

MERRA's Water and Energy Budget data

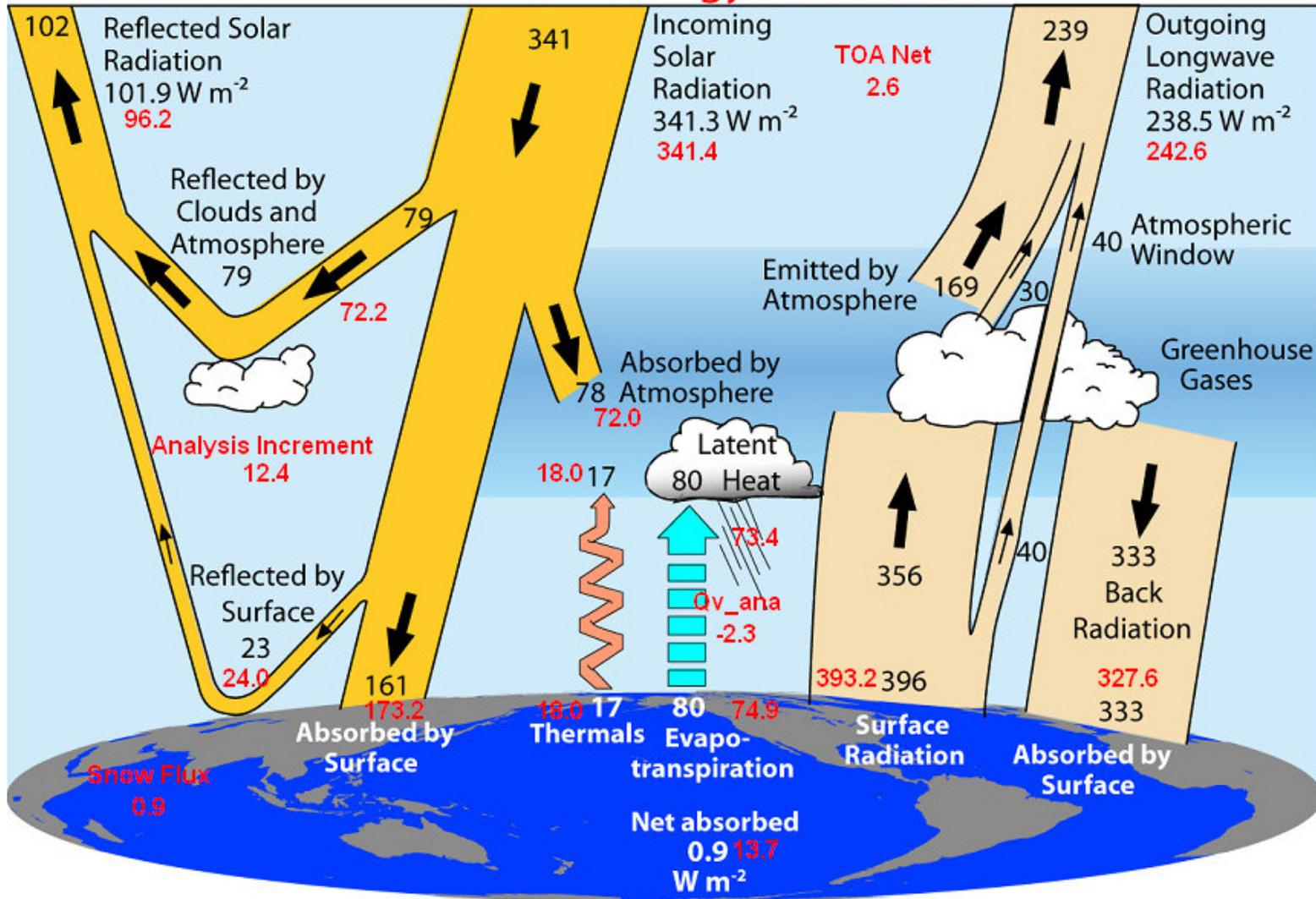
Global Energy Budget

- Critical estimate of the climate system especially in climate variations (e.g. ENSO, or how clouds affect the temperature)
- Need a closed budget to best understand interannual variations
- Climate Change is difficult with reanalyses
- Observations provide non-physical sources of energy and water in the system

Global budget, as it stands now

MERRA(RED) 179 Months

Global Energy Flows $W m^{-2}$

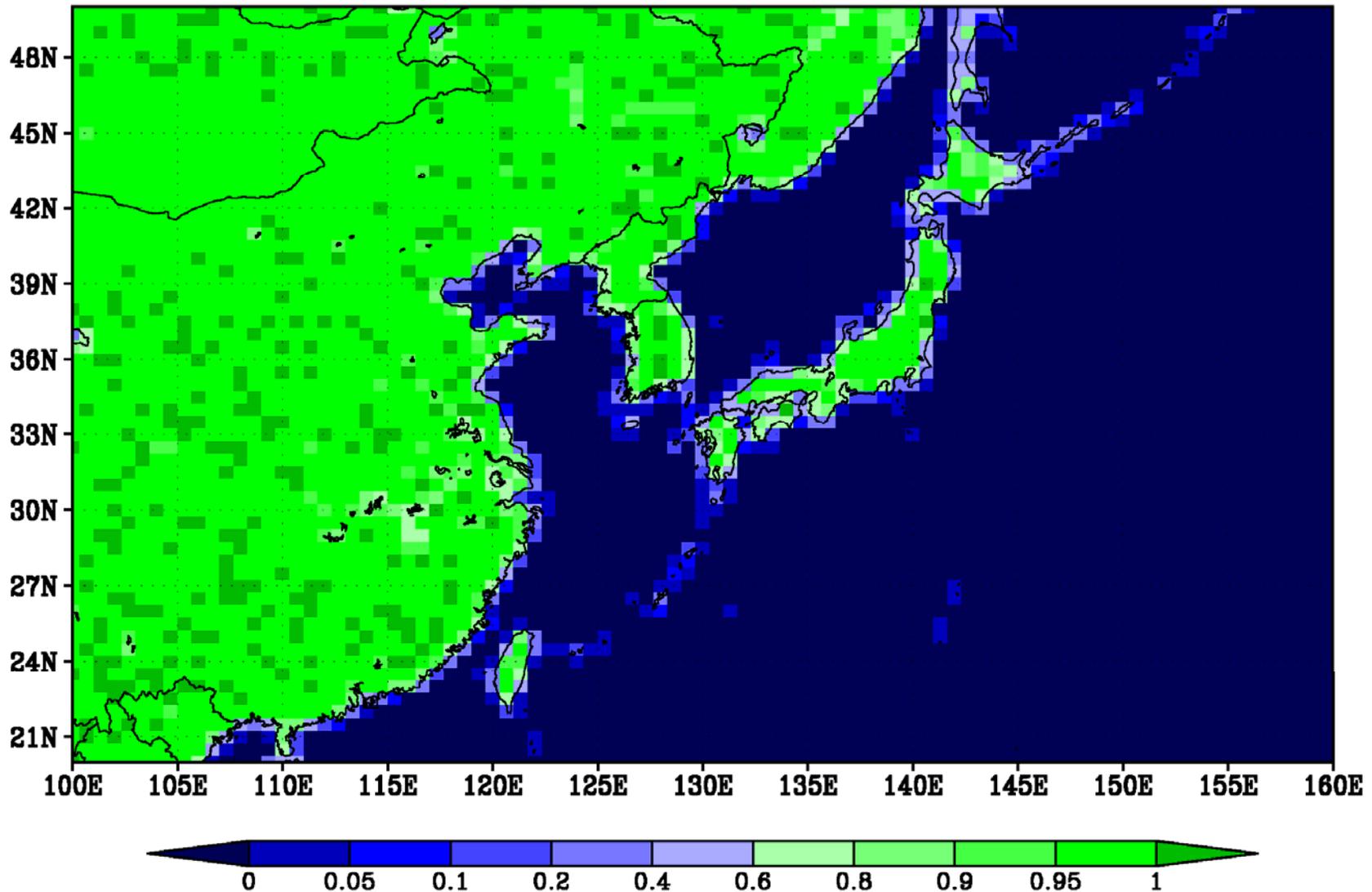


Background from Trenberth, Kiehl and Fasullo (2008, BAMS Accepted)

/GrADS20/merra/GlobalEnergy (Climate scripts using GDS)

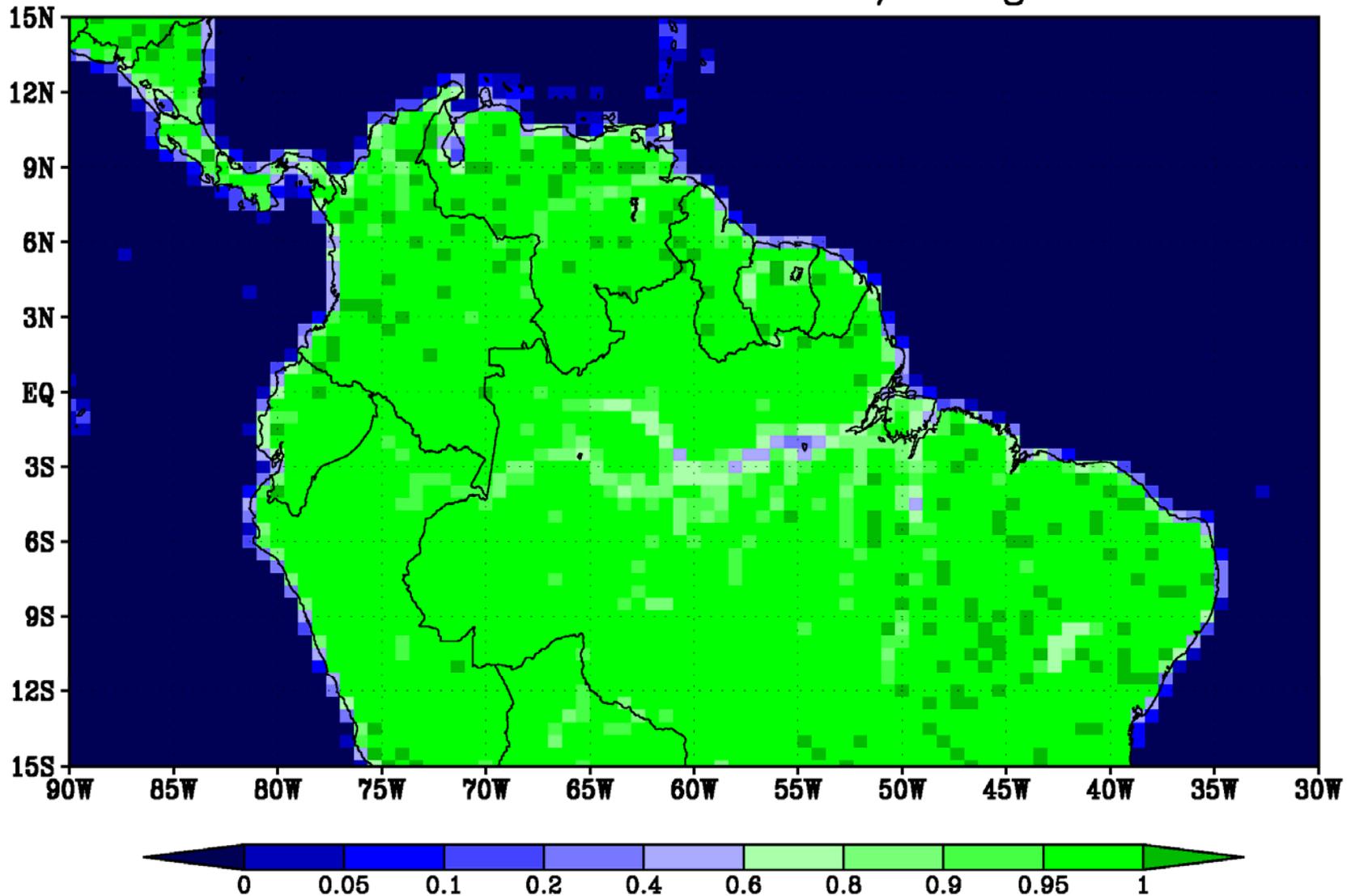
Defining a Land/Sea Mask

East Asia Land Fraction GEOS5 1/2 Degree Grid



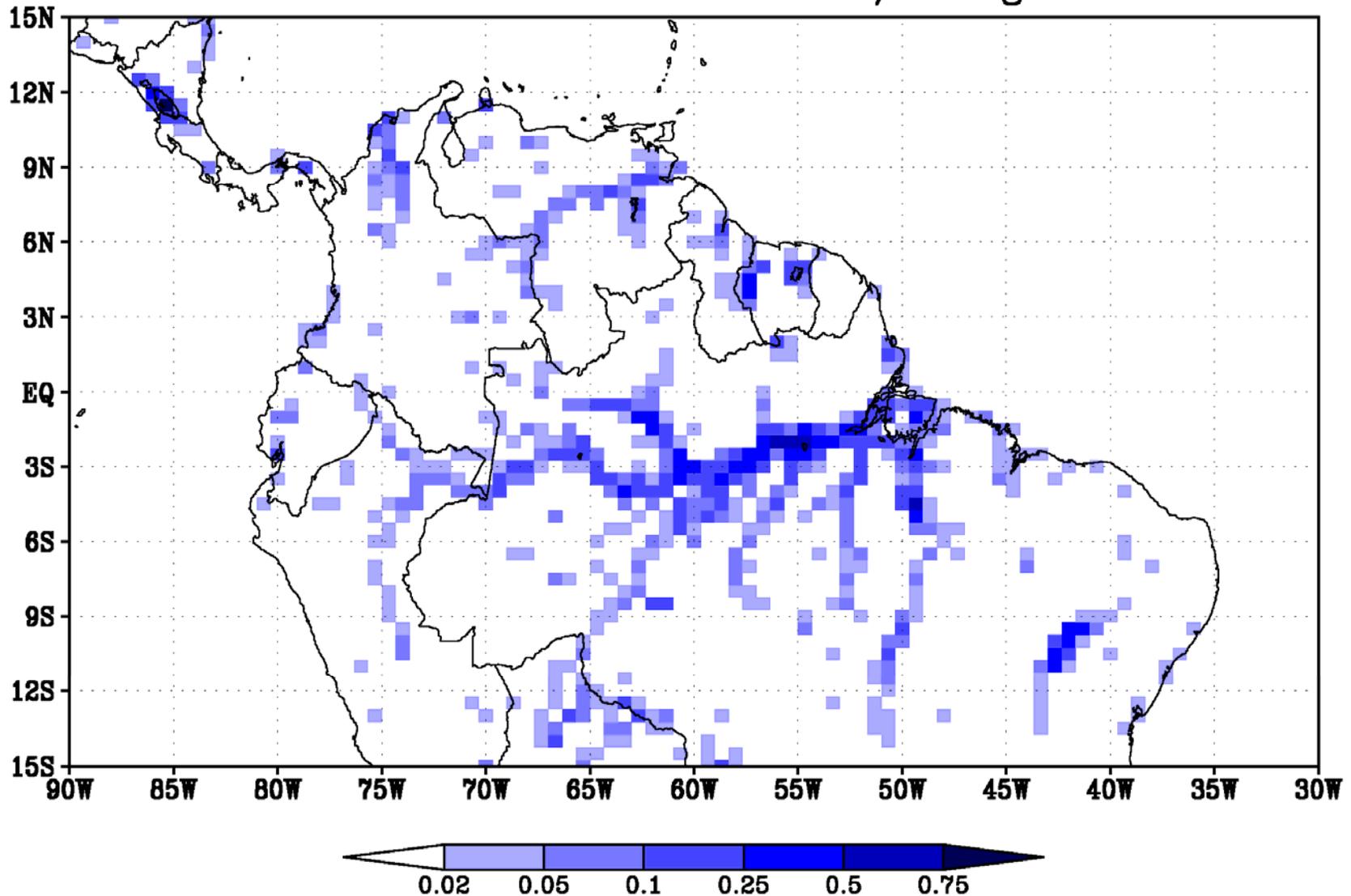
Defining a Land/Sea Mask

Amazon Land Fraction GEOS5 1/2 Degree Grid



Defining a Land/Sea Mask

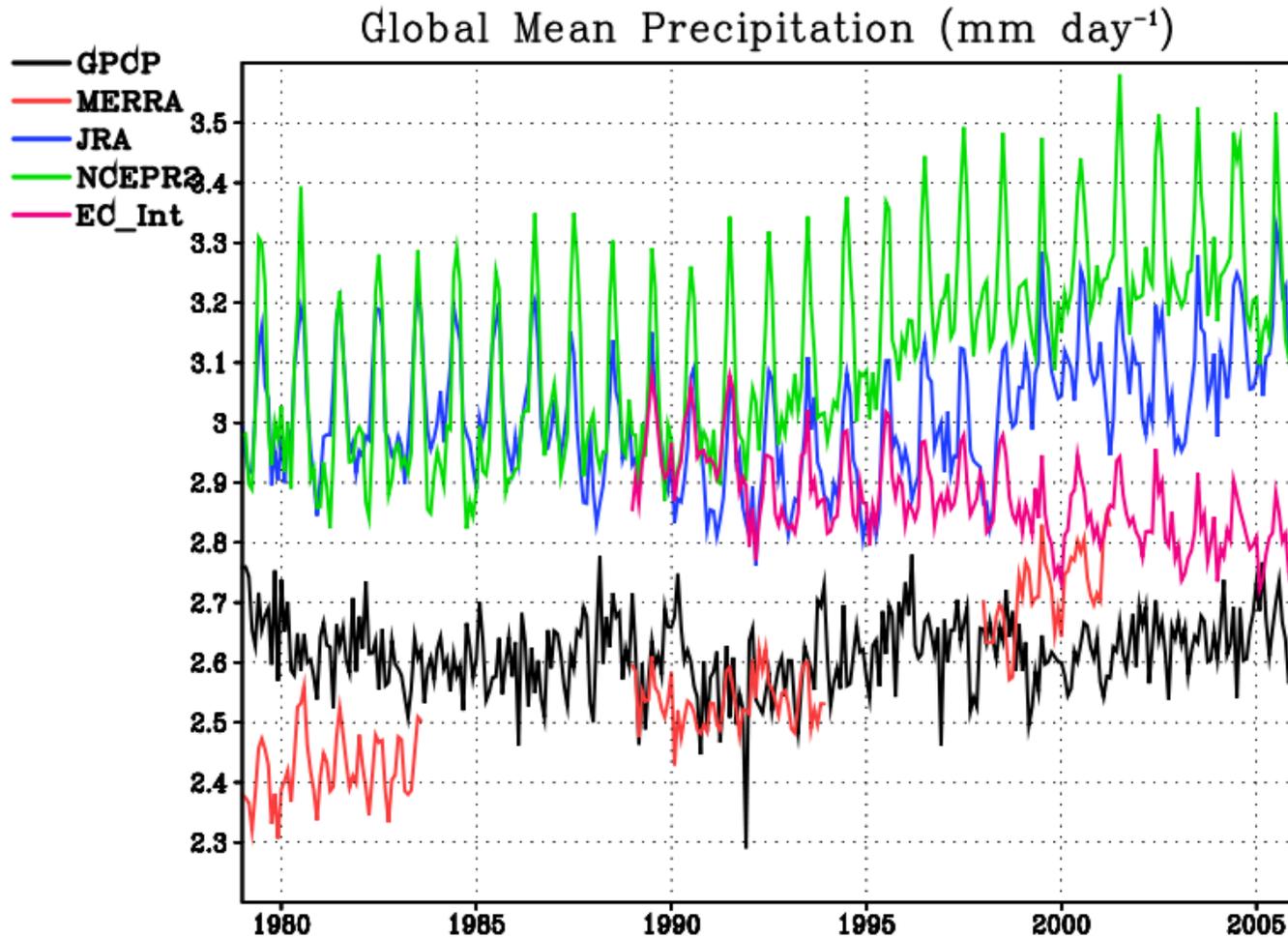
Amazon Lake Fraction GEOS5 1/2 Degree Grid



GEB Routine

- For choose a subset of variables, referring to the File Spec definitions and budget equations
- Define a land/sea mask
- Define mean annual cycle, then time average the 12 months
- Global average, repeating for masking
- Writes a comma delimited ASCII file (to paste into Excel)

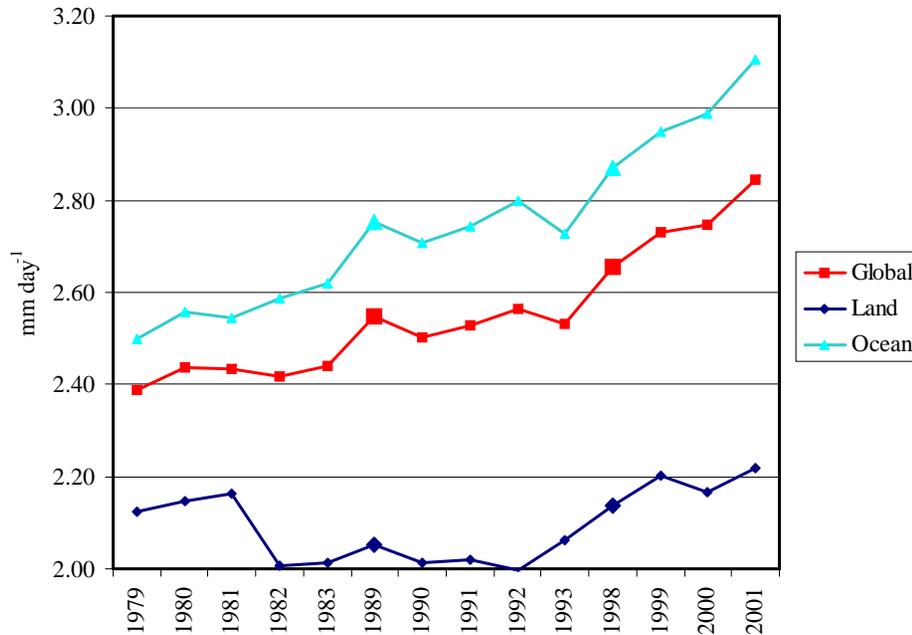
Time Series: Precipitation Comparison



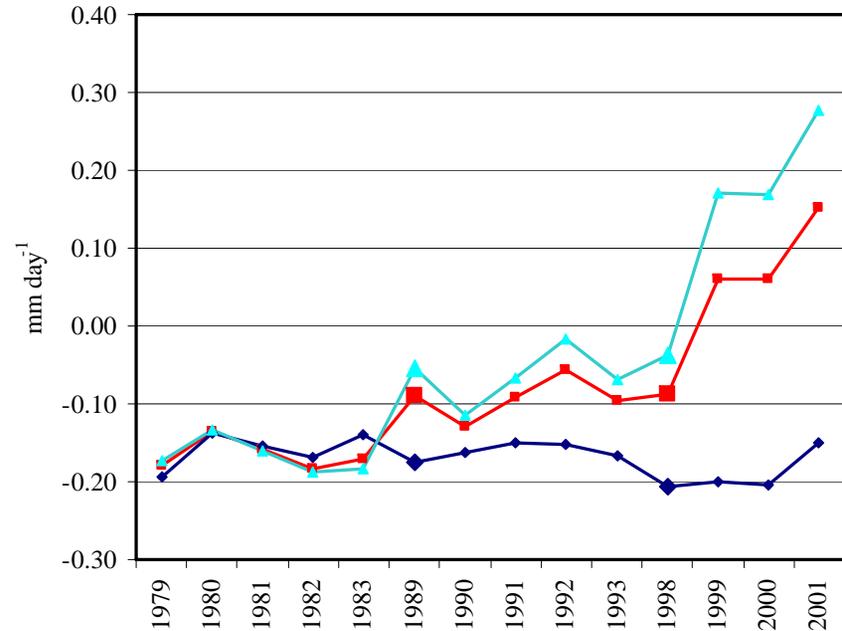
- GPCP has a full satellite era time series, so it makes a good benchmark
- `cd \GrADS20\merra\Water Budget\PrecipTimeSeries\`
- `gradsdods -l`
- `run precip_time_series.gs` (MAY TAKE LONG TIME!)
- Compare with the serverside script (`_ss`)

Time Series: Annual Means

Precipitation

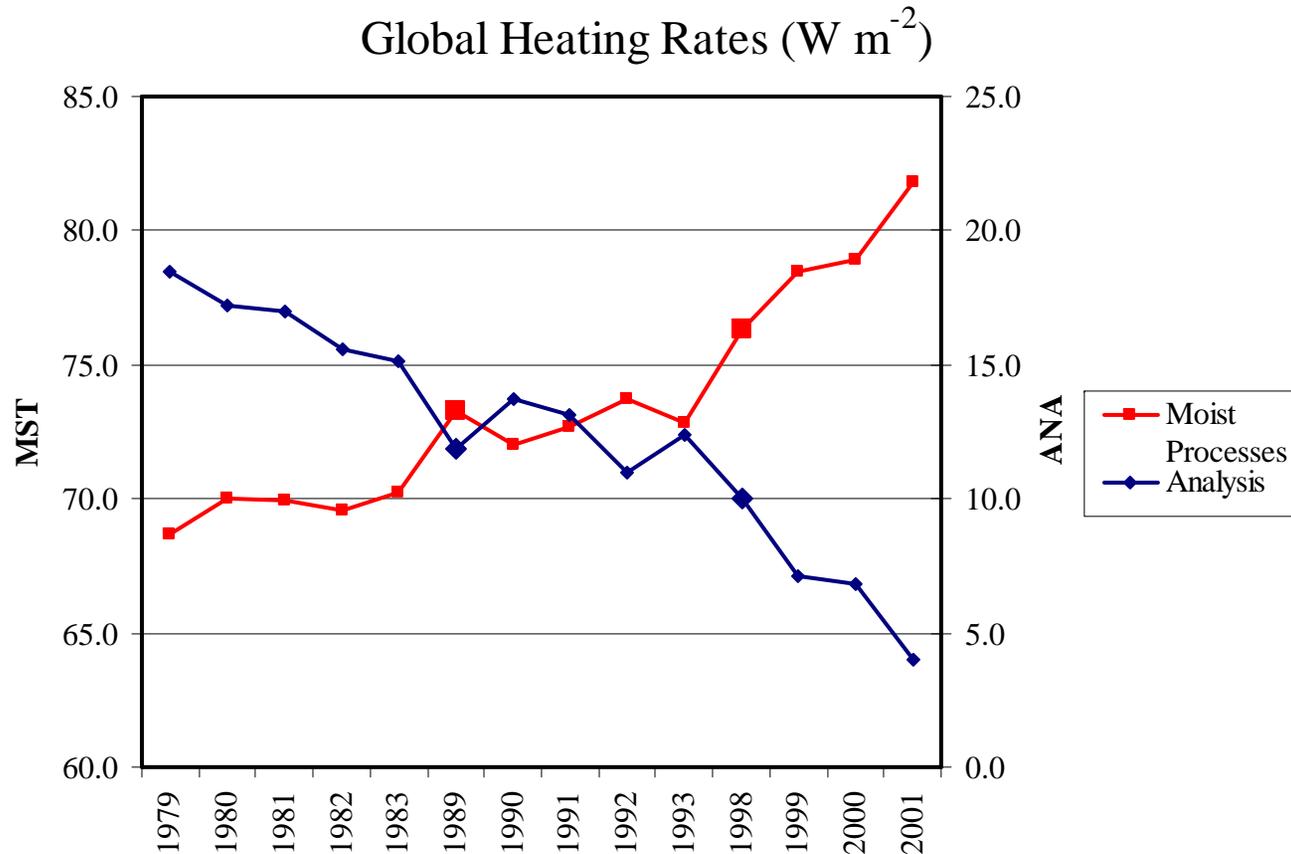


Water Vapor Increments



- Reduces annual variations to focus on the long period
- Follows the GEB routine, except cycles complete years in an annual average, writes ascii
- Command line RUN:
gradsdods -lbc "\GrADS20\merra\GlobalEnergy\GlobalEnergyAnn.gs 1979"
Accesses the GDS for data, Also can be run in a c-shell

Time Series: Heating Tendencies



- DHDT_MST – Tendency due to moist processes – atm latent heating
- DHDT_ANA – Tendency due to temperature analysis

Regional (and Global) water budget

- July 1993 Midwest Flooding Heavy P
- Stationary convective environment involving all components of the water cycle
- Nearly complete budget (missing FIL and CHM tendencies)
- GrADS20\merra\Water Budget\1993_Midwest
- Local and Remote (GDS) scripts available
- A global script is also provided (shows residual)

MERRA WATER BUDGET PLOTS <http://gmao.gsfc.nasa.gov/merra>

