31.	57.	42.	792.
ETP	152.	152.	141.	100.	115.	113.	120.	124.	122.	140.	166.	168.	1613.
MAI	0.28	0.27	0.58	1.35	0.62	0.04	0.00	0.02	0.11	0.23	0.34	0.25	0.49

STATION SAXURA LAT 5.37S LONG 38.53E ELEV 40. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	54.	46.	124.	219.	199.	53.	43.	57.	57.	86.	123.	102.	1163.
TEM	28.	28.	28.	27.	25.	25.	24.	24.	25.	26.	27.	28.	26.
RS	381.	457.	390.	339.	359.	370.	340.	382.	412.	433.	388.	410.	388.
PO	27.	21.	74.	139.	125.	26.	19.	29.	29.	49.	74.	59.	977.
ETP	125.	141.	130.	106.	113.	110.	102.	115.	121.	135.	120.	134.	1454.
MAI	0.21	0.15	0.57	1.31	1.11	0.24	0.19	0.25	0.24	0.36	0.61	0.44	0.67

TANZANIA

STATION SHANWA LAT 3.10S LONG 33.46E ELEV 1342. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	107.	101.	127.	150.	49.	4.	1.	2.	10.	31.	77.	133.	792.
TEM	20.	21.	21.	20.	19.	18.	16.	17.	18.	20.	20.	20.	19.
RS	489.	520.	507.	480.	498.	501.	465.	528.	522.	522.	497.	470.	500.
PO	63.	59.	76.	92.	23.	0.	0.	0.	0.	11.	42.	81.	665.
ETP	133.	134.	140.	126.	129.	123.	113.	131.	130.	139.	130.	127.	1556.
MAI	0.47	0.44	0.55	0.73	0.18	0.00	0.00	0.00	0.00	0.08	0.32	0.63	0.43

STATION SAME LAT 4.05S LONG 37.43E ELEV 872. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	41.	64.	74.	125.	71.	6.	6.	12.	13.	22.	51.	68.	553.
TEM	25.	26.	26.	24.	23.	21.	21.	21.	22.	24.	25.	25.	23.
RS	500.	506.	489.	450.	404.	391.	395.	446.	466.	496.	517.	518.	465.
PO	18.	34.	40.	75.	38.	0.	0.	0.	0.	5.	25.	36.	465.
ETP	155.	147.	153.	132.	117.	106.	109.	124.	130.	148.	152.	159.	1631.
MAI	0.12	0.23	0.25	0.57	0.33	0.00	0.00	0.00	0.00	0.03	0.16	0.23	0.28

STATION SANJE LAT 7.49S LONG 35.55E ELEV 366. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	183.	243.	369.	404.	166.	33.	35.	20.	24.	42.	86.	142.	1747.
TEM	26.	26.	26.	25.	24.	22.	21.	22.	24.	26.	27.	27.	25.
RS	464.	494.	433.	322.	357.	386.	402.	415.	421.	457.	543.	518.	435.
PO	114.	155.	241.	265.	103.	12.	14.	4.	6.	18.	49.	87.	1463.
ETP	147.	145.	135.	96.	110.	107.	113.	119.	122.	142.	170.	166.	1573.
MAI	0.78	1.07	1.78	2.76	0.94	0.12	0.12	0.03	0.05	0.13	0.29	0.52	0.93

STATION SAO HILL LAT 8.20S LONG 35.12E ELEV 1982. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	190.	169.	207.	89.	18.	4.	2.	2.	3.	11.	65.	180.	936.
TEM	17.	18.	17.	17.	15.	14.	13.	14.	15.	18.	18.	18.	16.
RS	464.	494.	433.	322.	367.	386.	402.	415.	421.	457.	543.	518.	435.
PO	119.	105.	131.	48.	2.	0.	0.	0.	0.	0.	34.	112.	786.
ETP	116.	117.	108.	77.	86.	84.	88.	94.	97.	115.	135.	132.	1250.
MAI	1.02	0.89	1.21	0.62	0.03	0.00	0.00	0.00	0.00	0.00	0.25	0.86	0.63

STATION SELEM LAT 6.03S LONG 39.14E ELEV 19. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	67.	65.	186.	331.	276.	54.	45.	76.	78.	123.	199.	152.	1562.
TEM	28.	29.	29.	28.	26.	26.	25.	25.	26.	26.	28.	28.	27.
RS	381.	457.	390.	339.	359.	370.	340.	382.	412.	433.	388.	410.	388.
PO	36.	34.	117.	215.	177.	33.	20.	42.	43.	74.	126.	93.	1396.
ETP	127.	144.	131.	107.	114.	112.	105.	118.	124.	138.	123.	135.	1476.
MAI	0.29	0.24	0.89	2.01	1.56	0.30	0.19	0.35	0.35	0.53	1.03	0.69	0.95

TANZANIA

STATION SINGIDA LAT 4.48S LONG 34.45E ELEV 1498. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	143.	118.	119.	73.	14.	1.	0.	1.	1.	7.	44.	137.	658.
TEM	21.	21.	21.	21.	19.	19.	18.	19.	20.	21.	22.	24.	21.
RS	489.	520.	507.	480.	498.	501.	465.	528.	522.	522.	497.	470.	500.
PO	87.	70.	71.	40.	0.	0.	0.	0.	0.	0.	20.	83.	553.
ETP	137.	136.	142.	129.	132.	127.	119.	137.	137.	146.	139.	142.	1521.
MAI	0.64	0.52	0.50	0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.59	0.34

STATION SONGEA LAT 10.41S LONG 35.40E ELEV 1153. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	273.	234.	257.	111.	15.	1.	1.	3.	3.	9.	46.	174.	1127.
TEM	22.	23.	22.	21.	20.	18.	17.	19.	21.	22.	24.	23.	21.
RS	303.	319.	283.	278.	252.	221.	230.	244.	296.	323.	343.	314.	284.
PO	176.	149.	165.	65.	0.	0.	0.	0.	0.	0.	21.	108.	947.
ETP	87.	88.	81.	75.	67.	54.	58.	63.	78.	93.	98.	91.	935.
MAI	2.01	1.70	2.04	0.87	0.00	0.00	0.00	0.00	0.00	0.00	0.22	1.19	1.01

STATION SUMBAWANGA LAT 7.57S LONG 31.36E ELEV 1723. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	156.	138.	164.	90.	21.	2.	0.	2.	5.	9.	77.	154.	818.
TEM	29.	29.	27.	28.	27.	26.	25.	26.	26.	27.	29.	29.	27.
RS	489.	520.	507.	480.	498.	501.	465.	528.	522.	522.	497.	470.	500.
PO	96.	84.	102.	51.	4.	0.	0.	0.	0.	0.	42.	95.	687.
ETP	164.	163.	165.	152.	160.	153.	142.	164.	160.	170.	161.	158.	1911.
MAI	0.59	0.51	0.62	0.34	0.03	0.00	0.00	0.00	0.00	0.00	0.26	0.60	0.36

STATION TANGA LAT 5.05S LONG 39.04E ELEV 35. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	29.	33.	104.	265.	272.	60.	70.	81.	88.	120.	141.	58.	1321.
TEM	28.	28.	28.	27.	26.	25.	24.	24.	25.	26.	27.	28.	26.
RS	381.	457.	390.	339.	359.	370.	340.	382.	412.	433.	388.	410.	388.
PO	10.	12.	61.	170.	175.	31.	33.	45.	50.	72.	86.	29.	1109.
ETP	125.	141.	130.	106.	113.	110.	102.	115.	121.	135.	120.	134.	1454.
MAI	0.08	0.09	0.47	1.60	1.55	0.28	0.37	0.39	0.41	0.53	0.71	0.22	0.76

STATION TARIME LAT 1.22S LONG 34.23E ELEV 1525. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	79.	100.	159.	226.	161.	77.	47.	75.	87.	124.	140.	125.	1400.
TEM	21.	21.	21.	21.	19.	19.	18.	19.	20.	21.	22.	24.	21.
RS	556.	579.	530.	441.	400.	343.	315.	348.	446.	494.	459.	508.	452.
PO	44.	58.	98.	144.	100.	42.	22.	41.	49.	74.	85.	75.	1176.
ETP	156.	151.	148.	119.	106.	87.	81.	90.	117.	138.	128.	153.	1473.
MAI	0.28	0.38	0.66	1.21	0.94	0.49	0.27	0.45	0.42	0.54	0.67	0.49	0.80

TANZANIA

STATION TABORA LAT 5.02S LONG 32.49E ELEV 1265. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	132.	129.	166.	134.	27.	2.	0.	1.	7.	17.	103.	174.	893.
TEM	23.	23.	23.	23.	22.	21.	21.	23.	24.	26.	25.	23.	23.
RS	489.	520.	507.	480.	498.	501.	465.	528.	522.	522.	497.	470.	500.
PO	80.	78.	103.	81.	8.	0.	0.	0.	0.	2.	60.	108.	750.
ETP	141.	142.	147.	134.	142.	136.	130.	153.	153.	162.	147.	137.	1725.
MAI	0.57	0.55	0.70	0.61	0.06	0.00	0.00	0.00	0.00	0.01	0.41	0.79	0.43

STATION TALAMAI LAT 5.22S LONG 37.21E ELEV 1135. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	104.	86.	80.	101.	39.	6.	4.	3.	5.	16.	36.	78.	559.
TEM	23.	23.	23.	23.	23.	21.	21.	23.	25.	26.	25.	23.	23.
RS	381.	457.	390.	339.	359.	370.	340.	382.	412.	433.	388.	410.	388.
PO	61.	49.	44.	59.	17.	0.	0.	0.	0.	1.	15.	43.	469.
ETP	111.	126.	115.	96.	104.	100.	95.	112.	122.	135.	115.	121.	1353.
MAI	0.55	0.39	0.39	0.61	0.16	0.00	0.00	0.00	0.00	0.01	0.13	0.36	0.35

STATION TAVETA LAT 9.01S LONG 35.31E ELEV 915. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	255.	160.	302.	369.	96.	7.	4.	14.	15.	20.	81.	175.	1498.
TEM	23.	23.	23.	22.	20.	19.	18.	18.	19.	20.	21.	22.	21.
RS	303.	319.	283.	278.	252.	221.	230.	244.	296.	323.	343.	314.	284.
PO	163.	99.	195.	241.	55.	0.	0.	0.	0.	4.	45.	109.	1258.
ETP	88.	88.	83.	76.	69.	56.	59.	63.	75.	87.	93.	90.	926.
MAI	1.85	1.13	2.36	3.16	0.81	0.00	0.00	0.00	0.00	0.04	0.48	1.21	1.36

STATION TUKUYU LAT 9.15S LONG 33.38E ELEV 1617. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	253.	228.	351.	617.	349.	104.	74.	59.	51.	48.	137.	229.	2500.
TEM	20.	20.	20.	20.	19.	17.	17.	17.	19.	20.	21.	20.	19.
RS	303.	319.	283.	278.	252.	221.	230.	244.	296.	323.	343.	314.	284.
PO	162.	145.	229.	410.	227.	61.	40.	30.	25.	23.	83.	146.	2100.
ETP	81.	80.	75.	72.	66.	54.	57.	61.	75.	88.	92.	86.	887.
MAI	1.99	1.81	3.01	5.71	3.46	1.13	0.71	0.49	0.33	0.25	0.90	1.70	2.37

STATION TUNDURU LAT 11.06S LONG 37.22E ELEV 702. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	253.	237.	225.	91.	13.	3.	1.	2.	3.	7.	39.	174.	1048.
TEM	25.	25.	25.	24.	23.	22.	21.	22.	23.	25.	24.	24.	24.
RS	303.	319.	283.	278.	252.	221.	230.	244.	296.	323.	343.	314.	284.
PO	162.	151.	143.	52.	0.	0.	0.	0.	0.	0.	17.	108.	881.
ETP	93.	91.	86.	81.	74.	60.	64.	70.	84.	99.	100.	95.	996.
MAI	1.75	1.65	1.66	0.64	0.00	0.00	0.00	0.00	0.00	0.00	0.17	1.14	0.88

TANZANIA

STATION TUNUNGUO LAT 7.03S LONG 37.58E ELEV 174. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	160.	157.	245.	323.	195.	26.	25.	36.	33.	83.	91.	175.	1549.
TEM	27.	27.	27.	26.	25.	24.	23.	23.	24.	25.	26.	27.	25.
RS	464.	494.	433.	322.	367.	386.	402.	415.	421.	457.	543.	518.	435.
PO	99.	97.	157.	210.	123.	8.	7.	15.	12.	46.	52.	109.	1301.
ETP	150.	150.	141.	98.	112.	111.	117.	122.	121.	139.	164.	166.	1591.
MAI	0.66	0.65	1.11	2.13	1.09	0.07	0.06	0.12	0.10	0.33	0.32	0.66	0.82

STATION UKIRIGURU LAT 2.42S LONG 33.01E ELEV 1200. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	91.	76.	124.	138.	71.	9.	1.	12.	29.	38.	116.	104.	809.
TEM	23.	23.	21.	23.	23.	22.	22.	23.	24.	25.	24.	23.	23.
RS	556.	579.	530.	441.	400.	343.	315.	348.	446.	494.	459.	508.	452.
PO	52.	42.	74.	84.	38.	0.	0.	0.	10.	15.	69.	61.	680.
ETP	16[illegible].	158.	157.	125.	115.	95.	89.	101.	129.	151.	132.	148.	1563.
MAI	0.[illegible]	0.27	0.47	0.67	0.33	0.00	0.00	0.00	0.07	0.10	0.52	0.41	0.44

STATION URAMBO LAT 5.04S LONG 32.03E ELEV 1105. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	142.	140.	169.	142.	37.	1.	1.	1.	4.	25.	104.	180.	946.
TEM	23.	23.	23.	23.	23.	21.	21.	23.	25.	26.	25.	23.	23.
RS	489.	520.	507.	480.	498.	501.	465.	528.	522.	522.	497.	470.	500.
PO	87.	85.	105.	87.	15.	0.	0.	0.	0.	7.	61.	112.	795.
ETP	143.	143.	149.	136.	145.	136.	130.	155.	155.	163.	148.	138.	1741.
MAI	0.61	0.60	0.70	0.64	0.11	0.00	0.00	0.00	0.00	0.04	0.41	0.81	0.46

STATION URUWIRA LAT 6.25S LONG 31.21E ELEV 1068. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	150.	138.	163.	161.	33.	1.	0.	0.	5.	20.	121.	198.	995.
TEM	24.	24.	24.	23.	22.	21.	20.	21.	22.	24.	25.	25.	23.
RS	489.	520.	507.	480.	498.	501.	465.	528.	522.	522.	497.	470.	500.
PO	92.	84.	101.	100.	16.	0.	0.	0.	0.	4.	72.	125.	836.
ETP	146.	145.	150.	136.	142.	133.	125.	145.	144.	155.	147.	143.	1712.
MAI	0.63	0.58	0.[illegible]	0.73	0.11	0.00	0.00	0.00	0.00	0.02	0.49	0.87	0.49

STATION USHIROMBO LAT 3.30S LONG 31.58E ELEV 915. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	117.	93.	156.	157.	79.	7.	0.	6.	16.	53.	115.	115.	914.
TEM	23.	24.	24.	24.	24.	23.	23.	24.	25.	25.	23.	23.	24.
RS	489.	520.	507.	480.	498.	501.	465.	528.	522.	522.	497.	470.	500.
PO	70.	53.	96.	97.	44.	0.	0.	0.	1.	25.	68.	68.	768.
ETP	144.	144.	150.	138.	148.	142.	135.	157.	154.	159.	142.	137.	1751.
MAI	0.48	0.37	0.64	0.70	0.29	0.00	0.00	0.00	0.01	0.16	0.48	0.50	0.44

TANZANIA

STATION UTETE LAT 8.01S LONG 38.45E ELEV 52. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	108.	102.	154.	191.	73.	11.	7.	7.	15.	31.	83.	102.	884.
TEM	28.	28.	28.	27.	26.	25.	24.	25.	25.	26.	27.	27.	26.
RS	464.	494.	433.	322.	367.	386.	402.	415.	421.	457.	543.	518.	435.
PO	63.	59.	95.	120.	40.	0.	0.	0.	0.	11.	46.	59.	743.
ETP	152.	151.	142.	99.	115.	115.	121.	126.	126.	144.	168.	169.	1628.
MAI	0.42	0.39	0.67	1.21	0.34	0.00	0.00	0.00	0.00	0.08	0.28	0.35	0.46

STATION UYINZA LAT 5.07S LONG 30.22E ELEV 991. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	121.	129.	146.	147.	35.	2.	1.	2.	17.	41.	129.	165.	935.
TEM	23.	23.	23.	22.	21.	20.	19.	20.	21.	23.	25.	24.	22.
RS	489.	520.	507.	480.	498.	501.	465.	528.	522.	522.	497.	470.	500.
PO	72.	78.	89.	90.	14.	0.	0.	0.	2.	18.	78.	102.	786.
ETP	144.	142.	149.	134.	139.	131.	123.	143.	142.	153.	146.	142.	1688.
MAI	0.50	0.55	0.60	0.67	0.10	0.00	0.00	0.00	0.01	0.12	0.53	0.72	0.47

STATION VICTORIA GARDEN LAT 6.10S LONG 39.11E ELEV 5. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	45.	52.	160.	367.	315.	48.	43.	51.	66.	107.	189.	121.	1564.
TEM	29.	29.	29.	27.	27.	26.	25.	25.	25.	26.	27.	28.	27.
RS	381.	457.	390.	339.	359.	370.	340.	382.	412.	433.	388.	410.	388.
PO	21.	25.	98.	240.	205.	23.	19.	25.	35.	63.	119.	73.	1314.
ETP	127.	144.	131.	107.	115.	113.	105.	118.	123.	136.	121.	135.	1473.
MAI	0.16	0.18	0.75	2.25	1.78	0.20	0.18	0.21	0.28	0.46	0.98	0.54	0.89

STATION WETE PASHA LAT 5.04S LONG 39.43E ELEV 18. M

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
PREC	65.	47.	157.	433.	456.	136.	77.	47.	34.	100.	223.	151.	1926.
TEM	27.	27.	28.	26.	26.	25.	24.	24.	24.	25.	26.	27.	26.
RS	381.	457.	390.	339.	359.	370.	340.	382.	412.	433.	388.	410.	388.
PO	34.	22.	97.	284.	300.	82.	42.	22.	13.	58.	142.	93.	1618.
ETP	123.	138.	127.	105.	112.	109.	102.	114.	120.	134.	118.	131.	1433.
MAI	0.28	0.16	0.76	2.72	2.68	0.75	0.42	0.19	0.11	0.43	1.20	0.70	1.13