Global HydroNET: A Strategy for Monitoring the Dynamics of the Hydrosphere

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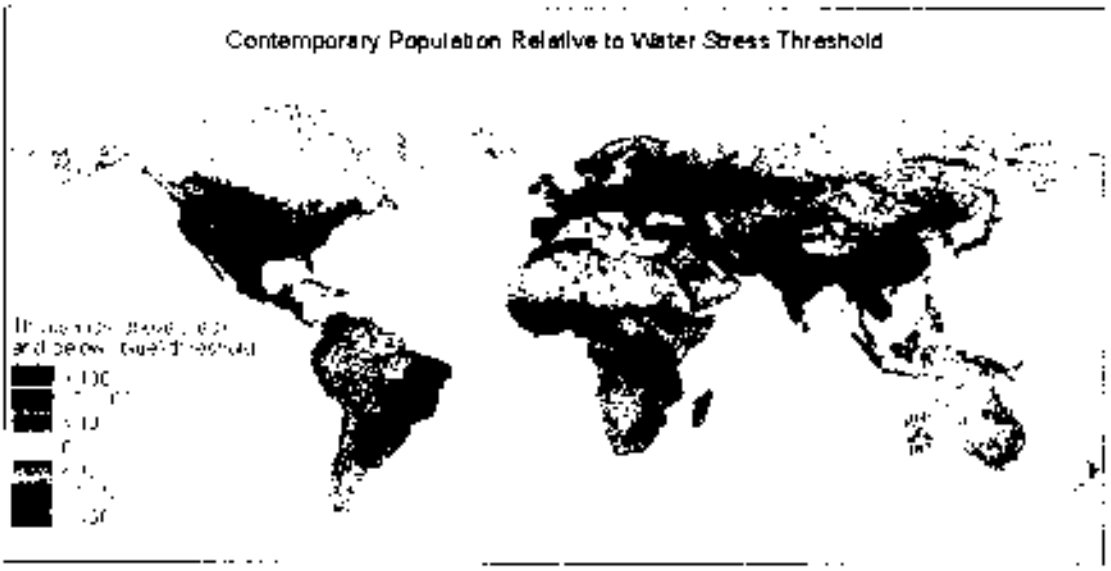
BOX 4-3: Assessing Global Water Scarcity: Tabulations at Contrasting Spatial Scales



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Water Stress	DIA/Q (unitless)	Total Population (billions) Country-level U.N.	Country-level Grid Sum[1]	Grid-based 30' Full Resolution
Low	<0.1	1.72	1.95	3.16
Moderate	0.1 to 0.2	2.08	1.73	0.38
Medium-high	0.2 to 0.4	1.44	1.54	0.37
High	>0.4	0.46	0.45	1.76

[1] Gridded 30' spatial resolution total water demand, runoff, and population were each summed to the national scale and corresponding aggregates then computed.

Using commonly-accepted levels of relative water stress (see Falkenmark 1998), relative water scarcity is tabulated here globally. The relevant metric is the total withdrawal/supply or relative water demand (DIA/Q). What is unknown is the appropriate spatial scale through which to make estimates of this relative measure of water stress. Tested here is the sensitivity of the accounting unit used to estimate the total population at risk.

Depth relationship

$$y_* = p_1 Q_*^{p_2} \left(\frac{dZ}{dl}\right)^{p_3} \tag{1}$$

$$y = \left[\frac{k}{c}\left(\frac{1+b}{b}\right)^{1+d}\right]^{\frac{1}{2+d}} Q_{mean}^{\frac{1}{2+d}} \tag{2}$$

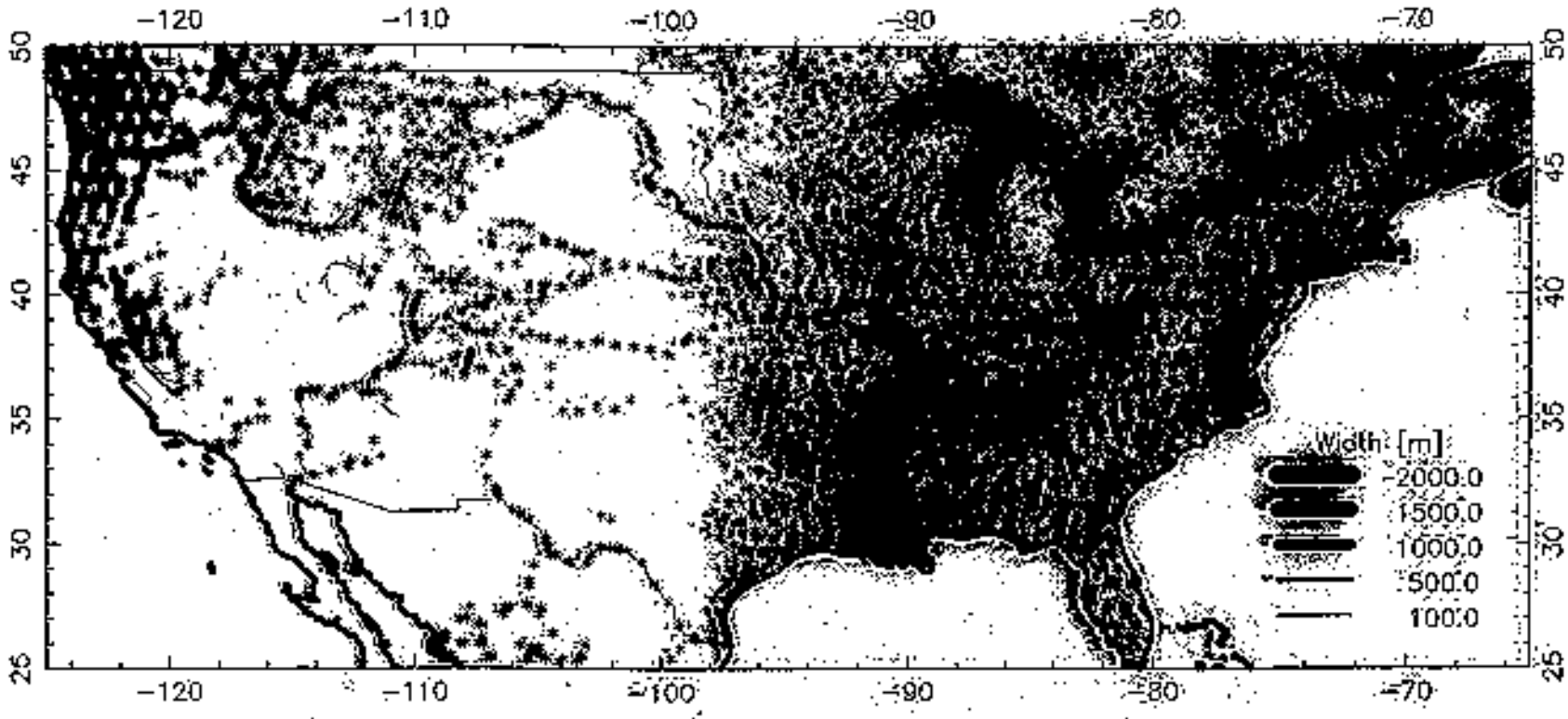
$$\tag{3}$$

Width relationship

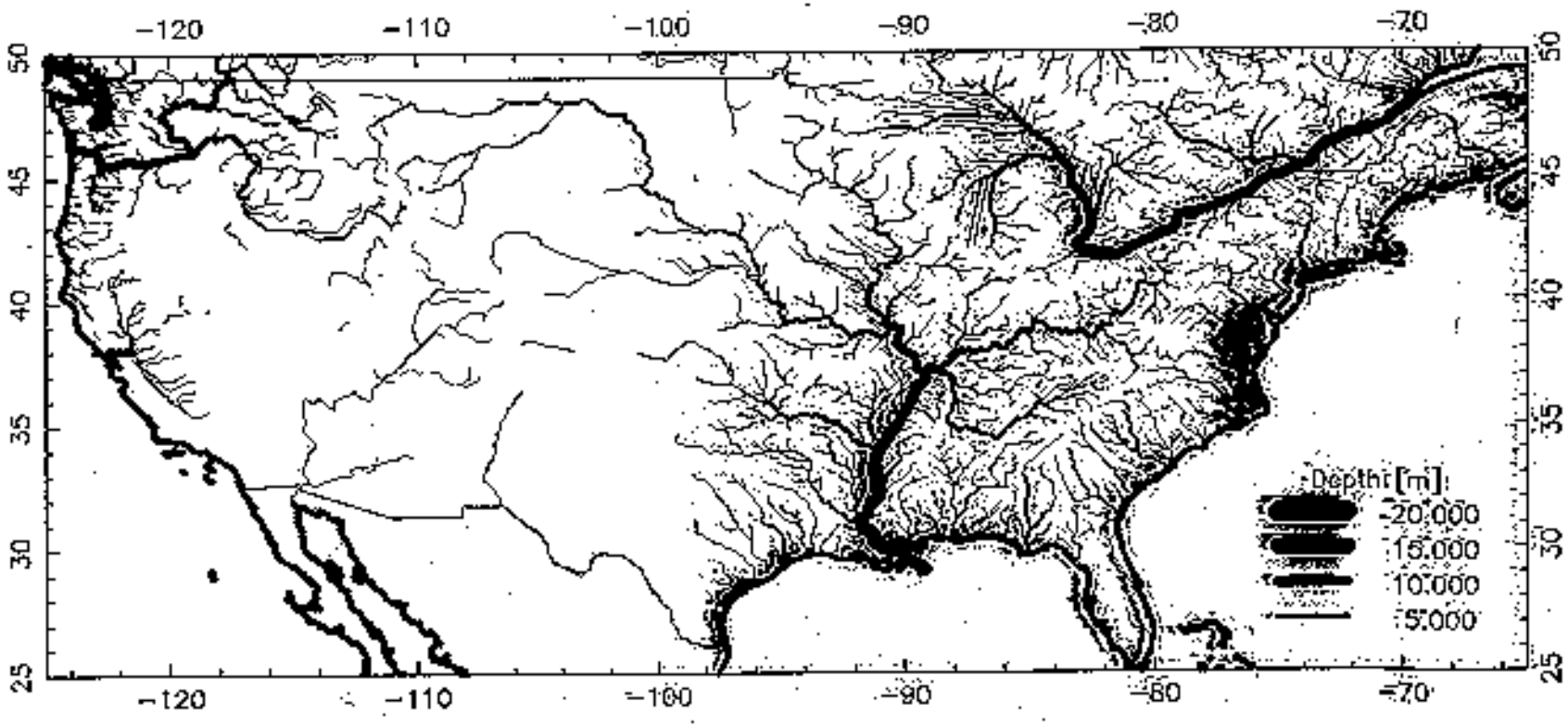
$$w_* = q_1 Q_*^{q_2} \left(\frac{dZ}{dl}\right)^{q_3} \tag{4}$$

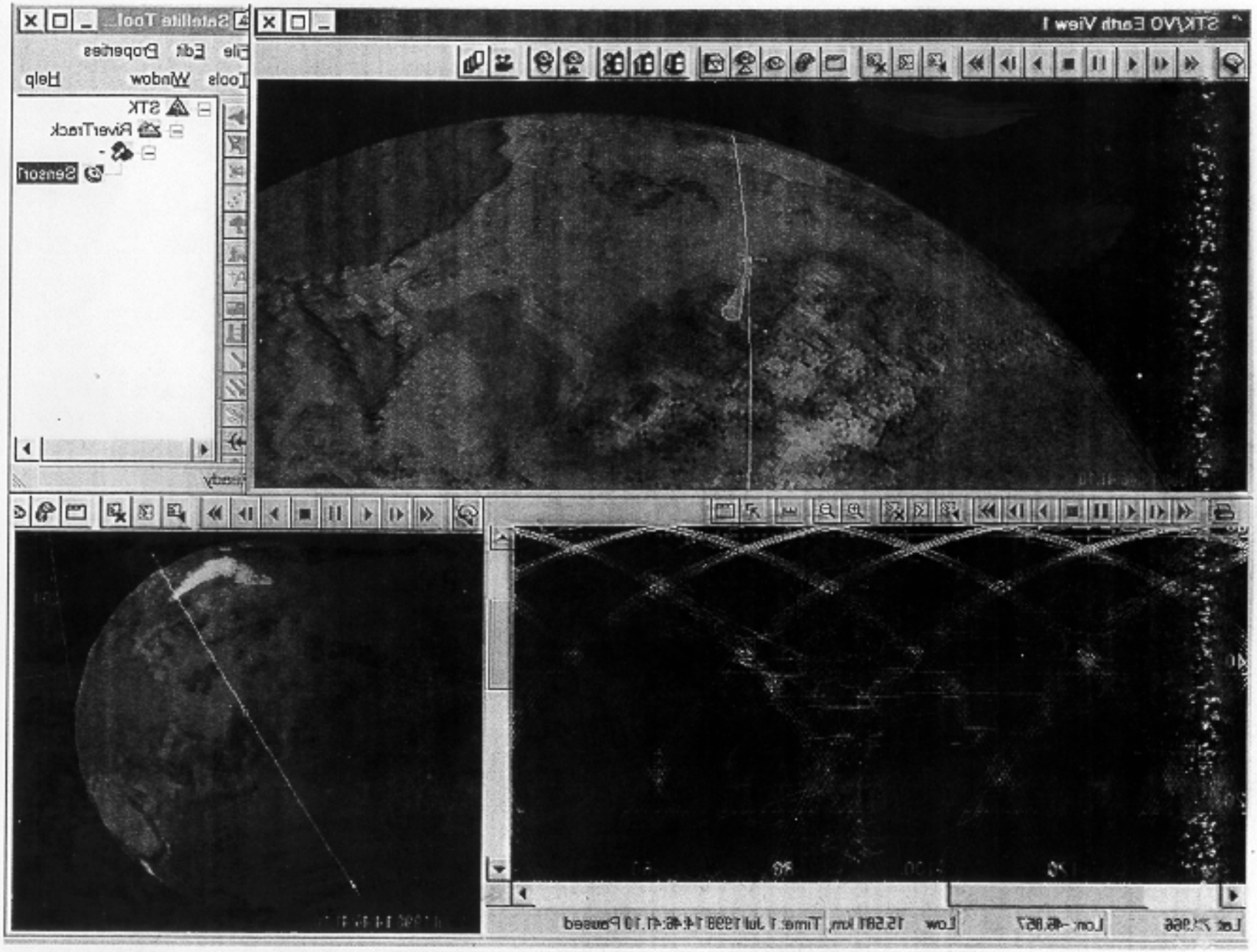
$$w_{mean} = \left[\frac{1}{ck^{1+d}}\left(\frac{1+b}{b}\right)^{1+d}\right]^{\frac{1}{2+d}} Q_{mean}^{\frac{1}{2+d}} \left(\frac{dH}{dl}\right)^{-e} \tag{5}$$

Simulated River Width at 6' Resolution



Simulated River Depth at 6' Resolution




Satellite Tool...
File Edit Properties
Tools Window Help
STK
RiverTrack
Sensor1
STK/VO Earth View 1
Low 15.581 km, Time: 1 Jul 1998 14:46:41.10 Paused
Lat: 72.966 Lon: -46.857

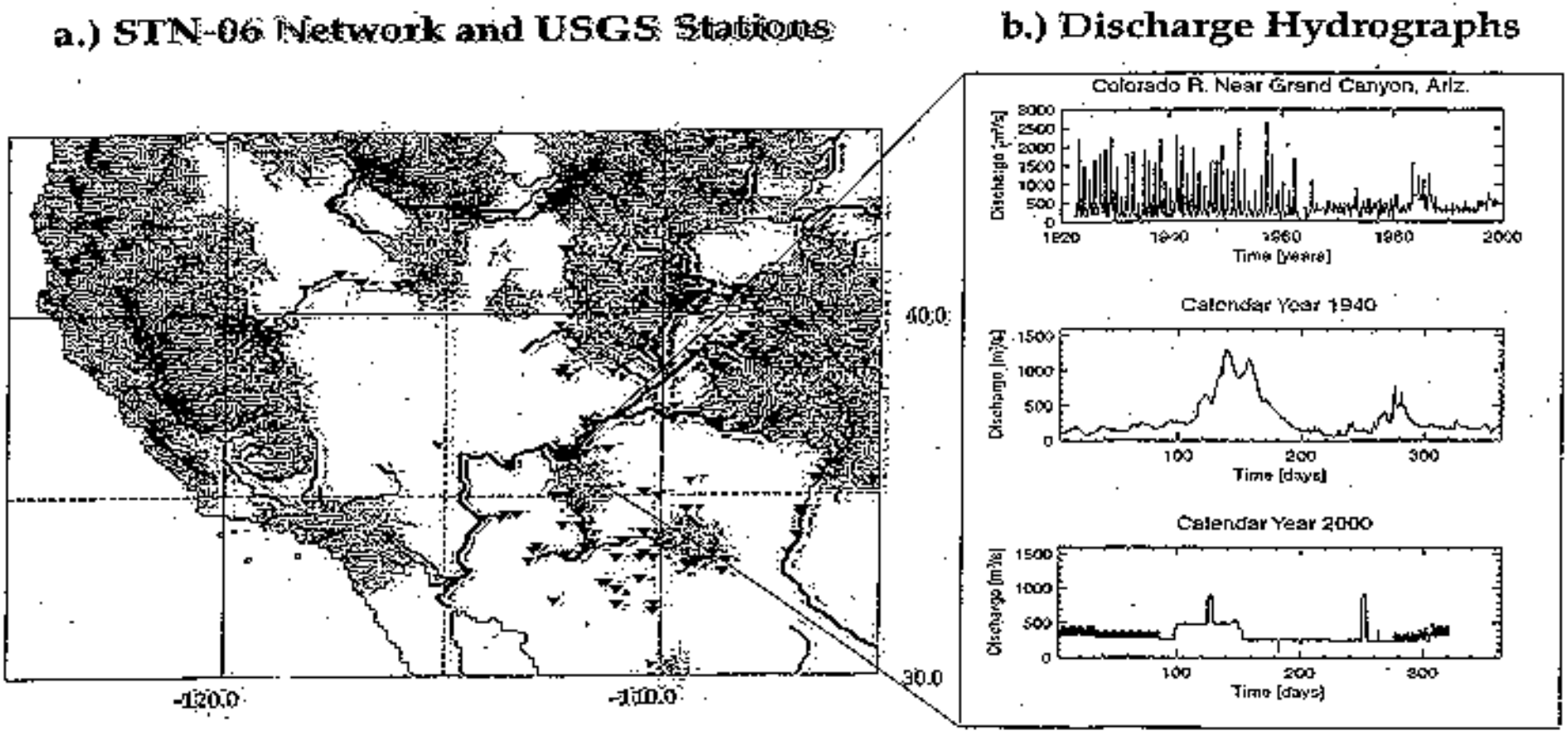


Figure 1. (a) USGS real-time discharge gauging stations co-registered to the simulated 6' (lon x lat) resolution river network (STN-06) for the United States. UNH has assembled an archive of USGS discharge data and updates more than 3700 stations daily. (b) Time series of discharge for the Colorado River near Grand Canyon, Arizona (367000 km^2 drainage area) showing dramatic change in the basin hydrograph due to flow regulation (see Vörösmarty and Sahagian 2000 for further examples).

NASA Post-2002 Land Surface Hydrology Mission
Component for Surface Water Monitoring:

HYDRA-SAT
HYDRlogical Altimetry SATellite

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A report from the NASA Post-2002 Land Surface Hydrology Planning Workshop, Irvine, CA, April 12-14th, 1999.

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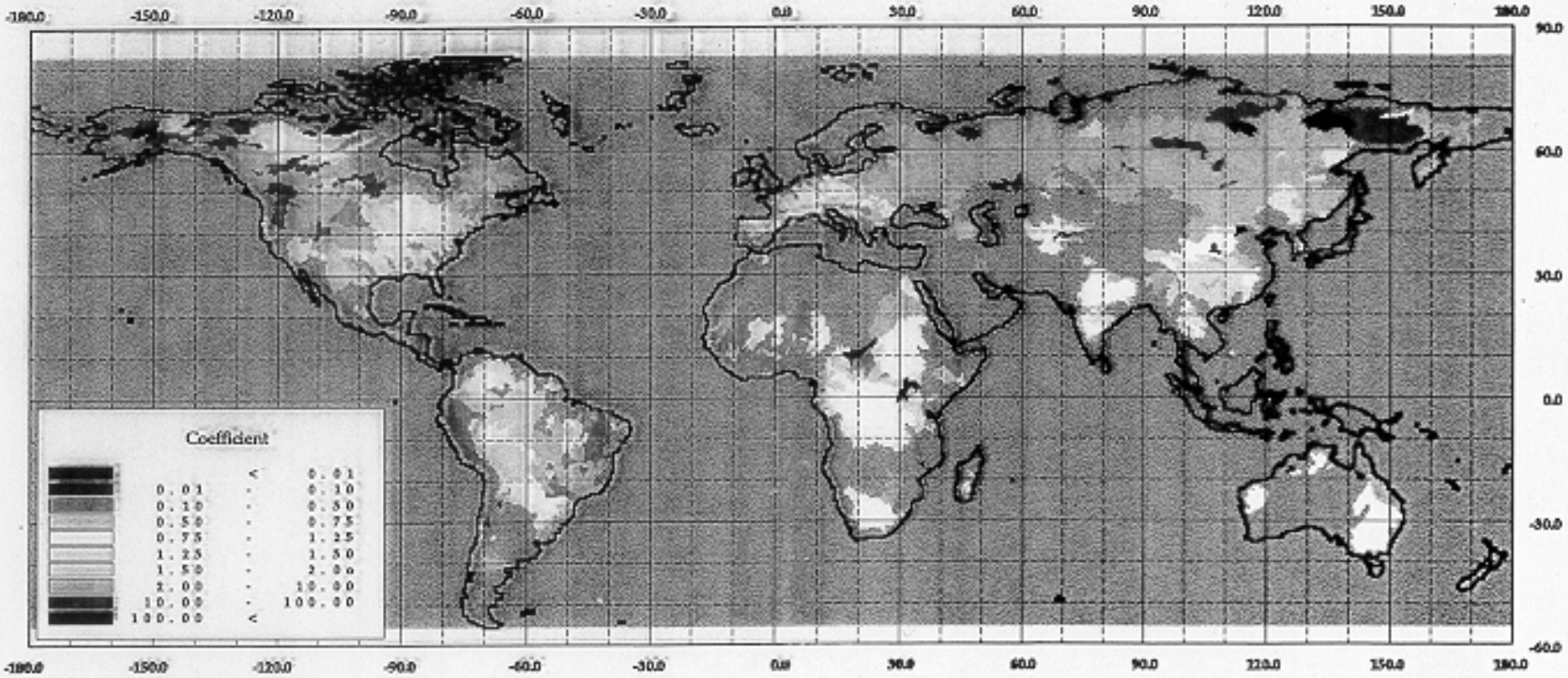
http://lshp.gsfc.nasa.gov/Post2002/hydrasat/hydrasat2.html

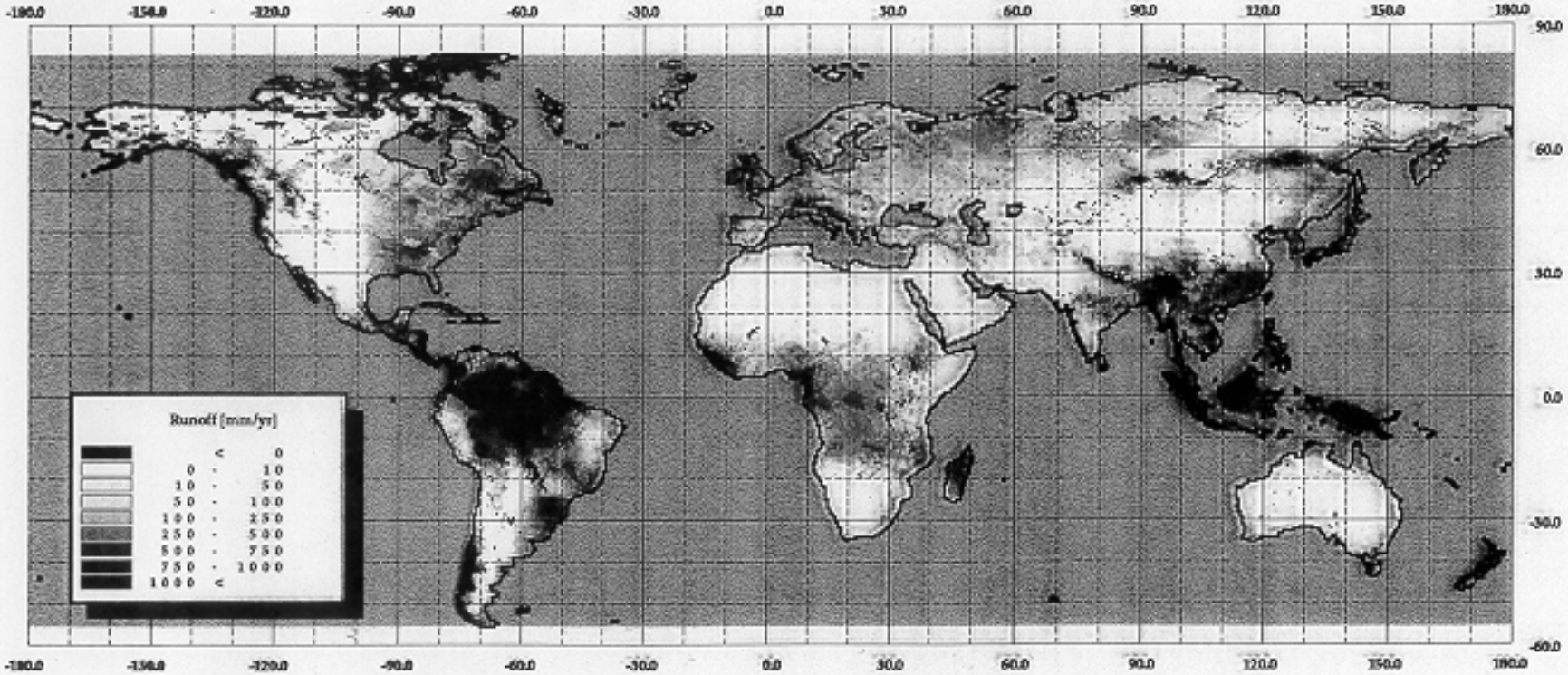
WBM Runoff Correction Coefficients

30-minute spatial resolution



Composite Mean Annual Runoff

30-minute spatial resolution



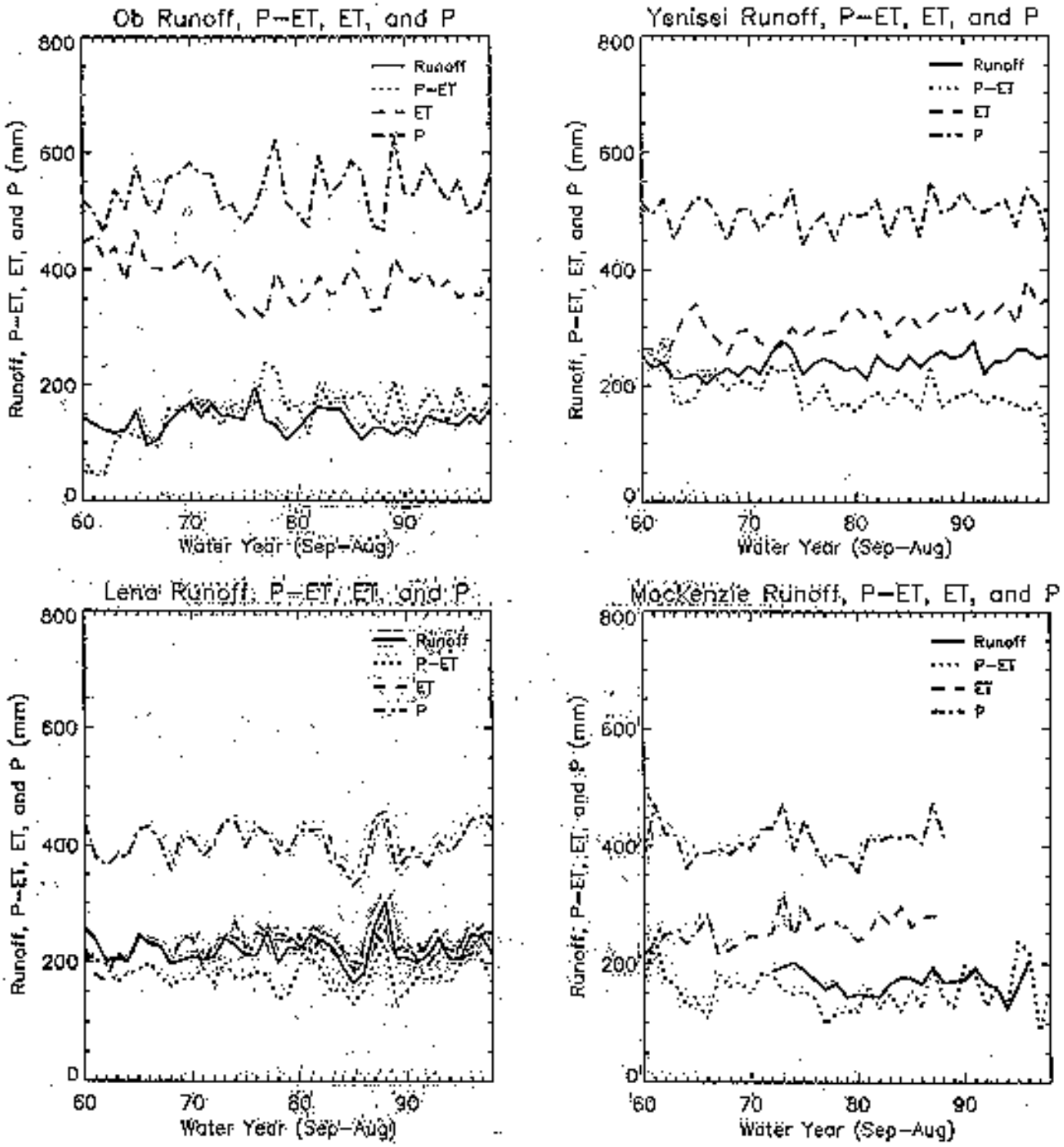
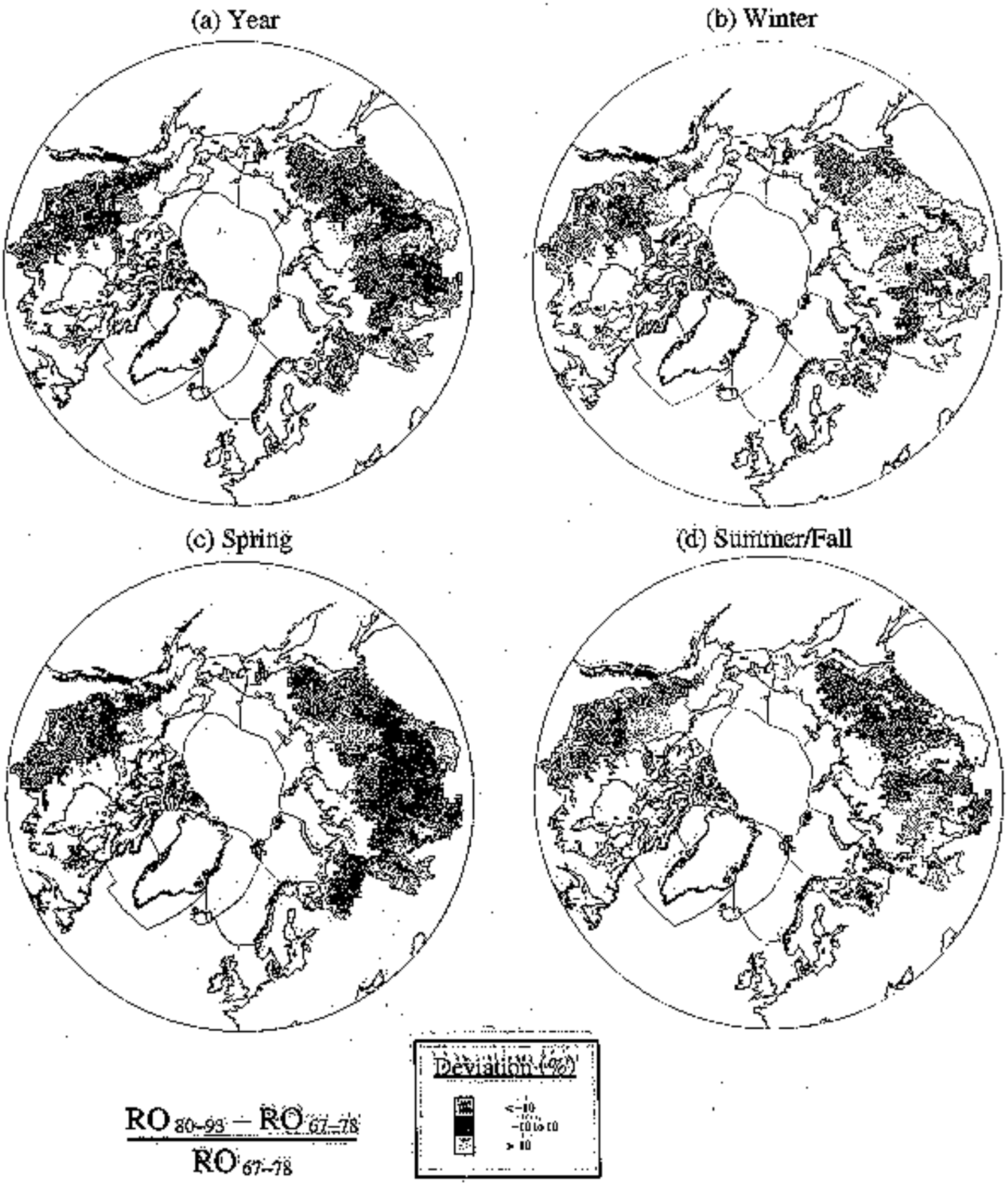
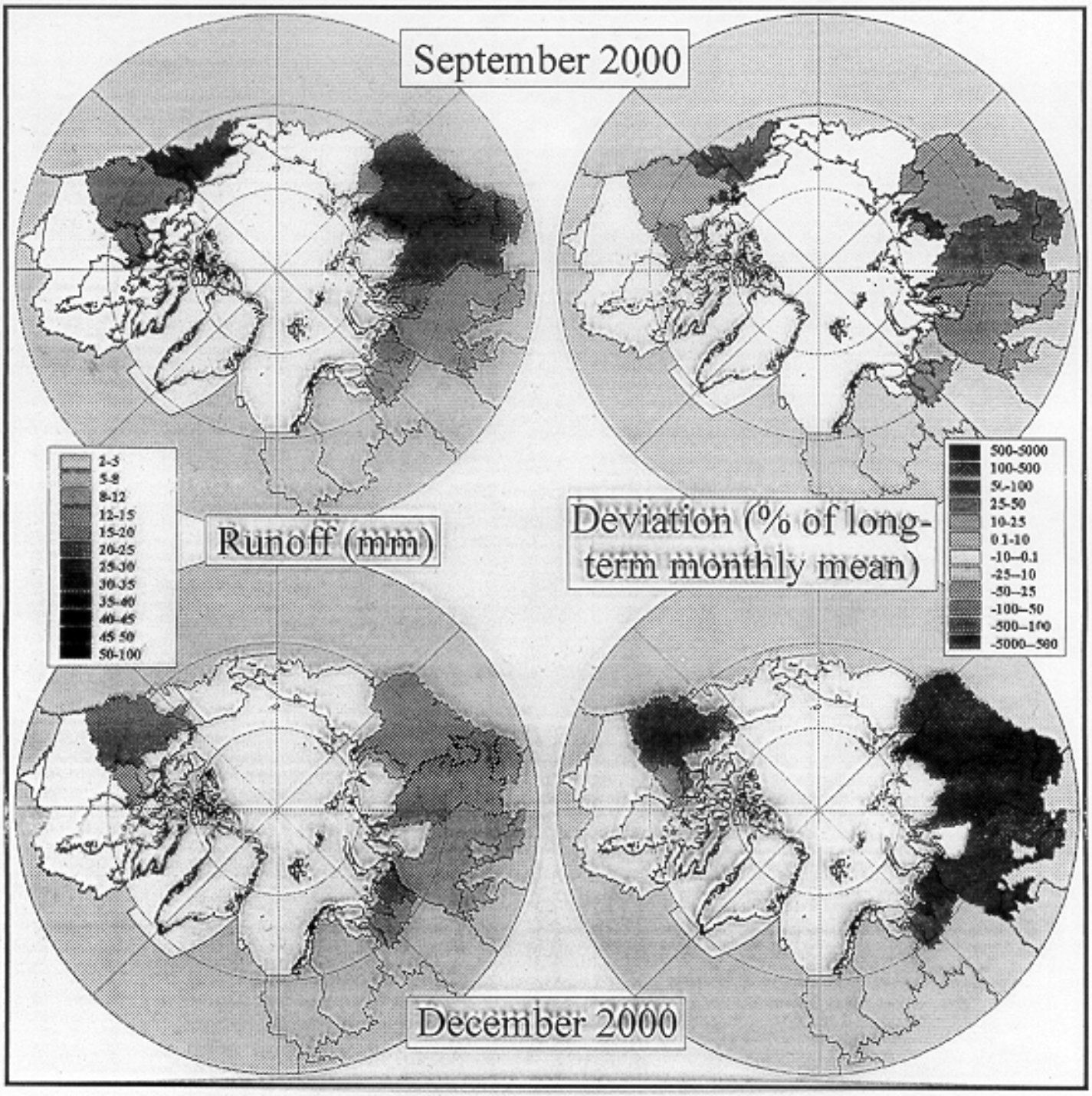

Ob Runoff, P−ET, ET, and P
Runoff
P−ET
ET
P
Runoff, P−ET, ET, and P (mm)
Water Year (Sep−Aug)
Yenisei Runoff, P−ET, ET, and P
Runoff
P−ET
ET
P
Runoff, P−ET, ET, and P (mm)
Water Year (Sep−Aug)
Lena Runoff, P−ET, ET, and P
Runoff
P−ET
ET
P
Runoff, P−ET, ET, and P (mm)
Water Year (Sep−Aug)
Mackenzie Runoff, P−ET, ET, and P
Runoff
P−ET
ET
P
Runoff, P−ET, ET, and P (mm)
Water Year (Sep−Aug)

Figure 14 Deviation in Mean Annual and Seasonal Runoff



$$\frac{RO_{80-93} - RO_{67-78}}{RO_{67-78}}$$


September 2000
Runoff (mm)
2-5
5-8
8-12
12-15
15-20
20-25
25-30
30-35
35-40
40-45
45-50
50-100
Deviation (% of long-term monthly mean)
500-5000
100-500
50-100
25-50
10-25
0.1-10
-10--0.1
-25--10
-50--25
-100--50
-500--100
-5000--500
December 2000

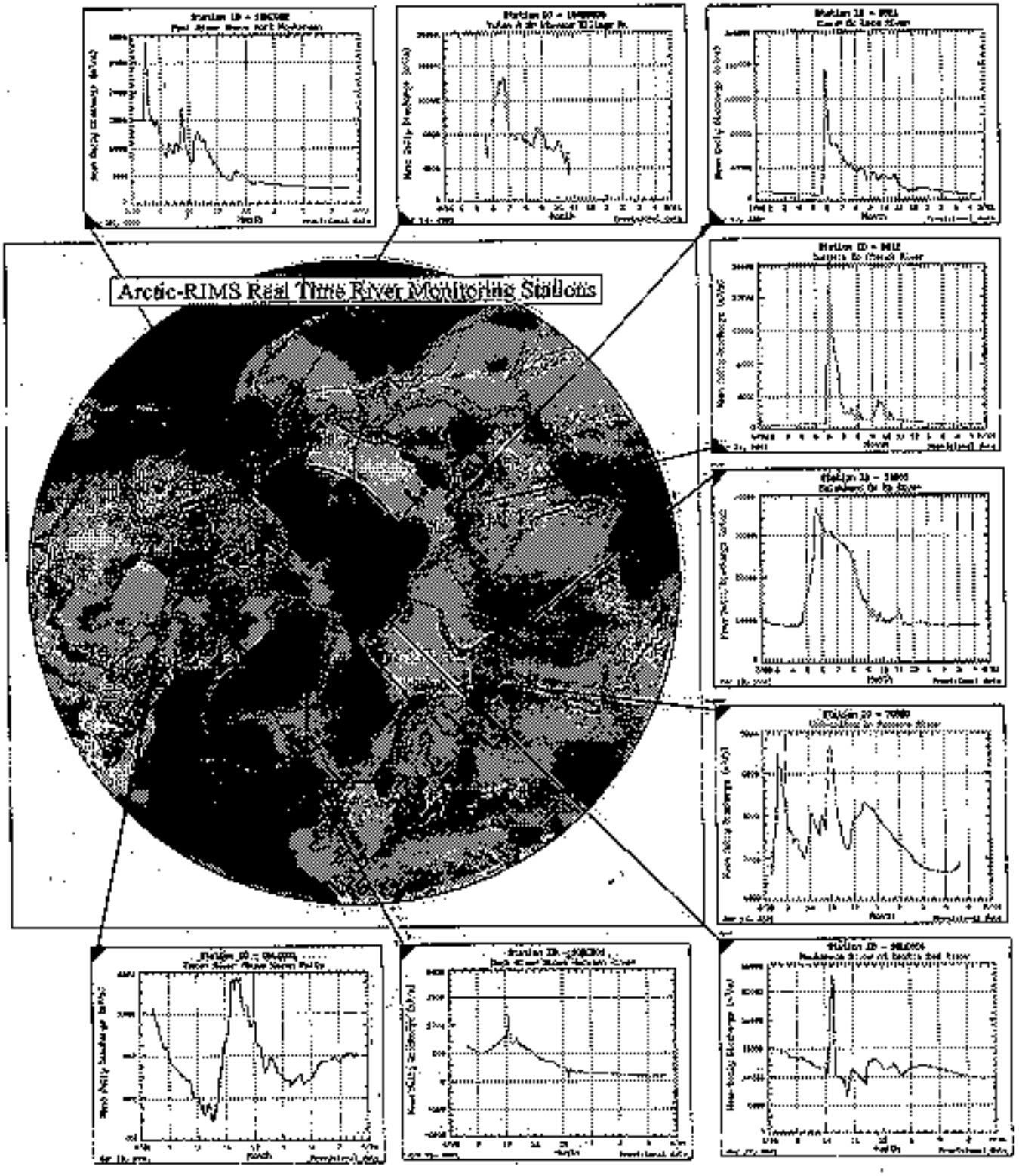
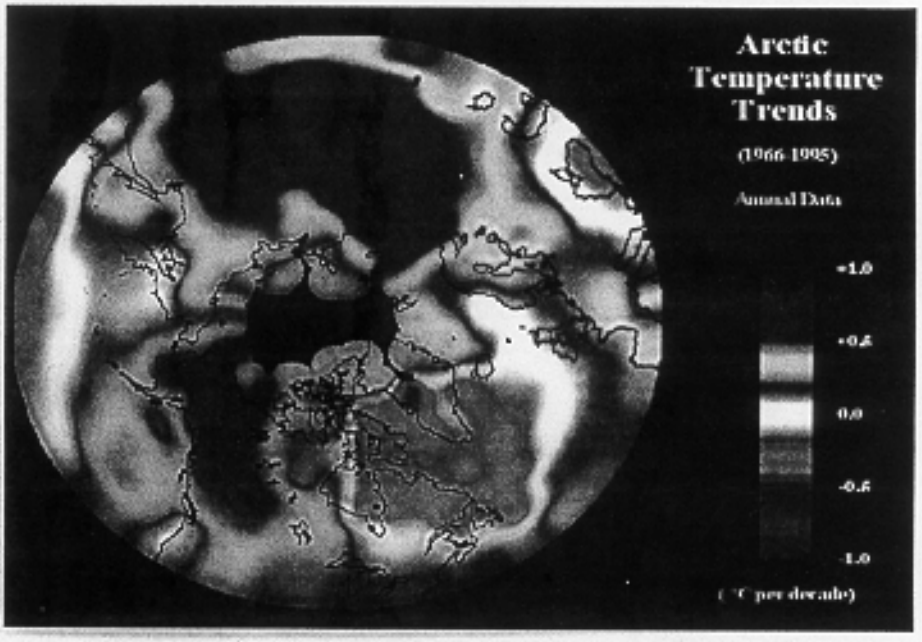
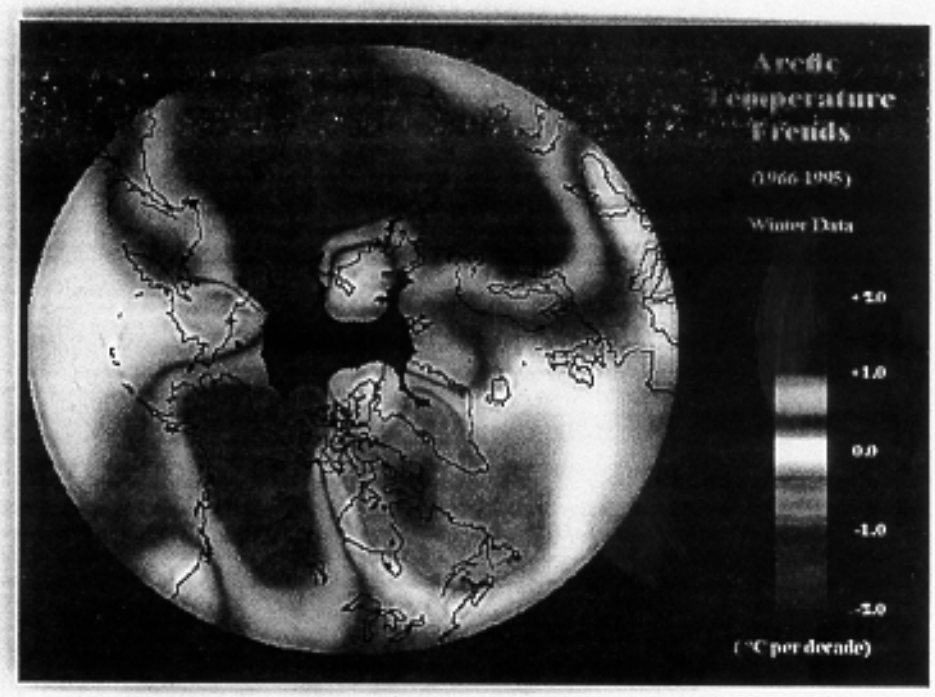

Arctic-RIMS Real Time River Monitoring Stations

Figure 4-5. **The geography of recent circumarctic temperature change. Updated mapping from Serreze et al. (2000) and Chapman and Walsh (1993).**





Welcome to

R-ArcticNET

(v2.0)

A Regional, Electronic, Hydrographic Data Network For the Arctic Region

R-ArcticNET Abstract and Background
Enter R-ArcticNET Geographically Referenced Database
Direct Link to the Datafiles
R-Arcticnet V1.0

Canada Environment Canada

USGS science for a changing world

NASA

CHAMMP

Return to the Pan-Arctic Project Main Page
Return to Global Hydrology Group Main Page

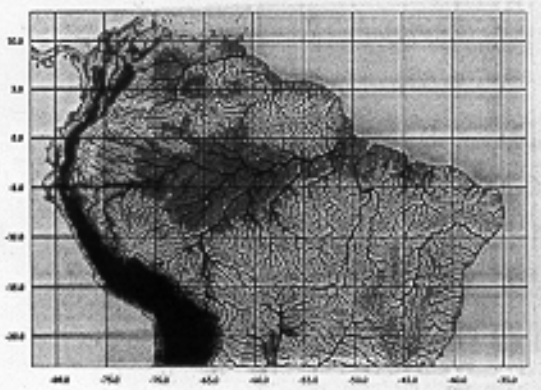
LBA-HydroNET

(V1.0)

A Regional, Electronic Hydrometeorological Data Network For the LBA Study Domain

http://www.LBA-HydroNET.sr.unh.edu

6-Minute Simulated Topological Network for Rivers



LBA-HydroNET System

- A contribution of NASA's Land Surface Hydrology Program to the overall LBA campaign.
- Community-wide data repository recently established for hydrometeorological variables: observed data and value added products.
- System integrates several existing tools to produce high-resolution weather variable fields from station data, observed hydrography, water balance and river transport model outputs.
- Data provided by participating hydrometeorological agencies and LBA researchers.
- Data bank seeks to support both LBA-Ecology and LBA-Hydromet Investigations.

1st LBA-HydroNET Workshop

- Held 4-6 December 2000; CPTEC-INPE Cachoeira Paulista, SP BRAZIL.
- Workshop Goal: Assemble core group of hydrometeorological collaborators to further develop the contents of the LBA-HydroNET data bank.
- Working groups established to articulate hydrometeorological data needs of the LBA community, focusing on specific research activities:

(a) Precipitation Analysis (Lead, Lelys Bravo de Guenni; Simon Bolivar University, Caracas)
(b) Basin-Scale Water Budget Closure (Lead, Jose Marengo; CPTEC/INPE, Cachoeira Paulista)
(c) Linked Carbon-Water-Nutrient Modeling (Co-Leads, Eric Smith; NASA, Huntsville; Julio Tota da Silva; CPTEC/INPE, Cachoeira Paulista)
(d) Operational Hydrometeorology (Co-Leads, Juan Julio Ordonez Galvez; Servicio Nacional de Meteorologia e Hidrologia, Lima; Valdemar Guimaraes; ANEEL, Brasilia)

Ongoing Development

Inputs from the LBA research community are welcome to further refine the LBA-HydroNET data base by defining particular needs for hydrometeorological information:

- Specific variables
- Essential attributes such as time domain and step, spatial resolution, etc..
- New data sets

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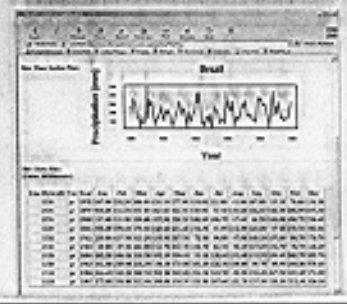
4km Resolution South America Precipitation Data (16 December 1999)

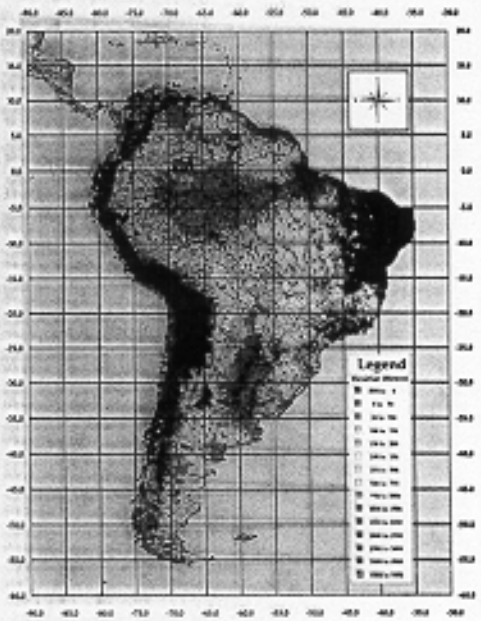
(From: Gilberto A. Vicente, GSFC)

Navigation Map from LBA-Hydronet

Example of WWWeb-based Data Entry



LBA-HydroNET Base Map Hydrometeorological Station Holdings



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Grid passive microwave data sets provide an important opportunity during the operational phase of this project with the impending launch of the NASA EOS AMSR-E instrument in late 2000. Having the lower frequency channels of SMMR (6.6 and 10.7 GHz) and the higher frequency channels of SSM/I (85.5 GHz) in the same format will facilitate the preliminary development of applications which could potentially make use of similar frequencies from AMSR-E (6.9, 10.7, 89.0 GHz). Processing of the current and EOS data streams will be ongoing as part of this work.

4.4. OTHER VARIABLES

A broad set of biophysical data inputs (i.e. soils, land cover, topography) is necessary to run the water balance and transport models and is routinely applied in our ongoing research. For this work, all data sets will be identical to those in continental and global-scale applications (see Vörösmarty et al. 1998a, Fekete et al. 1999a) except for an upgrade using 1-km USGS EDC (1996) land cover in a mosaic (sub-grid) version of the P/WBMo. Data are available from the State Hydrologic Institute on river freeze-up/break-up dates. A few records for Arctic-draining rivers have been acquired by NSIDC and acquisition of additional records is planned. Formal agreement via Working Group VIII on Environmental Data Exchange will be sought in 2000. Data on the circumpolar extent of frozen ground and characteristics of the seasonal active layer are available on the Circumpolar Active Layer System (CAPS) CD released by NSIDC in 1998. Long records of soil temperature (to 3.2m depth) across Russia are being assembled and those for 120 stations are now at NSIDC as part of an ongoing grant through NSF-OPP.

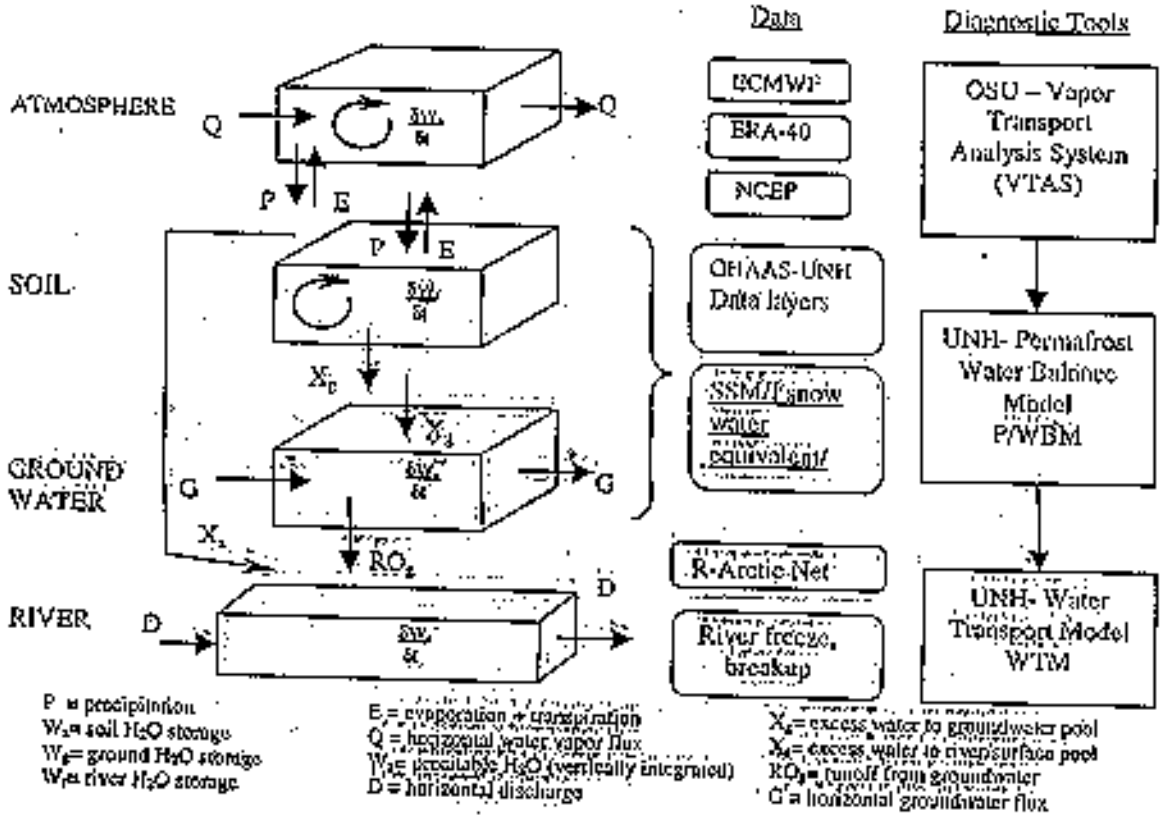

Figure 3. The overall Arctic-ROMS water budgeting scheme linking aerological, land-based, and riverine transport algorithms developed by the co-I's. Linkage across the full domain of the water cycle will facilitate identification of inconsistencies among modeled and observed variables as well as systematic and random errors in water budget closure.