The State of the Global Water System
A pilot study on indicators for operational monitoring of water resources

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The City University of New York
City College of New York
CUNY

Governance Session
GWSP GCI Conference
Bonn GERMANY
6 December 2010

Earth System Science Partnership

GWSP
Global Water System Project

DIVERSITAS

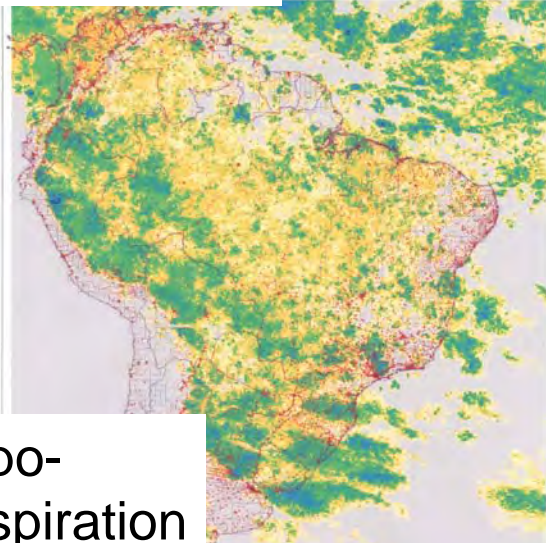# Integrated Approaches to Global Water Resource Assessment and Global Change Studies

Links Geophysics of Water, Governance, Vulnerability, Supply Limitations Imposed by Pollution and Ecosystem Flow Requirements
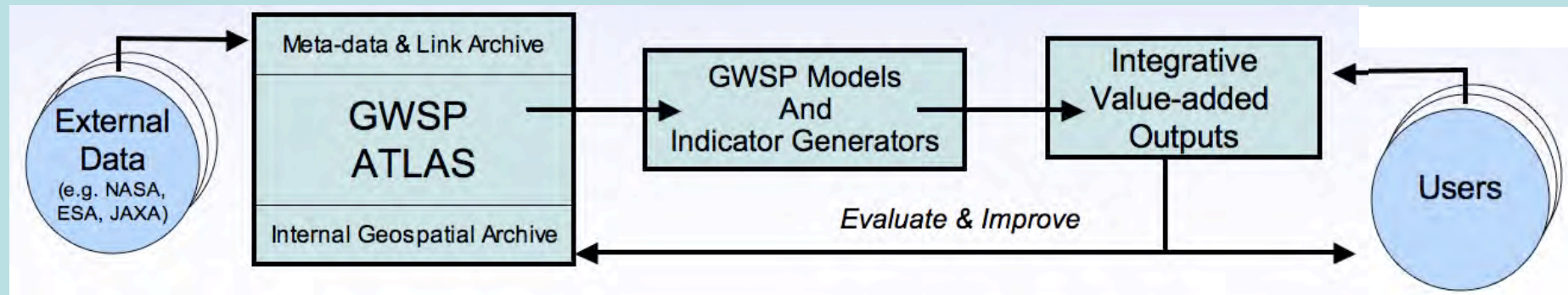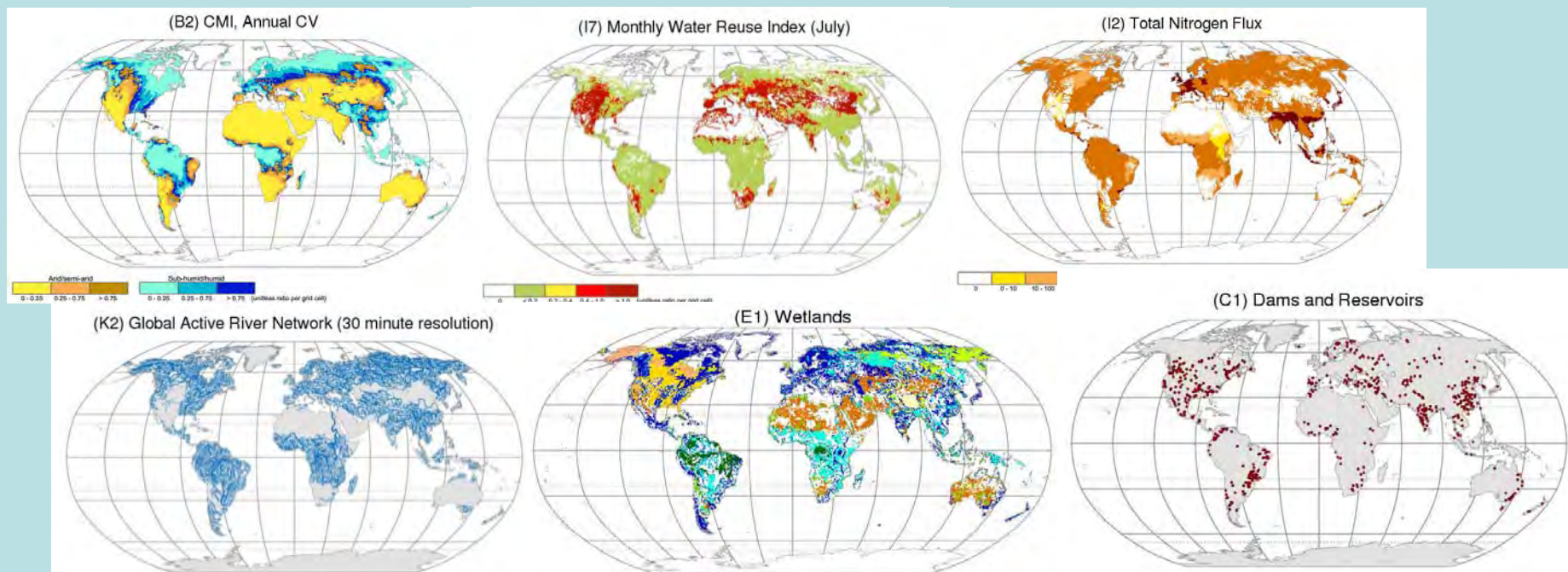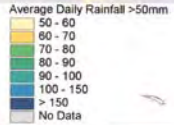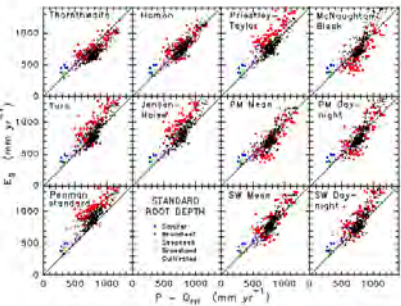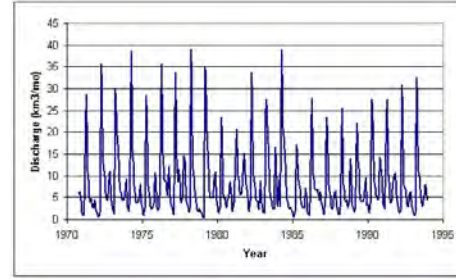
WATER RESOURCE MODULE

Precipitation

Discharge=
*Basin &
Inter-basin
Resource*

Lateral Transport

Evapo-
transpiration

Digital River
Networks

Average Daily Rainfall >50mm
	50 - 60
	60 - 70
	70 - 80
	80 - 90
	90 - 100
	100 - 150
	> 150
	No Data

Cal/Val

Managed
Water

ET   Precipitation

ETirr

Root Zone
Runoff

Deep Soil
Runoff

Root Zone

Deep Soil Zone
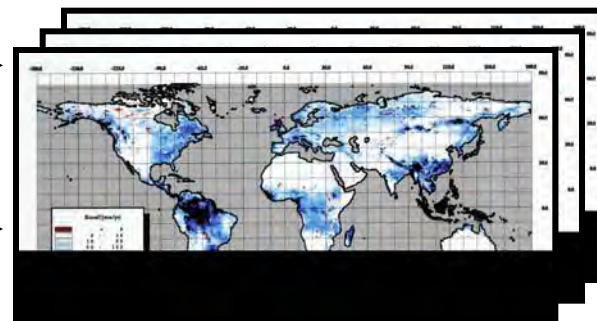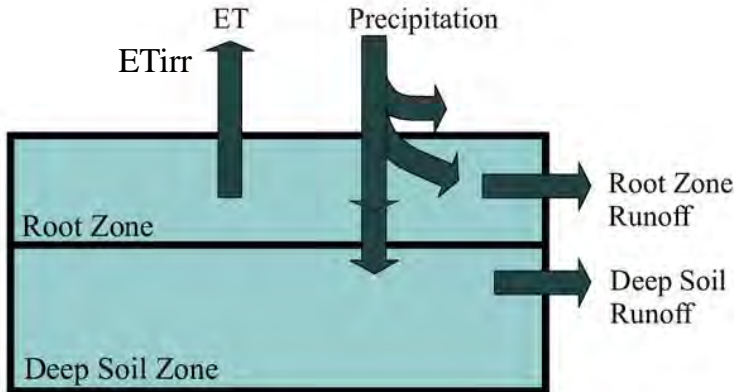
Runoff=
Local
Water
Resource

Two Points of "External" Engagement

- GWSP "Global Scale Initiative"

- GTN-H and Its Coordination *(in conjunction with WMO and GCOS)*

Three Classes of Data Sets

- Hydro-met: Biogeophysical "Forcings" (e.g. ppt, T) and derived products (soil moisture, runoff, Q)

- Socio-economic: Human system "Forcings" (e.g. population, GDP)

- Indicators: Combinations of the two

Workshop Preceding the 4th Session of the GTN-H Coordination Panel

Programmatic, Research and Applications Opportunities for Users and Sponsors of the Global Terrestrial Network – Hydrology (GTN-H)

The City College of New York at the CUNY, New York, NY 10035

Steinmann Hall Exhibition Room
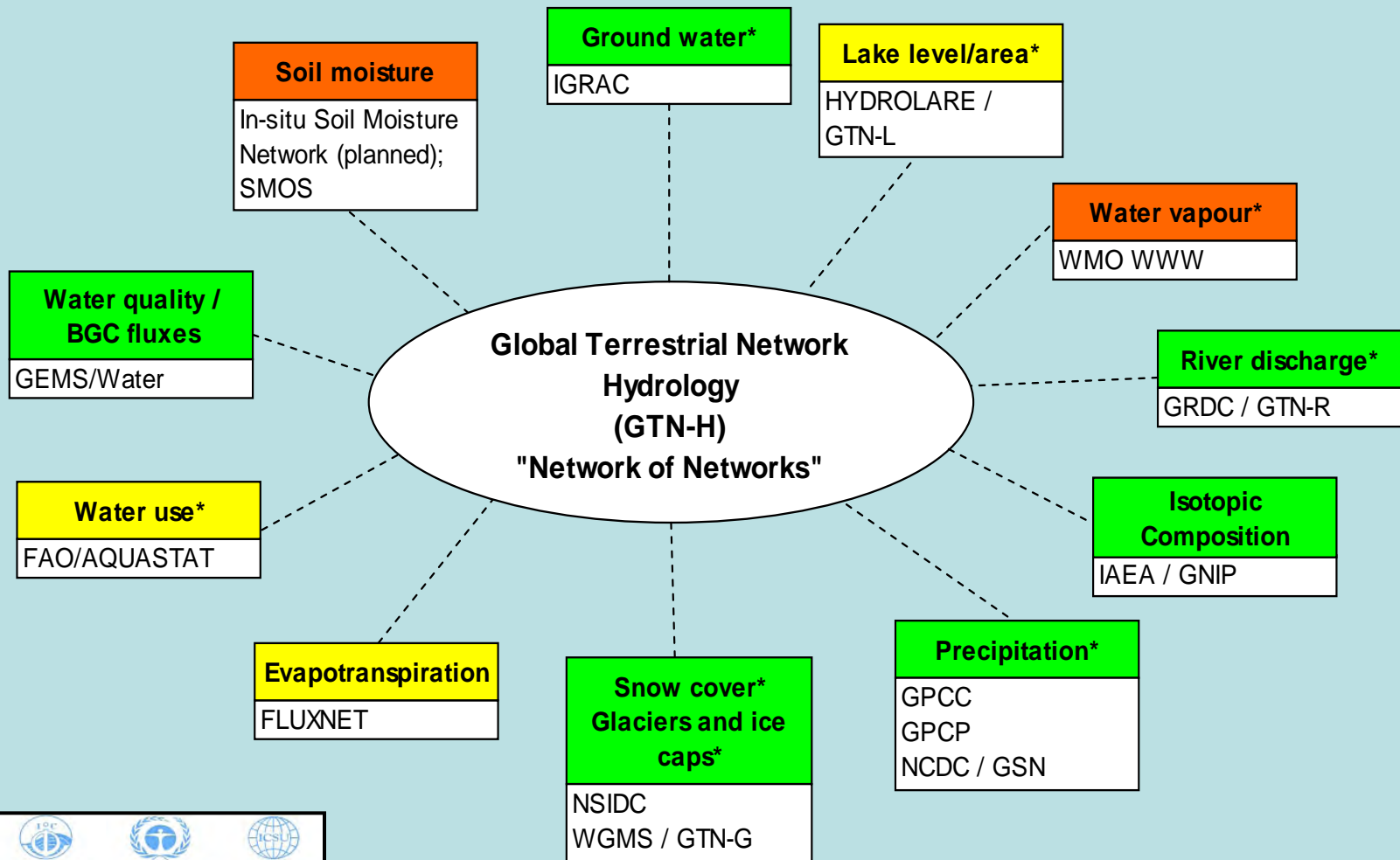
--07 to 08 July 2009—

GOAL: To set the stage for the planning of current and future GTN-H activities in the upcoming GTN-H Coordination Panel meeting:
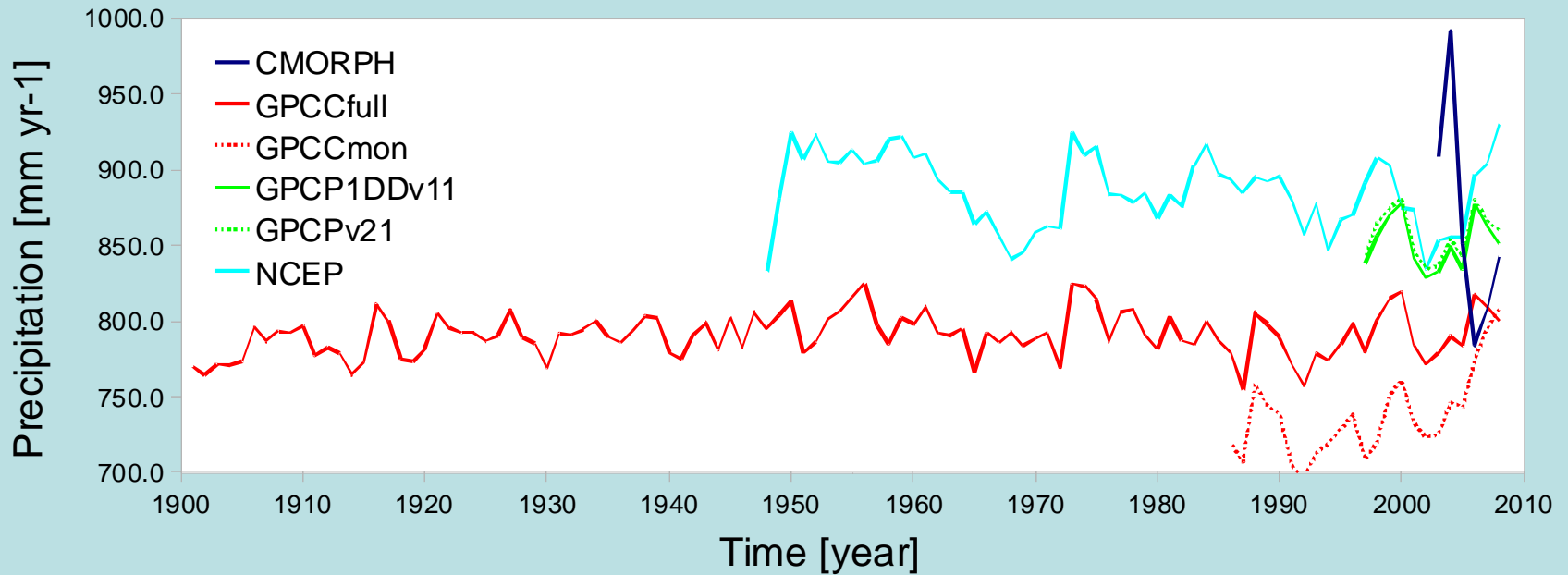
• *present key examples of progress in technical, scientific and applications realms developed thru and/or using GTN-H relevant data resources*

• *recognizing and integrating data provider, data user, and data synthesis perspectives*

• *developing vision of short (0-2 year), medium (2-5 yr), and longer term (>5 yr) progress*

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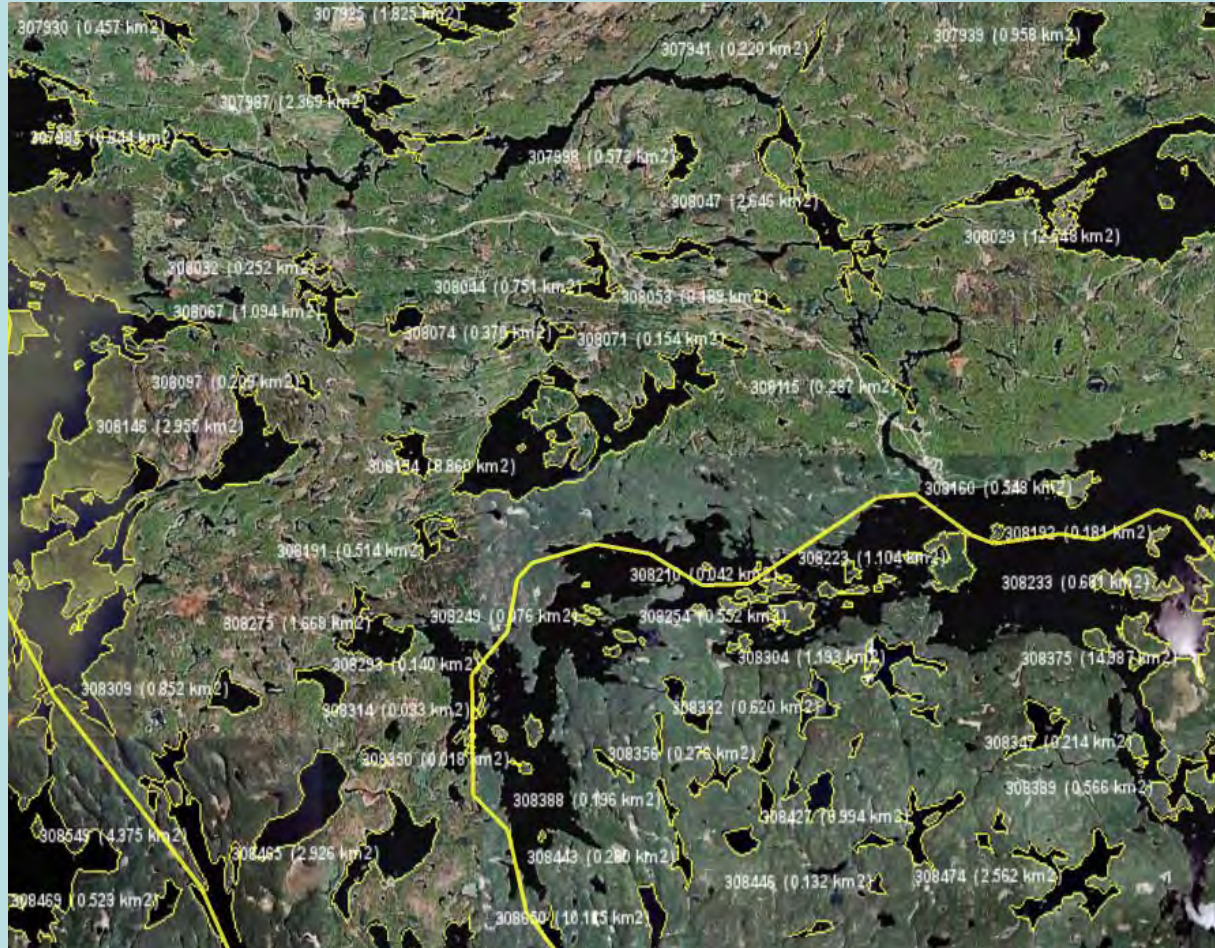# GTN-H Provides Rich Set of Information Streams for Many Applications

Ground water*
IGRAC

Lake level/area*
HYDROLARE / GTN-L

Soil moisture
In-situ Soil Moisture Network (planned); SMOS

Water vapour*
WMO WWW

Water quality / BGC fluxes
GEMS/Water

Global Terrestrial Network Hydrology (GTN-H) "Network of Networks"

River discharge*
GRDC / GTN-R

Water use*
FAO/AQUASTAT

Isotopic Composition
IAEA / GNIP

Evapotranspiration
FLUXNET

Snow cover* Glaciers and ice caps*
NSIDC
WGMS / GTN-G

Precipitation*
GPCC
GPCP
NCDC / GSN

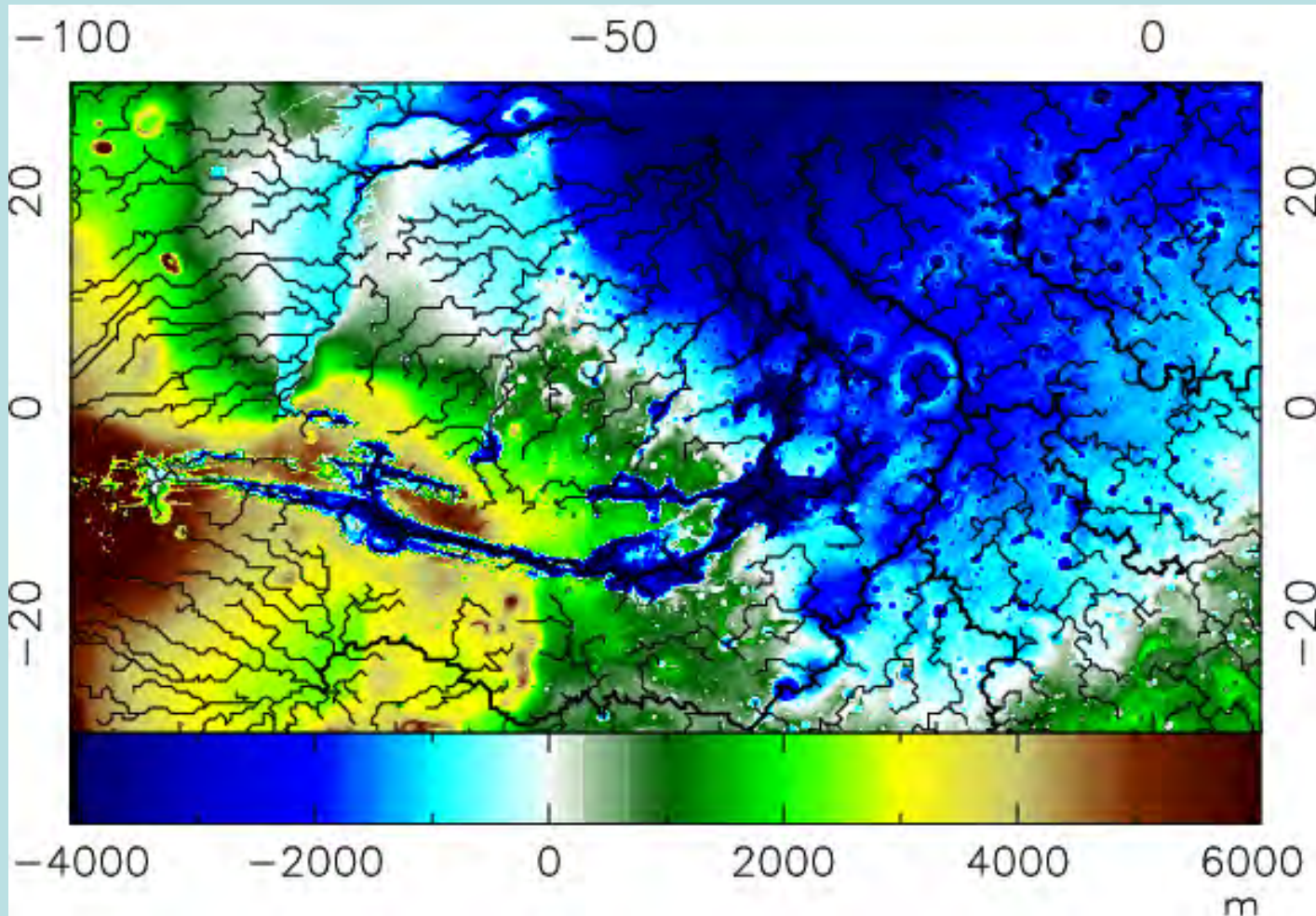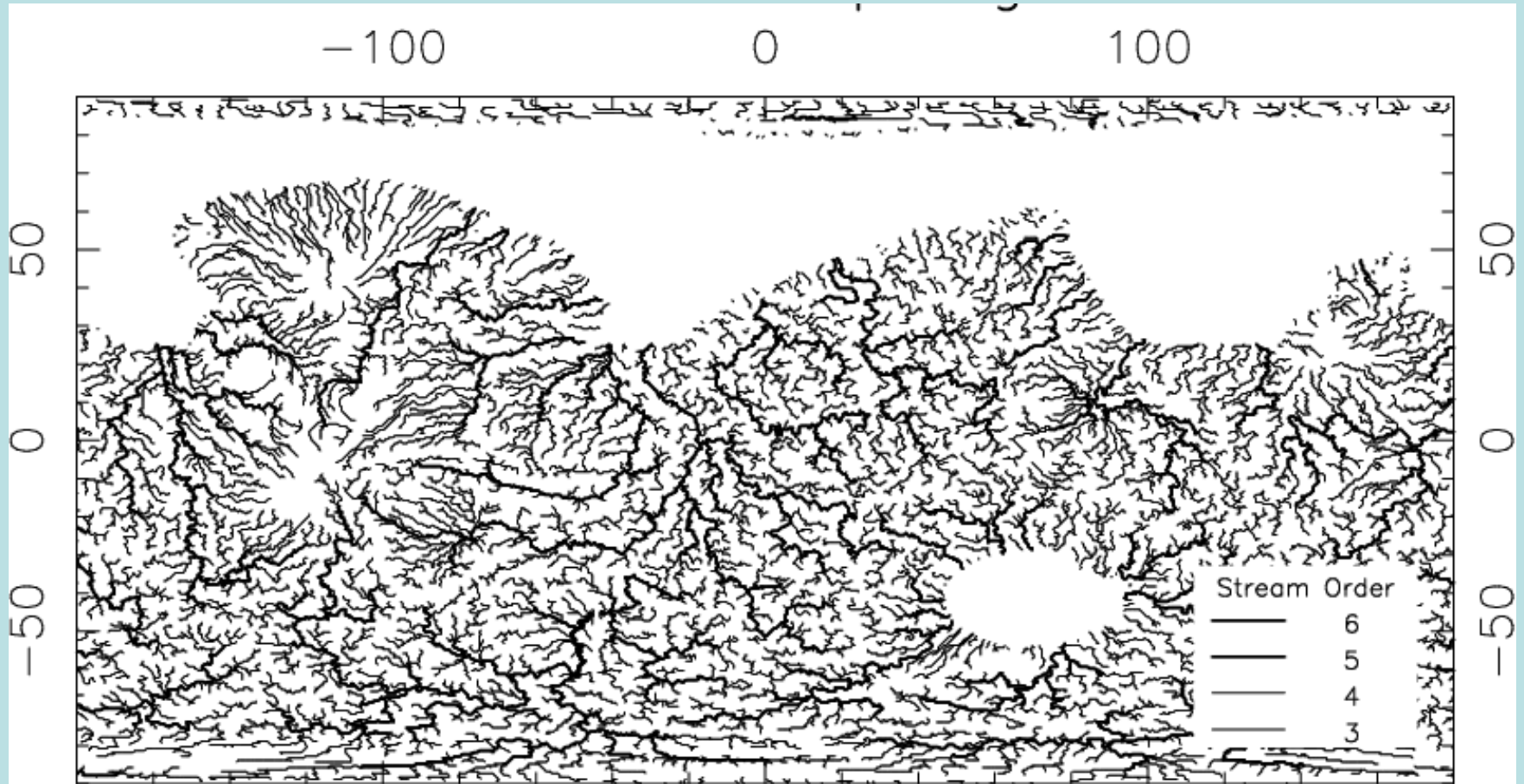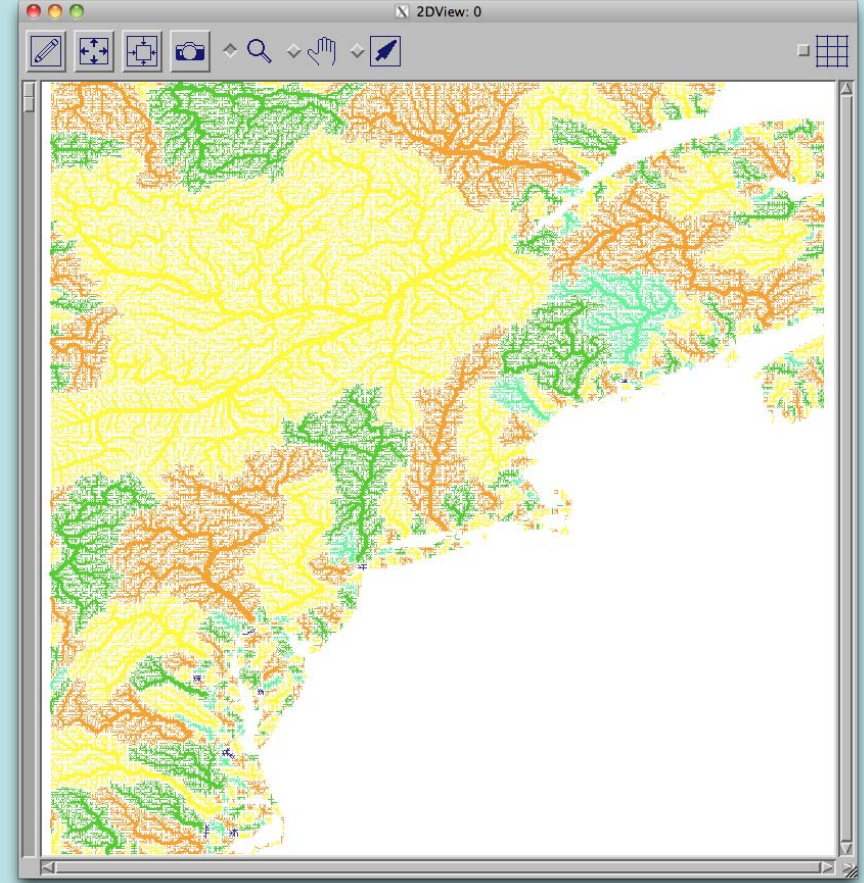# Continental Precipitation

Co-registered Reservoirs
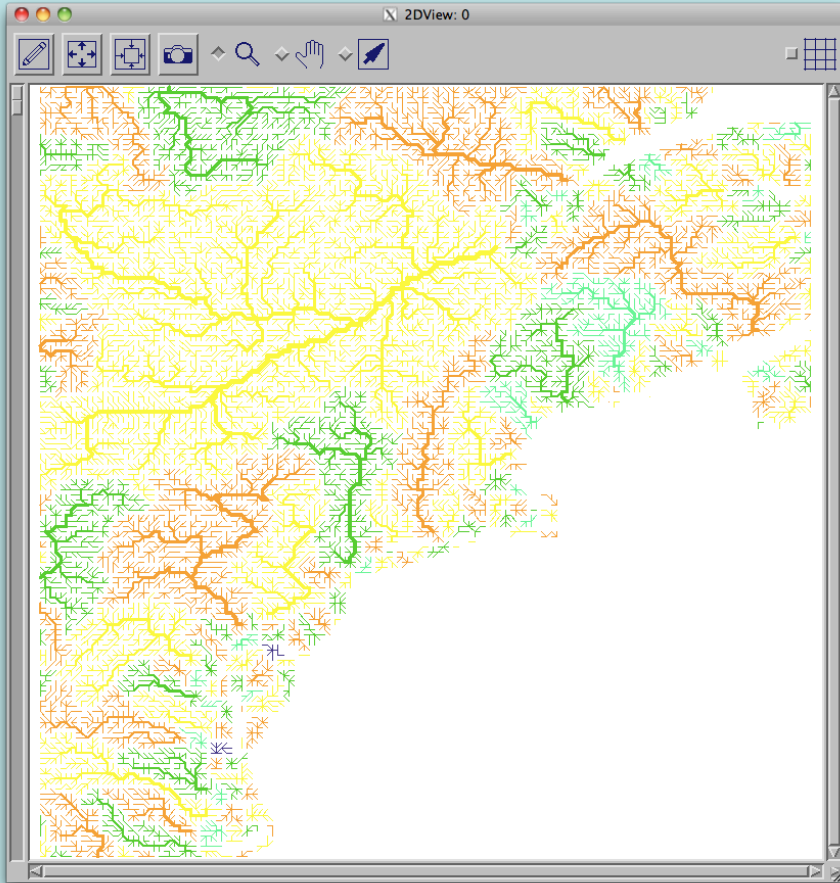
SWDB Lakes Polygons
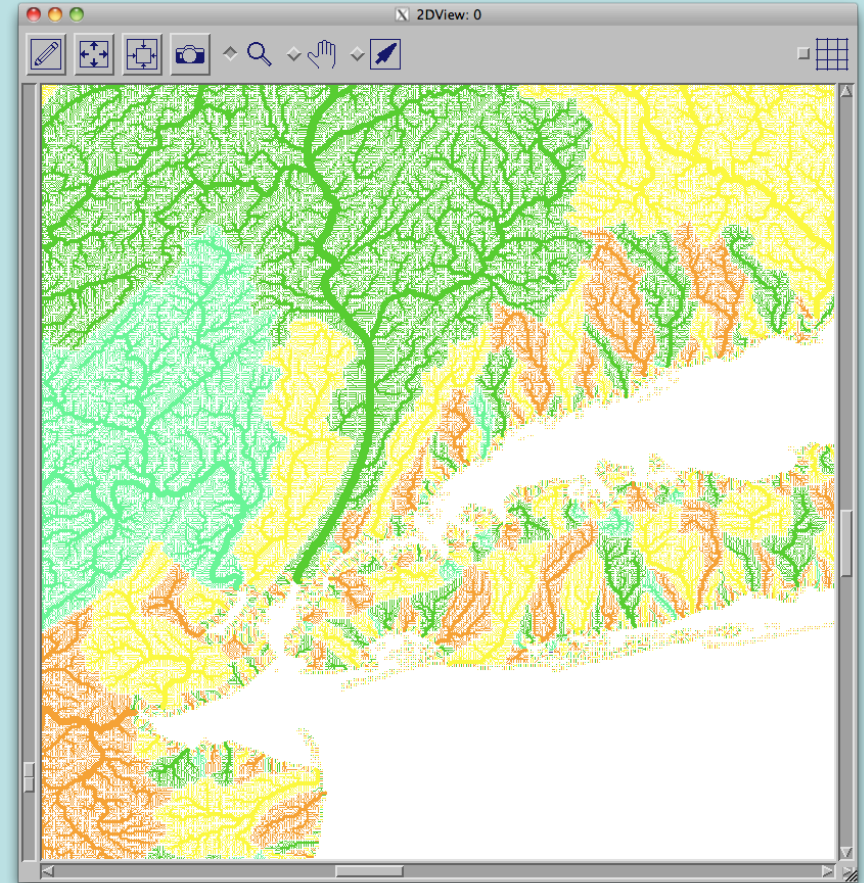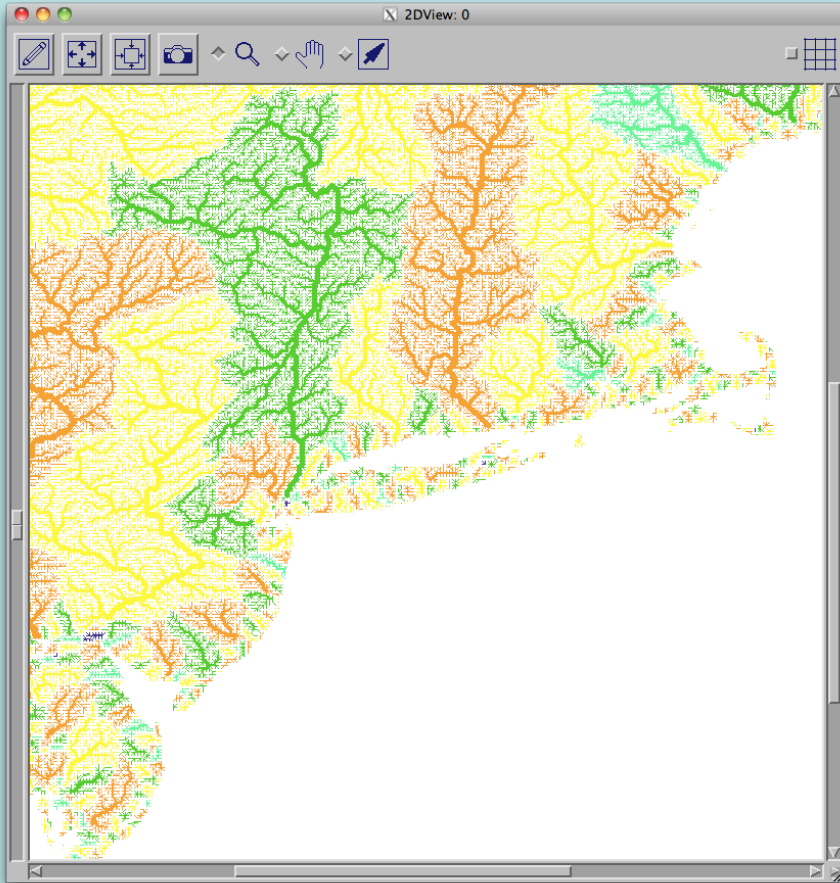
Locating Dams

Valles Marineris

Gridded Networks of Mars
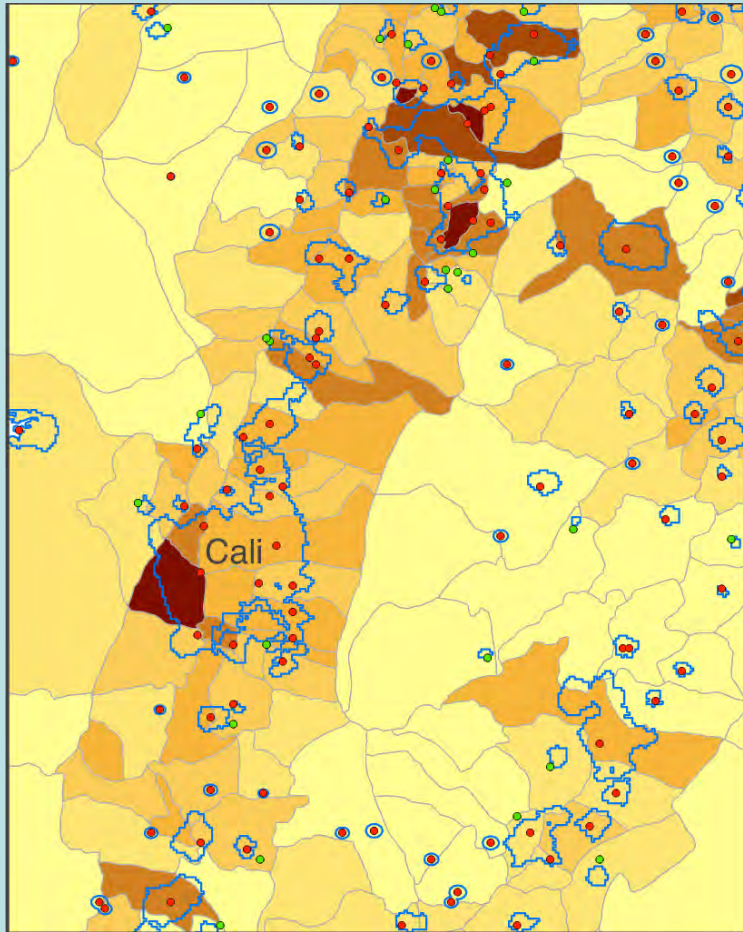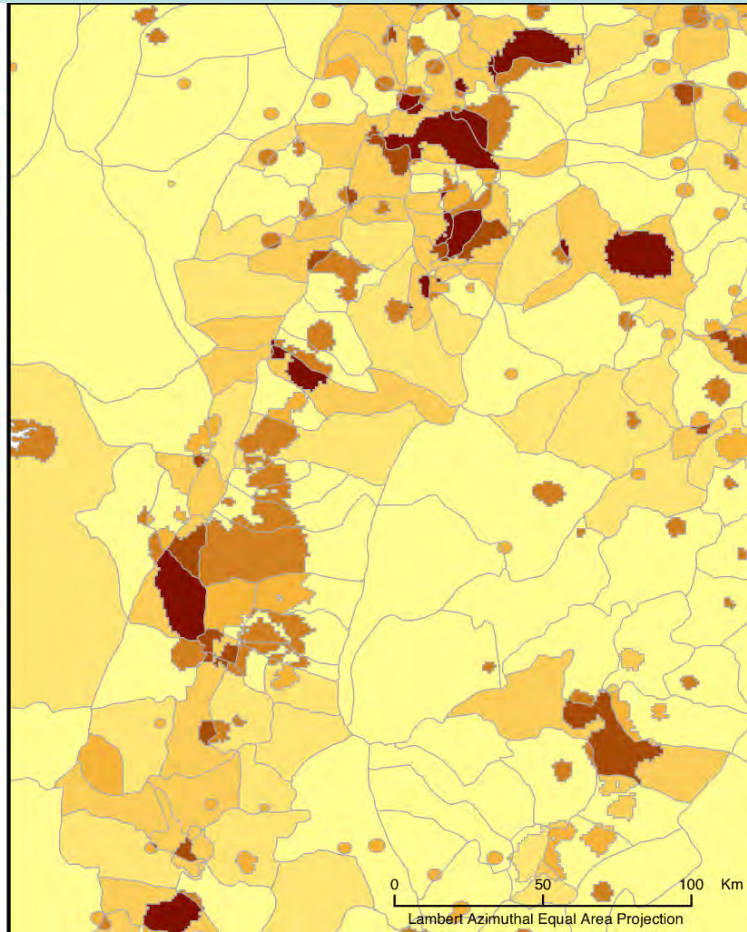
Gridded Networks

New York Area

Administrative units, urban extents, and points

GRUMP output

Population Density 2000

25 50 100 250 500 1000 1001+

● Points inside the urban extents

● Points within a 3 km buffer of the lights

☐ Urban extents

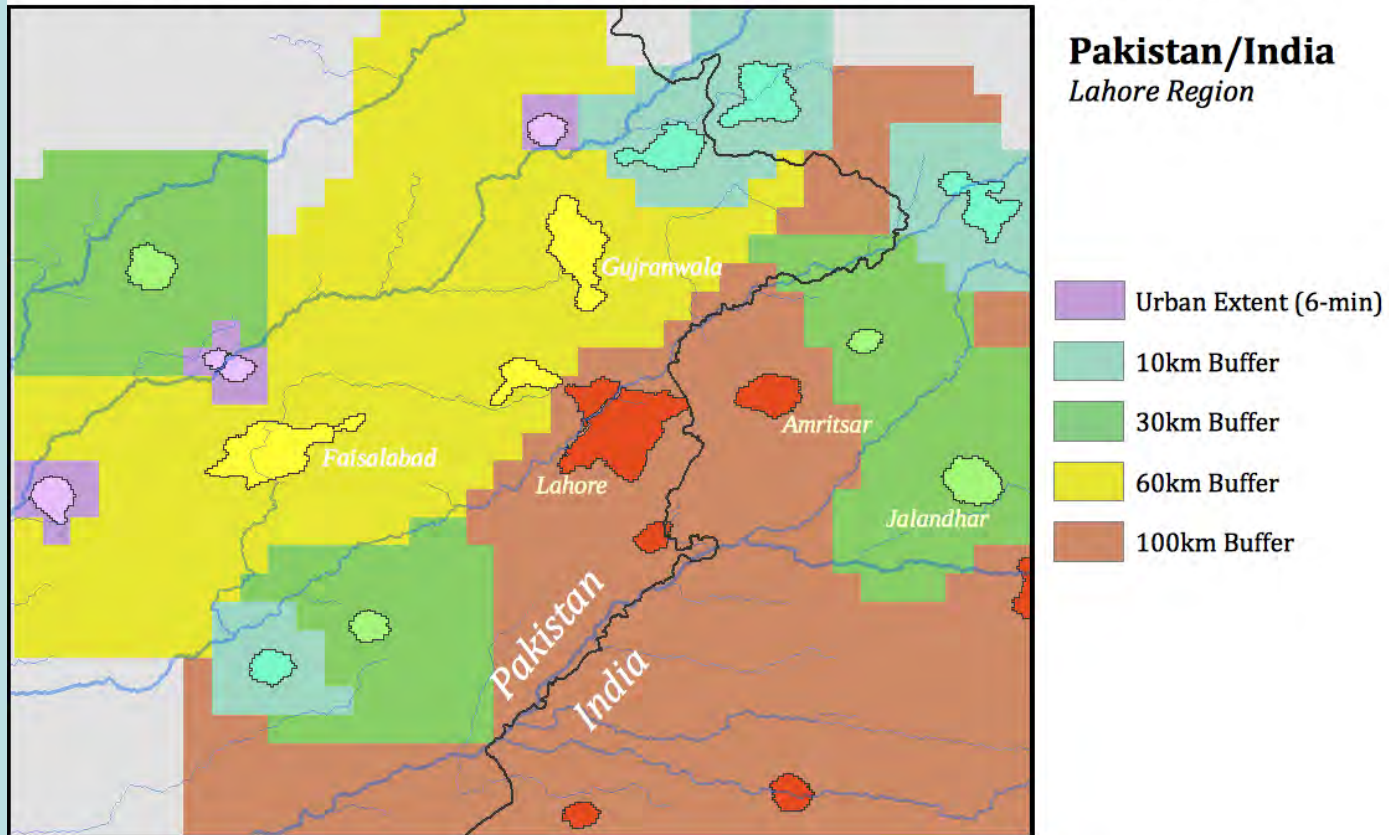Lambert Azimuthal Equal Area Projection

0   50   100 Km

16

City Lights

Water Footprint

Water Footprint Based on Seasonal Water Shortages (defined as < 100 L/person/day)
Buffers define how far an urban area needs to go out to access water to meet basic needs

Pakistan/India
Lahore Region

- Urban Extent (6-min)
- 10km Buffer
- 30km Buffer
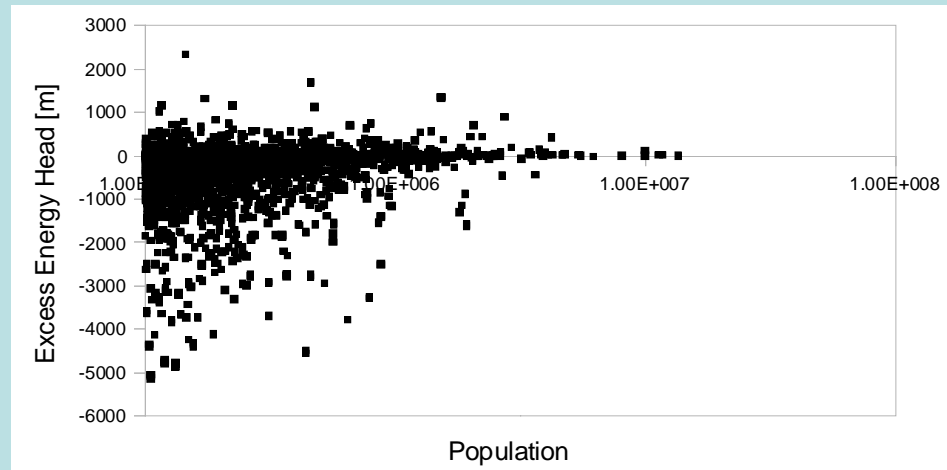- 60km Buffer
- 100km Buffer

Urban extents are from CIESIN GRUMP. Basic needs water threshold of 100 L/person/day
is based on Falkenmark water scarcity indicator (Falkenmark, 1989).

Gravity vs. Pumped Water Supply
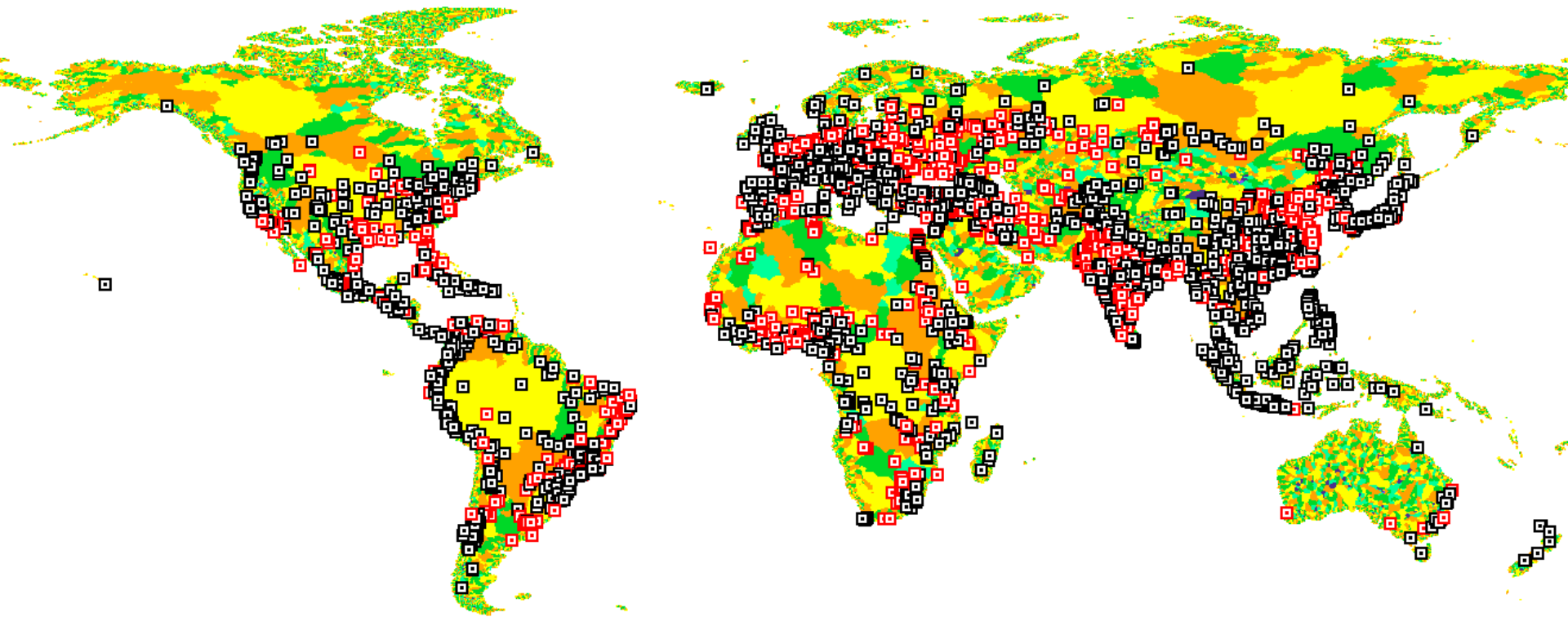
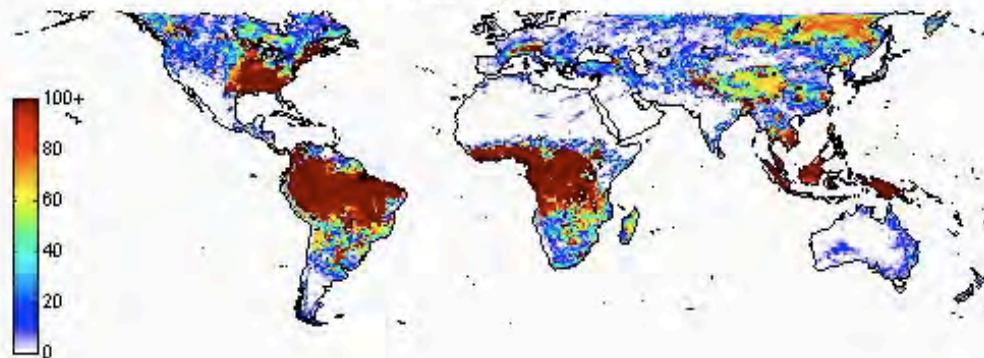# Excess Energy in Water Supply
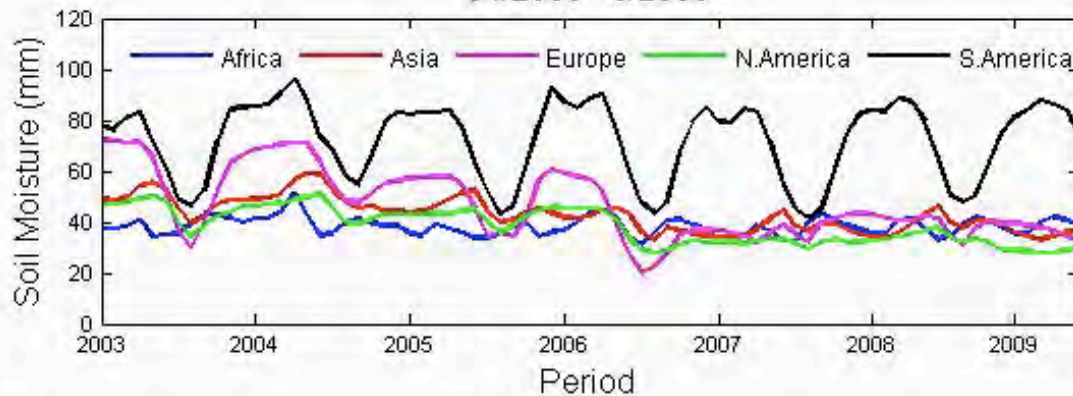
Pilot Study on Indicators (PSI)

Soil Moisture (mm) - 5-2009

Average Monthly Soil Moisture per Continent (mm)
01/2003 - 5/2009

Soil Moisture

The Water Balance/ Water Transport Model (WBM/ WTM) provides the monthly soil moisture corresponding to the period January 2003 to December 2008 used here. The input data for the model includes air temperature from the National Center for Environmental Prediction (NCEP) and combined precipitation products from the GPCP /CMORPH project.

Data:

Global_CMORPH-GPCP1dd_SoilMoisture_30min (2003-2008).

Source:

- National Center for Environmental Prediction (NCEP).
- GPCP/CMORPH (Joyce 2004).
- Water Balance Model / Water Transport Model (Vörösmarty, et al., 1989; Vörösmarty, et al., 1998).
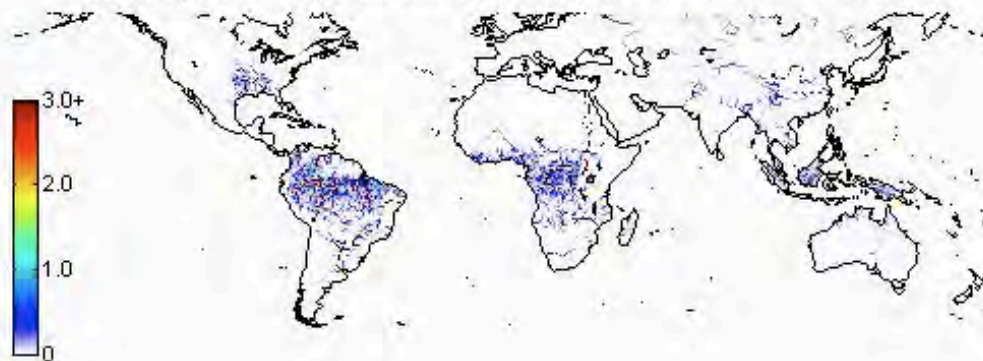
Monthly Discharge (m^3/sec) per Square Kilometer - 5-2009

Average Monthly Discharge (m^3/sec) per Continent per Square Kilometer 1/2003 - 5/2009
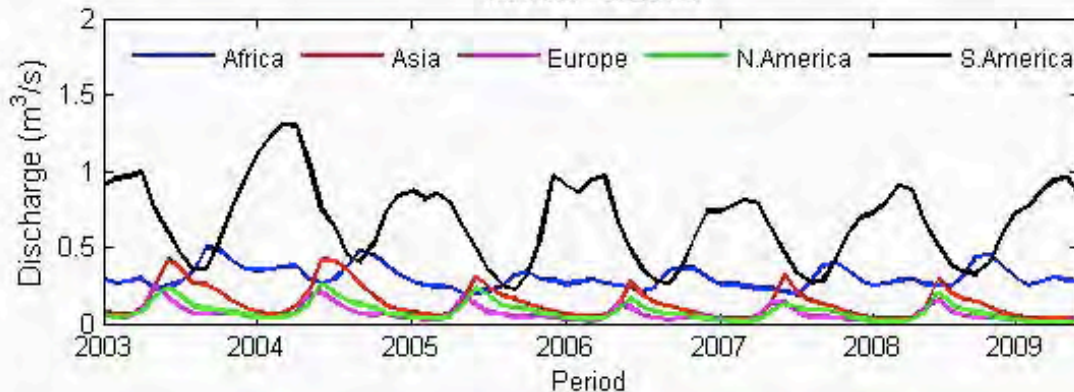
Discharge:

The Water Balance/ Water Transport Model (WBM/ WTM) provides the monthly discharge corresponding to the period January 2003 to December 2008 used here. The input data for the model includes air temperature from the National Center for Environmental Prediction (NCEP) and combined precipitation products from the GPCP /CMORPH project.

Data:

Global_CMORPH-GPCP1dd_Discharge_30min (2003-2008).

Source:

- National Center for Environmental Prediction (NCEP).
- GPCP/CMORPH (Joyce 2004).
- WBM/WTM (Vörösmarty, et al., 1989; Vörösmarty, et al., 1998)