European Space Agency
CLIMATE CHANGE INITIATIVE (CCI)

« Monitoring Sea Level Rise from Space »

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Why is this important?

Sea Level Rise…..

•Satellite and in situ tide gauge observations indicate that sea level is currently rising

• Sea level will continue to rise in the future decades/centuries

• But how much? We don't know…..

•Climate models are still unable to provide reliable sea level projections

•Sea level responds to change of ALL components of the climate system (ocean, atmosphere, cryosphere, hydrosphere) and to their interactions

•Coastal impacts of sea level rise are among the most threatened consequences of global warming

Coastal Impacts

Adverse effects of sea level rise in coastal regions

- Permanent inundation
- Recurrent flooding associated with storm surges
- Shoreline erosion
- Wetland loss
- Saltwater intrusion in aquifers
- Rising water tables

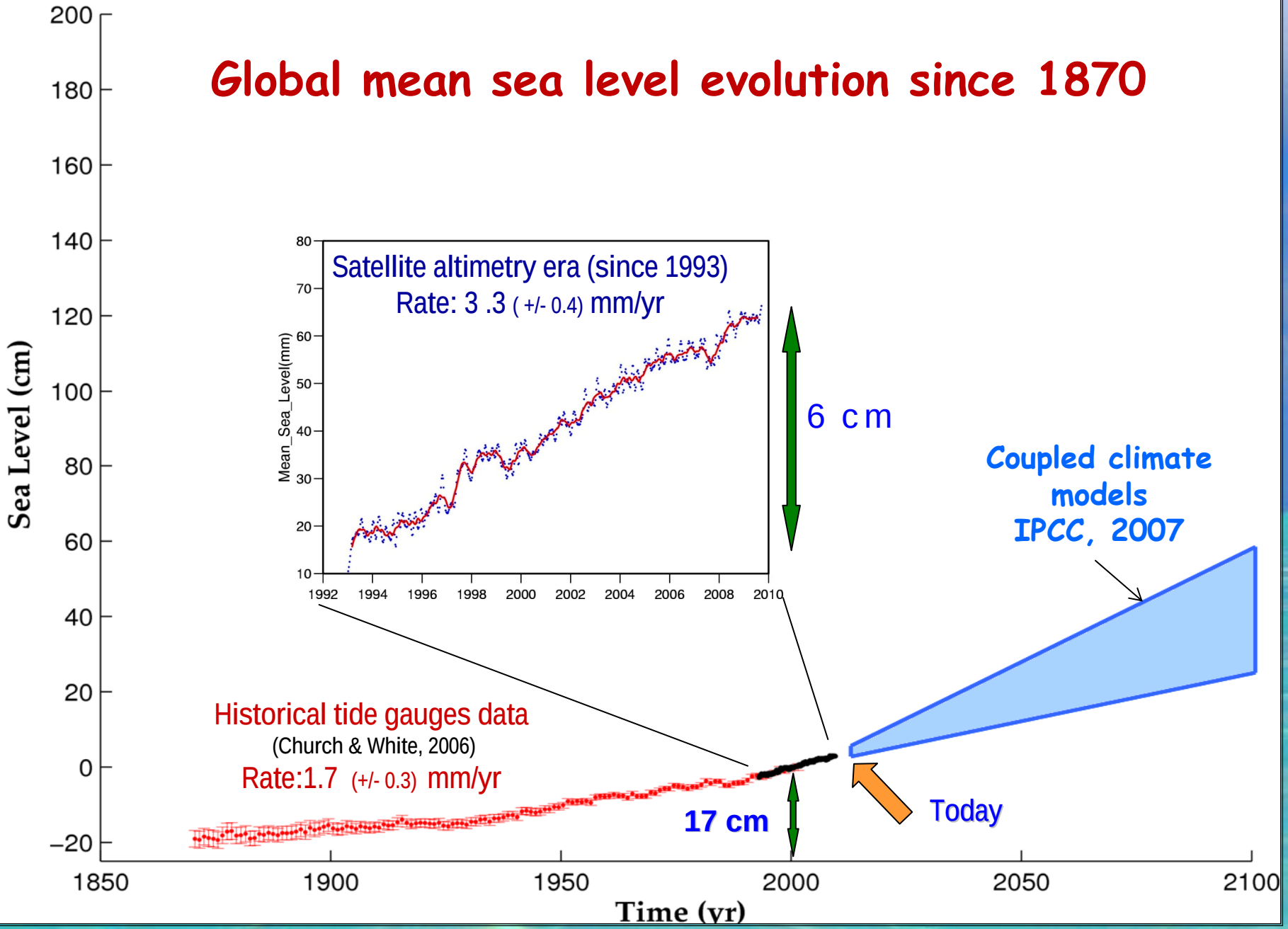
Amplify other natural & anthropogenic negative factors

- Ground subsidence due to water withdrawal, hydrocarbon extraction, natural processes
- Decreased fluvial sediment deposition in river deltas (dam building)
- Change in coastal currents

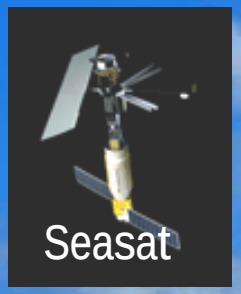
…..


How much is sea level rising?

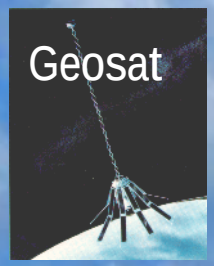
Global mean sea level evolution since 1870



Monitoring sea level rise by satellite altimetry



1978



1985

1991; 1995

1992

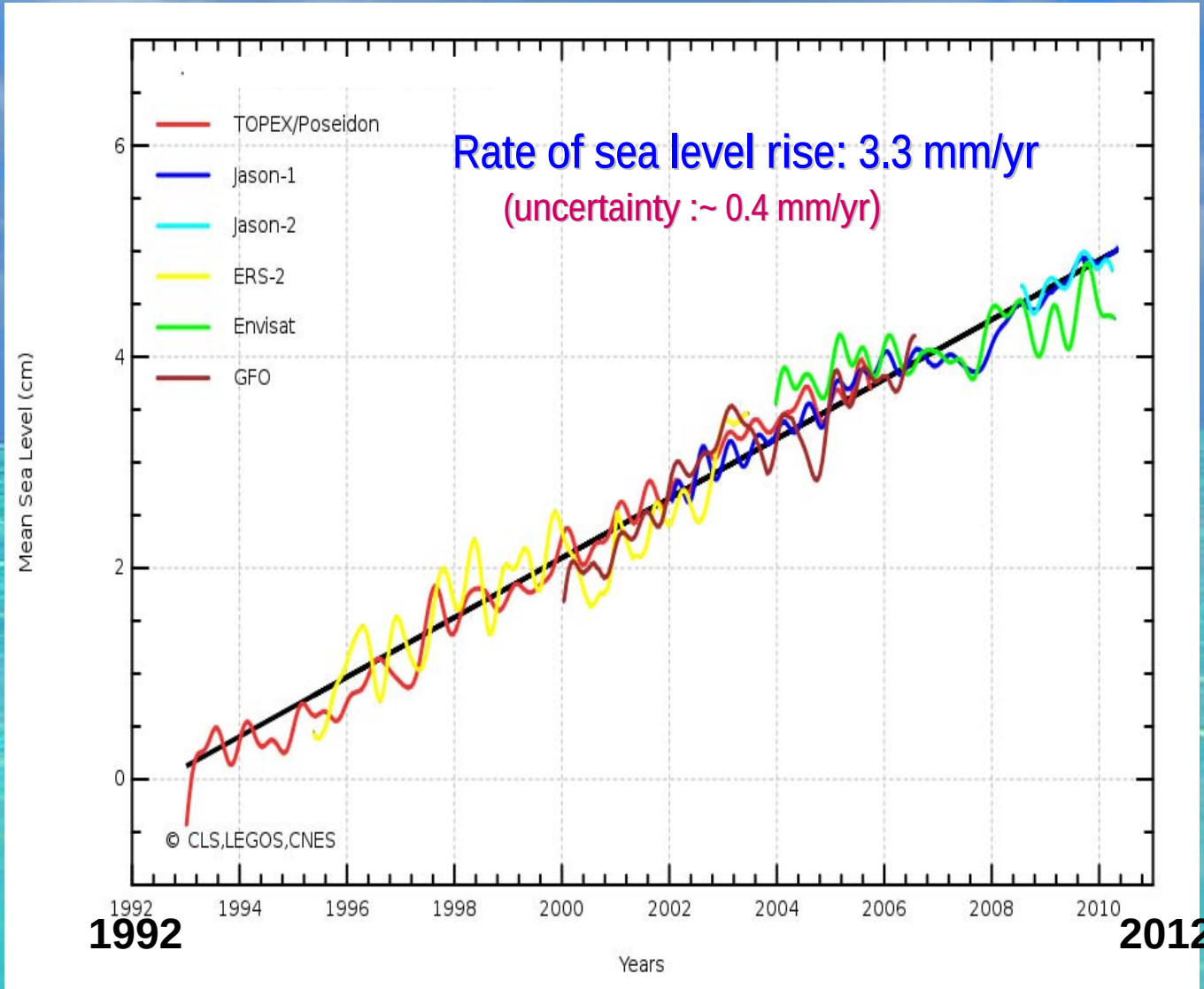
2001

2002

2008

→ High-precision altimetry

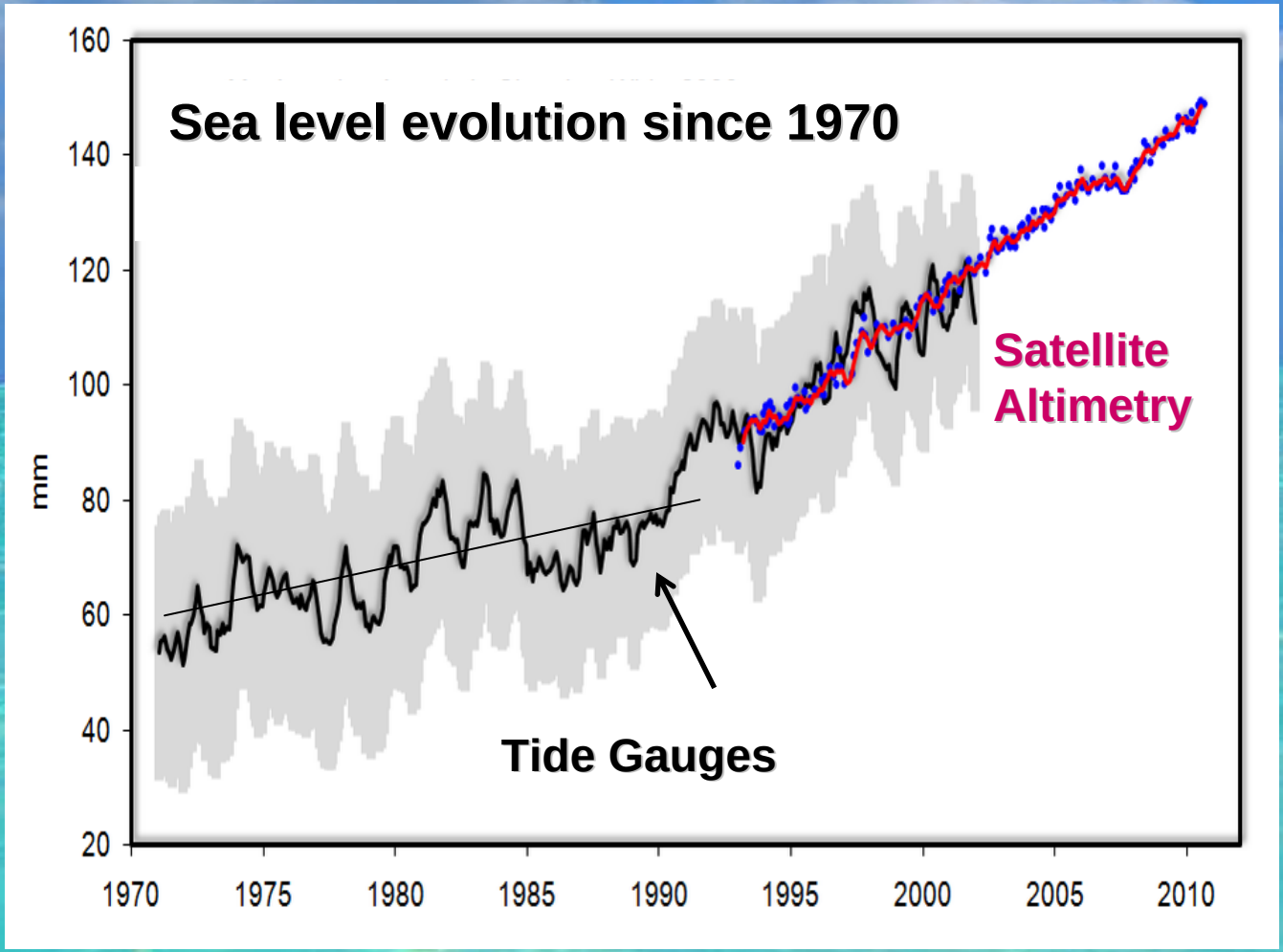
Global mean sea level from satellite altimetry (1993-2010)



1992 2012

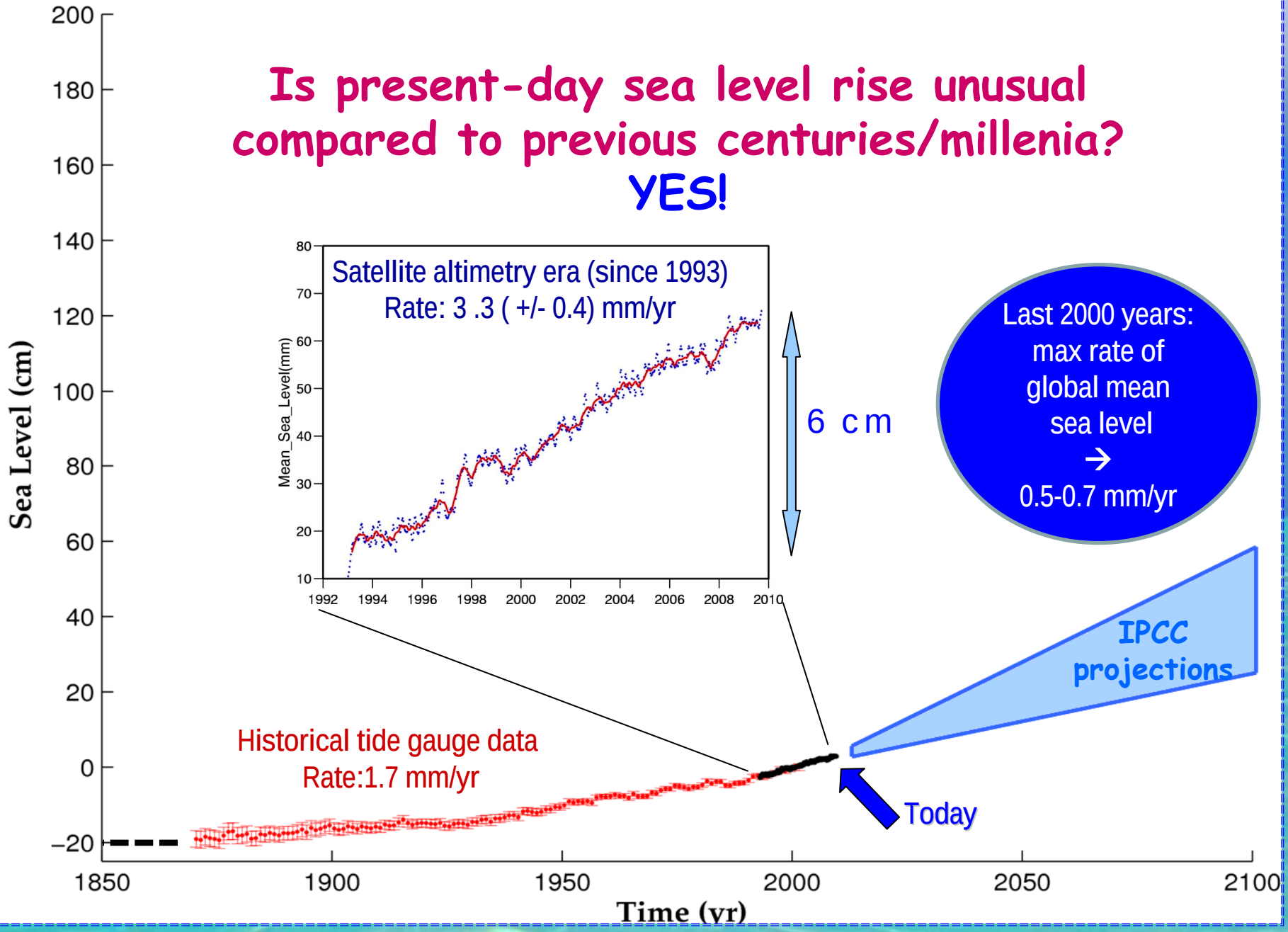
Is sea level rise accelerating?

YES!



Is present-day sea level rise unusual compared to previous centuries/millenia?

YES!

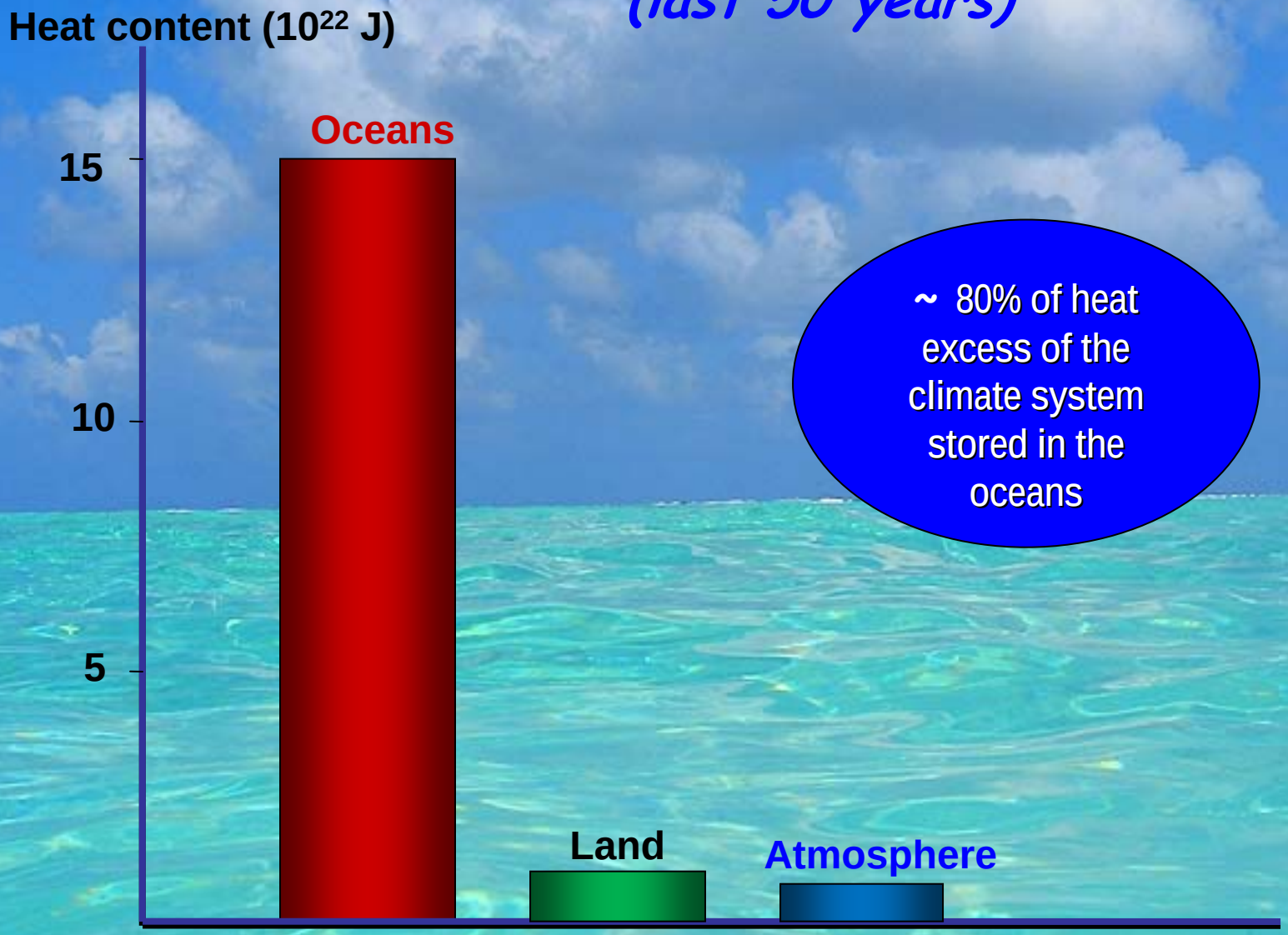


Can we explain present-day sea level rise?

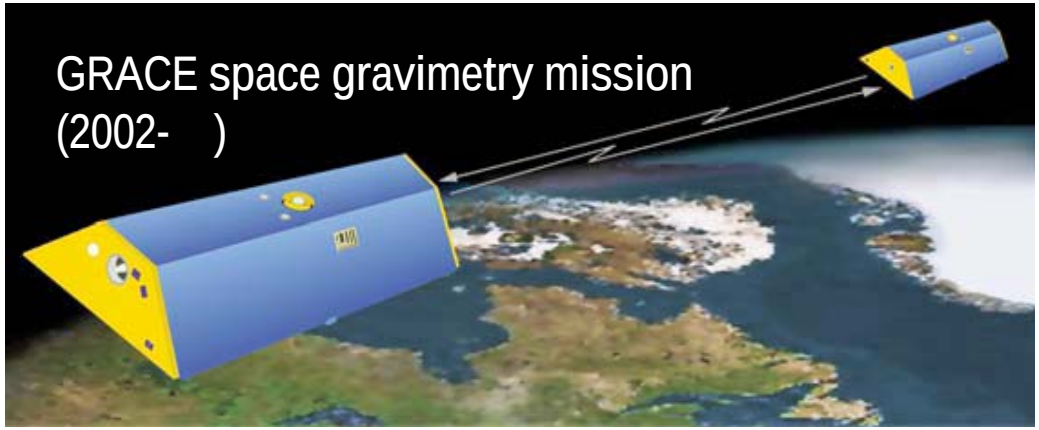
YES!

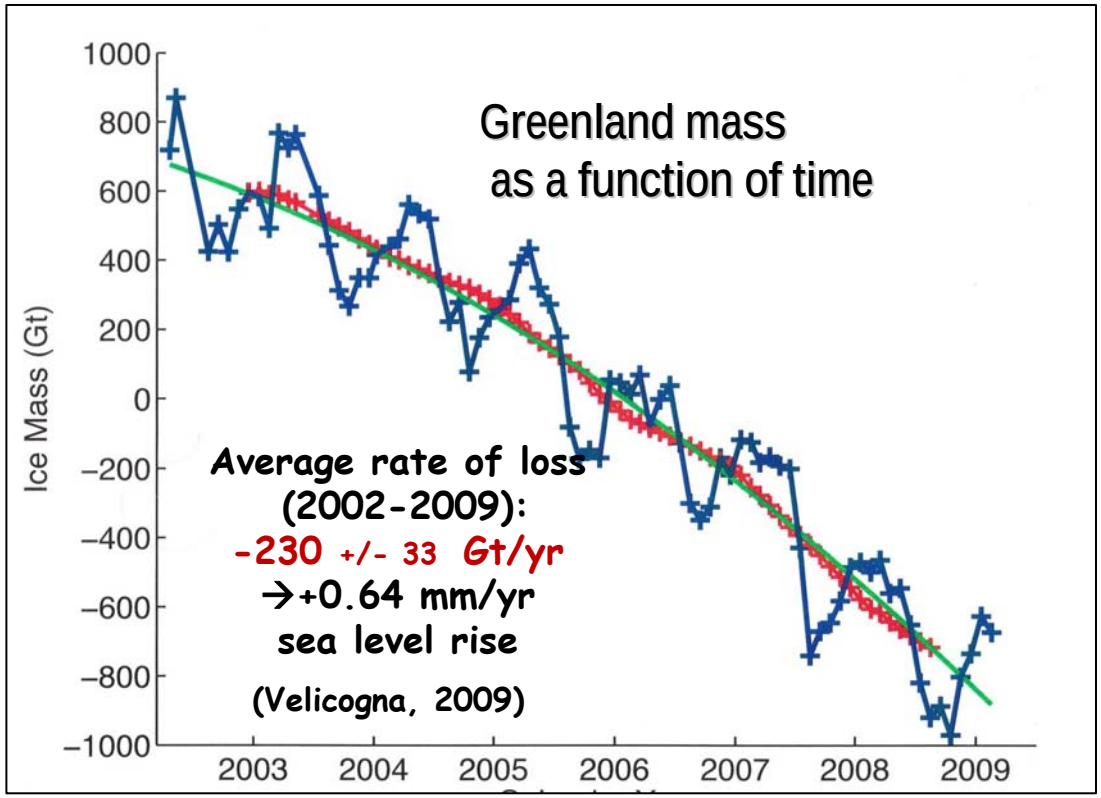
- Ocean is warming
- World glaciers are melting
- Greenland and Antarctica are loosing ice

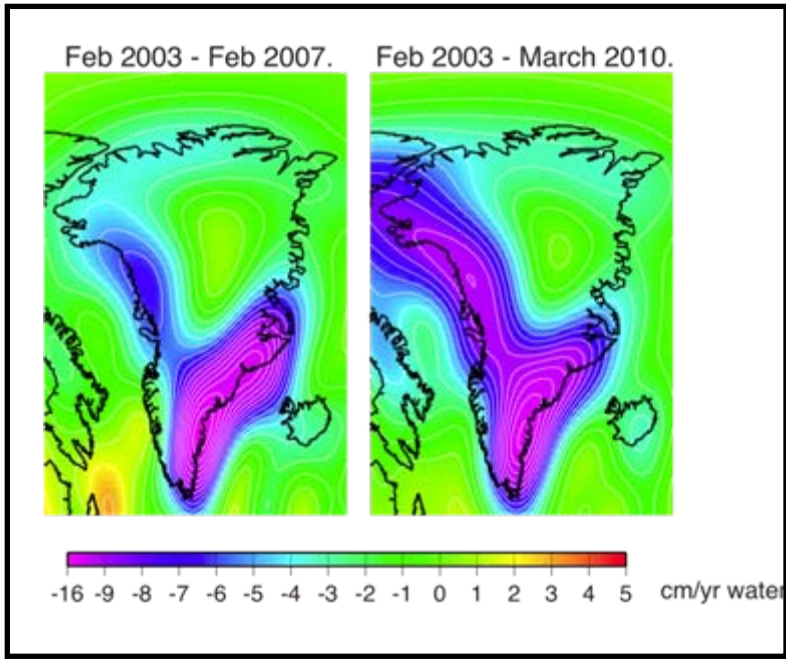
Thermal budget of the climate system
(last 50 years)



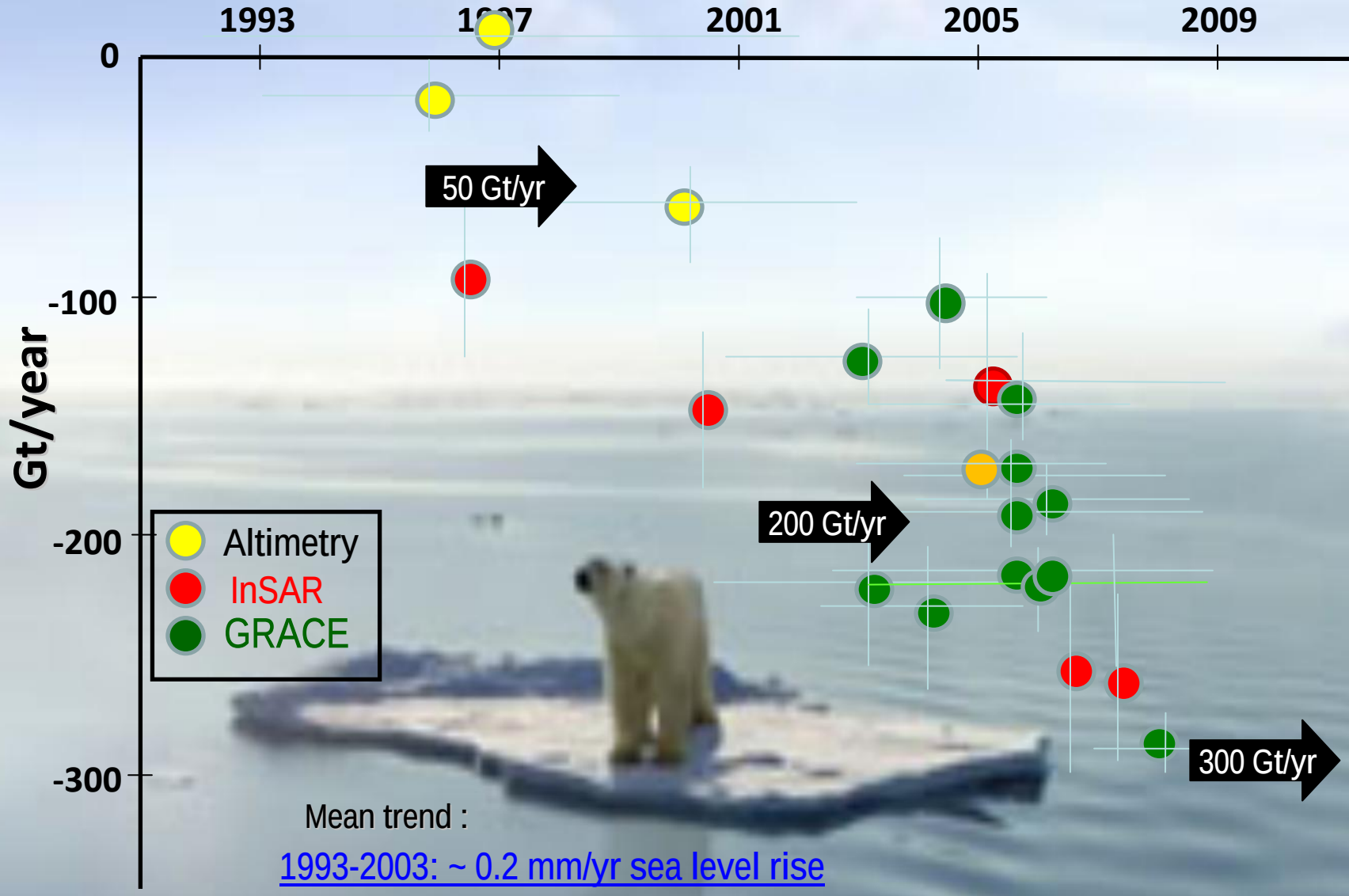
Greenland ice mass loss from space gravimetry







Observed rates of annual ice mass loss – Greenland-

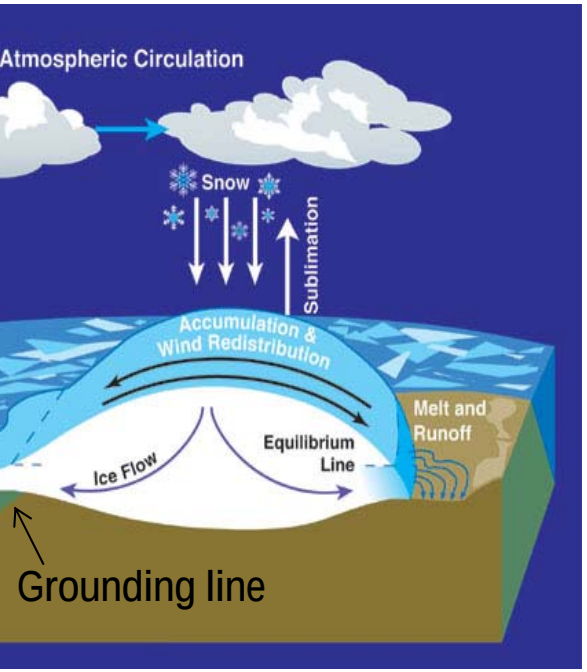


Mean trend :

1993-2003: ~ 0.2 mm/yr sea level rise

2003-2009: ~ 0.6 mm/yr sea level rise

Ice sheets dynamical instabilities



Different processes at work

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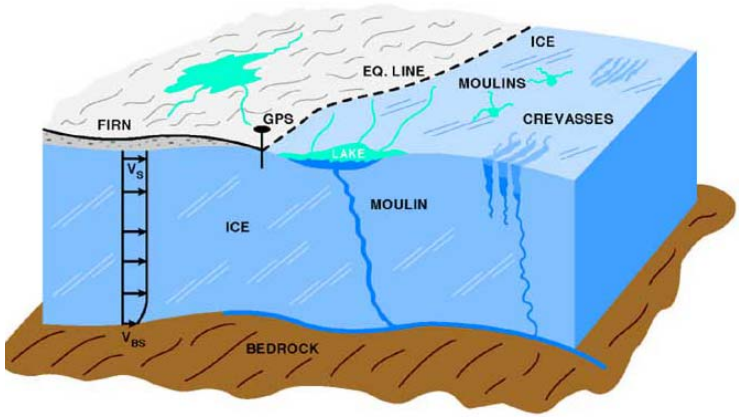
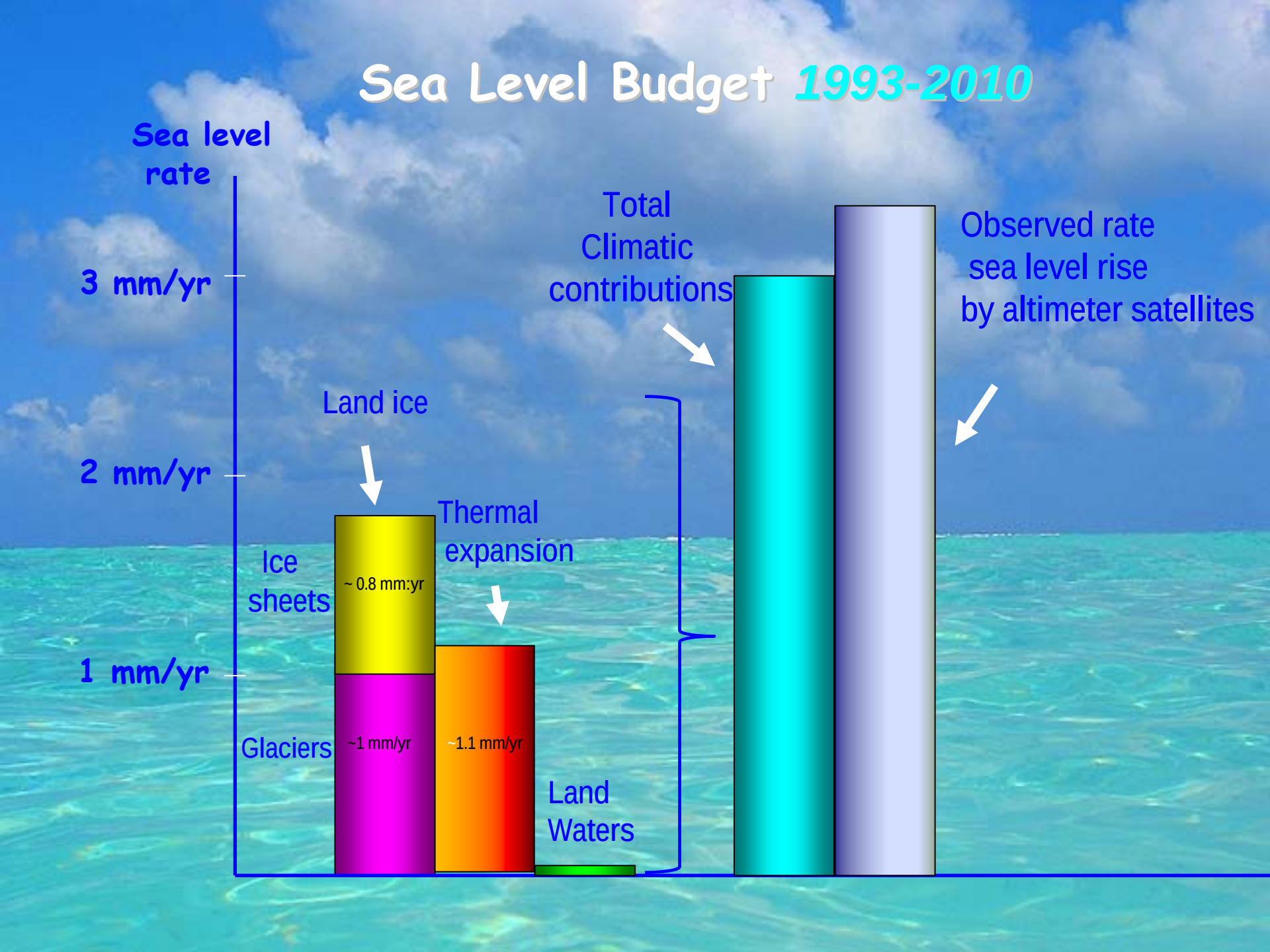
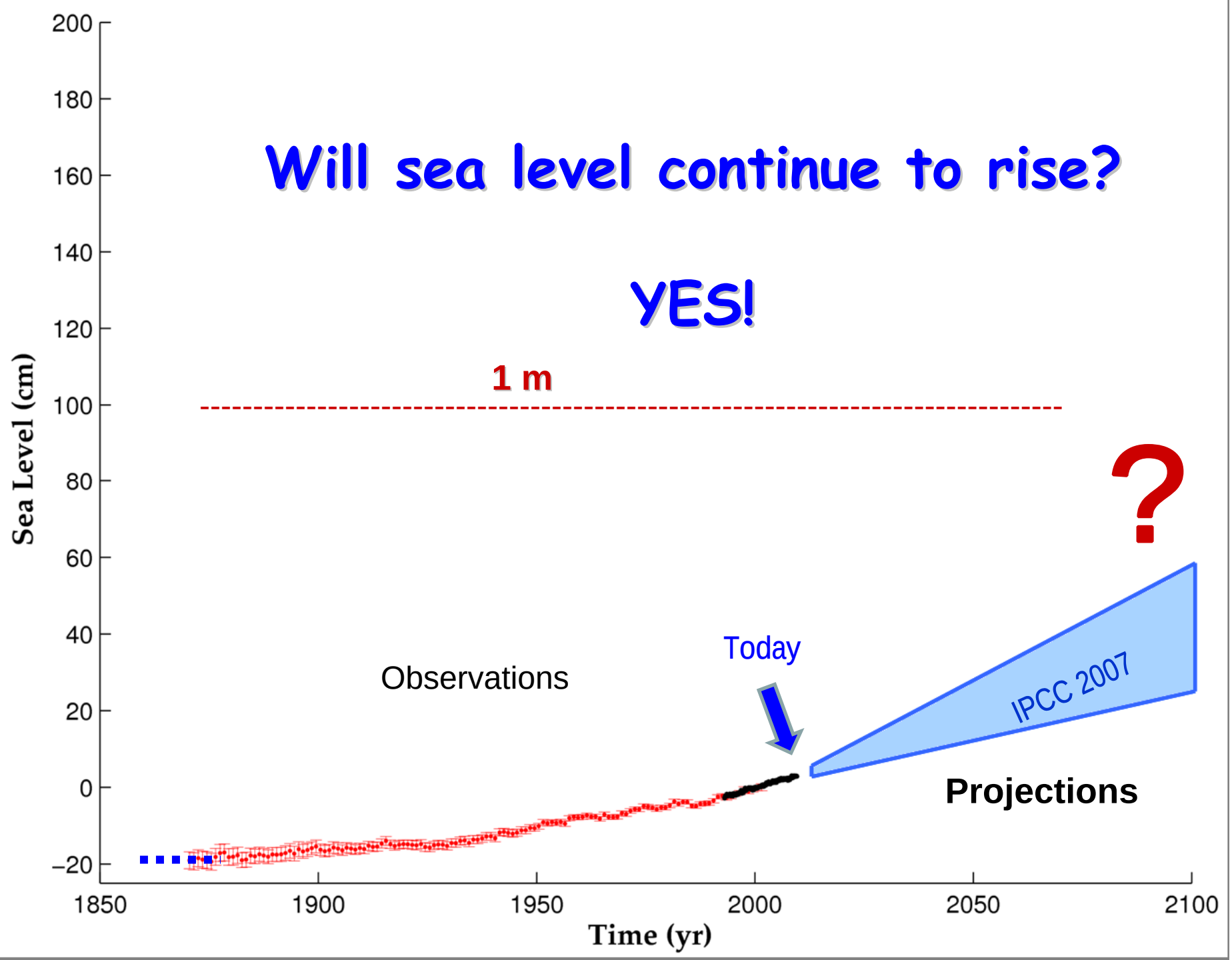


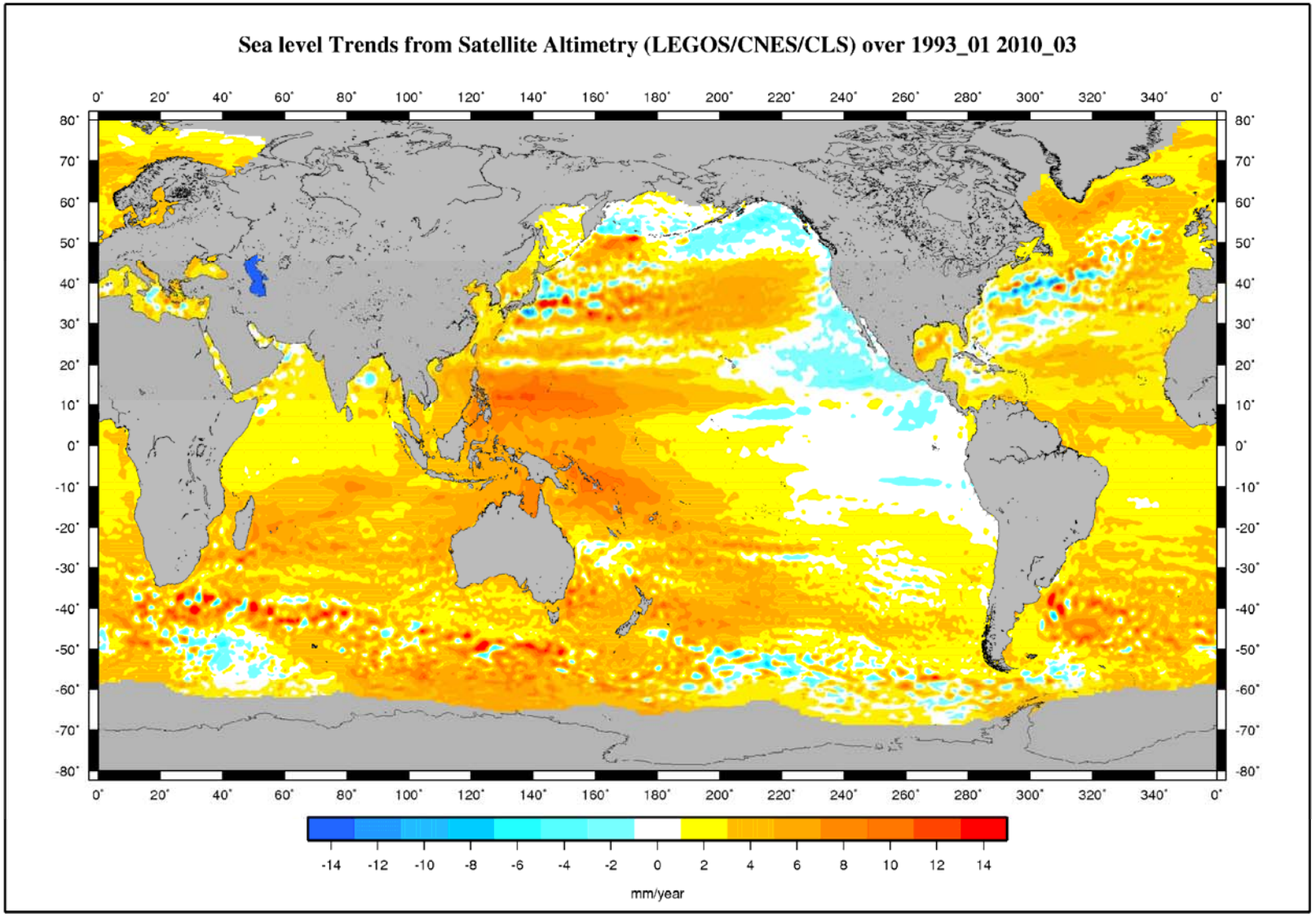
Sea Level Budget 1993-2010




Will sea level continue to rise?
YES!
1 m
?
Today
Observations
IPCC 2007
Projections
Sea Level (cm)
Time (yr)
200
180
160
140
120
100
80
60
40
20
0
−20
1850
1900
1950
2000
2050
2100

Sea level rise is not uniform!

(observations from satellite altimetry over 1993-2010)



Accurate monitoring of sea level change
(globally and regionally)
by (multi-missions) satellite altimetry
is a high-priority objective

→

- Acceleration?
- Detection of the anthropogenic warming signature?
- Constraints on climate models

« Sea Level » CCI Project : Objective

Provide accurate « Sea level » observations :

- Global mean time series
- Gridded time series
- Spatial trend pattern grids

- Multi mission satellite altimetry
- Time span: 1991-2010 (+ regular updates)
- Weekly interval

Important contribution to climate research


Thanks for attention