Weltdatenbank Abfluß
Bundesanstalt für Gewässerkunde
Koblenz, Deutschland

Global Runoff Data Centre
Federal Institute of Hydrology
Koblenz, Germany

Report No. 14

The Use of GRDC - Information
- Review of Data Use 1993/1994 -

Status: January 1997

February 1997

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1. General

Information about data use and researchers/institutions using GRDC data is essential for networking between researchers and is an important link in the "Feedback-Loop" between data providers -the national hydrological services- the GRDC and the data users. In the GRDC User Declaration which has to be signed by data users, users are agreeing with their signature that "After completion of the studies and parts thereof, two copies of the results will be made available for the GRDC, as well as publications arising from the use of the data set or parts thereof". This report is a first attempt to network users and though the results are encouraging albeit not fully satisfactory, the GRDC calls for an improved information flow from data users.

2. The Feed-Back Exercise

To obtain an overview of research undertaken with GRDC data, GRDC in 1996 launched a "Feed-back" activity, contacting users who requested GRDC-data in the years 1993/94. The time lag of 2 years between data delivery and feed back request has been chosen because research projects have a duration of normally 24 - 36 months.

This report is being distributed first of all to those who requested GRDC data and information and also to international programmes and projects. In case of river basin data used, the report will be sent to the respective hydrological services. Readers of this report are welcome to request the GRDC for any further information and are encouraged to contact the researchers and institutions mentioned in the report for networking. Readers are also invited to visit our Web-site at:

http://www.wmo.ch/web/homs/grdchome.html

3. Requests for Data and Information 1993/1994

A summary of data requests in 1993 and 1994 is presented in table 1 below. Table 2 gives an overview of the profile of data users. Regional and global hydrological research and climate as well as ocean-related research made up 62% of the data requests followed by 16% for operational hydrological issues. From user communication it is clear that data and information requests will increase when more information and especially also meta-data is made available to the GRDC.

The rational for the establishment of the GRDC and the data acquisition priorities favor the data use for regional and global hydrological research and climate modeling. There seems to be a deficit in requests for regional comparative hydrological research which is important to fill spatial gaps with none or insufficient hydrological information. This is of special importance for regional and global change programmes which require observational data or at least plausible proxi- data from regions with insufficient information.

Topic	Requests received
Hydrometeorological modeling	2
Operational hydrology	12
Regional/global hydrological issues	23
Climate and ocean related research	23
Information/advisory requests	7
Others	7
TOTAL	74

Table 2: User profile of GRDC data 1993/1994

4. Status of Feedback-Response from Data Users

Table 3 contains information about the use of data from identified data users. From 74 requests, 50 were selected to be contacted. 56% of the contacted users responded. This is not fully satisfactory. As this report will be sent to all previously contacted persons and institutions, it is hoped that this record will improve.

5. Abstracts and Summaries from Data Users

The following pages contain information received from data users about their research or other use of the data. As can be seen from the status of feed-back response, some of the results are not yet available and the GRDC can be contacted for further information when the remaining information becomes available.

Table 1:

SUMMARY OF DATA REQUESTS FROM GRDC IN 1993

REQUEST MADE BY (NAME, COUNTRY)	COUNTRY OR RIVER, FOR WHICH DATA ARE REQUESTED	PURPOSE OF DATA USE
Bishop, J.M., Institute for Scientific Research, Kuweit	Iran, Kuweit	Design for prawn industries
Buren, T., International Institute for Applied Systems Analysis, Austria	Altogether 114 river basins in all regions	Climate change impact on regional water resources
Drange, H., Nansen Environental and Remote Sensing Centre, Norway	Report 100 MPI/GRDC	Discharge from 50 selected rivers of the world for GCM validation
Cunnane, C., University College, Dept. Hydrology, Ireland	GRDC catalogue	Selection of rivers for trend analysis of discharge
Ebel, Ch., State Environment Agency, Germany	Argentina	Environmental protection in the Rio Colorado basin
Freon, P.,ORSTOM, France	Italy	EC-program in Marine research
Friederich, State Agency for Agriculture and Water Resources, Germany	Rivers flowing in the Baltic Sea	Pollution fluxes in the Baltic Sea
Hastenrath,S., Univ. of Wisconsin, Dept. Atmospheric and Oceanic Sciences, U.S.A.	Zaire	Research on mechanisms of tropical climate anomalies
Zhou, J., Institute of Atmospheric Physics, China	Report 100 MPI/GRDC	Discharge from 50 selected rivers of the world for GCM validation.
Kisiel,K., Univ. Arizona, Dept. Hydrology, U.S.A.	12 large river basins globally	Development of GIS-system
Lee, T., UN Economic Commission, Chile	GRDC catalogue	Latin-American integrated water resources planning and management
Lal, M., Indian Institute of Technology, India	India	Validation of GCM's
Lean, J., U.K. Met. Office, U.K.	Report 100 MPI/GRDC	Discharge from 50 selected rivers of the world for GCM validation.
Mahfouf, J., Meteo-France, France	Report 100 MPI/GRDC	Discharge from 50 selected rivers of the world for GCM validation.
Mamayev,V., Central Research Centre, Oceanographic Institute, U.S.A.	Selected rivers in Eastern Europe	Sea level rise in the Black Sea

REQUEST MADE BY (NAME, COUNTRY)	COUNTRY OR RIVER, FOR WHICH DATA ARE REQUESTED	PURPOSE OF DATA USE
Manley, R.,Cambridge Univ., U.K.	Euphrat, Tigris	Marshes at the southern end of Euphrat and Tigris for World Conversation Union
Hua-Lu, P., NOAA, U.S.A.	Report 100 MPI/GRDC	Discharge from 50 selected rivers of the world for GCM validation.
Tonderski, A., Linköpping Univ., Sweden	West European and East European rivers	Hydrological data for research in water quality changes
Tateishi, R., Chiba Univ., Japan	Selected rivers over the world	Global water resources and water use
Braithwaite, D., EOS Project, Univ. of Arizona, U.S.A.	Selected rivers over the world	Preparation of selected global data sets for GCM modellers
Kwadijk, J., Univ. Utrecht, Netherlands	Ganges, Brahmaputra	Adaption and test of water balance model
Winnegge, Th., Fed. Inst. Hydrology, Germany	Niger river	Comparative studies with precipitation data held in the GPCC
Yamagata, T., University of Tokyo	Report 100 MPI/GRDC	Discharge from 50 selected rivers of the world for GCM validation.
Roth, R., Int. Meteorology & Climatology, Univ. Hannover	Report 100 MPI/GRDC	Discharge from 50 selected rivers of the world for GCM validation.

SUMMARY OF DATA REQUESTS FROM GRDC IN 1994

REQUEST MADE BY (NAME, COUNTRY)	COUNTRY OR RIVER, FOR WHICH DATA ARE REQUESTED	PURPOSE OF DATA USE
Adams, D., National Remote Sensing Centre Limited, Hampshire, UK.	Rivers Bosna, Fojnicka, Neretva (50 km around Sarajevo)	GIS-Input for flood modelling
Alexiou, A.G.Intergovernmental Oceangraphic Commission, UNESCO, France	River discharge into the Indian Ocean	Global ocean observing system
Aureli, A., UNESCO, IHP, France	Niger basin	GIS based assessment of water resources
Bainto, E.V., Climate Research Division, Scripps Institution of Oceanography, University of California, San Diego, U.S.A.	Major river inputs to North Pacific and Atlantic basins	Runoff computation into oceans
Barsoum, N., RITSEC - Regional Information Technology and Software Engineering Centre, Cairo, Egypt	Arab region and Europe	Regional information system update
Bergström, St., SMHI-Swedish Meteorological and Hydrological Institute, Sweden	Baltic region	BALTEX-Project
Braithwaite,D., University of Arizona, U.S.A.	Data of gauges in all regions	Earth Observation Project of NASA
Buchtele, W., Charles University, Prague,Czech Republic	Niger Basin	Water balances and rainfall-runoff modeling (Student-course)
Cayan, D., Scrips Institution of Oceanography University of California, San Diego, Climate Research Division, La Jolla, U.S.A.	Station in Canada, U.S.A., Europe with drainage area above 50 000 km^2	-
Chalise, S.R., International Centre for Integrated Mountain Development, Kathmandu, Nepal	Rivers in the Hindu Kush Himalayas	Hydrological studies in the Himalayan region
DeLiberty, T.L., Cooperative Institute for Meteorological Satellite Studies, Space and Engineering Centre University of Wisconsin-Madison, Madison, U.S.A.	Discharge data for rivers in Brasil; Amazon Basin	Research on moisture budget in the Amazon Basin

REQUEST MADE BY (NAME, COUNTRY)	COUNTRY OR RIVER, FOR WHICH DATA ARE REQUESTED	PURPOSE OF DATA USE
Dethleff,T., Forschungszentrum für Marine Geowissenschaften, Christian-Albrechts-Universität, Kiel, Germany	Discharge data of Sibirien rivers flowing to the Arctic Ocean	Research on Arctic Shelf zones
Dinar, A., Water Resources Economist, The World Bank, Washington, U.S.A.	Indian and Brazilian rivers	Research on Global Warming effects in India and Brazil
Dümenil, L., Max Planck Institute for Meteorology, Hamburg, Germany	Metadata only	GRDC-Catalogue, Research on global climate change
Fernandez-Jauregui, C.A., UNESCO, Montevideo, Uruguay	GRDC diskette	LACHYCOS project South America
Flachs, F., Friedrich-Alexander-Univ. Erlangen-Nürnberg, Germany	River basins Kongo/Zaire, Nile, Mekong, Parana	Research on river discharge and flood plaine ecology
Gelder, van A., Vakgroep Fysische Geografie, Univ. Utrecht, Netherland	Yellow River (Huanghe), China	Research on sediment transport
Georgiadi, A., IGAN. Moscow, Russia	Monthly flow of all rivers of GRDC	Information on rivers in former SU
Hamad, O., Freshwater Recources Management Program Centre for Environment & Development Arab Region and Europe, Oman, Giza, Egypt	GRDC catalogue	Establishing regional data base
Heller, H., Lehrstuhl für Geobotanik, Systematisch-Geobotanisches Institut, Göttingen, Germany	Discharge in Rivers Odra and Vistula	Vegetation Research
Hladny, J., Czech Hydrometeorological Institute, Praha, Czech Republic	Elbe-basin	WCP-Water Project B.3
Immendorf, R., Geographisches Institut der Universität Köln, Germany	Rivers in Western Europe	Research Project: Floods in Western Europe
Iyama, S., River Bureau, Ministry of Construction, Tokyo, Japan	GRDC information	Catalogue of rivers in SE-Asia
Kasalski, K., Poznan, Poland	Rivers Thames and Lee	Analysis of long-term time series

REQUEST MADE BY (NAME, COUNTRY)	COUNTRY OR RIVER, FOR WHICH DATA ARE REQUESTED	PURPOSE OF DATA USE
Kleeberg, H.-B., Institut für Wasserwesen, Universität der Bundeswehr München, Germany	GRDC information	Organisation of database and datastructure
Kwadijk, J., Geografisch Instituut, Vakgroep Fysische Geografie, Univ. Utrecht, Netherland	Rivers Ganges and Brahmaputra	Water balance with Rhine flow model for climate change research
Laval, K., Laboratoire de Météorologique Dynamique, Centre National de la Recherche Scientifique, Paris, France	Runoff and precipitation in river basins: Mississippi, Amazon, Europe, Sahel and Yenisey	Runoff simulation in Global Circulation Models
Lemmelä, R., National Board of Waters and the Environment, Hydrological Office, Helsinki, Finland	GRDC catalogue	Hydrological models for BALTEX project
Maidment, D.R. Centre for Research in Water Resources, University of Texas, Austin, U.S.A	GRDC catalogue. Streamflow data of the Niger and Benue basins	FAO/UNESCO Water Balance of Africa
Maier-Reimer, D., Hamburg, Germany	Runoff-data of rivers in Canada and Alaska. Runoff-data of rivers in France	Doctoral thesis on Hydrological Regimes
Malm, B., UNESCO, Division of Water Science, Paris, France	Station catalogue of rivers in Africa	Comparison of databases
Matsuoka, Y., Environmental and Sanitary Engineering, Univ. Kyoto, Japan	Runoff-data of 522 stations	Analysis of climatic change on East and South Asia
Matsuyama, H., Department of Geography, Tokyo Metropolitan University, Tokyo, Japan	Discharge data of 8 rivers, which drain into Lake Balkhas and of the Ili river	Studies on water budget around Lake Balkhash
McClimans, SINTEF NHL, Norwegian Hydrotechnical Laboratory, Trondheim, Norway	Data of Ob and Yenisei	
Naff, Th., School of Arts and Science, Dept. of Asian and Middle Eastern Studies, Univ. of Pennsylvania, U.S.A.	GRDC information	Middle East water issues project

REQUEST MADE BY (NAME, COUNTRY)	COUNTRY OR RIVER, FOR WHICH DATA ARE REQUESTED	PURPOSE OF DATA USE
Oki, T., Hydrology and Water Resources Engineering, Institute of Industrial Science, Tokyo, Japan	Selected global runoff data	Research on global soil wetness
Pelt, Ph., UNEP/GRID, Geneva, Switzerland	GRDC catalogue	User-guide for data base on natural hazards
Perlmutter, M.A., Texaco, Houston, Texas, U.S.A	GRDC information	Elevations and hypsometry of river drainage areas
Qu, W., Institut für Pflanzenökologie, Justus-Liebig Univ. Gießen, Germany	GRDC information	Water Cycle Model
Rohde, F., Lehrgebiet für Wasser-Energie Wirtschaft, RWTH Aachen, Germany	GRDC information	Structure of data and organisation of database
Sakho, M.A. Abidjan, Ivory Coast, Africa	Country catalogue, Catalogue of missing data	update of database
Schmitt-Heidrich, P., Institut für Hydrologie und Wasserwirtschaft, Univ. Karlsruhe, Germany	Gambia river	Irrigation projects (Salinization)
Singh, A., GRID-Sioux Falls, EROS Data Centre, Sioux Falls, U.S.A.	GRDC information	Digital elevation model
Sungwon, J., Korea Institute of Constuction Technology, Water Resources Eng. Div., Seoul, Korea	GRDC information (Korea)	Hydrologic data systems, update of regional database
The Hydrological Advisor to His Majesty's Government of Thailand	GRDC catalogue, catalogue of missing data	GRDC request for data: Comparison of databases
Tomé, A. R., Universidade da Beira, Covilha, Portugal	Spain: Ebro, Júcar, Liobregat, France: Rhône, Italy: Po, Arno, Tibre, Greece: Akhelóos, Axiós, Evros, Aliákman, Yugoslavia: Krka, Cetina, Neretva, Albania: Mat, Drin, Shkumbi, Devoli, Vigose, Lebanon: Litani, Egypt: Nile, Morocco: Moulouya, Tunesia: Medjerda, Algeria: Cheliff, Turkey: Cheyhan	PhD thesis intra and inter-annual variability in the Mediterranean region

REQUEST MADE BY (NAME, COUNTRY)	**COUNTRY OR RIVER, FOR WHICH DATA ARE REQUESTED**	**PURPOSE OF DATA USE**
Try, P. International GEWEX Project Office, Washington, U.S.A.	GRDC information (8 stations)	Preparation of CD-ROM for GEWEX (ISLSCP)
Vandewiele, G.L. Vrije Universiteit Brussel, Belgium	31 rivers (globally)	PhD thesis; development of stochastic runoff models for engineering purposes
Wiese, B., Geographisches Institut, Universität zu Köln, Germany	Senegal river	Desertification in Senegal
Wilkinson, W.B., Institute of Hydrology, Wallingford, UK	GRDC catalogue	Comparison of databases
Yang, R., Climate and Radiation Branch, NASA/GSFC, Greenbelt, U.S.A.	Global river flow data; 42 rivers	Research on global climate change
Zober, St.,IHP/OHP Secretariat, Koblenz, Germany	River Vistula	Floodplain pollution control

Table 3: **Status of Feed-Back Response 1993/1994**

Name, Address	Feedback yes/no	Abstract provided yes/no
Mr. Arthur G. Alexiou Intergovernmental Oceanographic Commission GOOS Support Office UNESCO 1, rue de Miollis 75732 Paris, CEDEX 15 France	yes	expected
Mrs. Alice Aureli UNESCO, IHP Division of Water Sciences 1, rue Miollis F - 75732 Paris CEDEX 15 France	no	no
Mr. Emilia V. Bainto Scripps Institution of Oceanography Climate Research Division University of California, San Diego La Jolla, California 92093-0224 U.S.A.	no	no
Professor Sten Bergström Swedish Meteorological and Hydrological Institute (SMHI) S-601 76 Norrköpping Schweden	no	no
Dr. Charon Birkett Remote Sensing Group Department of Space and Climate Physics Iniversity College, London Fax: 0044 - 483 - 278 312	no	no
Dr. James M. Bishop KISR, P.O.Box 1638 22017 Salmiya Kuweit	no	no

Mr. Dan Braithwaite, EOS Project Department of Hydrology and Water Resources University of Arizona Tucson, Arizona 85721 U.S.A.	yes	CDROM: Internat. Satellite Land Surface Climatology Project
Mr. Josef Buchtele Katedra hydrogeologie a inzenyrske geologie Priodovedecke faculty University Karlovy 128 43 Praha 2, Albertov 6 Tschechische Republik	yes	yes
Mr. T. A. McClimans SINTEF NHL Norwegian Hydrotechnical Laboratory Klaebuveien 153 N - 7034 Trondheim Norwegen	yes	announced
Dr. W. Cudlip Mullard Space Science Laboratory Department of Space and Climate Physics University College London Holmbury St. Mary Dorking Surrey RH5 6NT United Kingdom	no	no
Herrn Dirk Dethleff Forschungszentrum für marine Geowissenschaften Christian-Albrechts Universität Wischhofstr. 1-3 24148 Kiel	no	no
Mr. Ariel Dinar Agriculture and Natural Resources Department The World Bank 1818 H Street N.W. Room S 8 039 Washington DC. 20433 U.S.A.	yes	announced

John A. Dracup, Ph.D., P.E. Professor School of Engineering and Appolied Sciences University of California, Los Angeles 3066 Engineering 1 405 Hilgard Ave. Los Angeles, Calif. 90024-1593 Fax: 001 - 310 - 206-7245	no	no
Frau Dr. Lydia Dümenil Max Planck Institut für Meteorologie Bundesstr. 55 D - 20146 Hamburg	yes	GCM-modeling in progress
Herrn Christian Ebel Amt für Umweltschutz - Gewässer- und Bodenschutz - Baumwall 3 20459 Hamburg Fax: 040 - 34913-2482	no	no
Herrn Frank Flachs Erlenweg 2 95194 Regnitzlosau	no	no
Herrn Friederich Amt für Land- und Wasserwirtschaft Kiel Postfach 2980 24028 Kiel	yes	Research in planning phase
Dr. André van Gelder Universiteit Utrecht Vakgroep Fysische Geografie Faculteit Ruimteljike Wetenschappen Postbus 80115 NL - 3508 TC Utrecht Niederlande	yes	yes
Mr. Osama Hamad Freshwater Resources Management Programme Centre for Environment & Development Arab Region and Europe 21/23 Giza St., Nile Tower Bldg., 13 Fllor P.O.Box 52 Oman, Giza Egypt	no	no

Professor S. R. Chalise International Centre for Integrated Mountain Development (ICIMOD), Mt. Environmental Management Division Jawalakhel, Lalitpur P.O.Box 3226 Kathmandu Nepal	yes	Data used for regional survey of hydrological information
Herrn Dipl.-Ing. Peter Schmitt-Heiderich Institut für Hydrologie und Wasserwirtschaft (IHW) Universität Karlsruhe (TH) Kaiserstr. 12 Postfach 6980 76128 Karslruhe	yes	Data could not be used for the time frame of interest
Herrn Dipl.-Geogr. Ralf Immendorf Geographisches Institut der Universität Köln Albertus-Magnus-Platz 50923 Köln	no	no
Mr. Michael Jackson Meteorological Office Hadley Centre London Road, Bracknell, Berkshire RG12 2SY United Kingdom	yes	yes
Mr. Zhou Jiabin Institute of Atmospheric Physics Academia Sinica Beijing China	yes	yes
Mr. Kzyszkof Kasalski ul. Emilii Plater 1 61-406 Poznan Poland	no	no
Mr. Ken Kisiel The University of Arizona College of Engineering and Mines Building 11 Tucson, Arizona 85721 U.S.A.	no	no

Mr. I. C R. Kwadijk Rijksuniversiteit Utrecht Faculteit Ruimtelijke Wetenschappen Heidelberglaan 2 Postbus 80115 NL-3508 TC Utrecht Netherlands	yes	yes
Dr. M. Lal Principal Scientific Officer Centre for Atmospheric Sciences Indian Institute of Technology New Delhi-110016, INDIA Fax: 0091-11-6862037	no	no
Mrs. Katia Laval Laboratoire de Météorologique Dynamique École Normale Superieure Centre National de la Recherche Scientifique 24, Rue Lhomond 75231 Paris, Cedex 05 France	no	no
Mr. Terence R. Lee Natural Resources and Energy Unit Division of Environment and Development Economic Commission for Latin America and the Carribbean Casilla 179-D Santiago, Chile	yes	No actual data were ordered
Dr. Tracy L. DeLiberty CIMSS, Space Science and Engineering Centre University of Wisconsin, Madison 1225 West Dayton Street Madison, Wisconson 53706 U.S.A.	yes	announced
Professor T.A. McMahon Centre for Environmental Applied Hydrology Department of Civil & Environmental Engineering University of Melbourne Parkville, Victoria 3052 Australia	yes	announced

Prof. David R. Maidment University of Texas at Austin Centre for Research in Water Resources J.J. Pickle Research Center, Building 119 Austin, Texas 78712 U.S.A.	yes	yes
Mrs. Brigitte Malm UNESCO Division of Water Sciences 1, rue Miollis F - 75732 Paris, CEDEX 15 France	yes	Update of UNESCO Data-base Africa
Mr. Vladimir O. Mamayev Central Research Center Woods Hole, MA 02543 U.S.A.	yes	announced
Dr. R.E. Manley 78 Huntington Road Cambridge CB3 OHH United Kingdom	yes	yes
Dr. Megumi Maruyama Nagoya University Forest Resources Utilization Laboratory Chikusa-ku, Nagoya 464-01 Japan	yes	yes
Dr. Hiroshi Matsuyama Department of Geography Tokyo Metropolitan University Minami-Oshawa 1-1, Hachioji-shi Tokyo, 192-03 Japan	yes	yes
Dr. Taikan OKI Code 913 Goddard Space Flight Center Greenbelt, MD 20771, USA Fax +1 301 286-1759	yes	yes

Dr. M. Morell Le Responsable du Laboratoire d'Hydrologie ORSTOM Centre de Montpellier 911, avenue Agropolis B.P. 5045 F - 34032 Montpellier cdx 1 France	yes	announced
Mrs. Diane Portis Department of Atmospheric Sciences University of Illinois 105 South Gregory Avenue Urbana, Il 61801-3070 U.S.A. Fax: 001 - 217 244 4393	no	no
Herrn Daniel Meier-Reimer Friedensallee 166 22763 Hamburg	no	no
Mrs. Nadine Barsoum RITSEC - Regional Information Technology and Software Engineering Centre 11 A Hassan Sabry St. Zamalek Cairo Fax: 00202 - 341-2139	no	no
Dr. Ryotaro Tateishi Chiba University Remote Sensing and Image Research Center 1-33 Yayoi-cho, Inage-ku Chiba 263 Japan	yes	yes
Mr. António Rodriguez Tomé Universidade da Beira Rua Marquês D'Avia e Boloma 6200 Covilha Portugal	no	no
Prof. G.L. Vandewiele Vrije Universiteit Brussel Centrum voor Statistiek en Operationeel Onderzoek Pleinlaan 2 B - 1050 Bruxelles Belgique	yes	announced

Prof. Dr. Bernd Wiese Universität Köln Geographisches Institut Albertus-Magnus Platz 50923 Köln	no	no
Dr. (Mrs.) Runhua Yang Climate and Radiation Branch NASA/GSFC, Mail Code 913 Greenbelt, MD 20771 U.S.A. Fax: 001 - 301 - 286 - 1759	yes	announced

Feedback 1995

Mr. H. Goosse Institut d´Astronomie et de Géophysique G. Lemaitre Chemin du Cyclotron, 2 B-1348 Louvain-la Neuve Belgium	yes	yes

Feedback 1996

Mr. Yonkan Xue Center for Ocean-Land-Atmosphere Studies 4041 Powder Mill Rd., Suite 302 Calverton, MD 20705 U.S.A.	yes	yes

Publications reported to GRDC
from research undertaken in 1993/1994 *

* Including two publications 1995 and 1996

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MODÉLISATION DE LA RÉLATION PLUIE - DÉBIT POUR LE BASSIN DU NIGER AU PROFIL DE KOULIORO*

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**Cet article est un extrait de ma thèse de fin d'études*

I. INTRODUCTION

Les modèles hydrologiques sont considerés comme un outil capable d' évaluer les changements du processus d' écoulement dûs aux changements climatiques, à l'action de l' homme, etc... .
Le but de cet article est de faire les simulations du débit du Niger au profil de Koulikoro en vue d'analyser:

-La sensibilité des paramètres du modèle aux changements de condition dans le bassin versant;

-L'effet des variations climatiques(augmentation ou diminution des précipitations, de l'évapotranspiration. etc...) sur le débit simulé.

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SEDIMENTARY GEOLOGY

Overbank and channelfill deposits of the modern Yellow River delta

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Abstract

The Huanghe is noted for its high transport rate of silt and clay, which may reach depth-averaged values of 200 kg m^{-3} during peak discharge. The sediment load transported through the river on entering the delta plain, amounts to 10^{12} kg per year. In contrast to most other large deltas only one distributary channel is active at any one time. The high sediment load causes the rivermouth to prograde at a yearly rate of 1–4 km into the shallow (less than 20 m deep) Bohai gulf. The vertical aggradation of the channel belt and mouth bar complex is also rapid (decimetres per year on average), so that after a normal average of twelve years increasing channel instability and avulsion create the start of a new delta lobe.

A series of satellite images covering the last fifteen years has provided insight in the evolution of the river pattern as well as the progradation of the delta front. A newly developed distributary passes from a multichannel to a single, straight channel system, and ends with the formation of meanders. The protruding mature delta lobe shows a radiating pattern of crevasse channels.

Overbank/crevasse deposits are made of vertically stacked dm-scale waning flow sequences, structurally characterized by (from bottom to top) small scour-and-fills, even (parallel) lamination, and climbing-ripple crosslamination. Accumulation rates on crevasse splays can be predicted on the basis of estimated river sediment discharge. It can be concluded that each sequence has been deposited within a few hours, and that tidal waterlevel fluctuations may have played a role in the generation of a single sequence.

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Sensitivity of a global ice–ocean model to the Bering Strait throughflow

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Submitted to Climate Dynamics

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Abstract

To understand the influence of the Bering Strait on the World Ocean's circulation, a model sensitivity analysis is conducted. The numerical experiments are carried out with a global, coupled ice–ocean model. The water transport through the Bering Strait is parameterized according to the geostrophic control theory. The model is driven by surface fluxes derived from bulk formulae assuming a prescribed atmospheric seasonal cycle. In addition, a weak restoring to observed surface salinities is applied to compensate for the global imbalance of the imposed surface freshwater fluxes. The impact of the Bering Strait throughflow on the ocean general circulation is found to be relatively small. On opening the Bering Strait, the thermohaline circulation in the deep Atlantic weakens by about 6%, owing to the freshening of the surface waters in the North Atlantic which reduces the convective activity. It is argued that the contrasting results obtained by Reason and Power (1994) are due to the type of surface boundary conditions they used.

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The Second Hadley Centre Coupled Ocean-Atmosphere GCM: Model Description, Spinup and Validation.

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Abstract

This paper describes a new coupled ocean-atmosphere general circulation model (OAGCM) developed for studies of climate change and results from a hindcast experiment. The model includes various physical and technical improvements relative to an earlier version of the Hadley Centre OAGCM. A coupled spinup process is used to bring the model to equilibrium. Compared to uncoupled spinup methods this is computationally more expensive, but helps to counter climate drift arising from inadequate sampling of short timescale coupled variability when the components are equilibrated separately. Including sea ice advection and enhancing reference surface salinities in high southern latitudes in austral winter to promote bottom water formation during spinup appears to have stabilised the high latitude drift exhibited in the earlier model's control run. In the present study, the atmospheric control climate is stable on multi-century timescales with a drift in global average surface air temperature of only +0.016 K/century, despite a small residual drift in the deep ocean. The control climate is an improvement over the earlier model in several respects, notably in its variability on short timescales. Two anomaly runs are presented incorporating estimated forcing changes over the period 1860 to 1990 arising from greenhouse gases alone and from greenhouse gases plus the radiative scattering effect of sulphate aerosols. These allow validation of the model against the instrumental climate record. Inclusion of aerosol forcing gives a significantly better simulation of historical temperature patterns, although comparisons against recent sea ice trends are equivocal. These studies emphasize the potential importance of including additional forcing terms apart from greenhouse gases in climate simulations, and refining estimates of their spatial distribution and magnitude.

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PRELIMINARY STUDY ON THE GLOBAL CHANGE OF RUNOFF

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ABSTRACT

Using moving t-test, Mann-Kendall rank statistic test and Pettitt test, the global change of runoff is investigated.

Moving t-test gives an interval of change point of time series, we choose the point for which the value of t-static is maximum among the values of t for all the change points.

In order to investigate the climatic change in various time-scale we propose the following approaches. First a change point is got. Then the time series is cut at the change point (of first class) and we have two series. Third we use the above mentioned statistical techniques for every series and get two new change points (of second class). We repeatly these procedures until no change point can be found.

The result indicates that 1960's is a key period. Runoff of many rivers changes their trend of variation then.

KEY WORDS: Climatic change - runoff - change point

INTRODUCTION

It is widely recognized that the global mean surface temperature has increased since last one hundred years or so. The change of temperature, however, is only one kind of the global change. It is better to investigate the change of other elements.

The runoff of a river represents the hydrological characteristics in a valley. It seems to us that the change of runoff may be a good factors to identify the climatic change.

In this paper moving t-test, Mann-Kendall rank statistic test and Pettitt test is used to study the change of runoff of river in the world.

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CONCEPT

The impacts of climate change on the water balance of the Ganges-Brahmaputra and Yangtze basin

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RESOURCE ANALYSIS

1 Introduction

One of the major controls for the future global water supply situation is the availability of fresh water. Other important factors are socio-economic factors such as population growth, economic growth, technology, infrastructure and so on. Both the physical and socio-economic factors can highly influence the fresh water supply. Furthermore, the fresh water supply is not only a matter of water quantity, it is also very much related with water quality issues. For policy makers, it is important to know which combination of physical and socio-economic factors is responsible for changes in the water supply situation.

Major concerns of global water policy issues are related to drought and flooding. Climate change, described in terms of changing precipitation patterns and quantities and changes of temperatures is almost directly related to these issues. An important question for policy making is: what are the contributions of the two main global mechanisms causing drought and flooding, and which policy options - *e.g.* climate policy or water management policy - are expected to be most efficient in preventing or reducing the impacts of drought and flooding.

An integrated analysis on these aspects can be developed along the same line. A detailed research into the physical impacts of climate change on the soil water balance has to be combined with an analysis of the socio-economic factors related to water supply issues. This is one of the major goals for the development of TARGETS (Tool to Assess Regional and Global Environmental and Health Targets for Sustainability) at the National Institute of Public Health and Environmental Protection (RIVM) in The Netherlands [Rotmans et al. 1994]. An important part of the TARGETS project is the development of AQUA, a tool for global water policy making [Hoekstra, 1994].

Within the framework of TARGETS, several studies are carried out. One of these studies is aimed at a detailed integrated study of the Indian subcontinent, with special focus on the Ganges-Brahmaputra basin. Both socio-economic (SEIS-project) and physical factors (using the AQUA tool) are studied.

This paper describes the development and application of a spatial distributed water balance model for the Ganges Brahmaputra basin. This model enables the analysis of the impacts of climate change on the fresh water hydrology of this basin. The questions that are discussed deal with the availability of water in the catchments, the temporal and spatial distribution of this availability and the changes in the availability as a result of climate change. Two very important aspects of the water balance are the availability of water for agricultural purposes and the runoff regime of the catchments. Climate change will have an impact on both these aspects. This paper describes the reaction of the water balance to climate change, and the related changes in water availability and runoff.

In addition to the studies on the Ganges - Brahmaputra basin, the model has been applied on the Yangtze river in China. Although this part of the study is not finished yet, this paper describes the preliminary results of the application of the model in this basin.

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FAO/UNESCO Water Balance of Africa

Water Balance of the Niger Basin

Prepared for the

UN Food and Agriculture Organization
and UNESCO

by the

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University of Texas at Austin

Interim Report

July 1995

FAO/UNESCO Water Balance of Africa

- Case study of the Niger Basin
- Prepared by David Maidment, Daene McKinney, Ray Lindner, Francisco Olivera, Seann Reed, Ye Zichuan,
- Soil water, surface water and groundwater balance model prepared using Arc/Info, Arcview and related programs
- Interim Report of a work in progress

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WATER BALANCE OF THE NIGER BASIN

by D.R. Maidment[1], F. Olivera, Z. Ye, S.M. Reed and D.C. McKinney

ABSTRACT

A map-based method is used to construct a monthly water balance model of the 2.3 million km^2 Niger River basin in West Africa. The watersheds and stream network within the basin are derived from a 1 km digital elevation model of Africa using an algorithm that produces a single stream for each watershed. Rainfall-runoff computations are done for each watershed and the runoff routed down through the river network using programs attached to the Arcview GIS. Results are presented for the monthly water balance of the Niger River at Koulikoro and Dire, gages which are upstream and downstream, respectively of the Inner Delta of the Niger River.

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HYDROLOGICAL STUDY OF THE MARSHES OF SOUTHERN IRAQ

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with

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Chapter 1

Introduction

1.1 Background

The Iraqi marshes occur at the confluence of two major rivers, the Tigris and the Euphrates. Both rivers rise in Turkey to the north and flow generally southward. In terms of flow to the southern Iraq region, including the marshes and low lying land further north, some 60% of the flow comes from the Tigris and the remainder from the Euphrates.

1.2 The Euphrates

The source of the Euphrates is in mountains over 3000 m in height in Eastern Turkey. One of the main tributaries, the Murat, rises on the slopes of Mount Ararat which at 5165 m is Turkey's highest mountain. The total river basin area of the Euphrates is 444,000 km^2 but parts of it are in very arid regions and contribute negligible flow. The effective contributing area is about half of that. Some 90% of the runoff comes from Turkey.

1.3 The Tigris

The Tigris also rises in the Turkish mountains - to the east of the Euphrates basin. Its total basin area is 471,000 km^2 but as with the Euphrates around half of this is non-contributing. The flows in the Tigris come 50% from Turkey, 40% from Iraq and 10% from Iran.

1.4 Natural Hydrological Regime of the Marshes

To the south of the river basins there is little rainfall and virtually all of it occurs during the winter months. Further north the precipitation is heavier and it can occur in any month but with a marked preponderance in the winter months, much of which falls as snow. When the snow melts, in March to April, flows in the river basin increase, reaching a peak in late spring and early summer. These flows flood into the low lying areas of the marshes. As the marshes expand they flow into areas which have been dry for several months and much of the initial flooding goes to fill the voids in the soil. When the flood recedes, under the effects of evaporation, transpiration and drainage, it leaves behind an area of saturated soil which supports a range of vegetation. Superimposed on this annual cycle there is also a more variable pattern of wet and dry years; some parts of the marshes will only be flooded in very few years but others will remain flooded even the driest year. It is this flow variation which has determined the vegetation and land use patterns of the marshes. In their natural state, the flooded area of the marshes will vary by a factor of three during the course of the year.

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速報

The impact of deforestation in the Brazilian Tropical Forests (II)
—Influence of deforestation upon the Madeira Basin in Rondônia—

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I Introduction

After the World War II, many development projects took place in Brazilian Amazonia. The deforested area within Legal Amazonia was 460,000km² in 1988 (FEARNSIDE, 1990) and in Rondônia State, it was 13,955.2km² in 1983 (*2*). The Polo Noroeste Plan was responsible for the large-scale clearance in Rondônia. The lots can be seen as a "fish bone" in the Landsat -TM imagery. In this paper, the actual situation of land use within the State of Rondônia in southwest of Legal Amazonia is studied, analyzing the Landsat-TM data, together with the hydrometeorological data of Madeira Basin to study the influence of vast clearance occurred over the 20 years (*3, 4*).

II Analysis method

1. The analysis of the imagery was made, using the INPE's digital CD-ROM data of Landsat 5-TM of July 28, 1993, scene 231-067 and of June 4, 1994, scene 232-067. The convertion of digital data into one hundred cut scenes was done using the program L2tiff of INPE's CD-ROM data choosing the bands 5, 4, 3 to represent the colors red, green and blue (RGB) respectively. These one hundred cut scenes were seen using the Image Processing Software "Paint Shop Pro". Analyzing the distribution of color level (grey-scale) of Band 5 that corresponds to the middle-infrared wavelengths of 1.55μm to 1.75μm (*1*), by means of Visual Basic Program, a direct comparison was made with the imagery of the cut scene, enabling the exact detection of grey-scale varying from 0 to 255 levels, corresponding to different categories as river, forest, cleared area, pastures; roads and city of Ariquemes and Jiparaná within the scenes. The analysis was made to the TM Spectral Bands 1, 2, 3, 4, 5 and 7 and the histograms of Bands 4 and 5 that well represented the artificial objects within the cut scene were used to calculate the cleared area.

2. The analysis of the discharge of the rivers Madeira that flows in the northern state towards Amazon River (1970-1985) and Jiparaná that flows from south to north of the state towards Madeira River (1978-1991) was done, together with the precipitation data of Santo Antônio BR-364 (Latitude 09—15'00"S Longitude 63—10'10"W, 1978-1994)) and Cachoeira do Samuel (Latitude 08—45'00"S Longitude 63—28'28"W, 1976-1984) and compared to the cleared area of Rondônia State from 1975 to 1983 (Table 1).

Table1. Deforestation of Rondônia State (2)

year	cleared forest area (km²)	source
1975	1,216.5	Tardin et al., 1980
1978	4,184 5	Tardin et al., 1980
1980	7,579.3	Carneiro et al., 1982
1983	13,955.2	Brazil, Min. da Agric., 1985, Fearnside and Salati, 1985

III Results

1. The grey scale for the cleared area of the scenes 232-067, 940604 and 231-067, 930728 was determined respectively, and multiplying the resolution of 28.5m x 28.5m to the number of pixels detected in the corresponding grey scale within the histogram, the deforested area was calculated. The total number of pixels detected from the former was 21525654, corresponding to 17,483.136km² of cleared area, representing 51% of the total area of the scene (34,225 km²) and from the latter was detected 14290849 pixels, corresponding to 11,607.027km² of cleared area, representing 34% of the total area of the scene.

2. During the period of 1970 to 1985, the average yearly runoff of Madeira River was 19,667m³/s and the maximum yearly average runoff was 26,553m³/s in 1982. In the same period, the maximum runoff during the rainy season was 49,410m³/s registered on April 16, 1984, reflecting the precipitation of the same year. The minimum runoff during the dry season was 3,224m³/s, registered on October 1, 1971 (fig.1). The discharge data of Jiparaná River is from 1978 to 1991, with blanks in 1988 to 1990. The maximum discharge occurred on January 25, 1986,

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The Seasonal Change of the Water Budget in the Congo River Basin

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Abstract

The seasonal change of the water budget in the Congo river basin is investigated by using hydrometeorological data averaged over long-term periods. Vapor flux convergence is calculated using the global objective analysis data of the ECMWF from 1985 to 1988. Precipitation and river discharge data mainly cover the periods 1920–1960 and 1932–1959, respectively. Evapotranspiration is estimated as precipitation minus vapor flux convergence on the monthly basis. The atmospheric water balance terms are related to the Normalized Difference Vegetation Index (NDVI) derived from the NOAA/AVHRR averaged from 1985 to 1987.

On the monthly basis, the NDVI and evapotranspiration are in phase with the seasonal change of precipitation in the evergreen forest region, which mainly covers the northern part of the basin. In contrast, the NDVI and evapotranspiration lag precipitation by one month in the southern deciduous forest region covering the southern part of the basin. As for the entire basin, the lag-relationship between the NDVI/evapotranspiration and precipitation is similar to that for the southern deciduous forest region.

In the dry season of the southern deciduous forest region, evapotranspiration exceeds precipitation in the entire basin, causing a decrease of the basin storage to its minimum value. In addition, from the viewpoint of the seasonal change of precipitation and evapotranspiration, it is concluded that the feature of the seasonal change of the water budget in the entire basin mainly reflects the characteristics of the southern deciduous forest region.

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The Water Budget in the Amazon River Basin during the FGGE Period

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The Water Budget in the Amazon River Basin during the FGGE Period

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Abstract

The seasonal change of the water budget in the Amazon river basin during the FGGE period is investigated, using the global objective analyzed data set, precipitation data and river discharge data. Substituting these data into the atmospheric water balance equation and that of the basin, the evapotranspiration and relative value of basin storage are estimated and the relationships of water balance terms are examined.

The annual water vapor flux convergence, calculated using the FGGE "main" III-b data set analyzed at the European Centre for Medium-Range Weather Forecasts, is estimated to be smaller than the annual runoff obtained by river discharge data. This is due to the characteristics of this global objective analyzed data set that it is made by the 4-dimensional data assimilation method which expresses the divergence and convergence of wind in the tropics as weaker than in the real state. The seasonal change pattern of precipitation shows good correspondence to that of water vapor flux convergence, which is multiplied by the factor 1.37 in order that its annual value meets the annual runoff. Evapotranspiration, estimated by the atmospheric water balance equation, remains almost constant within a year and the seasonal change of basin storage is very large. This result indicates that evapotranspiration in the entire Amazon river basin is not affected by the seasonal change of basin storage even in the dry season.

The evapotranspiration ratio (evapotranspiration/precipitation) of the dry season is larger than that of the rainy season. It is concluded that the rôle of evapotranspiration on the water cycle in the Amazon river basin is relatively more important in the dry season than in the rainy season.

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Estimation of Evapotranspiration in the Amazon River Basin Using the Atmospheric Water Balance Method

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Abstract

This study investigates the seasonal changes of evapotranspiration in the Amazon river basin during the FGGE period. The relationship between basin storage and evapotranspiration is also investigated. The atmospheric water balance method and that of the basin are used for the analysis, using the global objective analyzed data set, precipitation data and discharge data. Since the seasonal change pattern of precipitation shows good correspondence to that of water vapor flux convergence, monthly evapotranspiration remains almost constant within a year. On the other hand, the seasonal changes of basin storage are very great and it is concluded that evapotranspiration in the entire Amazon river basin is not affected by the seasonal changes of basin storage even in the dry season. It is also found that the role of evapotranspiration in the water cycle in the basin is relatively more important in the dry season than in the rainy season.

Key words: seasonal change, evapotranspiration, global objective analyzed data set, water vapor flux convergence, water cycle

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RIVER ROUTING IN THE GLOBAL WATER CYCLE

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River discharge returns water to the ocean that may have been carried deep into continents in a vapor phase by atmospheric winds. The global water cycle is not complete without considering the river discharge process. However, this process is not well defined in global climatological studies. Recently, it has been proposed that river discharge can be used for validating general circulation model (GCM) simulations. A river routing model is required in order to compare the runoff from GCMs with observations. This is due to a lag between runoff generated by a GCM grid using a land surface parameterization (LSP) and runoff observed at gauging stations.

The runoff routing model of Miller et al. (1994) was used off-line in this report (Kanae et al., 1995), for the runoff generated by the modified bucket model of Kondo (1993). The Kondo scheme is embedded in the atmospheric GCM of the Center for Climate System Research (CCSR), University of Tokyo and the National Institute for Environmental Studies (NIES). In the case of this bucket model, some portion of precipitation becomes runoff even before the bucket is "full". A numerical experiment was performed using the climatological mean sea surface temperature with its seasonal change and the seasonal runoff of major river basins (Oki et al., 1995).

The river channel network was built from digital elevation maps and manually modified to a 5.6°x5.6° grid corresponding to the T21 GCM resolution. The velocity of the water in the river channel is a tuning parameter in the runoff routing model, and it was found that the velocity of 0.3 m/s gives good seasonal cycles of river discharge for the Amazon, Ob, and Amur river basins (see Figure 1).

One advantage of this research is that total water storage in each river basin can be compared with independent estimates by the atmospheric water balance (AWB) method (Oki et al., 1995a, b). The total water storage estimated by the AWB method and by the atmospheric GCM (AGCM) compared reasonably well (solid lines with open stars in Figures 2 and 3). Total water storage in river basins is estimated by the AWB method that includes the changes of surface soil moisture, snow accumulation, ground water, water in lakes and river channels. This estimation is only a relative value. The minimum value was set to zero in Figure 3. It is important to examine not only the flux (discharge) from the model but also the state variable (storage) in the model with observations.

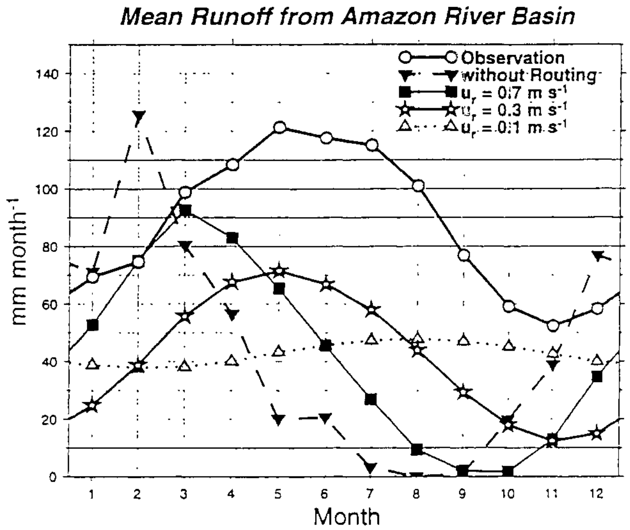

Figure 1: Effect of introducing routing model to the Amazon River Basin.

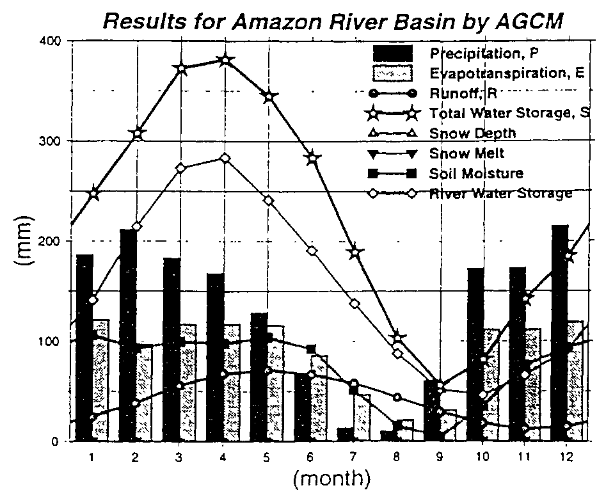

Figure 2: Water balance of the Amazon River Basin by the AGCM and the routing model.

* Visiting scientist, NASA, Goddard Space Flight Center, Greenbelt, Maryland.

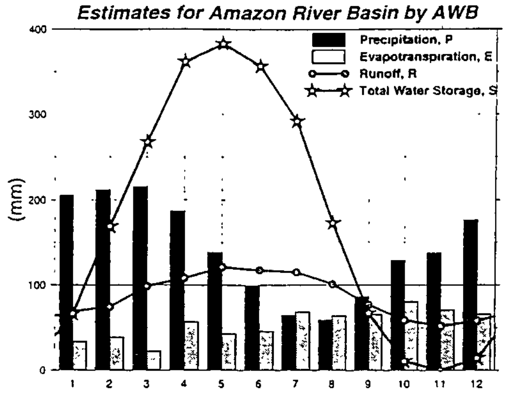

Figure 3: Hydrologic cycle of the Amazon River Basin estimated by atmospheric water balance.

Actually, 0.3 m/s seems slower than the flow speed in a channel of large rivers. The use of a bucket model in a GCM (Manabe, 1969) generates runoff, which has no relation to evaporation at the grid either by surface runoff or by percolation into deep soil layers. Therefore, the effective velocity should be regarded as an integrated mean velocity of rainwater traveling from the surface soil layer to the river mouth through various paths. The routing model in this study includes the ground water process, and river channel storage also consists of ground water storage.

The river routing model is currently included in a coupled atmosphere-ocean GCM of CCSR/NIES, and will be used to investigate how the inclusion of river routing affects the thermohaline circulation of the ocean. The irrigation effect on the soil moisture at a downstream grid by the runoff water from upstream soil moisture should be expressed in a coupled atmosphere-ocean-river GCM in the near future.

GCMs generally use more robust forcings and boundary conditions compared to traditional rainfall-runoff models in hydrology. Simulating river discharge by GCMs will realize the hydrograph estimation of *ungauged river basins*, which is a goal of some hydrologists. Therefore, river routing with a LSP in GCMs can be one of the most challenging issues for them.

For studies on the global water cycle, the river channel network for major basins of the globe (nearly 300) was recently constructed on a 1°x1° global mesh. Figure 4 is an example for South America. This global product can be used in studies such as the International Satellite Land-Surface Climatology Project (ISLSCP) Global Soil Wetness Project.

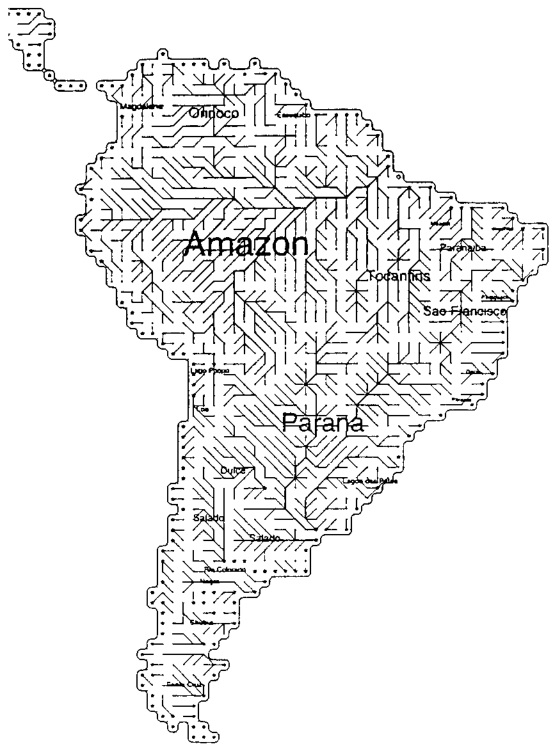

Figure 4: South America river basins in a 1° x 1° mesh.

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TOWARD GLOBAL PLANNING OF SUSTAINABLE USE OF THE EARTH
Development of Global Eco-Engineering
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Global Water Resources Assessment from Multiple Geo-Information

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Abstract

Global hydrological cycle is one of the key issues in the global environmental problems. The change of precipitation, evapotranspiration and runoff will have serious effect for the societal activities, and quantitative estimation of current and future hydrological cycle is crucial to build up a master plan against the possible global climate change. In this study, the global distribution of water balance and hydrological cycle is estimated using atmospheric and river basin water balance method. The results show the latest estimation of global water balance, and they will be used for the validation of present general circulation model (GCM)s. They can also be used for the model refinement of land-surface hydrological processes and regional water balance assessments.

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GLOBAL ATMOSPHERIC WATER BALANCE AND RUNOFF FROM LARGE RIVER BASINS

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ABSTRACT

Atmospheric vapour flux convergence is introduced for the estimation of the water balance in a river basin. The global distribution of vapour flux convergence, $-\nabla_H \cdot \vec{Q}$ is estimated using the European Centre for Medium-Range Weather Forecasts global analysis data for the period 1980–1988. From the atmospheric water balance, the annual mean $-\nabla_H \cdot \vec{Q}$ can be interpreted as the precipitation minus evaporation. The estimated $-\nabla_H \cdot \vec{Q}$ is compared with the observed discharge data in the Chao Phraya river basin, Thailand. The mean annual values are not identical, but their seasonal change corresponds very well. The four year mean $-\nabla_H \cdot \vec{Q}$ is also compared with the climatological runoff of nearly 70 large rivers. The multi-annual mean runoff is calculated from the Global Runoff Data Centre data set and used for the comparison. There is generally a good correspondence between the atmospheric water balance estimates and the runoff observations on the ground, especially in the mid- and high latitudes of the northern hemisphere. However, there are significant differences in many instances. The results emphasize the importance of accurate routine observations in both the atmosphere and river runoff. The global water balance of the zonal mean is compared with prior estimates, and the estimated value from this study is found to be smaller than previous estimates. The annual water balance in each ocean and each continent are also compared with previous estimates. Generally, the global run-off estimation using the conventional hydrological water balance is larger than the result by the atmospheric water balance method. Annual freshwater transport is estimated by atmospheric water balance combined with geographical information. The results show that the same order of freshwater is supplied to the ocean from both the atmosphere and the surrounding continents through rivers. The rivers also carry approximately 10% of the global annual freshwater transport in meridional directions as zonal means.

KEY WORDS Atmospheric water balance method Continental hydrology Large-scale evapotranspiration Total water storage Freshwater transport

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WATER CYCLE IN LARGE RIVER BASINS OF THE EARTH ESTIMATED BY ATMOSPHERIC WATER BALANCE AND ATMOSPHERIC GENERAL CIRCULATION MODEL

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abstract

The Seasonal water cycle in major river basins was investigated in a climatological sense using both the atmospheric-river basin water balance (AWB) method and an atmospheric general circulation model (AGCM) coupled with a runoff routing model. A runoff routing model was used for the calculation of river discharge from the runoff generated by the modified bucket model in the AGCM. The effective velocity u_r of the water in the river channel is a tuning parameter in the runoff routing model, and it was found that u_r of 0.3 m s^{-1} gives good seasonal cycle of river discharge for the Amazon, Ob and Amur river basins. Total water storage in river basins estimated by an atmospheric-river basin water balance method (AWB) includes the changes of surface soil moisture, snow accumulation, ground water, water in lakes and river channels. Total water storage estimated by the AWB and by the AGCM compared reasonably well. In the case of the Amazon river basin, the storage term which appears in the runoff routing model plays a significant role in the seasonal change of total water storage. These good correspondences suggest that the storage term in the runoff routing model is not an imaginary term but a physically meaningful variable.

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グローバル陸域蒸発散と水収支データセットの作成

Development of Global Land Surface Evapotranspiration and Water Balance Data Sets

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論文

グローバル陸域蒸発散と水収支データセットの作成

Development of Global Land Surface Evapotranspiration and Water Balance Data Sets

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論文要旨

本研究では既存のデータセットと簡略化した水収支モデルを用いて各月の蒸発散及び水収支の30分メッシュグローバルデータセットを作成した。他の方法による研究と比較した結果，蒸発散及び水収支は良い精度で求められた。特に全陸域における蒸発散量と流出量は Baumgartner and Reichel の推定値とよく一致した。また，本研究で得た蒸発散量と観測値との相関係数は0.89-0.95であった。緯度帯において他の方法による分布と比較した結果，本研究で得られた水余剰は45°N-75°N 付近，水不足は10°S-30°S 付近で他の方法より多く推定されている。しかし蒸発散量は一部高緯度地域を除いてよく一致した分布が得られた。さらに，国毎の水資源の評価のため，本研究で作成したデータセットと各国の統計値を比較した。

Abstract: The global data sets with half-degree resolution of monthly evapotranspiration and water balance were produced using simplified water balance model and published global data set. Results are compared with information obtained by previous investigations that used different data sets and analytical approaches. In general, the quantitative features of hydrologic regimes at the earth's surface are successfully simulated. The value of water balance components at the terrestrial area also agrees well with those obtained by Baumgartner and Reichel. Particularly, the good correlation ($r=0.89-0.95$) was obtained from the comparison results between the computed annual evapotranspiration and observed values. The comparison of the latitudinal distribution shows that the large amount of water surplus in 45°N-75°N and deficit in 10°S-30°S rather than those of Legates and Mather. On the other hand, the latitudinal distribution of annual evapotranspiration shows very similar, except in middle-high latitudes region. Preliminary results suggest possible solutions to the problem of the evaluation of national water resources using these developed data sets.

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グローバル30分メッシュ可能蒸発散データセットの作成

Development of Global 30-minute grid Potential Evapotranspiration Data Set

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論文

グローバル30分メッシュ可能蒸発散データセットの作成

Development of Global 30-minute grid Potential Evapotranspiration Data Set

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論文要旨

蒸発散は様々な空間的，時間的スケールの気候学関連の研究において重要な要素である。これまで蒸発散推定のための経験式や解析のためのモデルの研究が行われてきたが，本研究では現在利用可能なグローバルデータセットを用いた蒸発散量を推定する方法を提案する。NOAA-EPA 作成の Global Ecosystems Database に含まれている温度，アルベド，日照率，標高データを用いて Priestley-Taylor 式に基づいた緯度/経度30分メッシュの月別グローバル可能蒸発散量の推定を行った。

Abstract: Evapotranspiration is a key element in climate related studies on all spatial and temporal scales. Recent studies have shown that evapotranspiration can be estimated with some degree of precision using semi-empirical and analytical models. By this study, a method for the estimation of evapotranspiration using the available global data sets has been proposed.

Monthly global potential evapotranspiration (PET) on 30-minute latitude-longitude grid was estimated based on the Priestley-Taylor method using global data sets including air temperature, albedo, cloudiness, elevation, which are parts of Global Ecosystems Database supplied by NOAA-EPA.

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Biosphere feedback on regional climate in tropical north Africa

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Summary

The impact and mechanisms of the land surface degradation over the Sahel area on seasonal variations of atmospheric and hydrological components over tropical north Africa are investigated in this general circulation model (GCM) numerical experiment study. The model was integrated for four years with/without vegetation change over the Sahel region with different initial atmospheric conditions. The results demonstrate that the degradation of the land surface conditions can have significant impact on the Sahelian regional climate. It increases the surface air temperature, and reduces the precipitation, runoff and soil moisture over the Sahel region during July-August-September (JAS) period. The impact is not only limited within the specified desertification area and during the JAS period but also to the south of this area and during the October-November-December (OND) period. The changes in the rainfall annual cycles and the JAS mean surface temperature over the Sahel area are consistent with the observed climate anomaly of the past forty years. The changes of rainfall to the south of Sahel including eastern Africa are also in line with the observed anomalies.

The reduction in total diabatic heating rate and increase in relative subsidence motion in upper troposphere are consistent with the rainfall anomalies. The variations in convective heating rate, which were caused by latent heat flux and moisture flux convergence changes, are the dominating factor in this process. The radiative cooling is the secondary effect. The influence of the initial conditions on ground water cycle simulation is also analyzed in this paper.

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The Influence of Land Surface Properties on Sahel Climate. Part I: Desertification

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The Influence of Land Surface Properties on Sahel Climate. Part I: Desertification

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ABSTRACT

This is a general circulation model sensitivity study of the physical mechanisms of the effects of desertification on the Sahel drought. The model vegetation types were changed in the prescribed desertification area, which led to changes in the surface characteristics. The model was integrated for three months (June, July, August) with climatological surface conditions (control) and desertification conditions (anomaly) to examine the summer season response to the changed surface conditions. The control and anomaly experiments consisted of five pairs of integrations with different initial conditions and/or sea surface temperature boundary conditions.

In the desertification experiment, the moisture flux convergence and rainfall were reduced in the test area and increased to the immediate south of this area. The simulated anomaly dipole pattern was similar to the observed African drought patterns in which the axis of the maximum rainfall shifts to the south. The circulation changes in the desertification experiment were consistent with those observed during sub-Saharan dry years. The tropical easterly jet was weaker and the African easterly jet was stronger than normal. Further, in agreement with the observations, the easterly wave disturbances were reduced in intensity but not in number. Descending motion dominated the desertification area. The surface energy budget and hydrological cycle were also changed substantially in the anomaly experiment.