Activities of the GEWEX Hydrometeorology Panel
GHP: LBA as component of GHP

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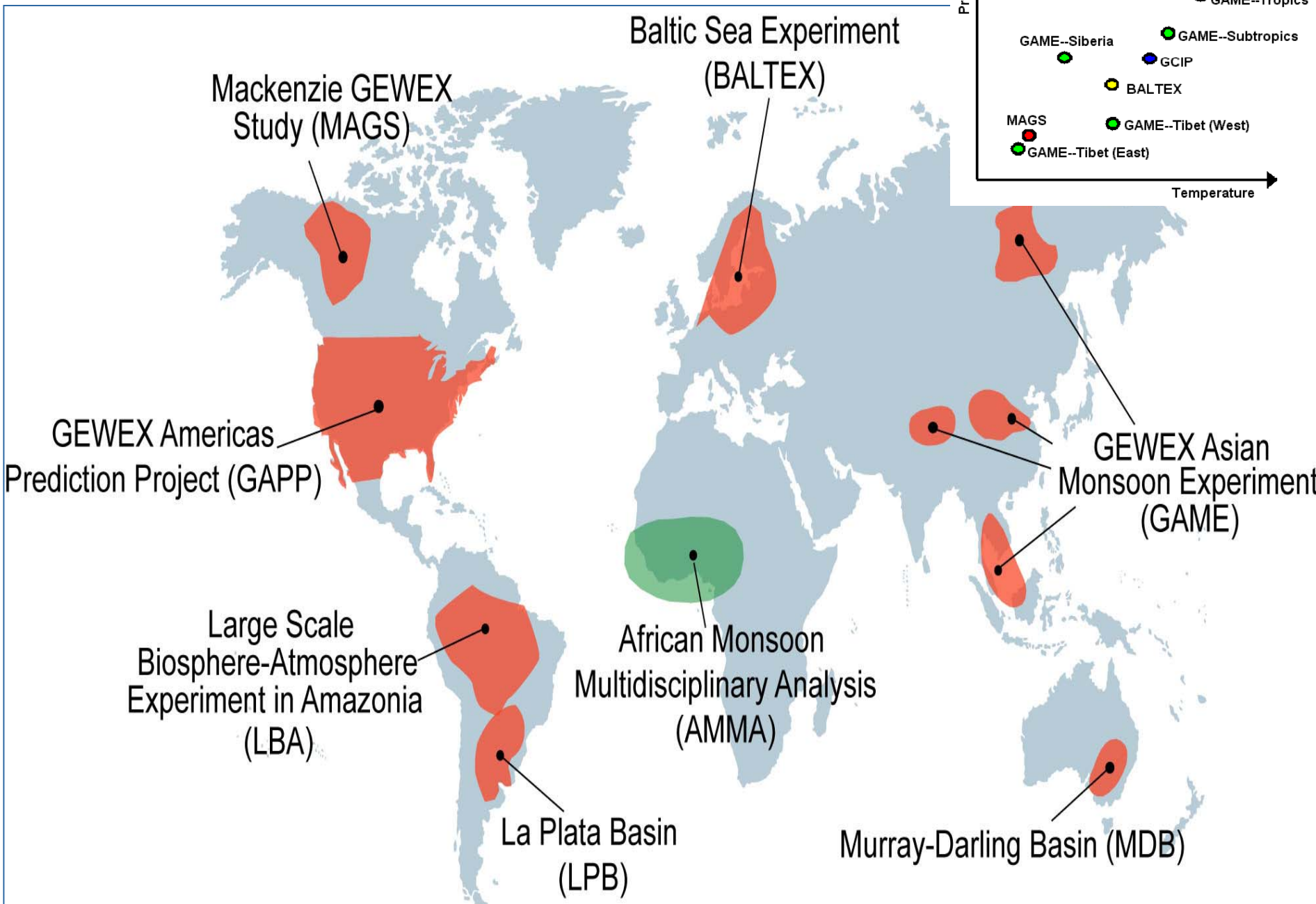
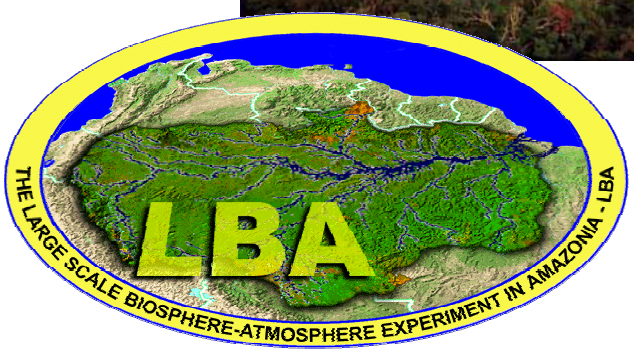
Continental Scale Experiments



LBA-Large Scale Biosphere Atmosphere Experiment in the Amazon Basin

LBA is an international research effort led by Brazil, and its main objective is to understand the functioning of the Amazon Basin in terms of its climate, hydrology, ecology, biogeochemistry, as well as on the impacts of land use changes on this functioning and on the interactions between Amazonia and the biogeophysical systems of the Earth.



LBA Components

- **PHYSICAL CLIMATE SYSTEM**
- **ATMOSPHERIC CHEMISTRY**
- **BIOGEOCHEMISTRY**
- **CARBON STORAGE AND EXCHANGE**
- **SURFACE HYDROLOGY AND WATER CHEMISTRY**
- **LAND USE AND LAND COVER CHANGE**
- **HUMAN DIMENSIONS**

GHP-LBA OUTSTANDING TASKS

These include:

- To develop and validate coupled atmosphere-surface-hydrology models
- To relate hydrological variables to water resource issues
- To identify surface, sub-surface and atmospheric scientific issues that are limiting our predictive capability
- To develop a strategy for advancing our understanding from regions to the global scale through the use of models, observational datasets and specific studies

GHP COMPONENTS

CSEs and 'Associate CSEs', ISLSCP, GRDC, GPCC

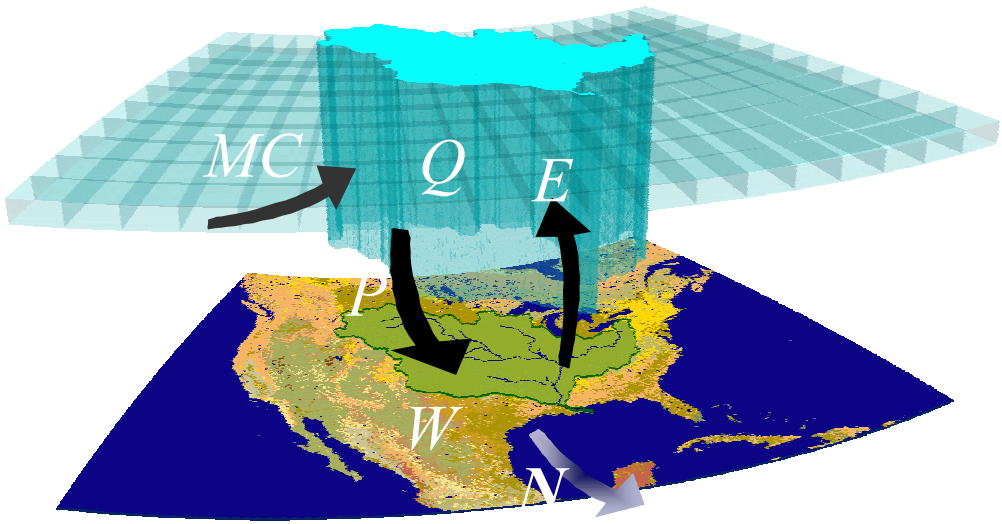
GHP	Cross-cutting efforts
WEBS	Water and Energy Balance Studies
WRAP	Water Resources Applications Panel
DMWG	Data Management Working Group
CEOP	Coordinated Enhanced Observing Period

CSE Matrix of Contributions to GEWEX for LBA

TECHNICAL/LOGISTICAL CRITERIA	LBA	SCIENTIFIC CRITERIA	Pr
1.) NWP center atmospheric and surface data assimilation and estimates of hydro-meteorological properties.	F	1.) Simulate the diurnal, seasonal, annual and interannual cycles.	Pr
2.) Suitable atmospheric-hydrological models and numerical experimentation and climate change studies.	I-F	2.) Close water and energy budgets.	Pr
3.) Mechanism for collecting and managing adequate hydrometeorological data sets.	F	3.) Determine and understand climate system variability and critical feedbacks.	C
4.) Participate in the open international exchange of scientific information and data.	F	4.) Demonstrate improvements in predictions of water-related climate parameters.	Pr
5.) Interactions with water resource agencies and related groups to address the assessment of impacts on regional water resources.	F	5.) Demonstrate the applicability of techniques and models to other regions.	Pr
6.) Evaluation of GEWEX global data products.	I-F		
7.)Contributions to CEOP and transferability databases.	F		

B: Beginning, Pr: Progressing, C: Concluding; P: in Planning; I: Implementing; F: Functioning;

GHP WEBS



$$MC-(P-E)=dQ/dt$$

$$(P-E)-N=dW/dt$$

$$MC-N=d(Q+W)/dt\sim 0$$

- One of the major objectives of the GEWEX CSEs, has been to study the accuracy to which continental-scale water and energy budgets (WEBs) can be characterized and “closed”.
- WEBs have begun in the CSEs and affiliated projects and we are now planning to develop a GHP WEBS (synthesis), which would provide a transition to CEOP WESP activitie

WEBS Variables

- Reservoirs
  - Precipitable Water, mm — GVAP
  - Soil Moisture, mm — Rean
  - Snow, mm — Rean
  - Surface Air Temp, K — Rean
  - Atmos. Enthalpy, J/m**2 — Rean
- Processes
  - Precipitation, mm/day — GPCP
  - Evaporation, mm/day — (GPCP-MC Rean)
  - Moisture Convergence, mm/day — Rean
  - Runoff, mm/day — GRDC (only annual means avail.)
  - Energy Convergence, W/m**2 — Rean
  - Sensible Heating, W/m**2 — (ISCCP+GPCP+HC Rean.)
  - Surf. Rad. Heating, W/m**2 — ISCCP
    - (BOA SW down-BOA SW up-BOA LW up+BOA LW down),
  - Atmos. Rad. Cooling, W/m**2 — ISCCP
    - (TOA SW down-TOA SW up-TOA LW up)- Surf. Rad. Heating
  - Radiation Fluxes W/m**2 — ISCCP
    - TOA SW down, SW up, LW up
    - BOA SW down, SW up, LW down, LW up

- **GPCP, 1979-present**
- **ISCCP, 1983-June 2001**
- **UNH/GRDC, climatology**
- **CSEs, 1997-2001? 5 years**

Water and Energy Budgets

Atmospheric Water

$$\frac{\partial Q}{\partial t} = E - P + MC + RESQ$$

Surface Water

$$\frac{\partial W}{\partial t} = P - E - N + RESW$$

Atmospheric Temperature

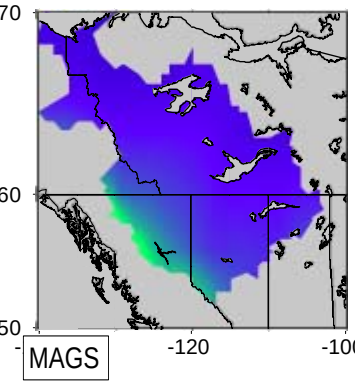
$$C_p \frac{\partial \{T\}}{\partial t} = QR + LP + SH + HC + REST$$

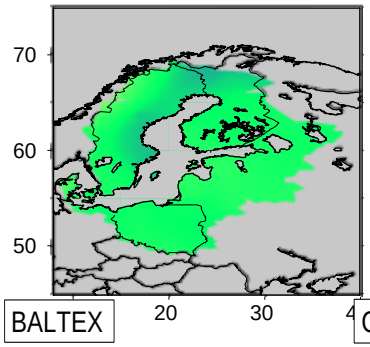
Surface Temperature

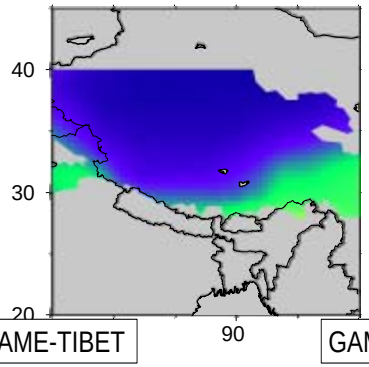
$$Cv \frac{\partial \{Ts\}}{\partial t} = QRS - LE - SH + G$$

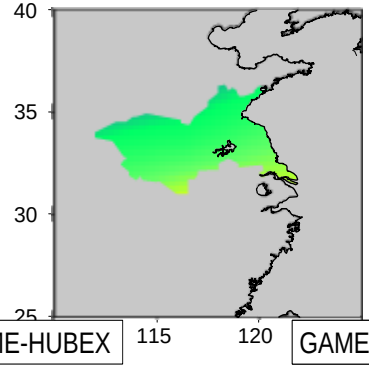
Q=Atmospheric Precipitable Water, mm
W=Surface Water (M+S), mm
M=Soil Moisture, mm
S=Snow, mm
T=Atmospheric Temperature, K
Ts=Surface Skin Temperature, K
T2=Surface Air Temperature (at 2m), K
E=Evaporation, mm/day
P=Precipitation, mm/day
MC=Moisture Convergence, mm/day
N=Runoff, mm/day
LP=Latent Heat of Condensation, W/m**2
SH=Sensible Heat (which is positive upward), W/m**2
HC=Dry Static Energy Convergence, W/m**2
LE=Latent Heat of Evaporation (which is positive upward), W/m**2
QR=Atmospheric Radiative Heating (which is negative), W/m**2
QRS=(NSW+NLW)=Surface Radiative Heating, W/m**2
NSW=Net Shortwave Radiation at the Bottom of Atmosphere (BOA), W/m**2
NLW=Net Longwave Radiation at the Bottom of Atmosphere (BOA), W/m**2
NSW (0)=Net Shortwave Radiation at the Top of Atmosphere (TOA), W/m**2
NLW (0)=Net Longwave Radiation at the Top of Atmosphere (TOA), W/m**2
RESQ=Atmospheric Residual Water Forcing, mm/day
RESW=Surface Residual Water Forcing, mm/day
REST=Atmospheric Residual Dry Static Energy Forcing, W/m**2
G=Surface Residual Temperature Forcing, W/m**2

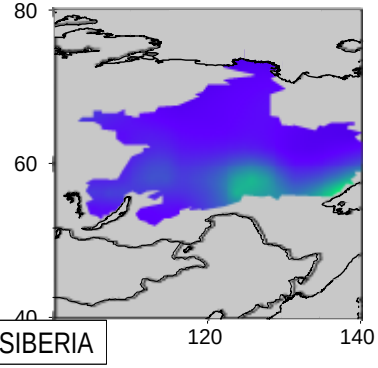
1996-99 Annual Mean Precipitation

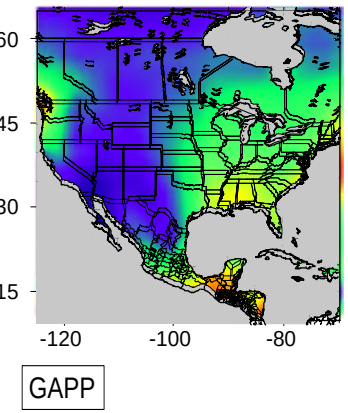


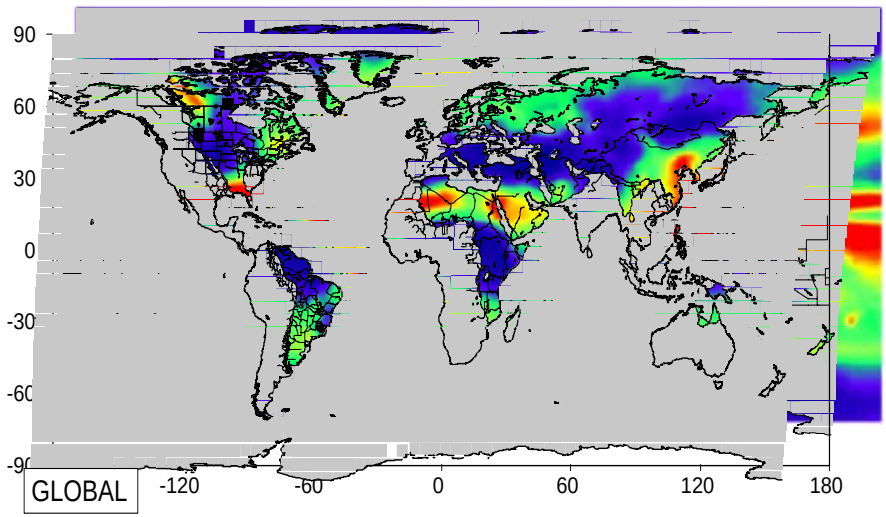


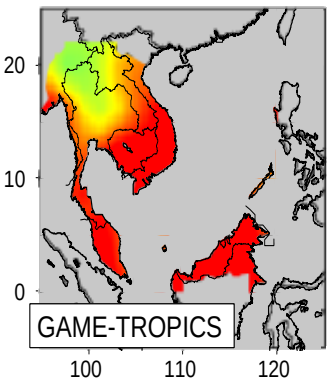


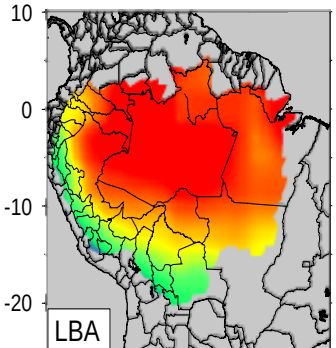


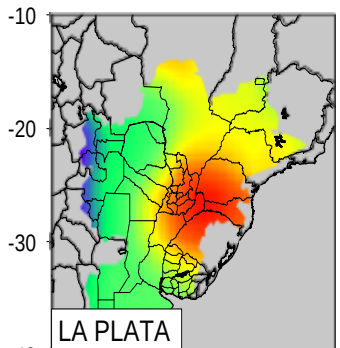


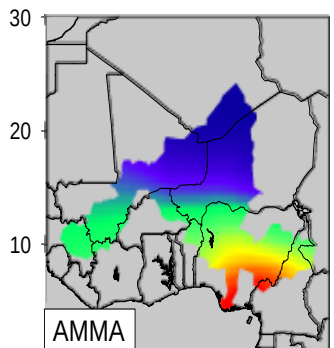


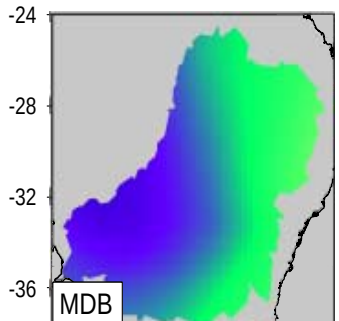




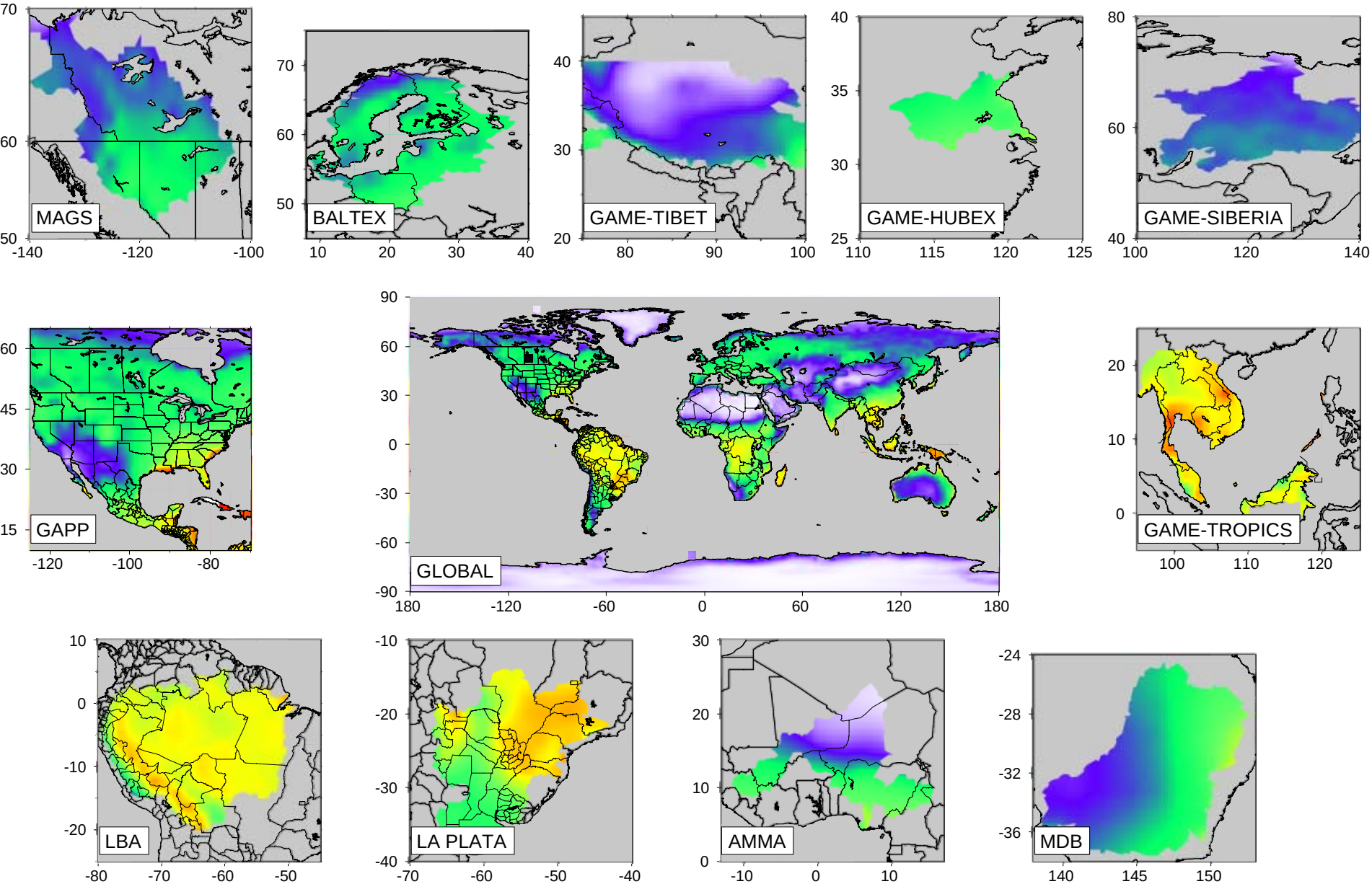




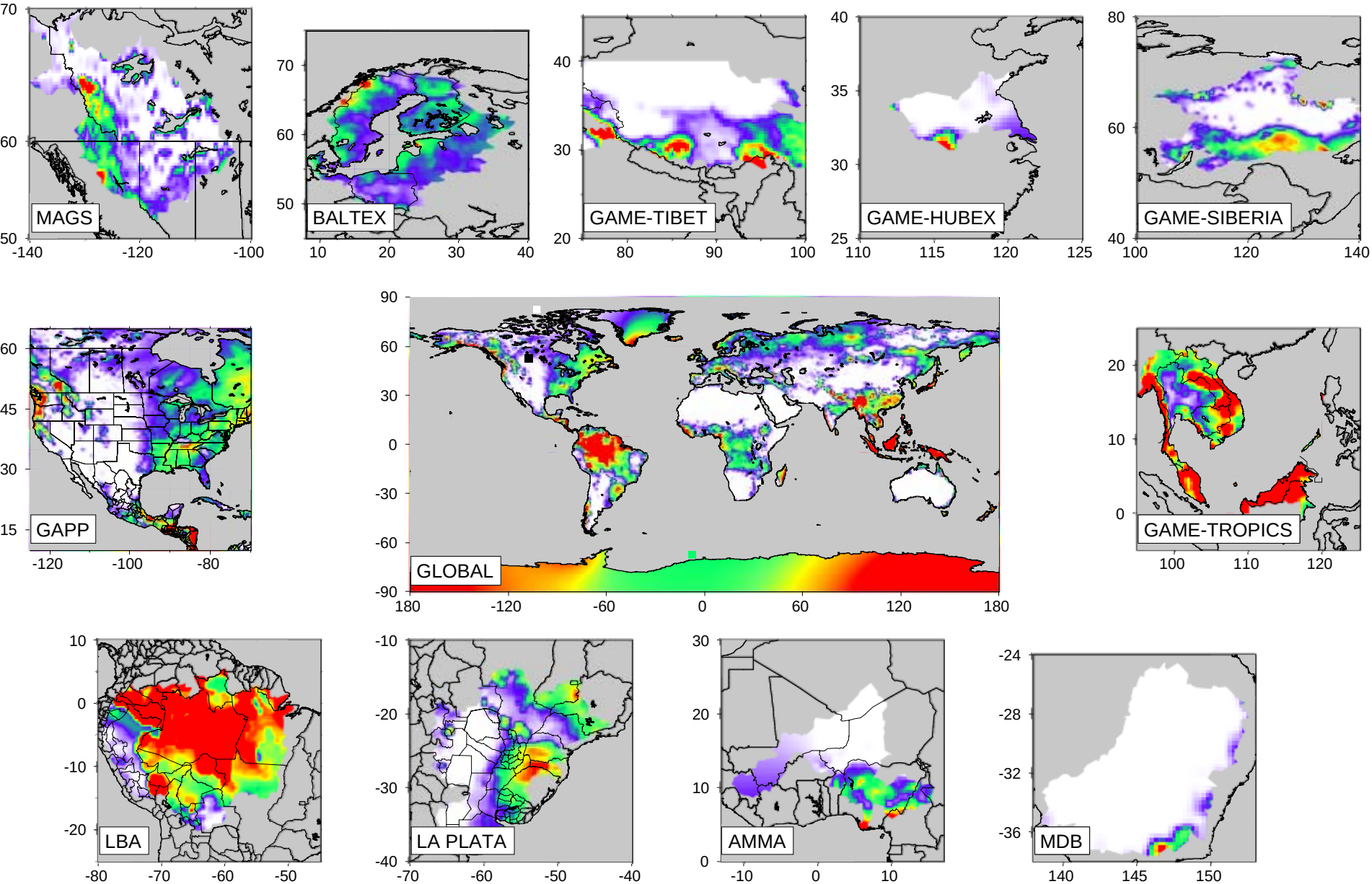




1996-99 Annual Mean Evaporation (RII)



1996-99 Annual Mean Runoff



LBA acontributions to GHP: LBA I and II

-Seasonal to interannual climate variability: Simulations and model validation, Predictability assessments and studies in South America using global and regional (Eta) models (WESP)

-Studies on the closure of the water and energy cycles in Amazonia: Assessmemt of uncertainties and sensitivity of the water balance to different rainfall data sets (WEBS)

-Applications to society: hydrological prediction for electric generation, risk of fire (WRAP)

-Model development and data assimilation of data from field campaigns (SALLJEX) for improvement of climate and weather predictability (WESP-CIMS)

-Clouds in the Amazon are modulated by land cover and influenced by land cover change. River vs forest contrats also modulate convection and rainfall (WEBS, WESP, CIMS)

-LBA BARCA