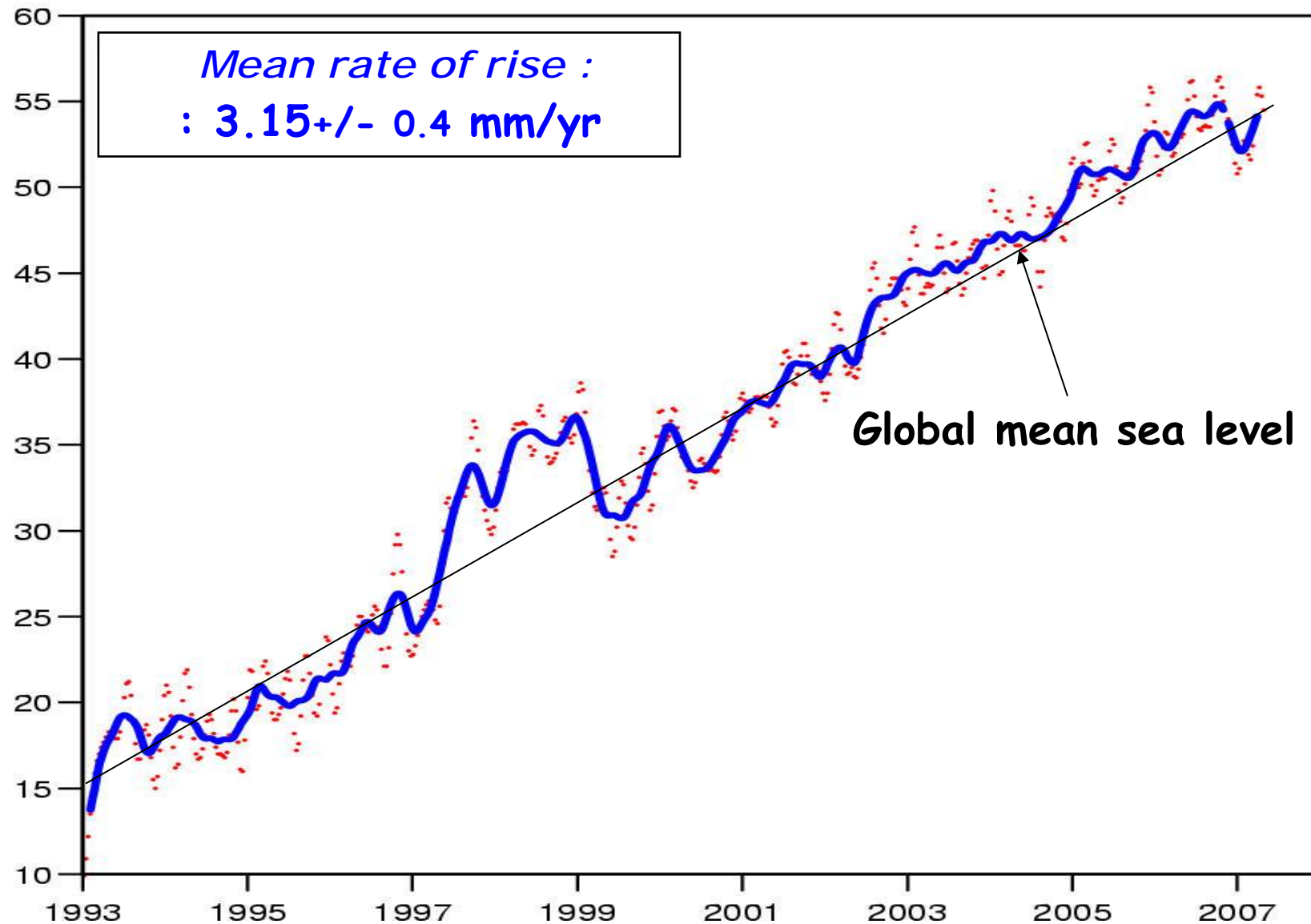


# **Contribution of lakes and reservoirs to present-day sea level change estimated from satellite altimetry**

**E. Burrillon, A. Cazenave, J.F. Crétaux and M. Berge-Nguyen**

**LEGOS-CNES, Toulouse**

## Sea level rise from Topex/Poseidon and Jason-1 satellite altimetry (1993-2007)



## Causes of sea level rise....

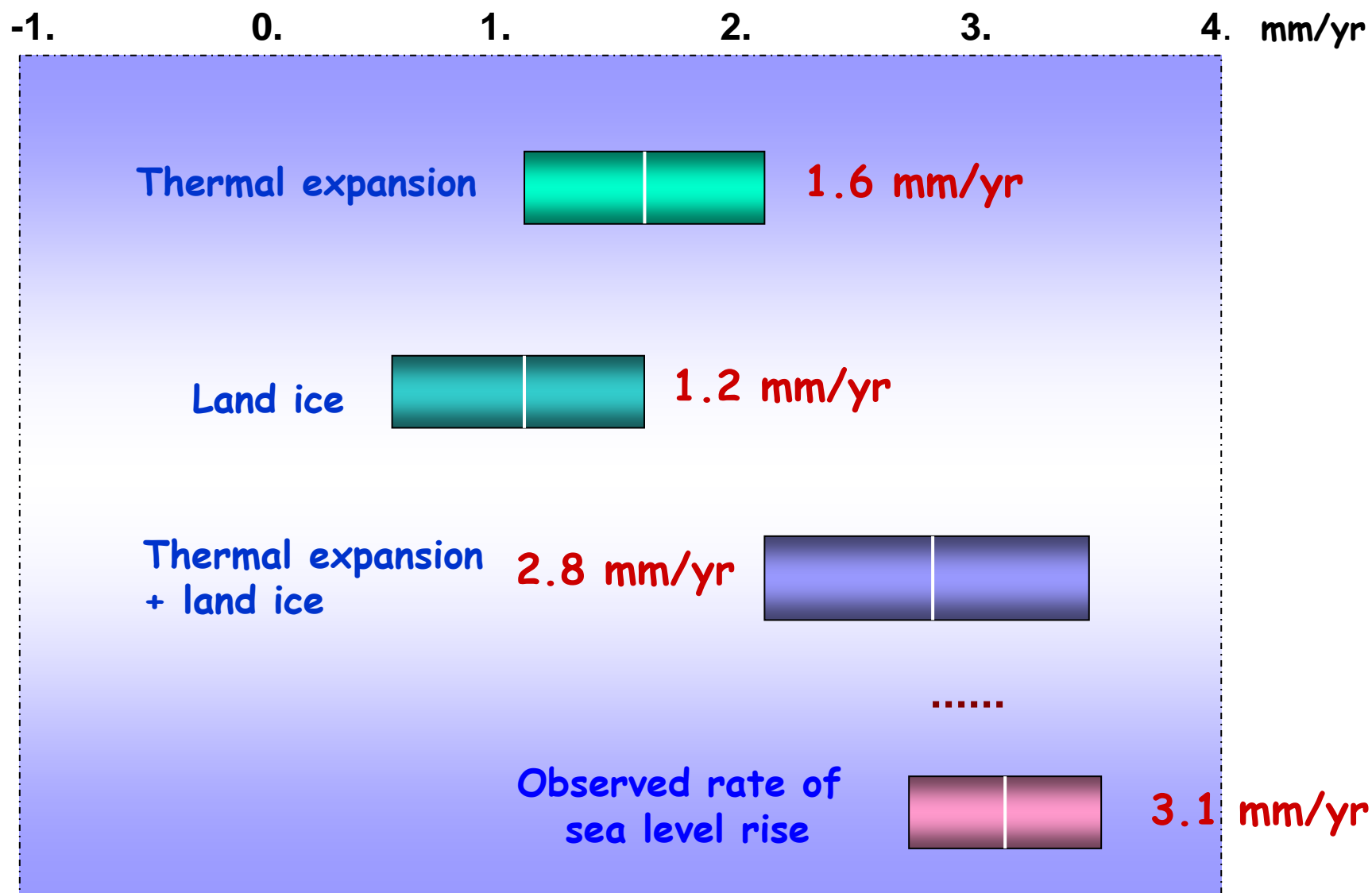
- Thermal expansion of sea water due to ocean warming
- Ocean mass increase due to:
  - land ice melt
  - terrestrial water storage change

**Sea Level Budget**

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**Recent Years**

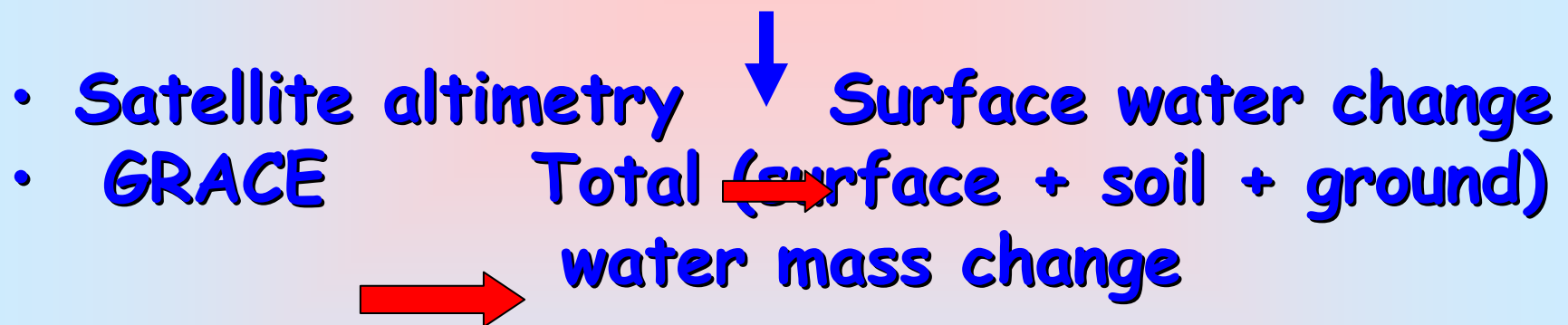
# SEA LEVEL BUDGET (recent years)



**Contribution  
of  
Land water storage?**

## Land waters : two components

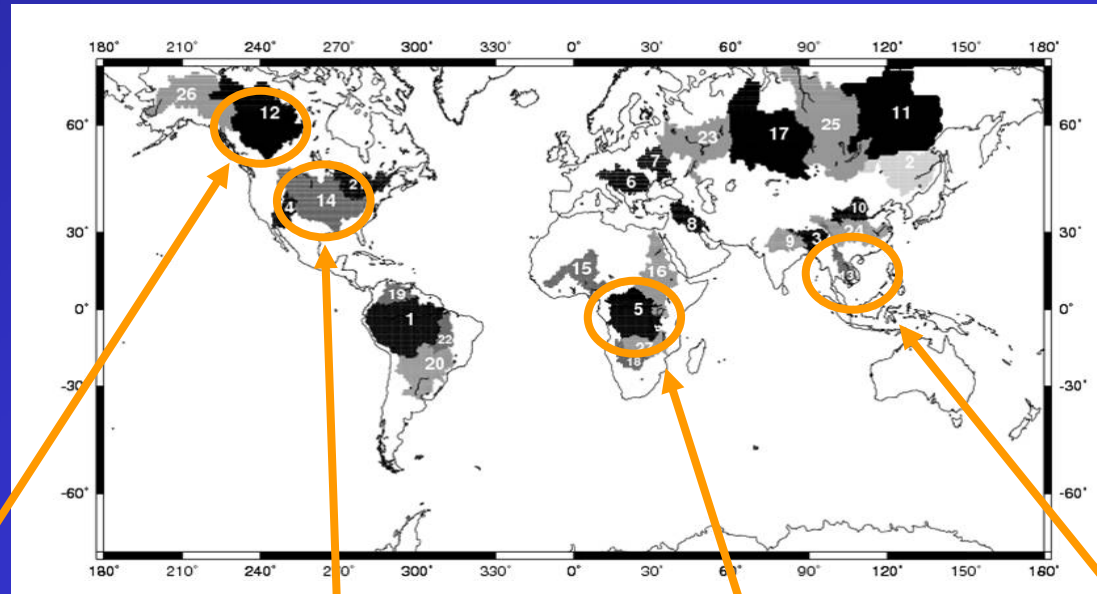
1. Surface waters
2. Soil + ground waters



# Summary of recent GRACE results



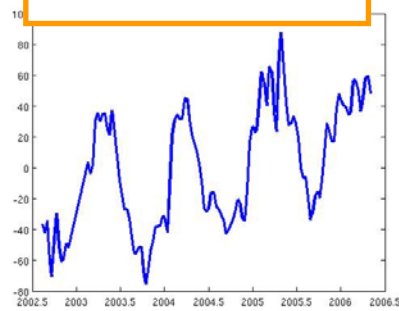
# Basin-scale water mass change from GRACE (2002-2006)



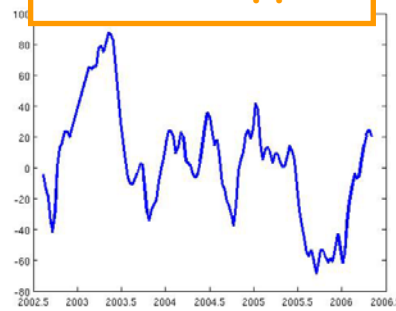
Equivalent water height (mm)

Time (yr)

Mac Kenzie



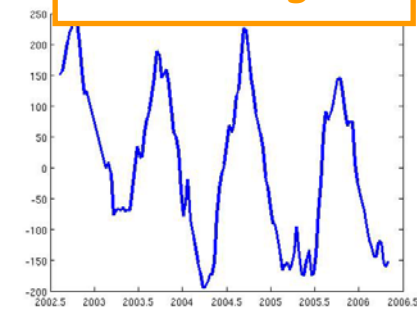
Mississippi



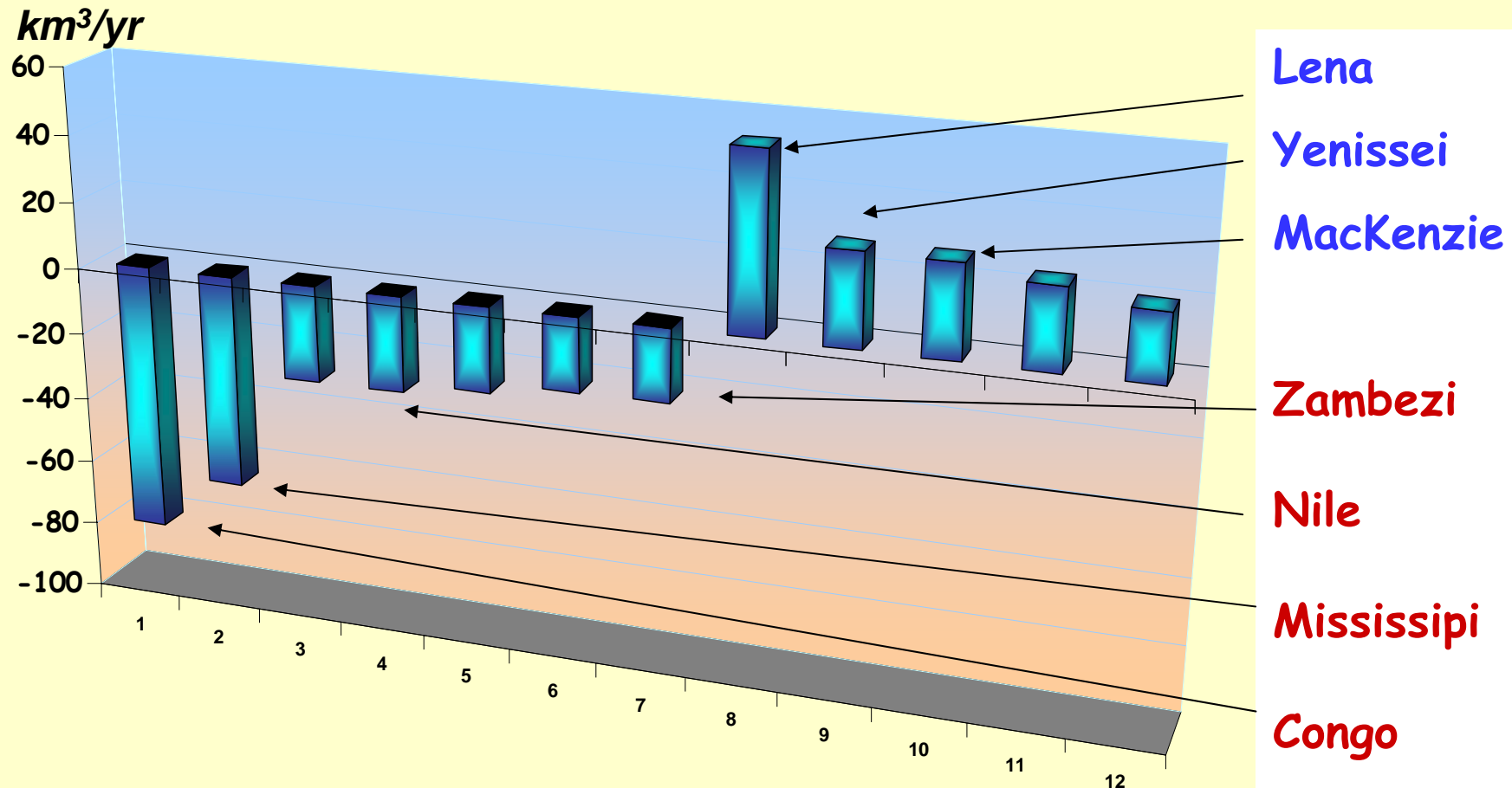
Congo



Mekong

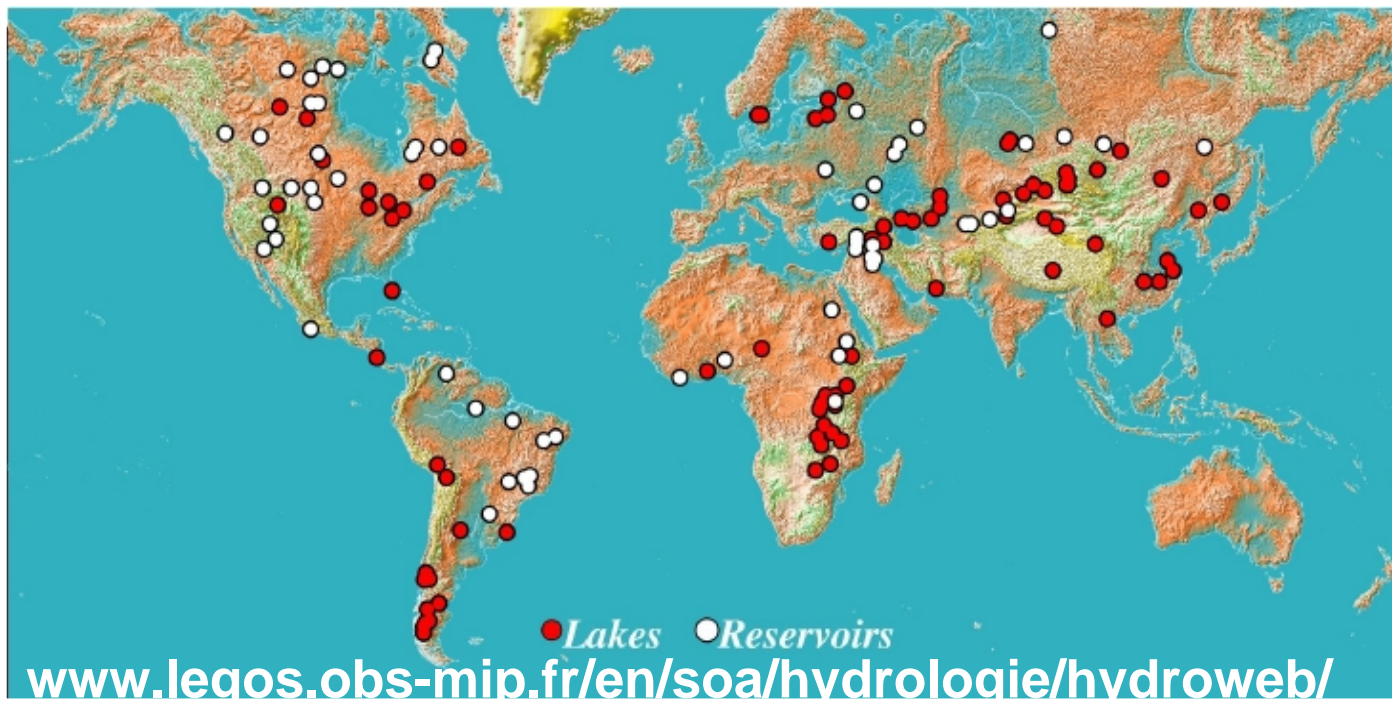


## Water mass trends over 2002-2006 from GRACE (largest river basin contributions)



*On average, land water mass decrease (over 2002-2006):  
..... Corresponds to + 0.2 mm/yr sea level rise*

# **Contribution of surface waters based on satellite altimetry**



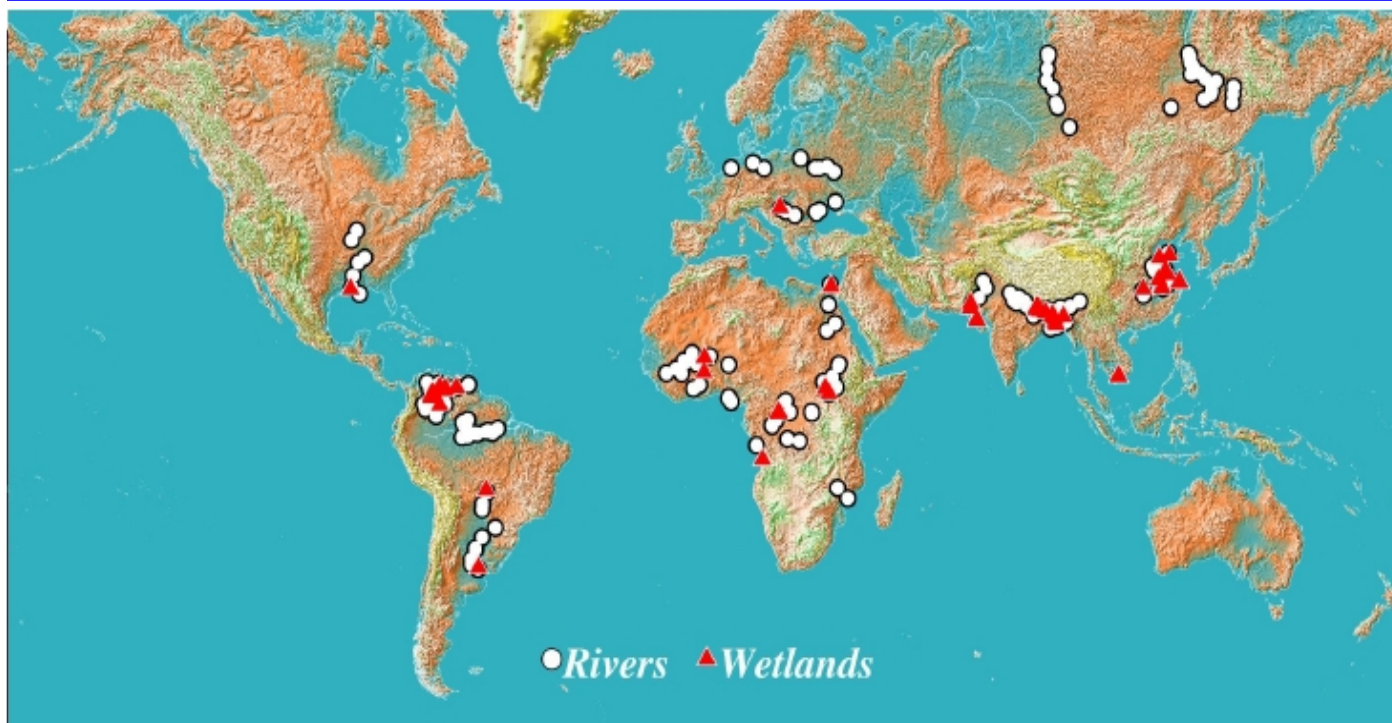
**HYDROWEB**  
data base:

**Altimetry-based  
water levels**



**100 lakes,  
50 reservoirs,  
250 sites on rivers,  
several sites  
on wetlands,  
30 largest river  
basins**

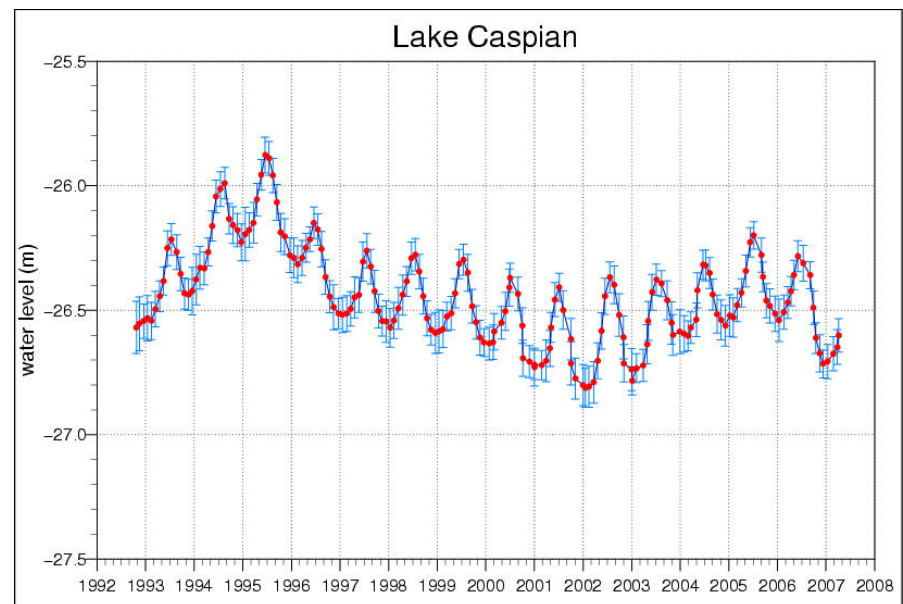
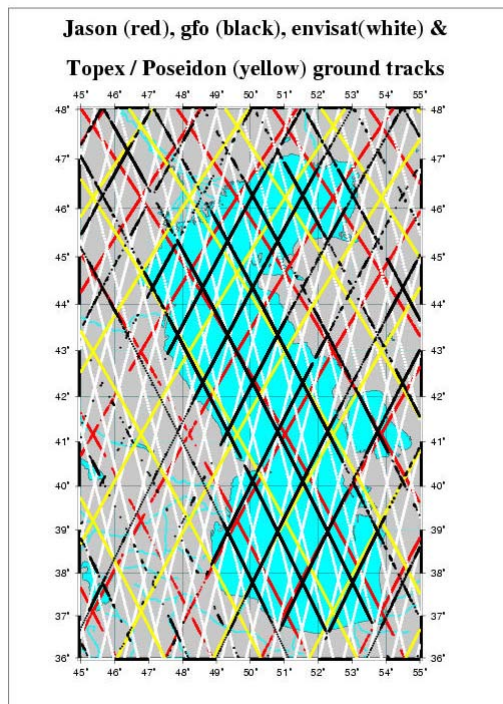
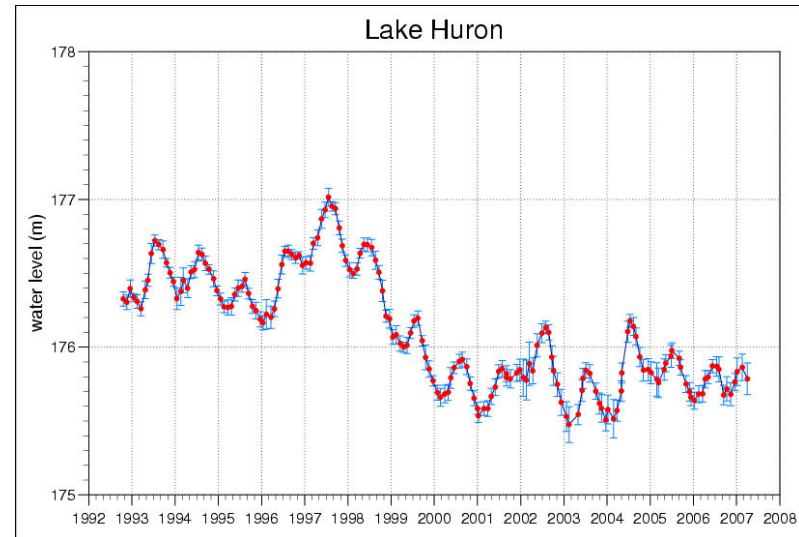
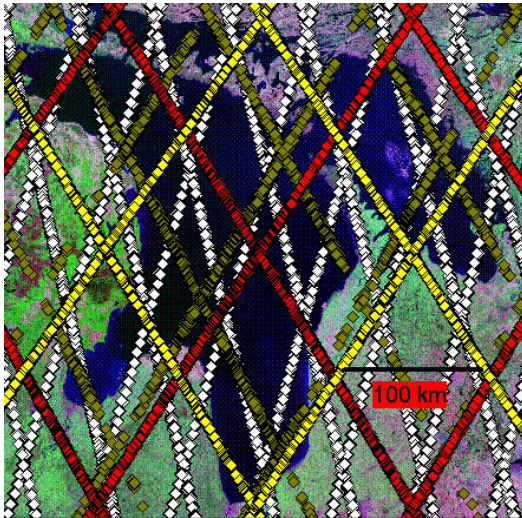
**LEGOS**  
**JF Cretaux/MC Gennero**



- 82 largest lakes/reservoirs
- Lake level variations over 1993-2006
- Multi satellite altimetry (Topex/Poseidon, Jason-1, Envisat, GFO)

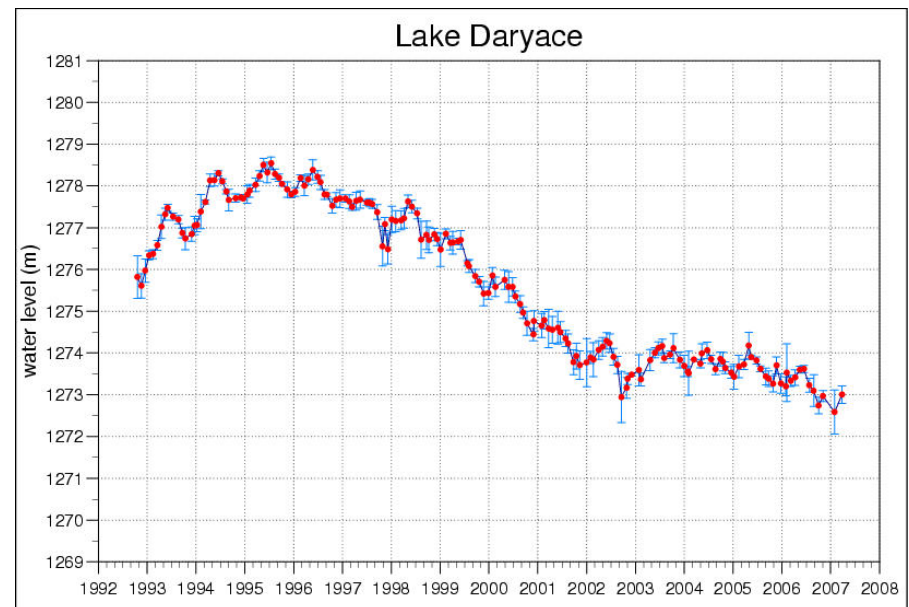
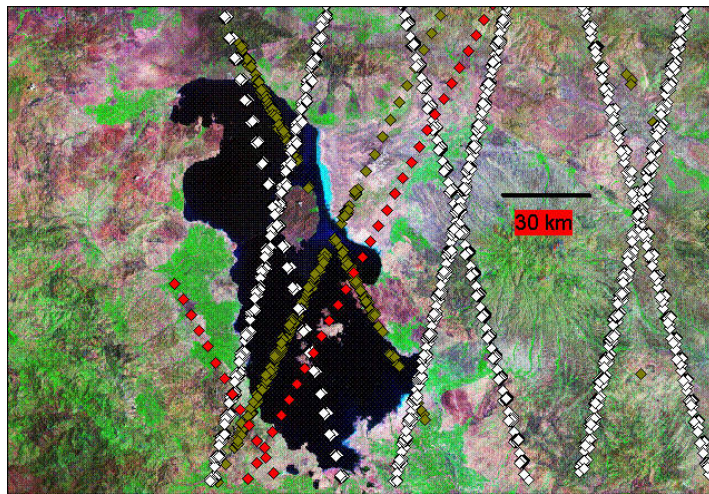
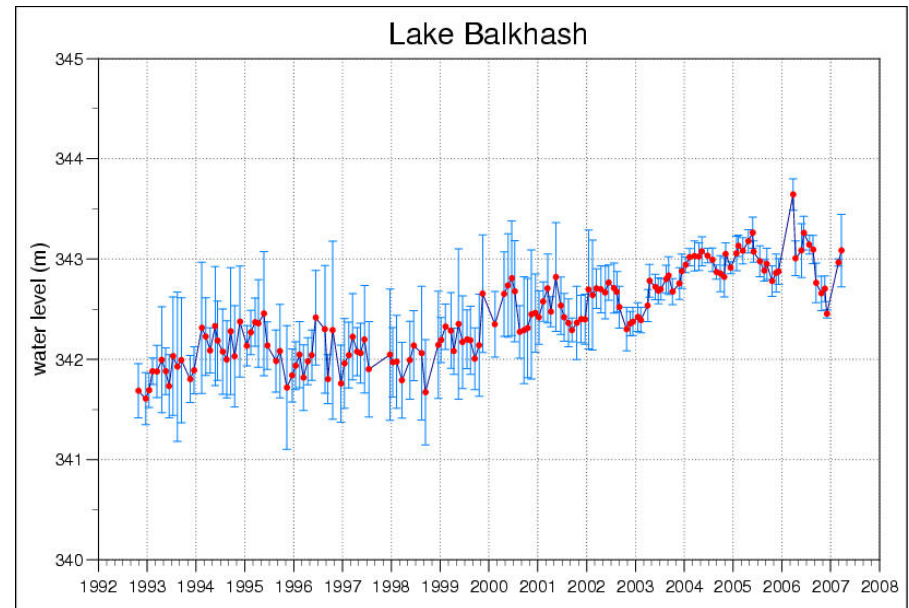
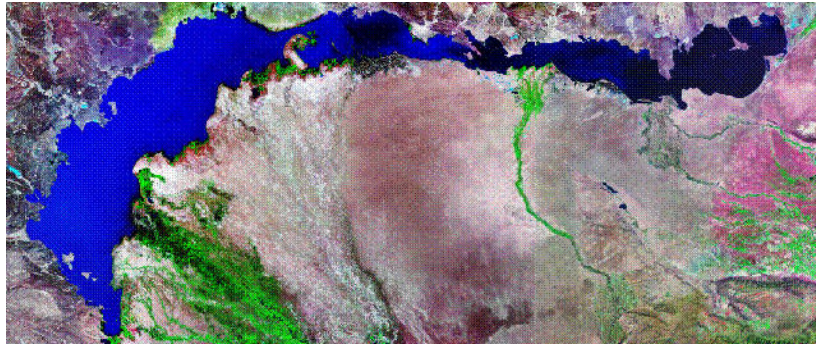


# Examples of lake level time series (1993-2006)

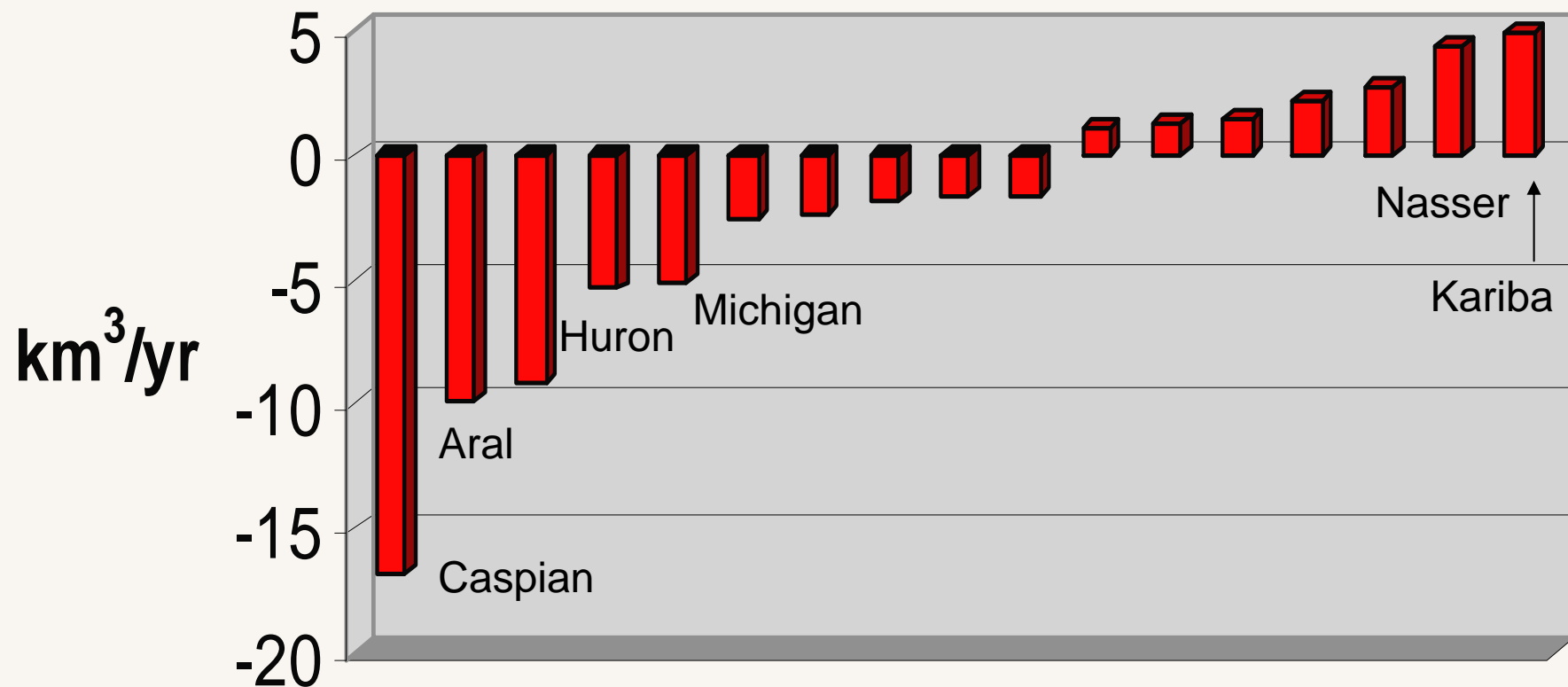




# Examples of lake level time series (1993-2006)



# Lake volume trends (1993-2006)



16 largest contributions



**Total contribution of lakes  
to sea level rise  
(1993-2006):**

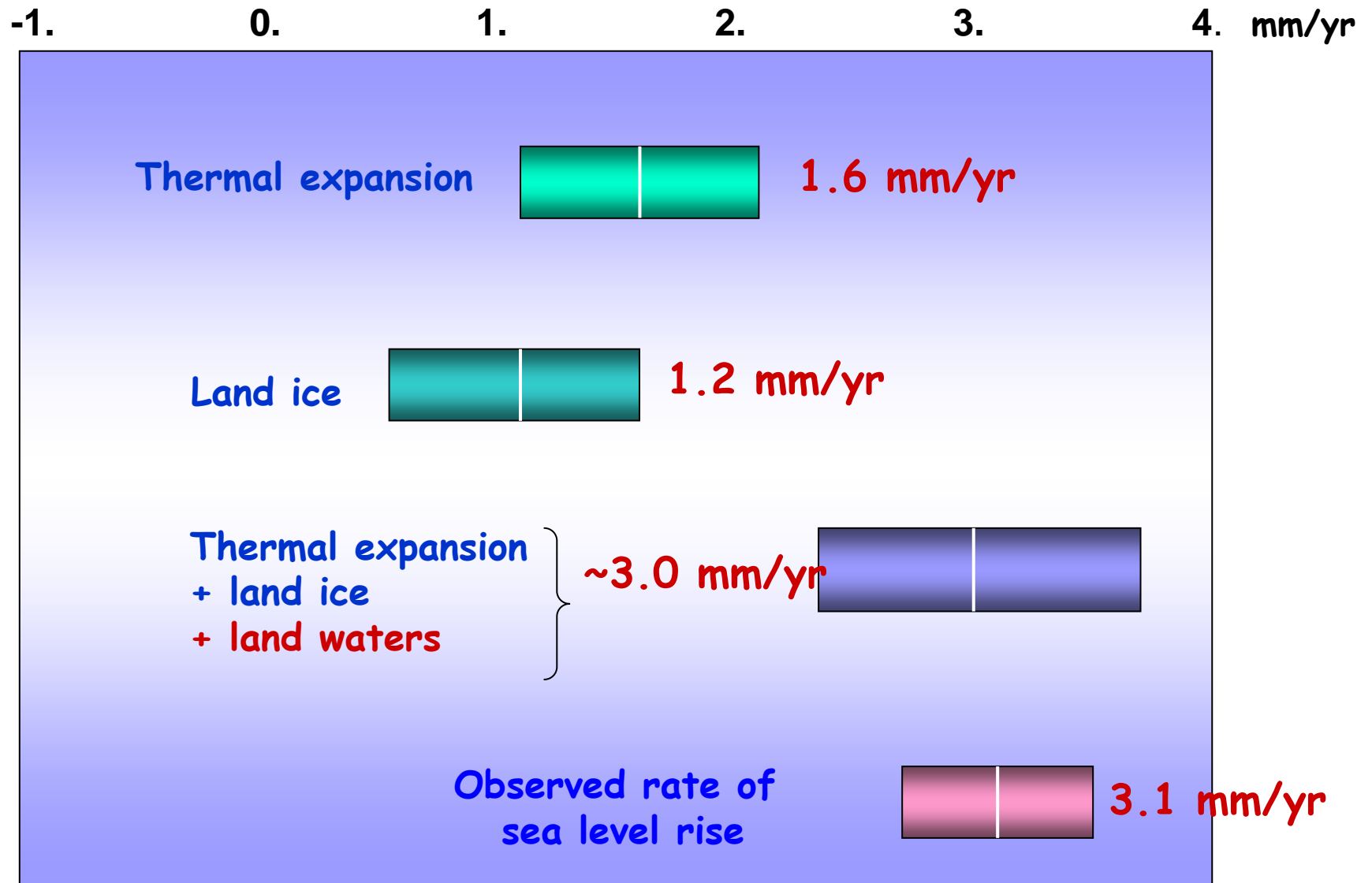
**+0.11  $\pm$  0.04 mm/yr**

**Over 2002-2006  
lakes contribution**

**$\sim 0.1 \text{ mm/yr ?}$**

**i.e., about 50% of total land water  
storage trend estimated from GRACE  
over the same time span (Ramillien et al.,  
2007, GPC, in press)**

# SEA LEVEL BUDGET (recent years)



**End**