INITIAL EVALUATION OF RIVER RUNOFF BASED ON JRA55

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'Extended' Meeting on Forcing Ocean-Ice Climate Models
14-15 January 2016, Yokohama, Japan

OUTLINE

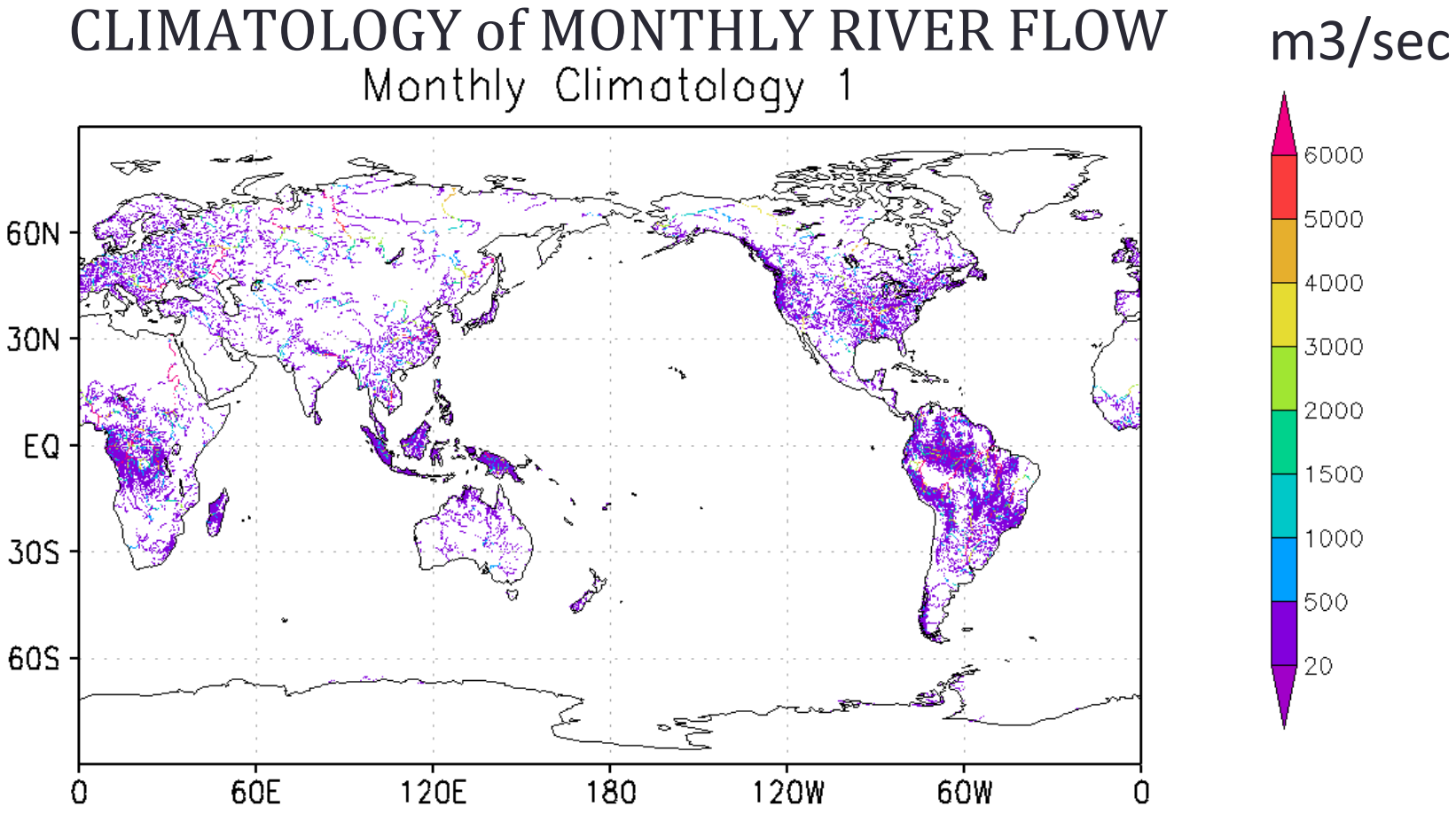
- Background
- Objective
- Water runoff from JRA55 land model
- River discharge into the Ocean by CaMa-Flood
- Bias Correction Strategy
  - Adjusted climatology and time series of river discharge.
- Summary

Background

- We need to renew and extend the period of the river discharge dataset, to simulate recent climate events using Ocean model (CORE2 historical data by Dai et al. (2009) is through 2007).
- CaMa-Flood is useful tool to calculate river discharge into the Ocean.
- JRA-55 provides water runoff from land to river.
- The final goal of this work is to build a historical river discharge data using CaMa-Flood with the JRA-55 runoff.
- Ice calving into the ocean is not considered (from CORE2 or SOMIP?).

CaMa-Flood

Horizontal resolution: 0.25 degree
Input data: Daily river runoff from JRA55 land model



Objectives

- To evaluate JRA55 water runoff from land to river
- To show the River Discharge into the Ocean by CaMa-Flood, comparing with CORE2.
- To propose bias correction strategy, which should be a time-independent method to extend near real-time.

Water runoff from Land

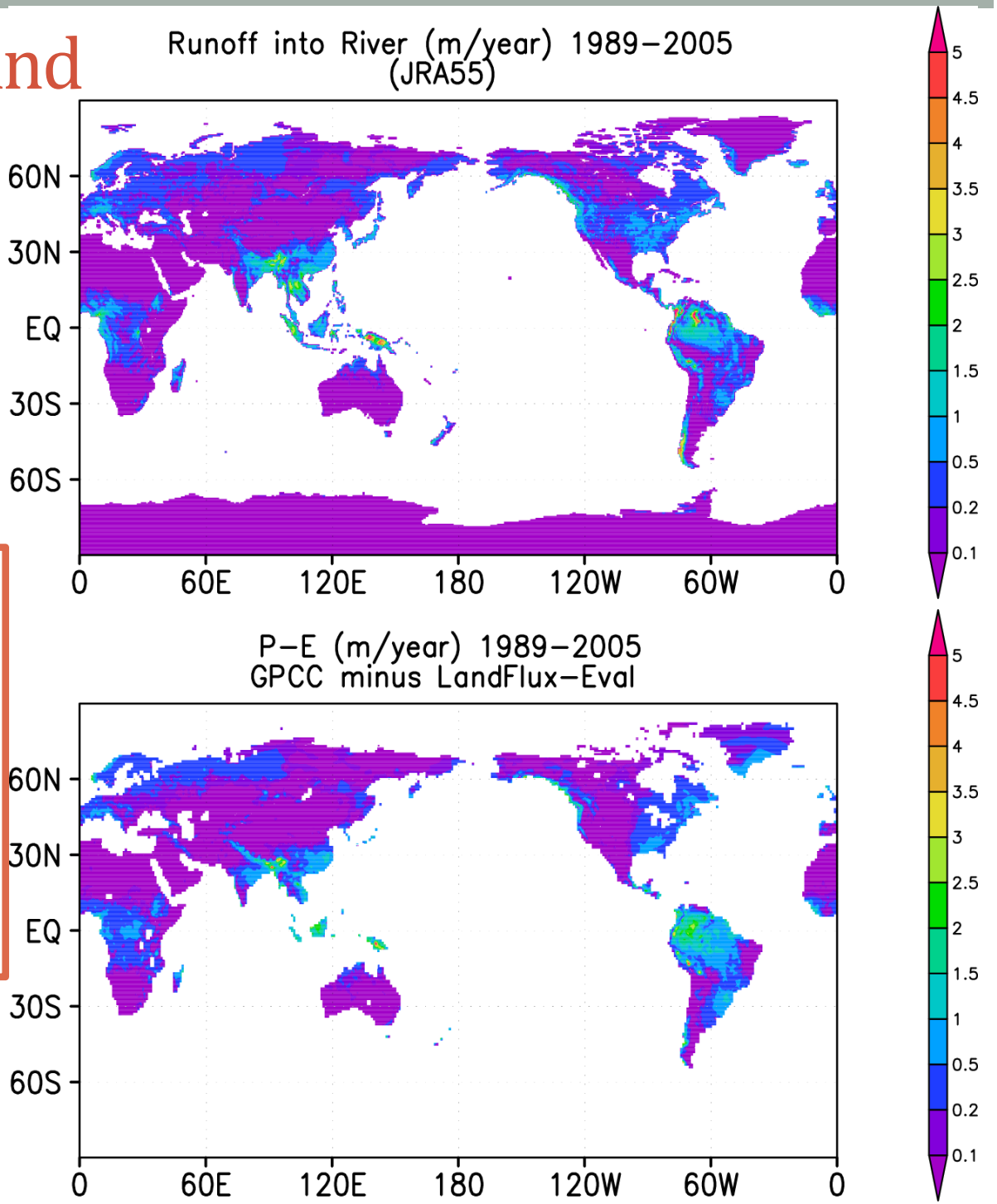
Climatology from 1989 to 2005

Under steady state condition, the water runoff should agree with Precipitation-Evaporation.

For reference data, we use observation based P-E

Precipitation
GPCC v.6 full, Schneider et al.(2011)
Monthly time series from 1901-2010
Evaporation
LandFlux-EVAL, Mueller et al.(2013)
Monthly Climatology 1989-2005
(considered remote sensing product, land surface model, Reanalysis data, and ground observations etc.)

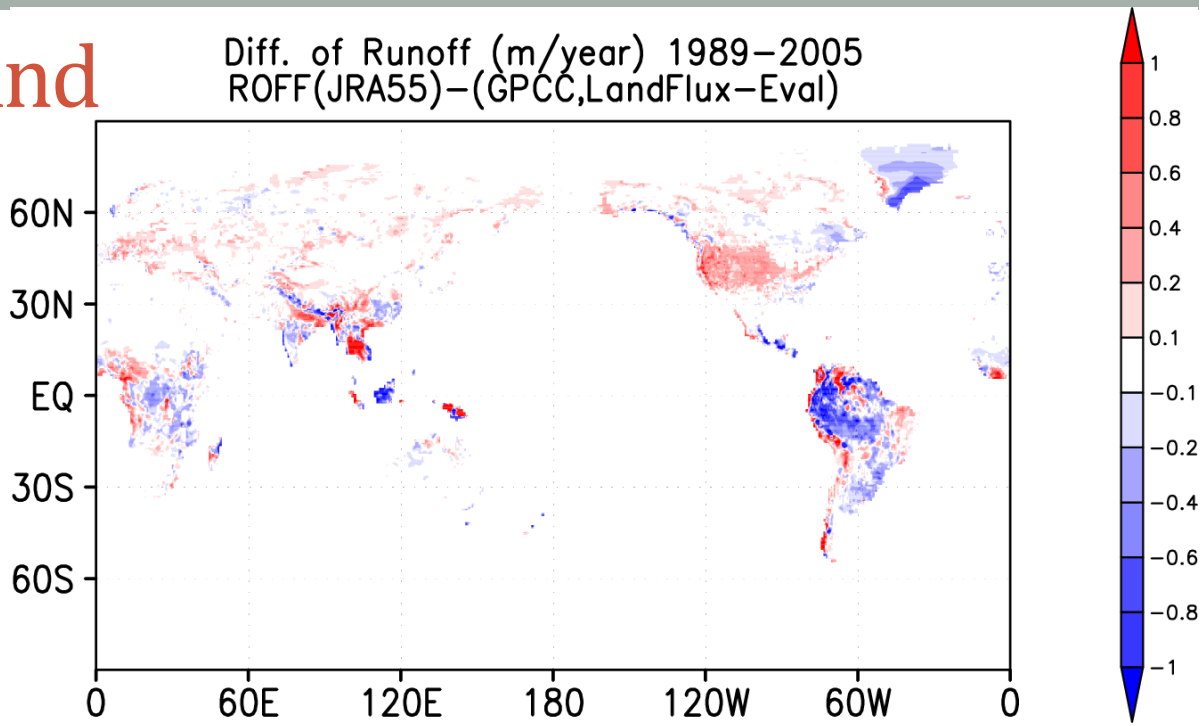
We can see a good agreement of the distribution between JRA55 runoff and the reference data

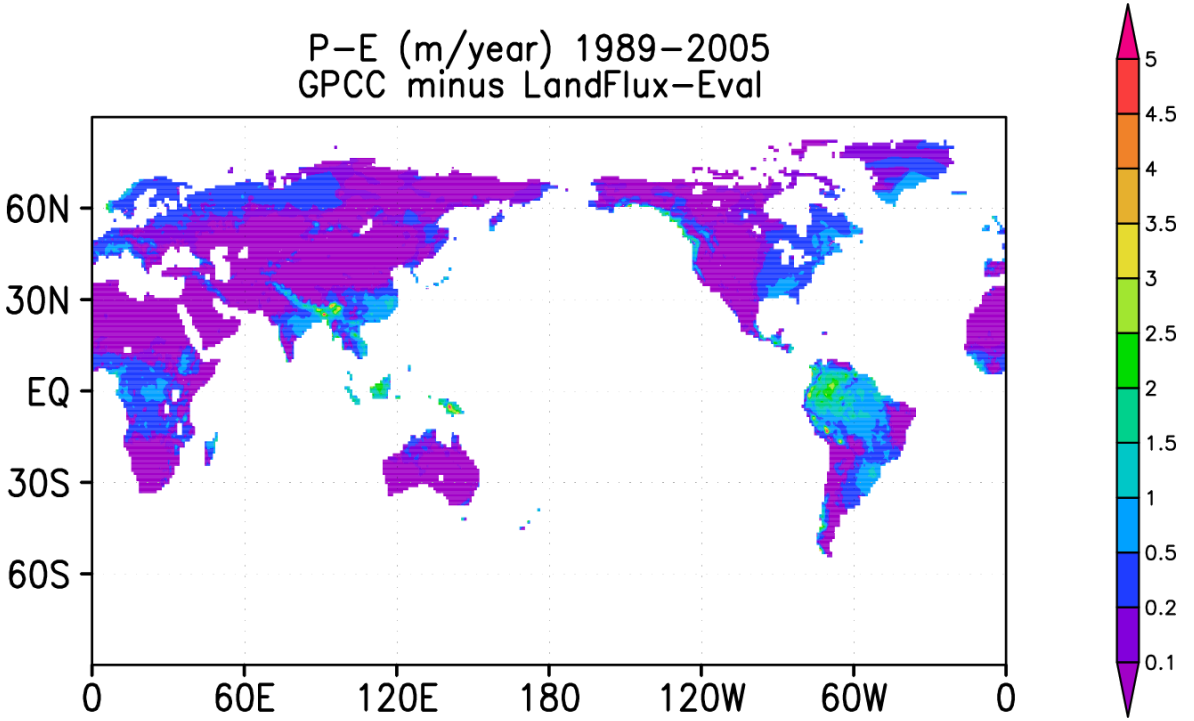


Water runoff from Land

Difference between water runoff of JRA55 and P-E reference data.

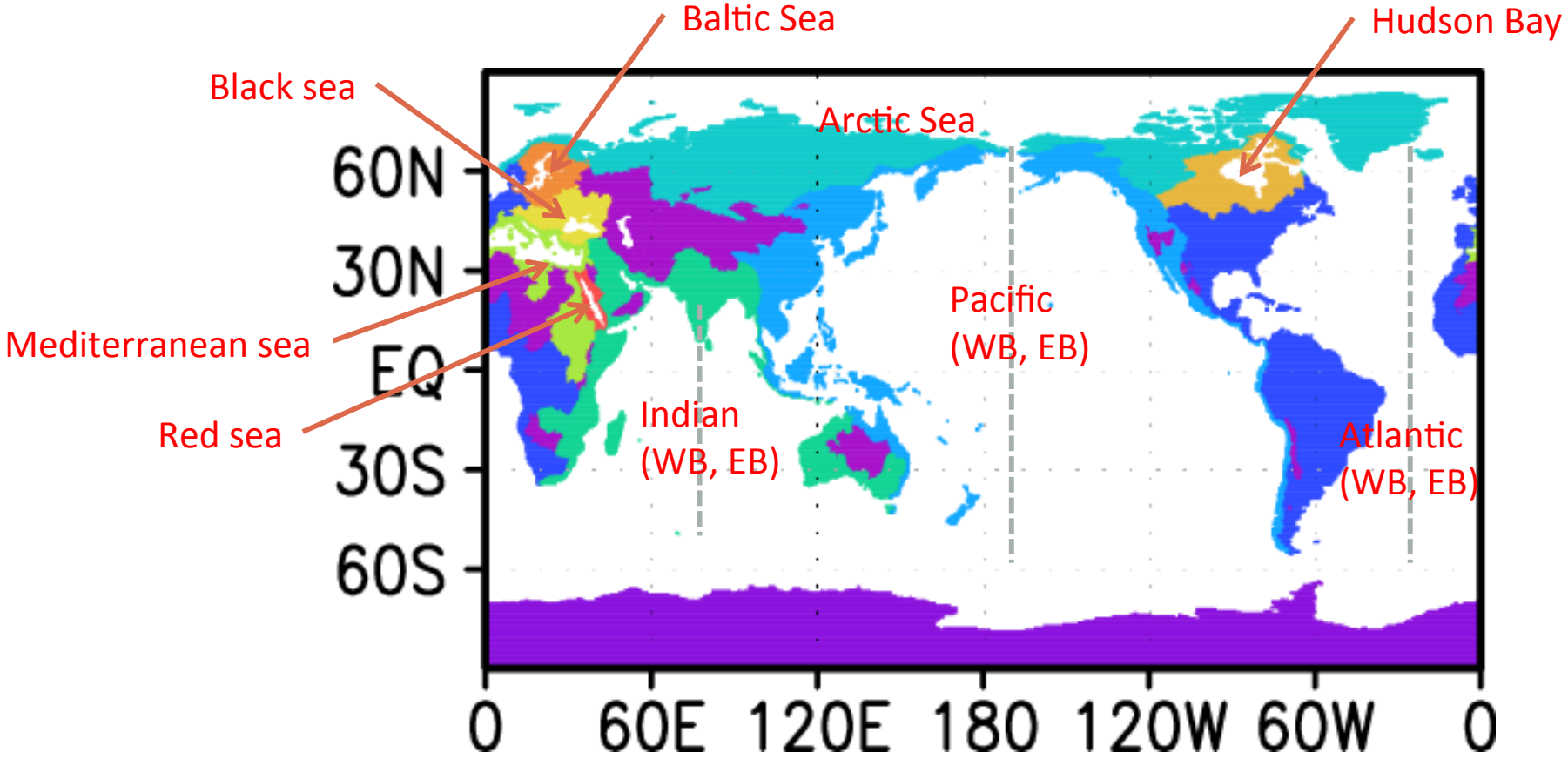
- Underestimate in the drainage basin of Amazon river.
- Overestimate over North America, Western coast of South America, around Congo river, and Indochina Peninsula.





Drainage Divide of CaMa-Flood

To compare the total amount of the water runoff over land and the related river discharge into the Ocean, We separate the continents to 12 drainage basins (This separation follows ocean basin index of CMIP).

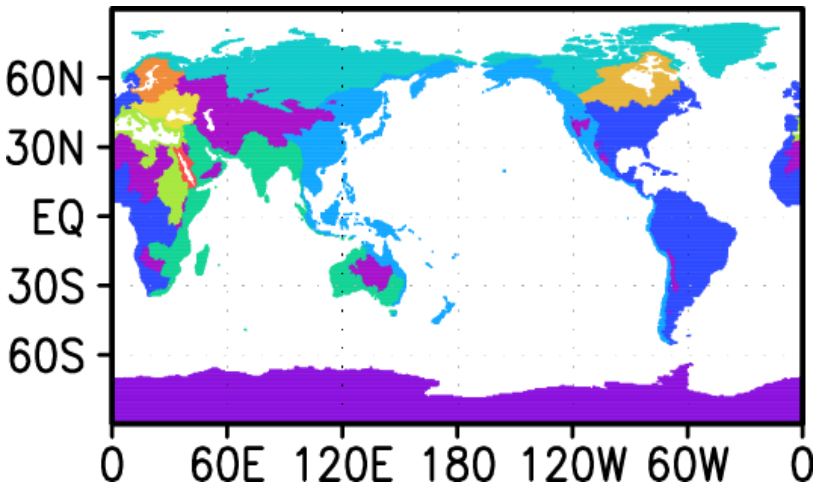


There are some Endorheic basins in the continents

Antarctica is not considered because the glaciers do not treated in CaMa-Flood

Total river runoff over the drainage basins

Basin	Total Runoff over drainage basins (Sv) 1989-2005		
	JRA55 (runoff)	P-E (obs.)	JRA55/ OBS.
Total w/o Antarctica	1.195	1.561	0.76
Atlantic (WB)	0.368	0.497	0.74
Atlantic (EB)	0.128	0.154	0.83
Pacific (WB)	0.255	0.367	0.69
Pacific (EB)	0.114	0.104	1.10
Indian (WB)	0.039	0.078	0.50
Indian (EB)	0.110	0.146	0.75
Arctic Sea	0.097	0.103	0.94
Mediterranean w/ black sea	0.042	0.060	0.70



Runoff of JRA55 agree with reference data over the drainage basins of Pacific eastern boundary and Arctic (the difference is within 10%). Meanwhile, JRA55 underestimate the river runoff over the other basins. That suggests Spatial-dependent correction is required.

Total water runoff over drainage basins and the related river discharge into the Ocean

Basin	Total Runoff over drainage basins (Sv) 1989-2005			River discharge into Ocean basins (Sv) 1989-2005		
	JRA55 (runoff)	P-E (obs.)	JRA55/ OBS.	JRA55 CaMa-Flood	CORE2	JRA55/ CORE
Total w/o Antarctica	1.195	1.561	0.76	1.180	1.146	1.03
Atlantic (WB)	0.368	0.497	0.74	0.365	0.434	0.84
Atlantic (EB)	0.128	0.154	0.83	0.128	0.109	1.17
Pacific (WB)	0.255	0.367	0.69	0.249	0.186	1.34
Pacific (EB)	0.114	0.104	1.10	0.111	0.083	1.34
Indian (WB)	0.039	0.078	0.50	0.039	0.046	0.85
Indian (EB)	0.110	0.146	0.75	0.108	0.075	1.44
Arctic Sea	0.097	0.103	0.94	0.096	0.133	0.72
Mediterranean w/ black sea	0.042	0.060	0.70	0.043	0.025	1.72

Under CORE2 reference, total River discharge seems well. However, spatial-dependent bias correction should required. River discharge into the Pacific is overestimated, and that into the Arctic sea is underestimated.

Strategy of bias correction

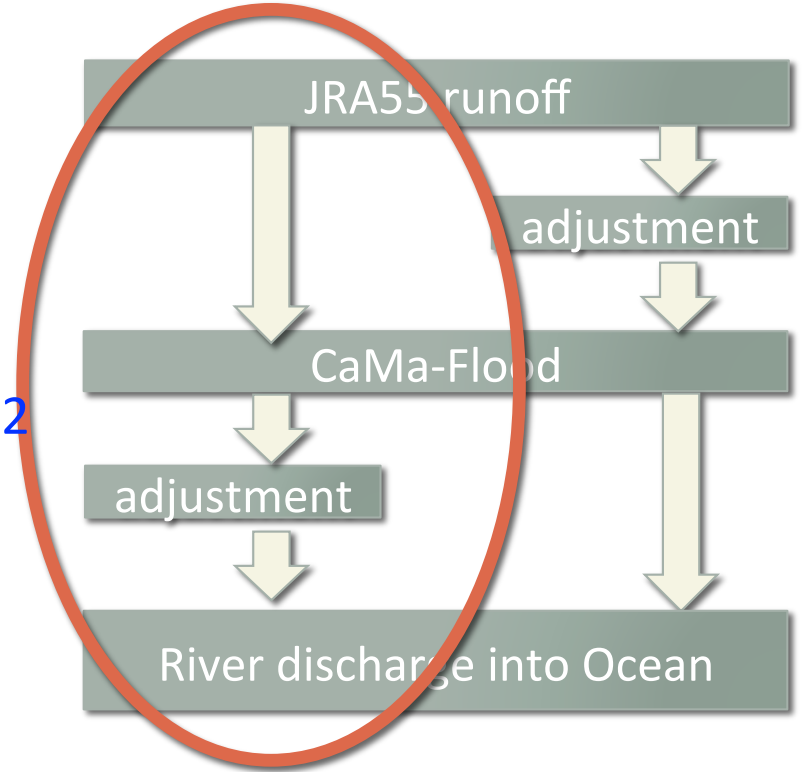
	reference data	adjustment factor determined based on	spatial dependency of adjustment factor	How is the factor used for calibration
River discharge (CaMa-Flood)	CORE2	1989-2005	12 drainage basins	multiply
River runoff (JRA55)	P-E (GPCC & LandFlux-EVAL)	1989-2005	(x,y) over land	multiply

adjustment after CaMa-Flood

- Total flux is consistent with CORE2.
- Difficulty of considering all small rivers.

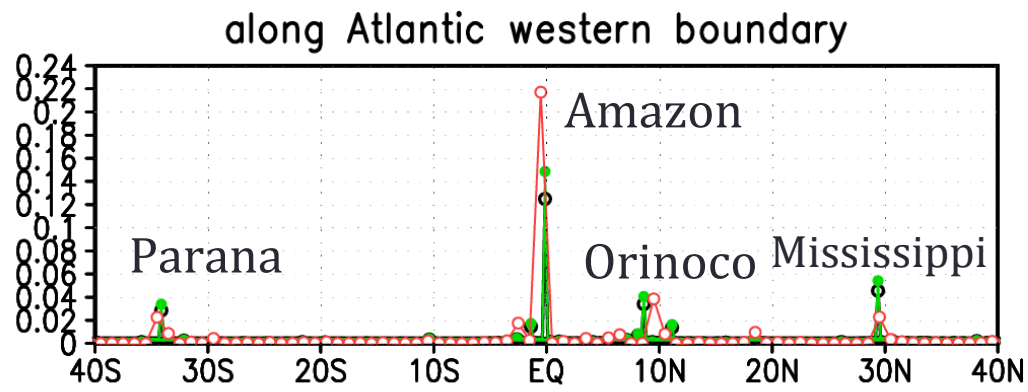
adjustment before CaMa-Flood

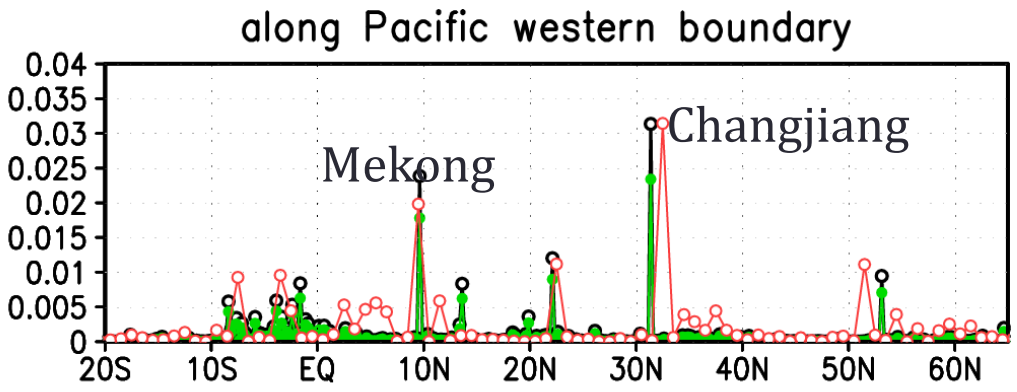
- Total flux is not consistent with original CORE2
- Bias correction for small rivers could be implicitly included.

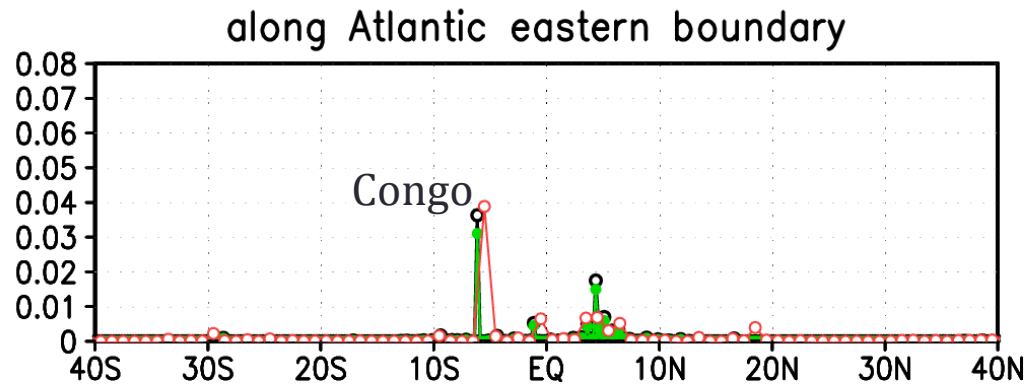


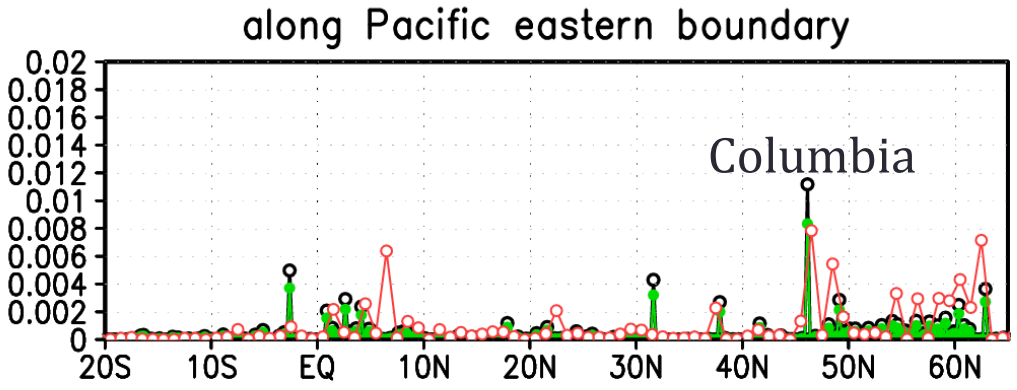
Climatology (1989-2005) of river discharge into the ocean

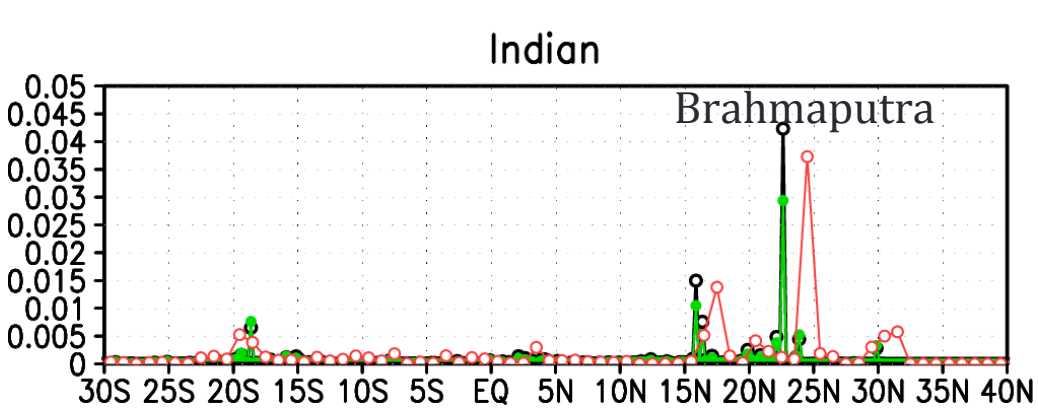
River discharge (Sv) into the Ocean (CaMa-Flood CORE2 CaMa-Flood-adjusted)

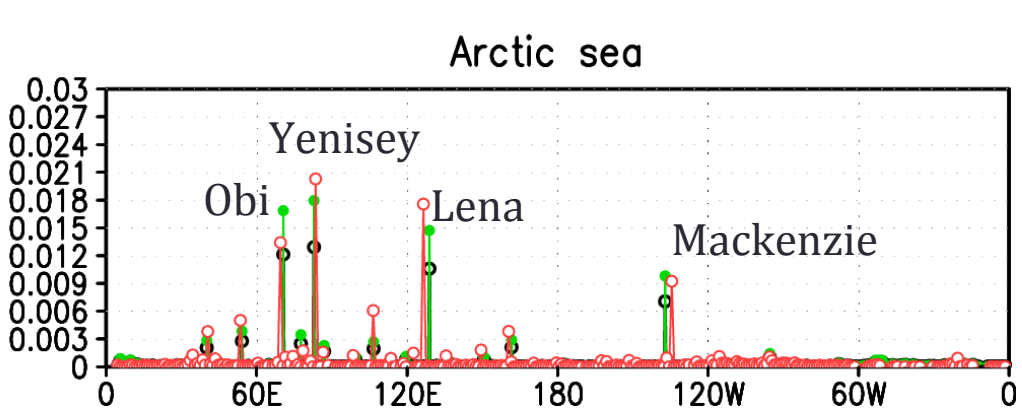






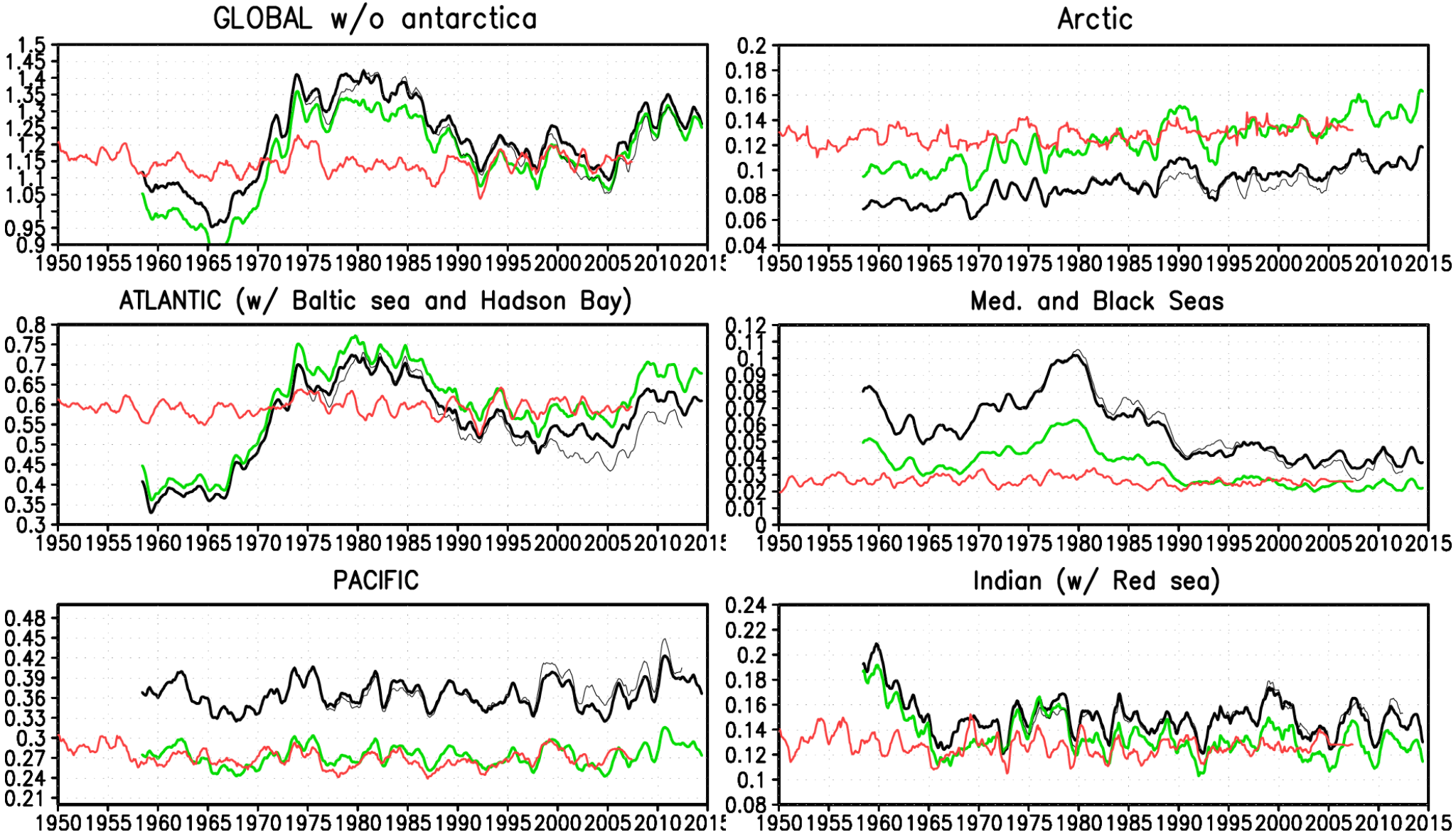






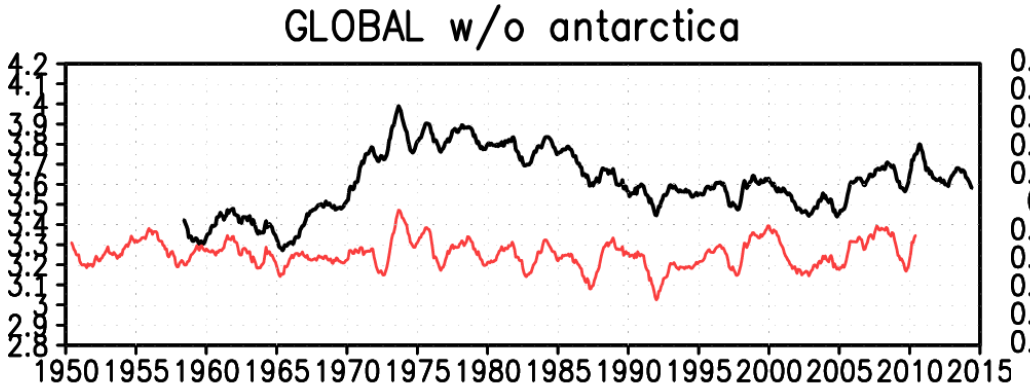
Time series of river discharge into the Ocean (unit: Sv)

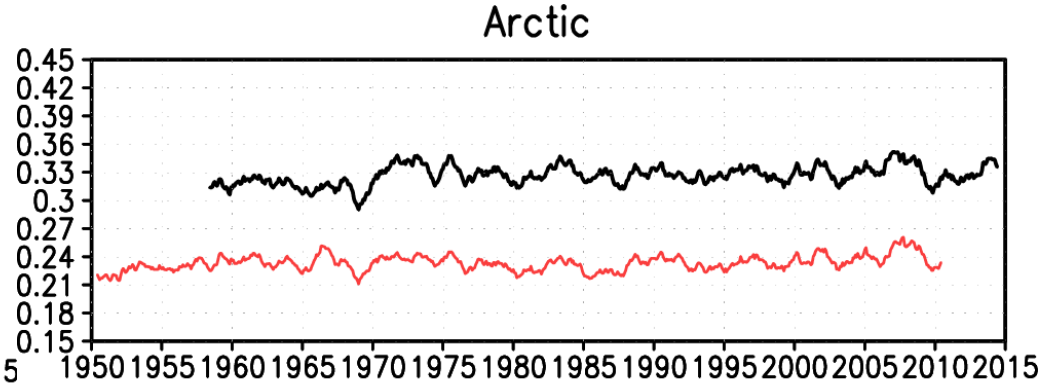
CaMa-Flood with JRA55: Thick Black Line, CaMa-Flood with JRA55c: Thin Black line,
CORE2: Red line, CaMa-Flood-adjusted Green line

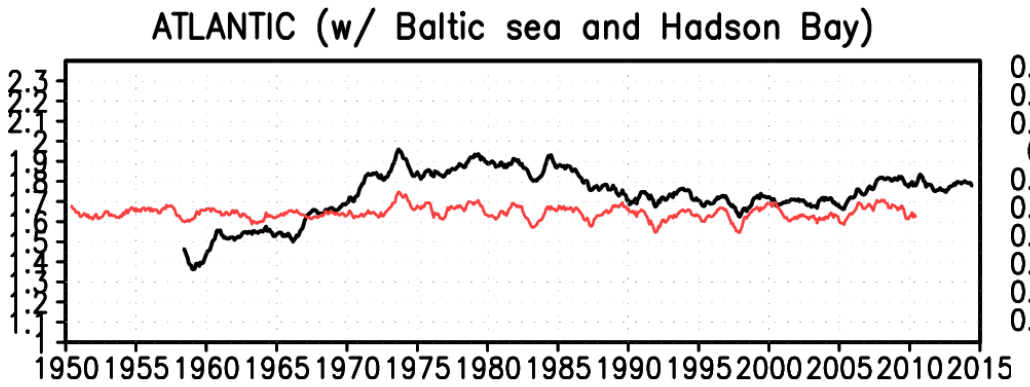


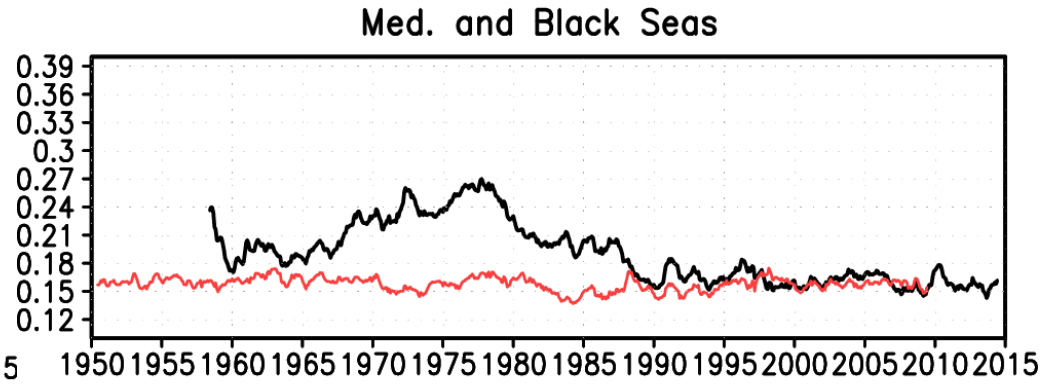
Time series of Precipitation over the drainage basins (unit: Sv)

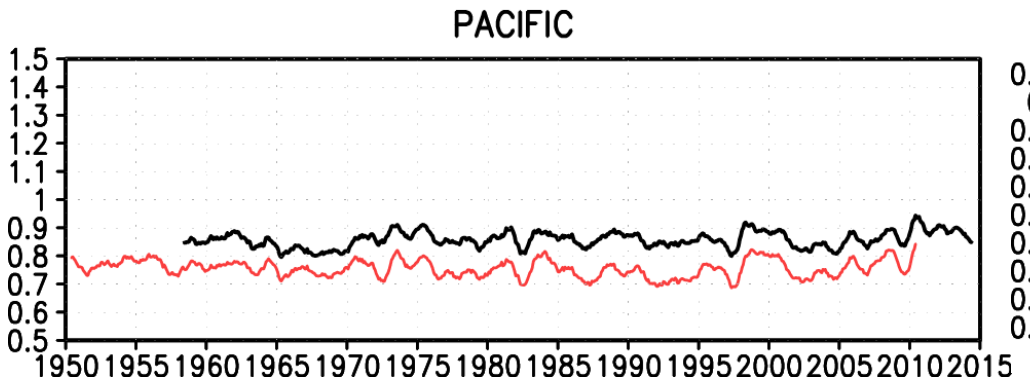
JRA55: Thick Black Line, GPCC: Red line

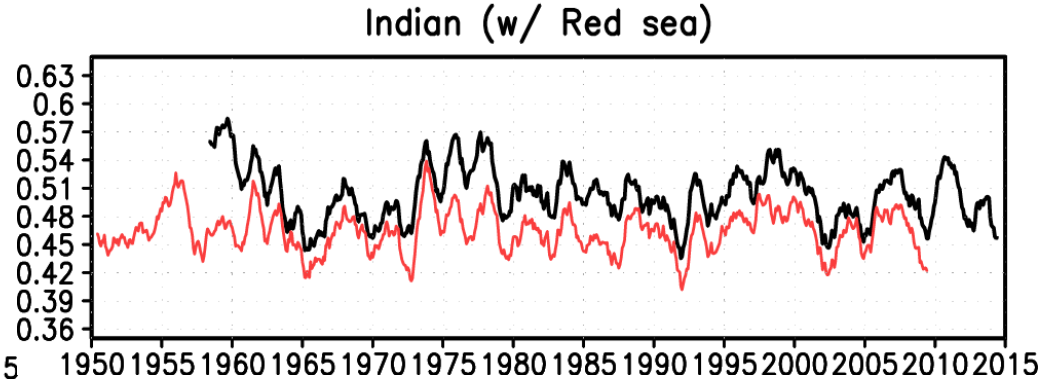












Summary

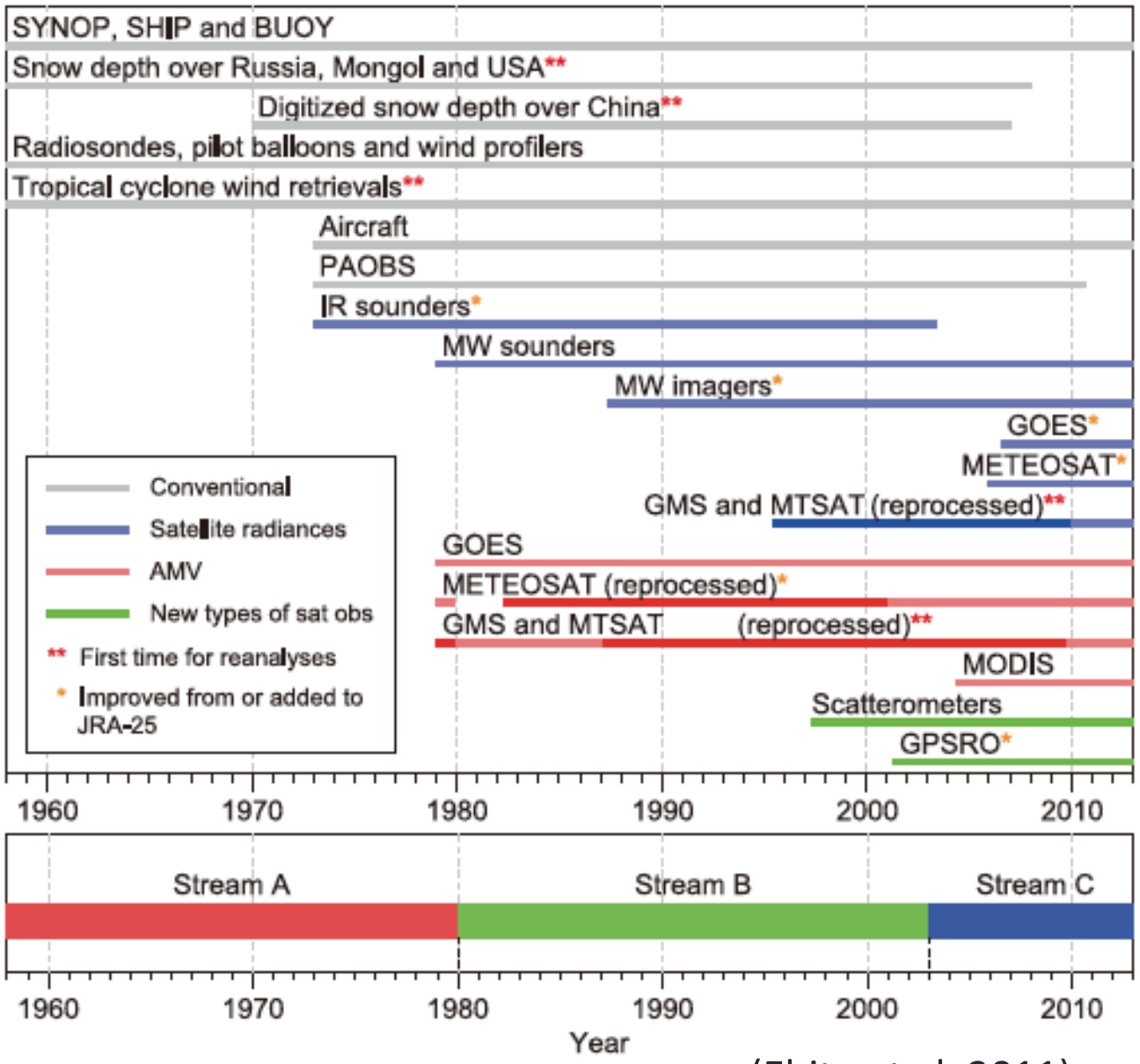
- Distribution of JRA55 runoff is similar to the reference data (P-E).
- Total river discharge into the ocean is consistent with CORE2 for the reference period.
- Spatial-dependent correction is required (the river discharge into the Pacific is overestimated, meanwhile into the Arctic sea is under-estimated).
- Total amount of the river discharge related to each drainage basin is adjusted to the CORE2 .
- Climatology of each river discharge is acceptably corrected.
- Phase of the interannual variation is consist with the reference data.
- Interdecadal variation of the total river discharge in JRA55 are not seen in the reference data.

- For next step, I will carry on both bias corrections before and after CaMa-Flood execution.

Thank you

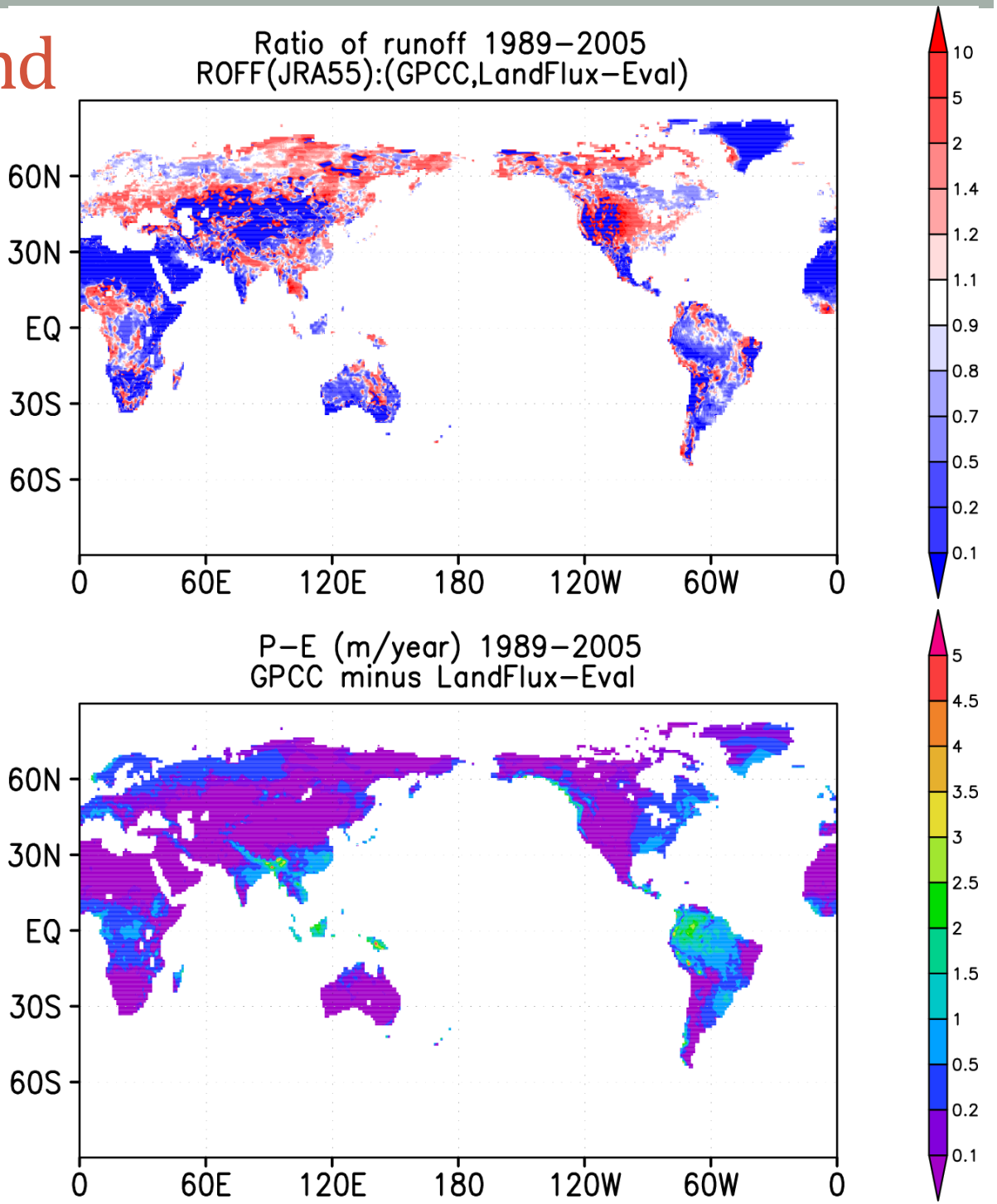
Supplementary materials

List of observation available for JRA55



(Ebita et al. 2011)

River runoff from Land



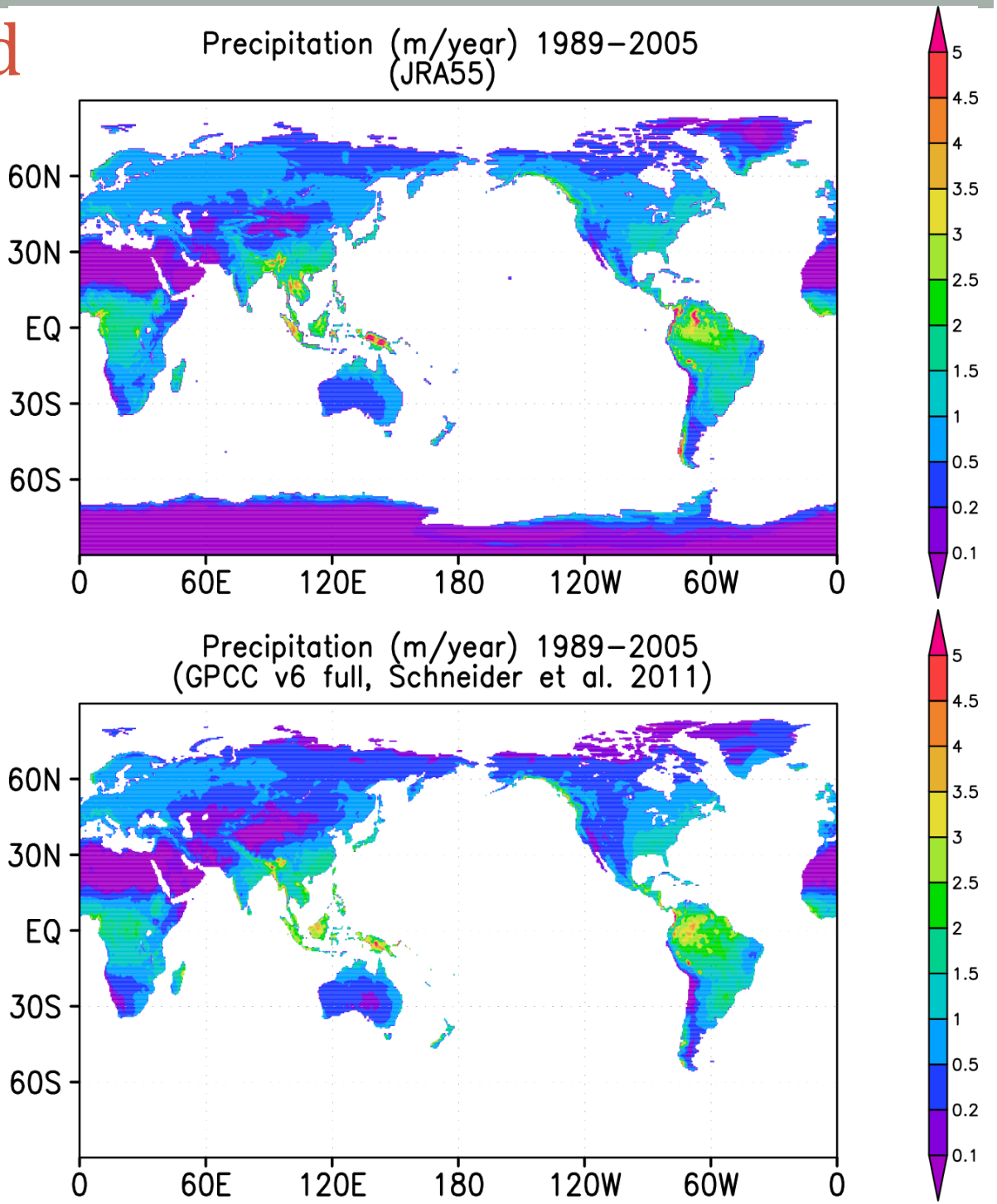
Water discharge into the Ocean by CaMa-Flood with JRA55 River runoff

Climatology of freshwater discharge into the ocean

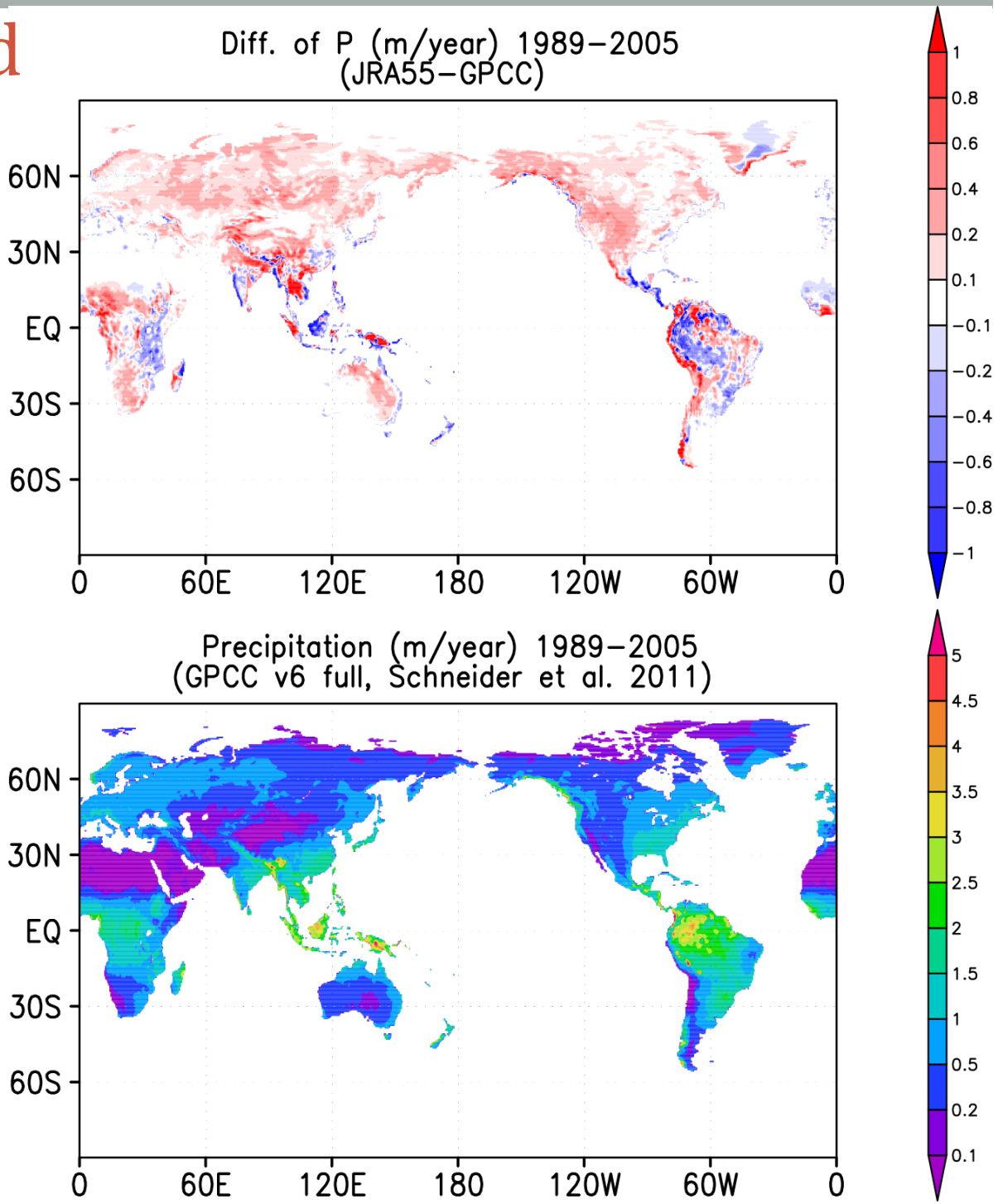
Climatology of precipitation over drainage basins

Basin	Water discharge (Sv) 1989-2005			Total precipitation (Sv) 1989-2005		
	JRA55	CORE	JRA55/ CORE	JRA55	GPCC	JRA55/ GPCC
Total w/o Antarctica	1.180	1.146	1.03	3.500	3.184	1.10
Atlantic (WB)	0.365	0.434	0.84	1.121	1.104	1.02
Atlantic (EB)	0.128	0.109	1.17	0.442	0.405	1.09
Pacific (WB)	0.249	0.186	1.34	0.628	0.578	1.09
Pacific (EB)	0.111	0.083	1.34	0.215	0.156	1.38
Indian (WB)	0.039	0.046	0.85	0.200	0.196	1.02
Indian (EB)	0.108	0.075	1.44	0.284	0.258	1.10
Arctic Sea	0.096	0.133	0.72	0.324	0.232	1.40
Mediterranean w/ black sea	0.043	0.025	1.72	0.161	0.154	1.05

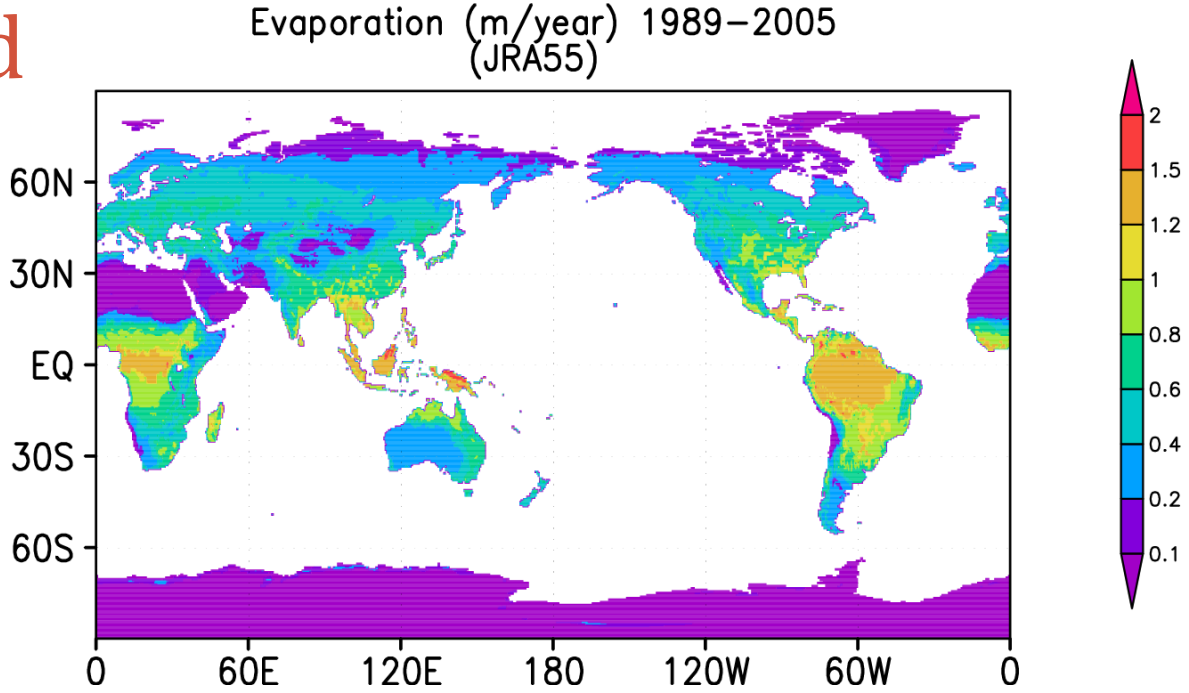
Precipitation over land

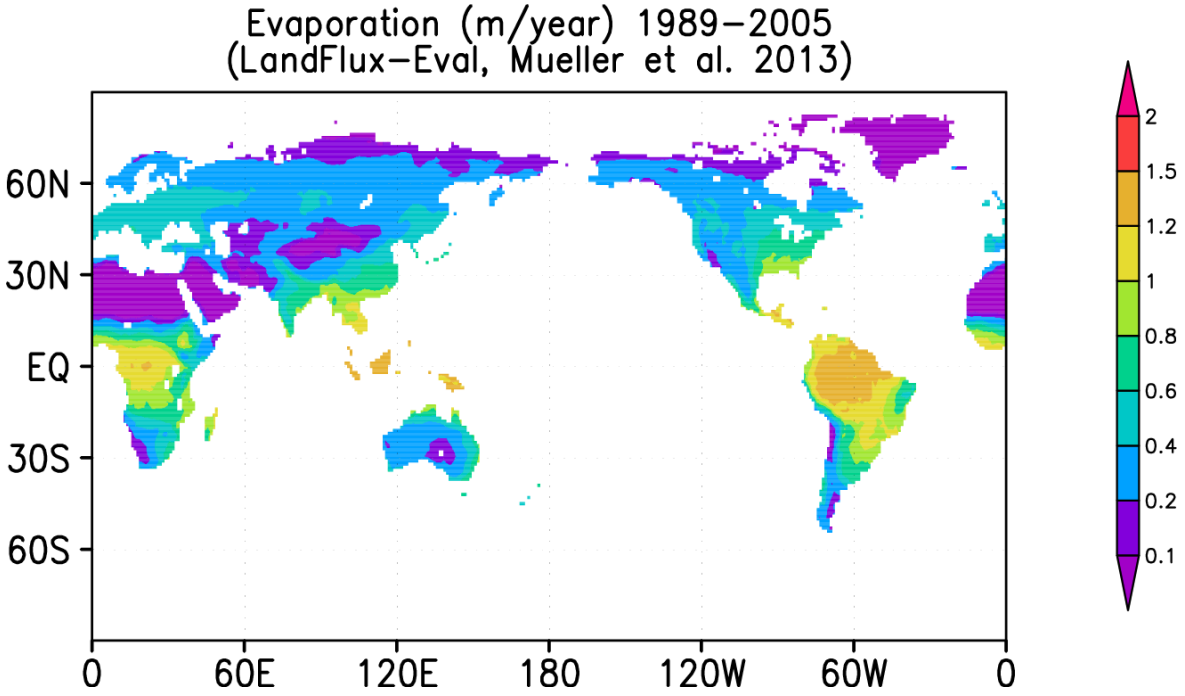
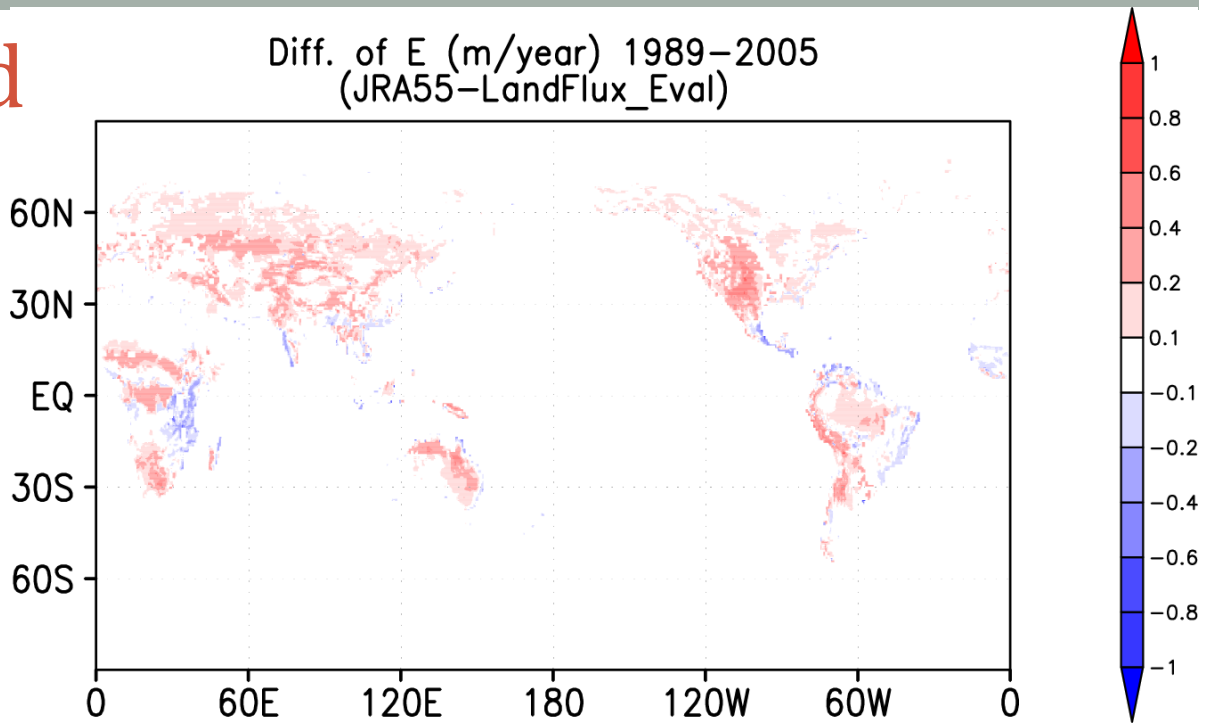
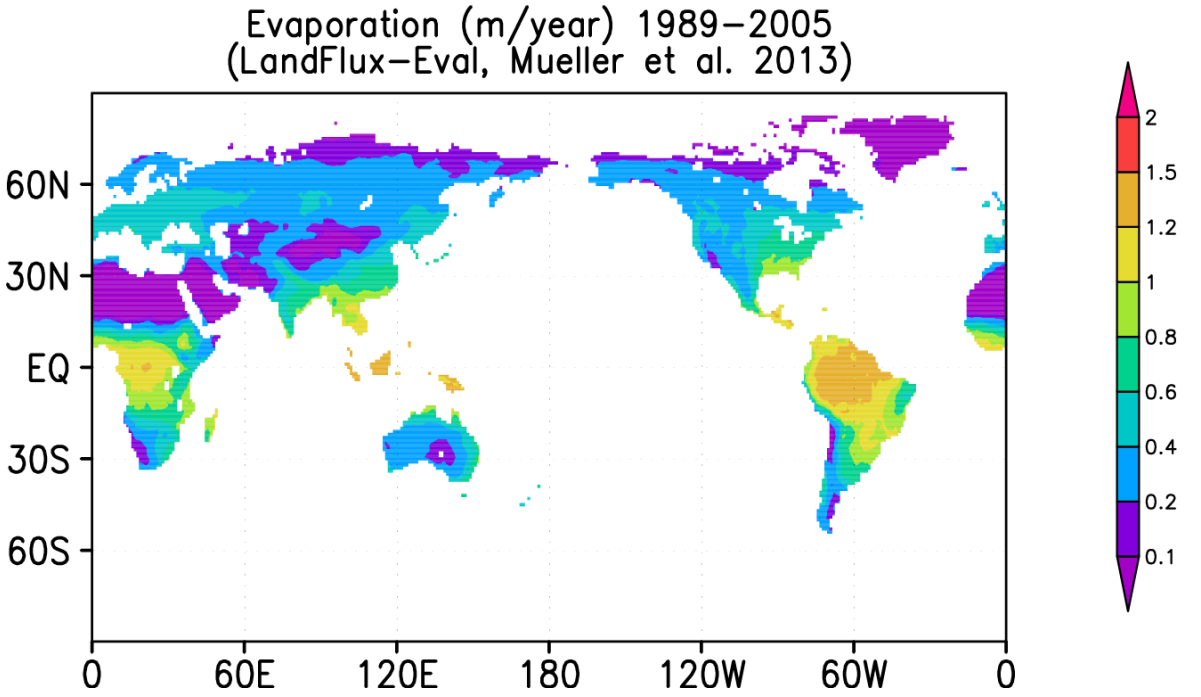


Precipitation over land



Evaporation over land





Evaporation over land