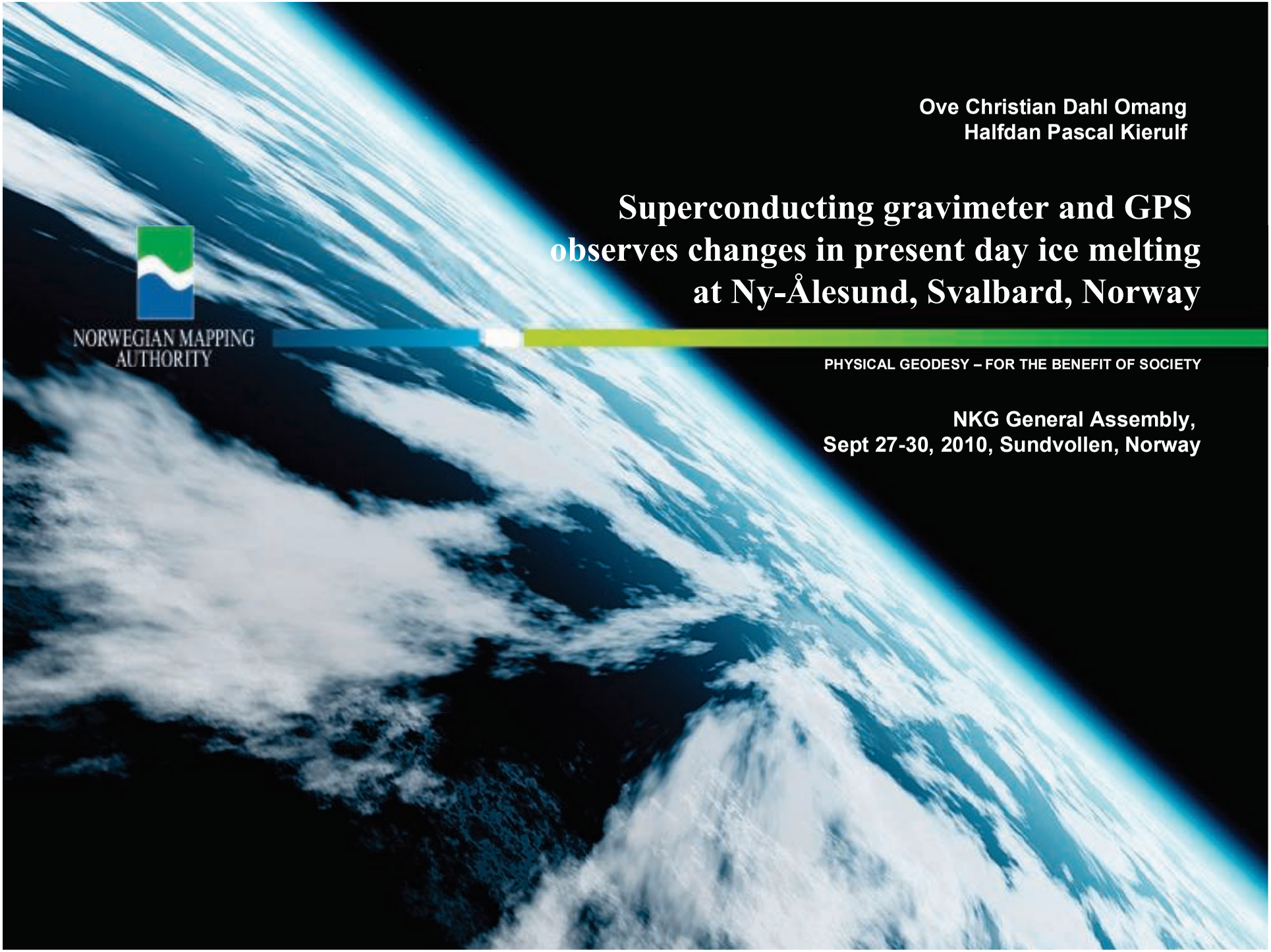


Ove Christian Dahl Omang
Halfdan Pascal Kierulf

Superconducting gravimeter and GPS observes changes in present day ice melting at Ny-Ålesund, Svalbard, Norway

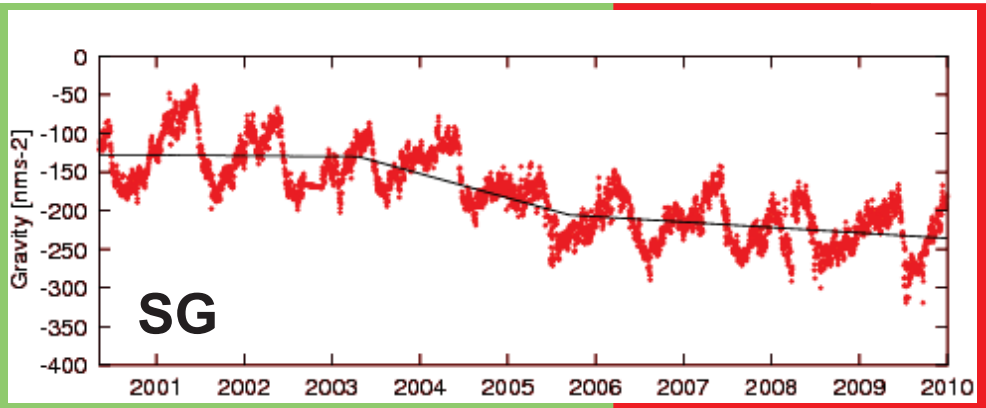
NORWEGIAN MAPPING AUTHORITY

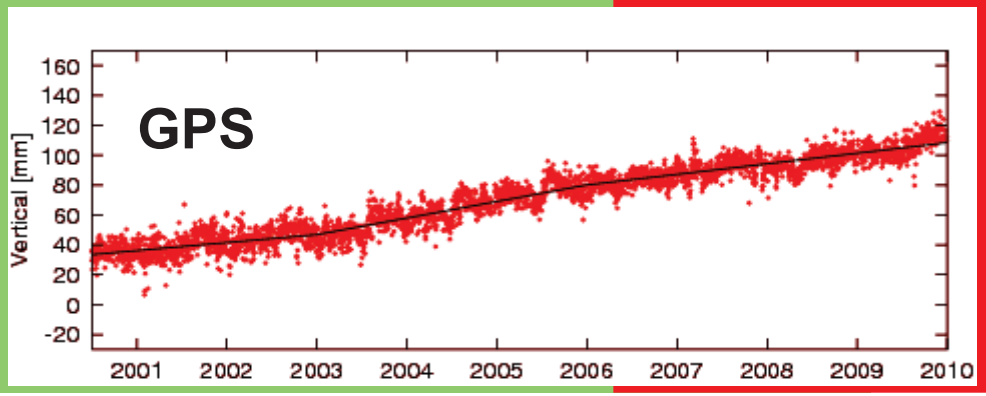
PHYSICAL GEODESY – FOR THE BENEFIT OF SOCIETY

NKG General Assembly,
Sept 27-30, 2010, Sundvollen, Norway

OUTLINE

DATA



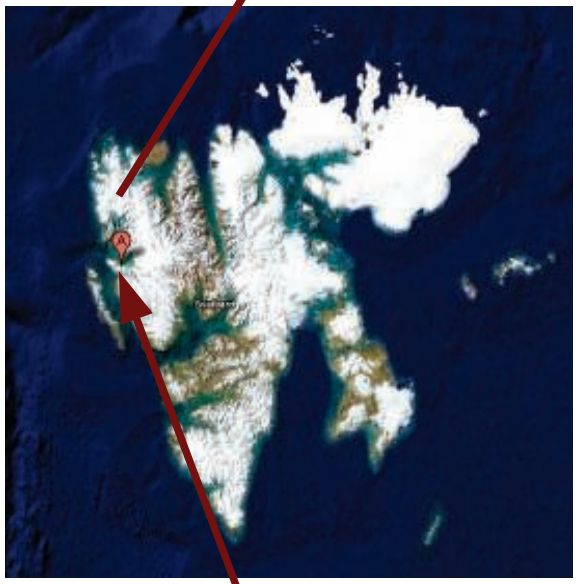


RESULTS

GEODETIC OBSERVATORY AT NY-ÅLESUND

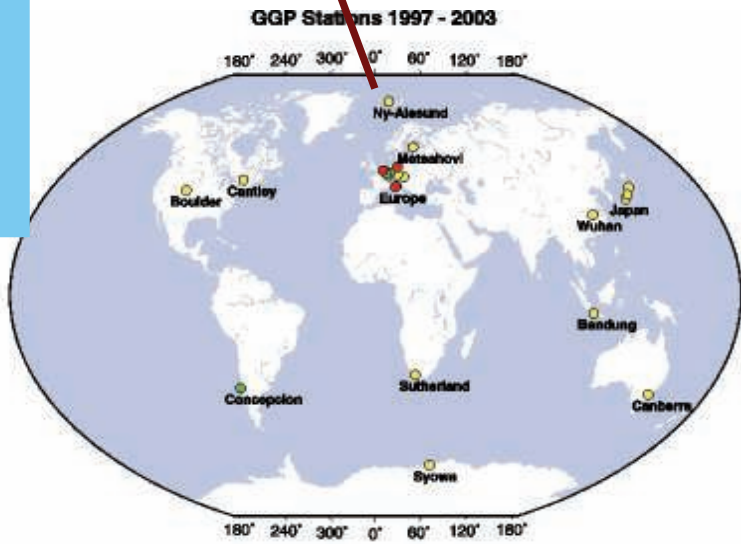
Continuous measurements

- SG (1999-)
- VLBI (1994-)
- 2 GPS(IGS) (1991-)
- DORIS (1997-)
- TG (1976-)



Campaigns

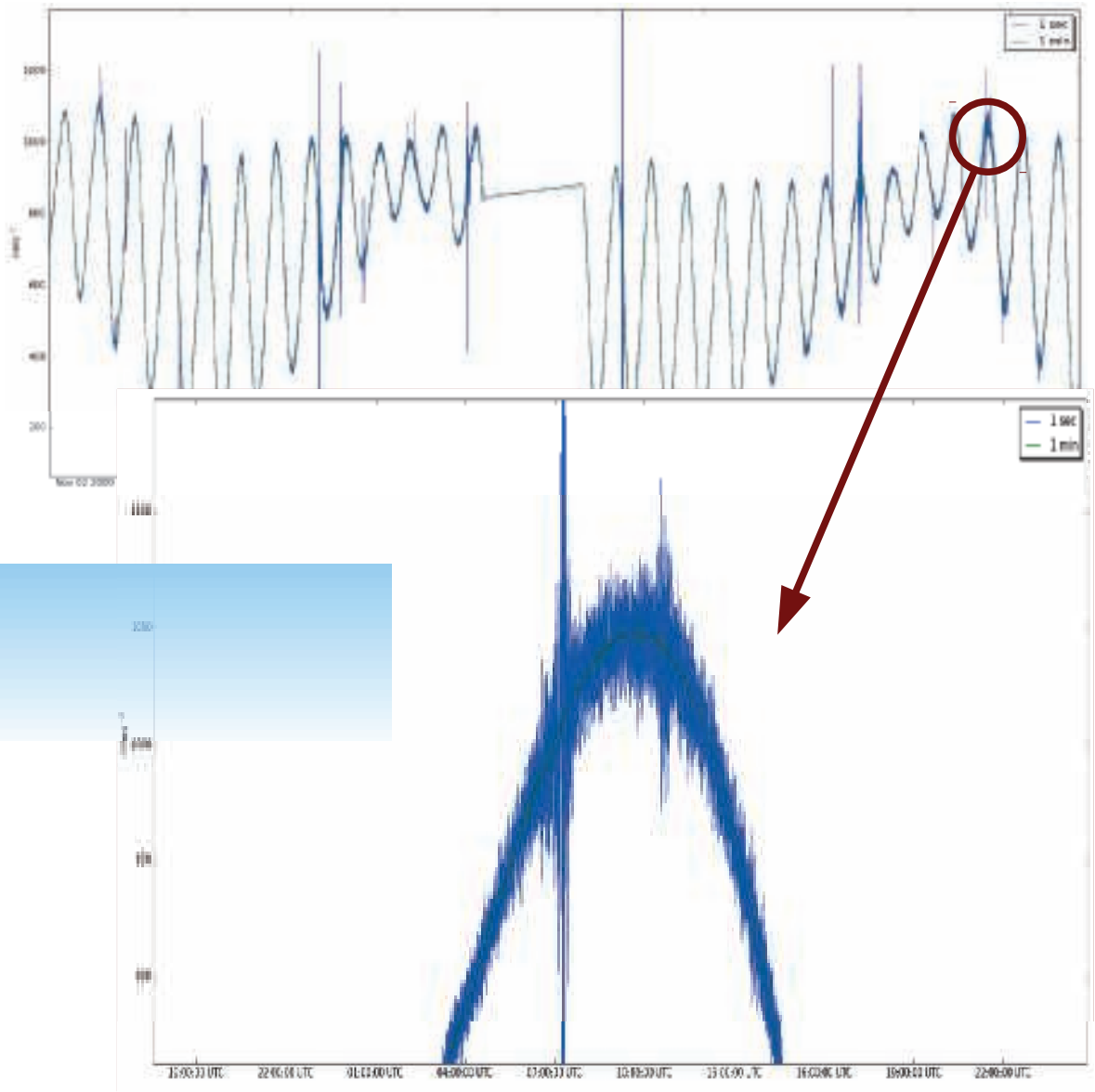
- AG (1998 →)
- Local ties, network, stability measurements, PRARE, GPS, relative gravity



Planning 2 new VLBI2010 antennas

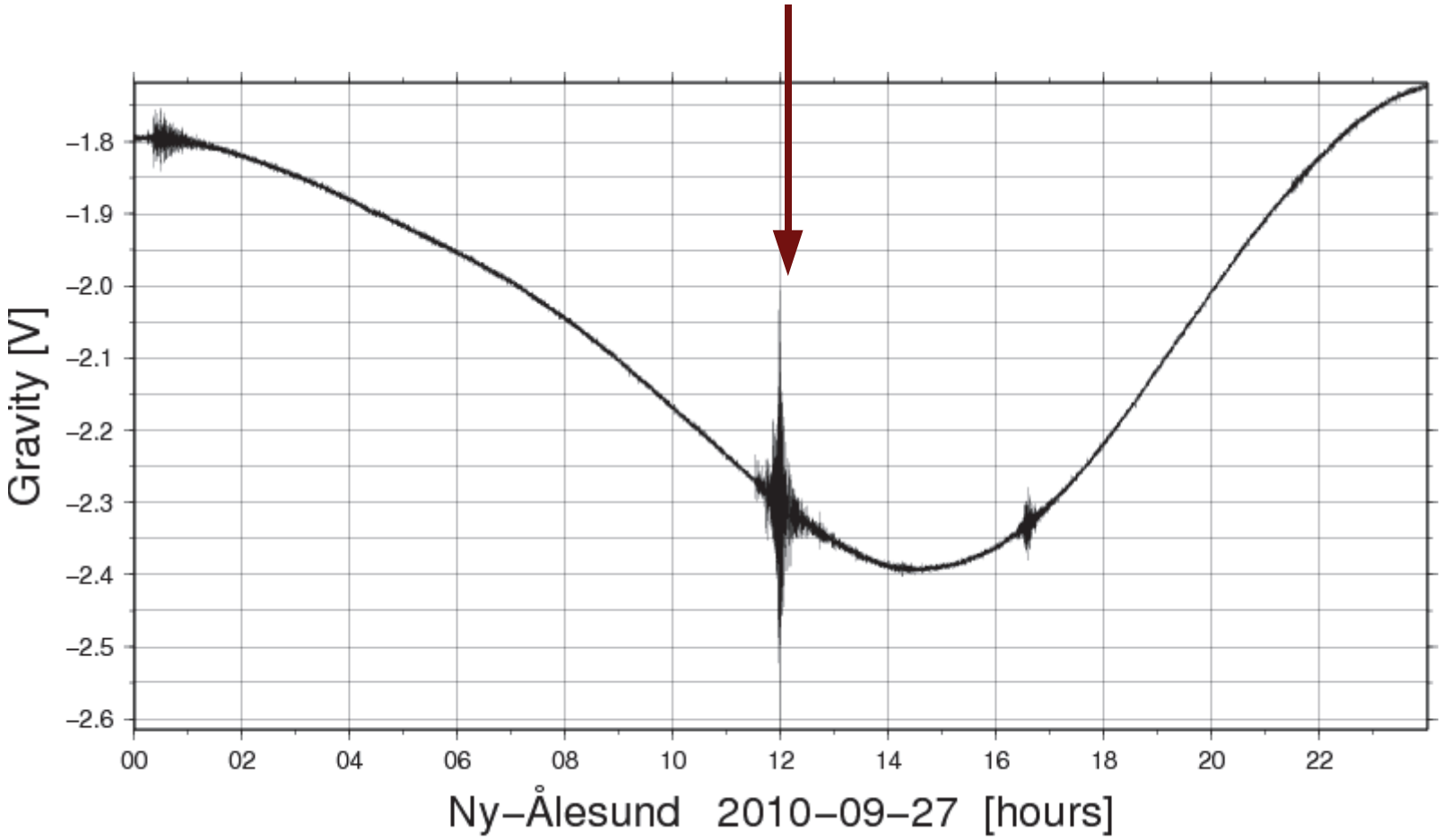
NORWEGIAN MAPPING AUTHORITY

RAW SG DATA

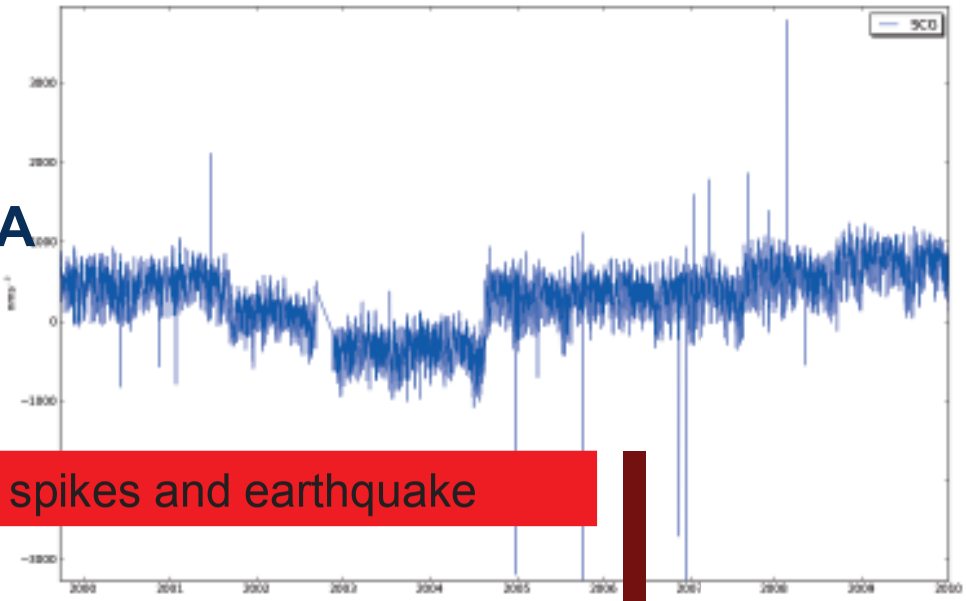


- 1 second SG data
- Decimate to 1 minute

EARTHQUAKE 122 KM SOUTHEAST OF LONGYEAR

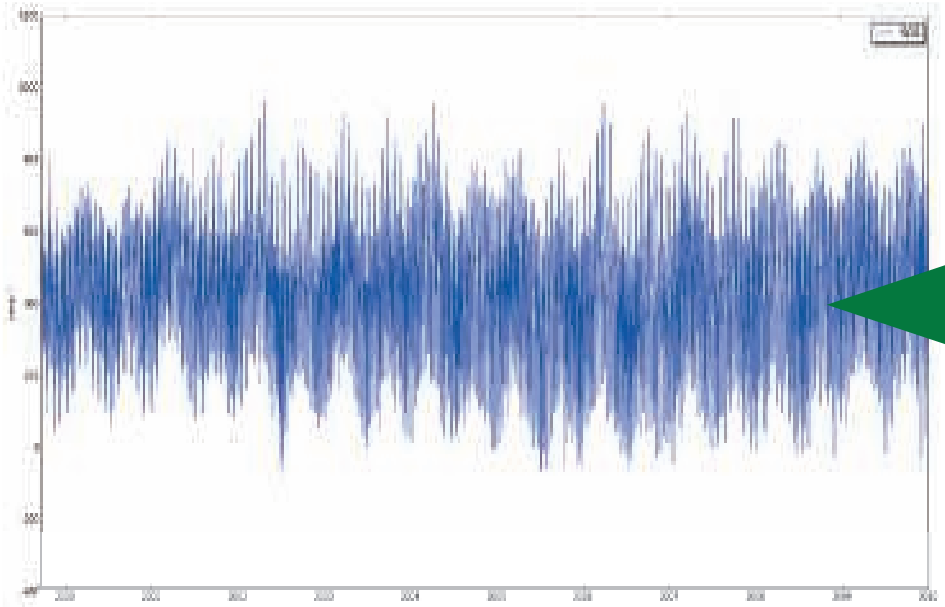


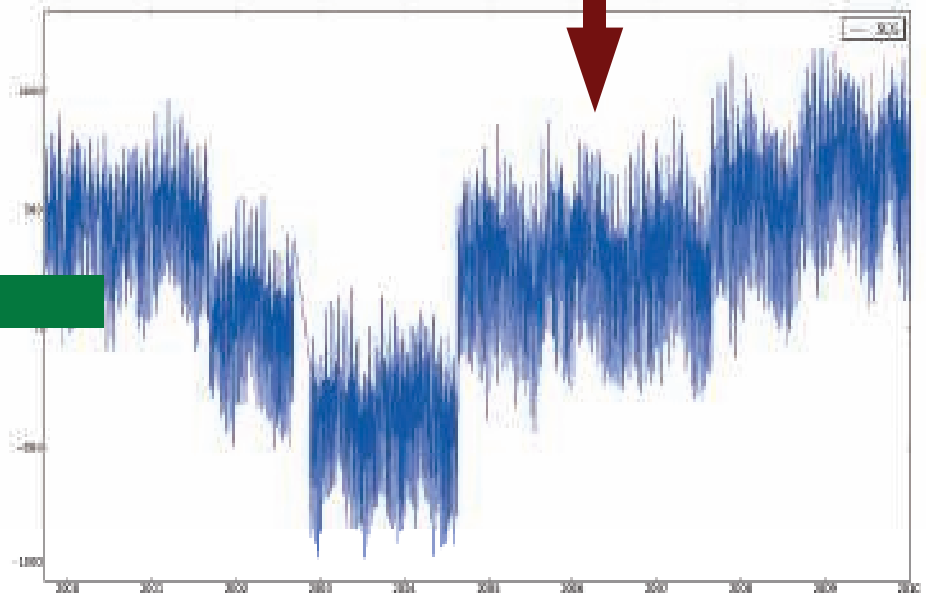
CORRECTION OF SG DATA



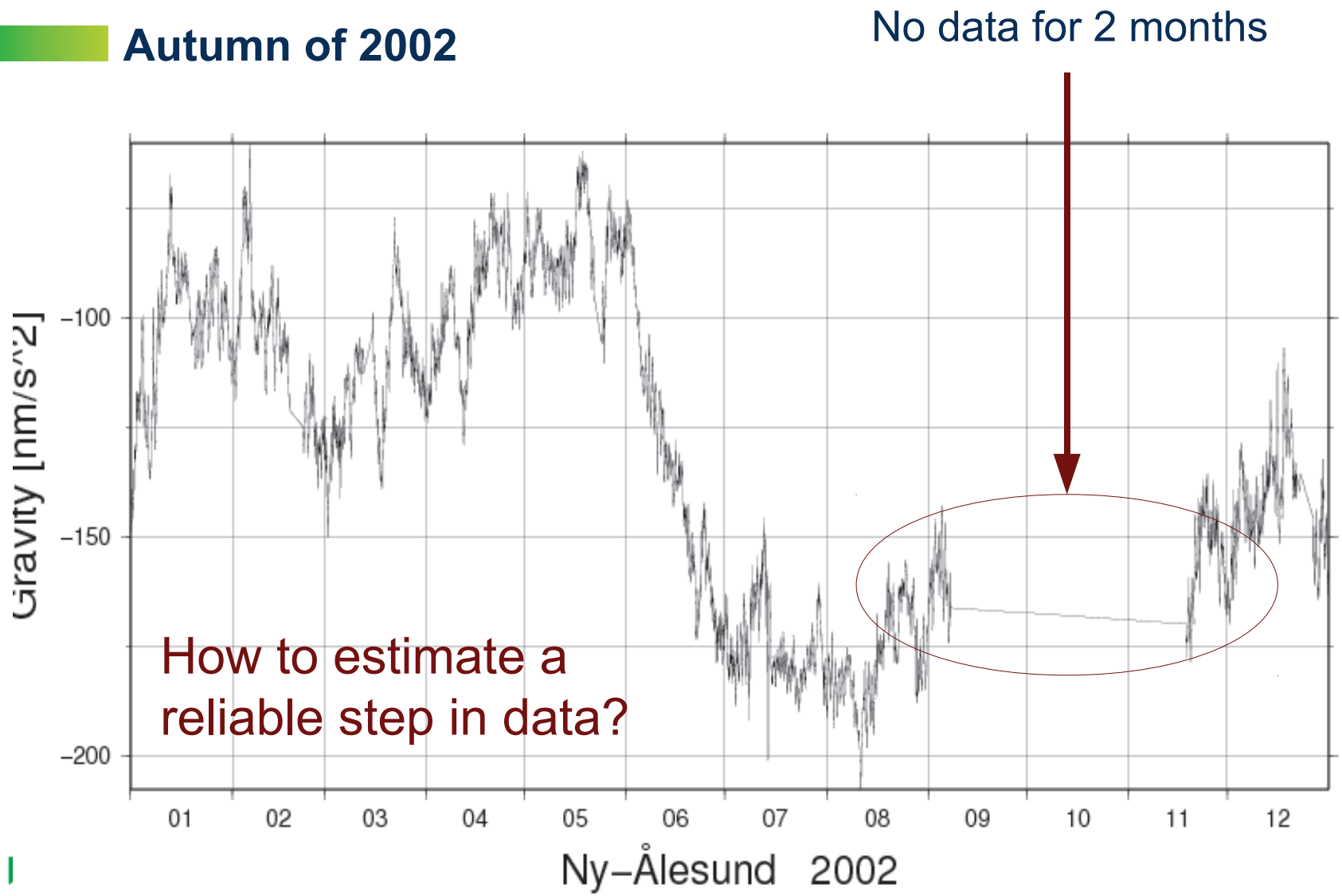
Remove spikes and earthquake

Remove steps and atmospheric pressure

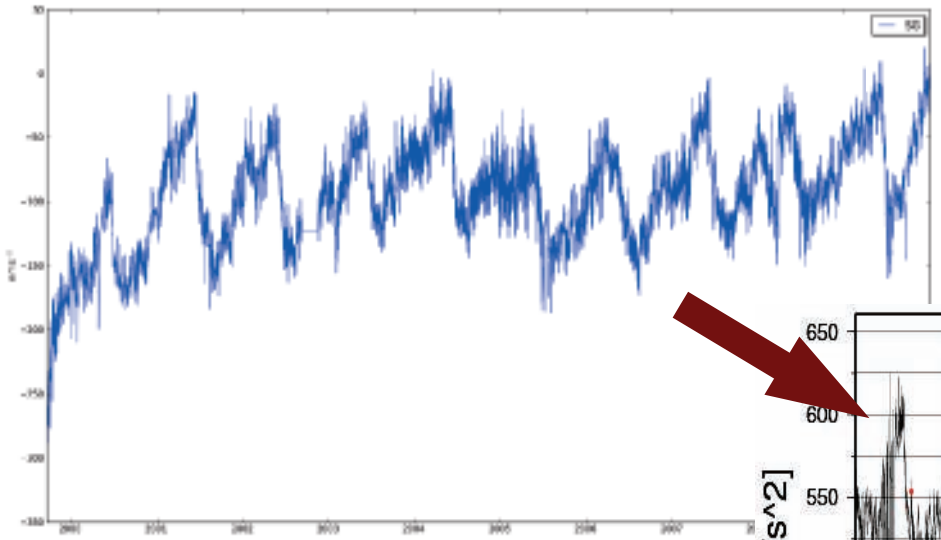




Autumn of 2002



REMOVE LINEAR DRIFT IN SG DATA

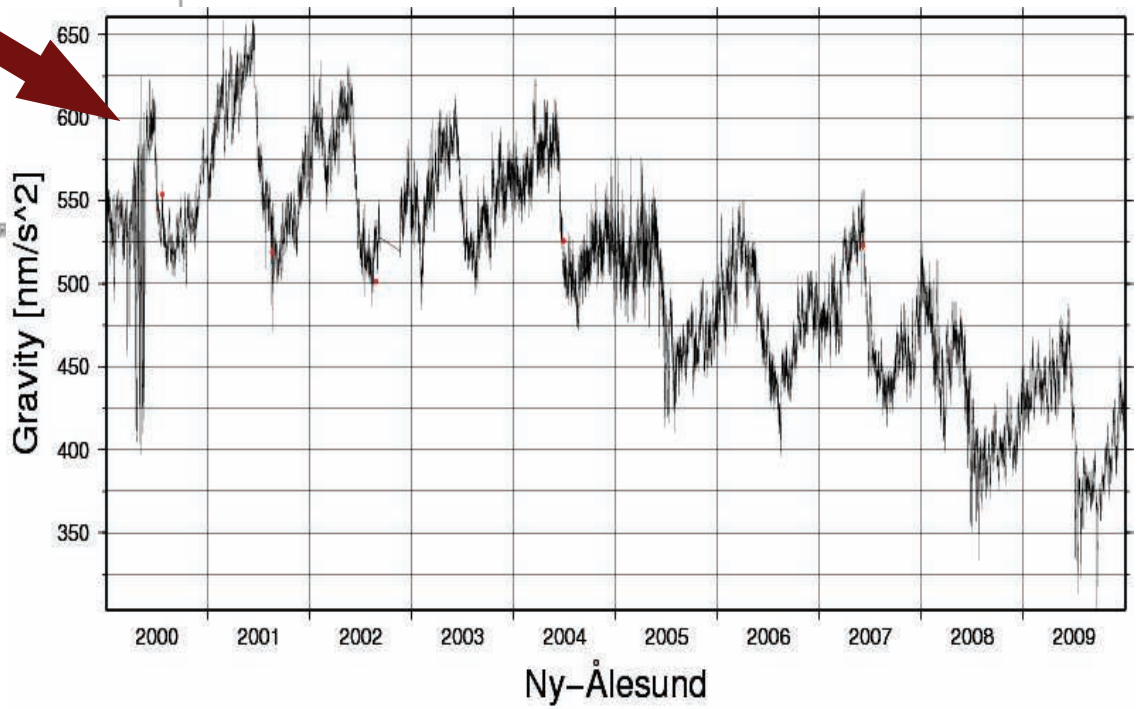


Use AG data

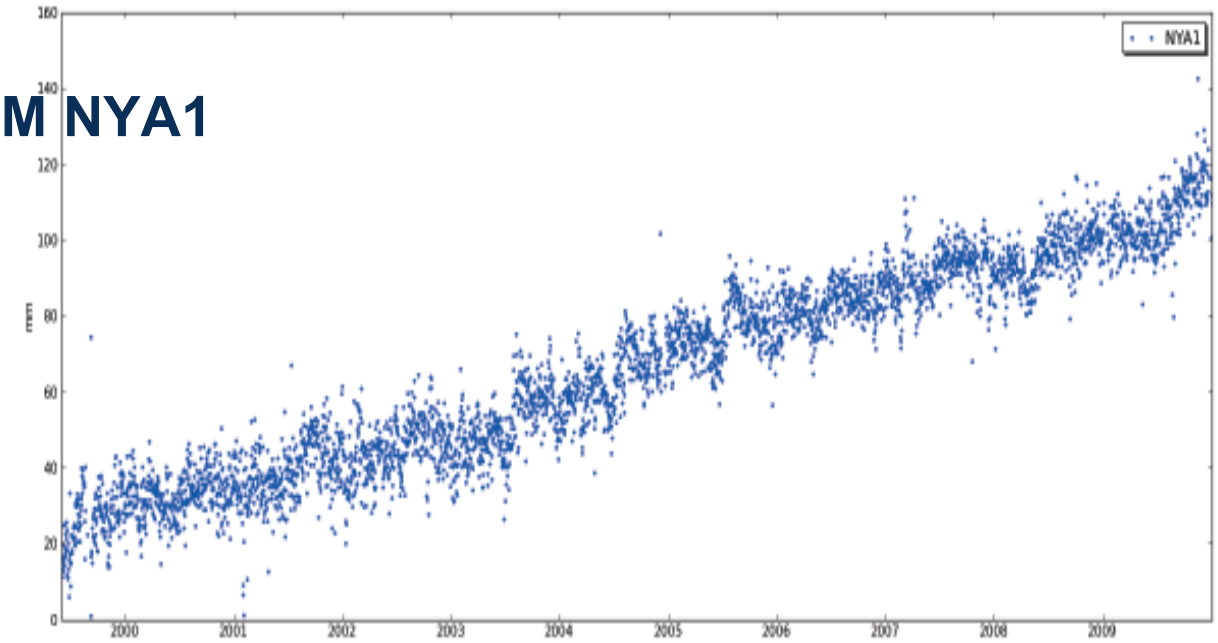
- 2000,2001,2002,2004,2007

SG data detrended

- -1.87 μGal/yr

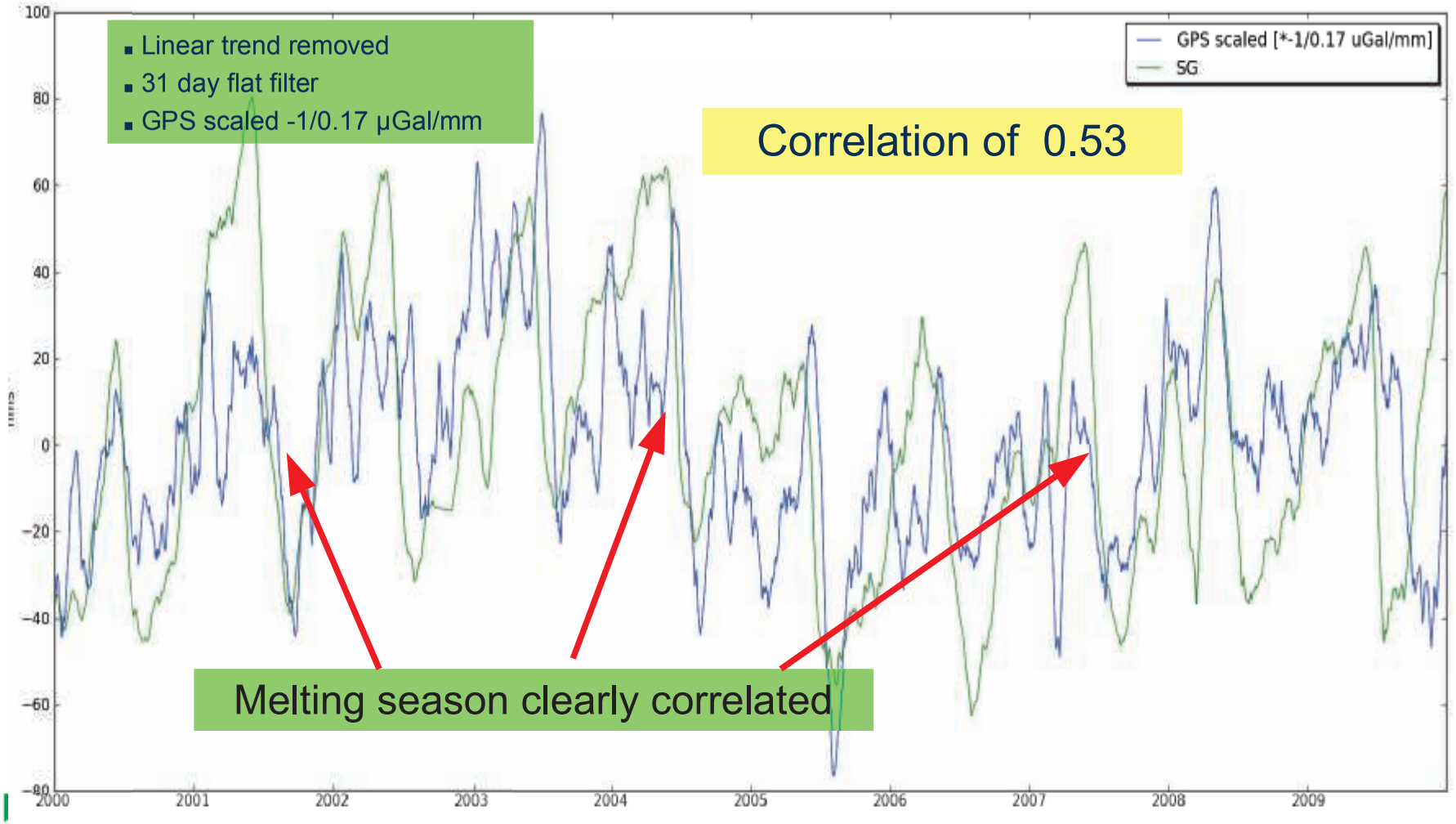


GPS DATA FROM NYA1



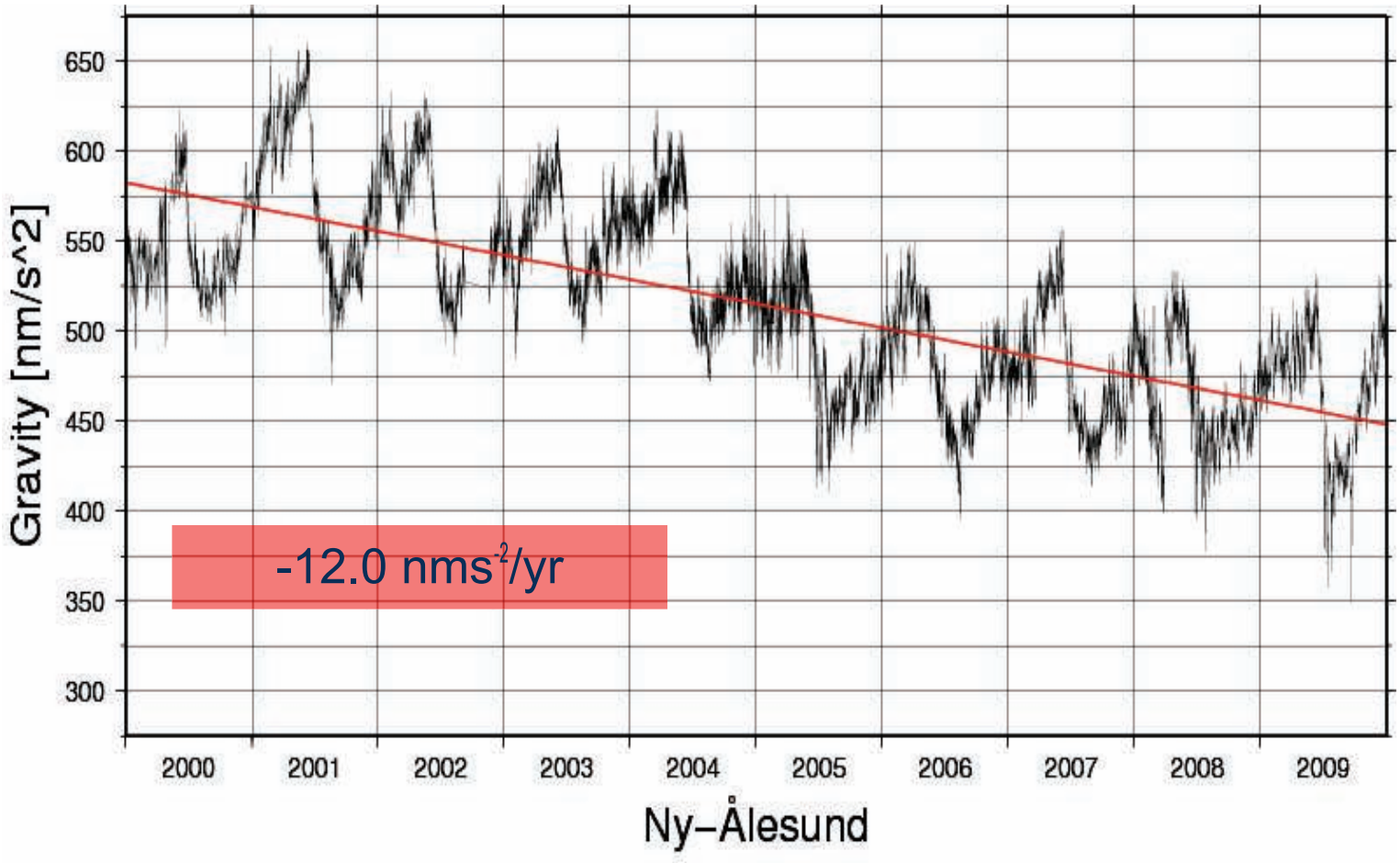
- NYA1 in ITRF2005
- GIPSY-PPP using JPL reprocessed orbit and clocks
- Transformed to itrf2005 using JPL x-files
- Elevation cut off 10 degree
- Ocean loading using FES2004
- Absolute phase center variations (igs05_*.atx files)

SEASONAL VARIATIONS IN SG AND GPS

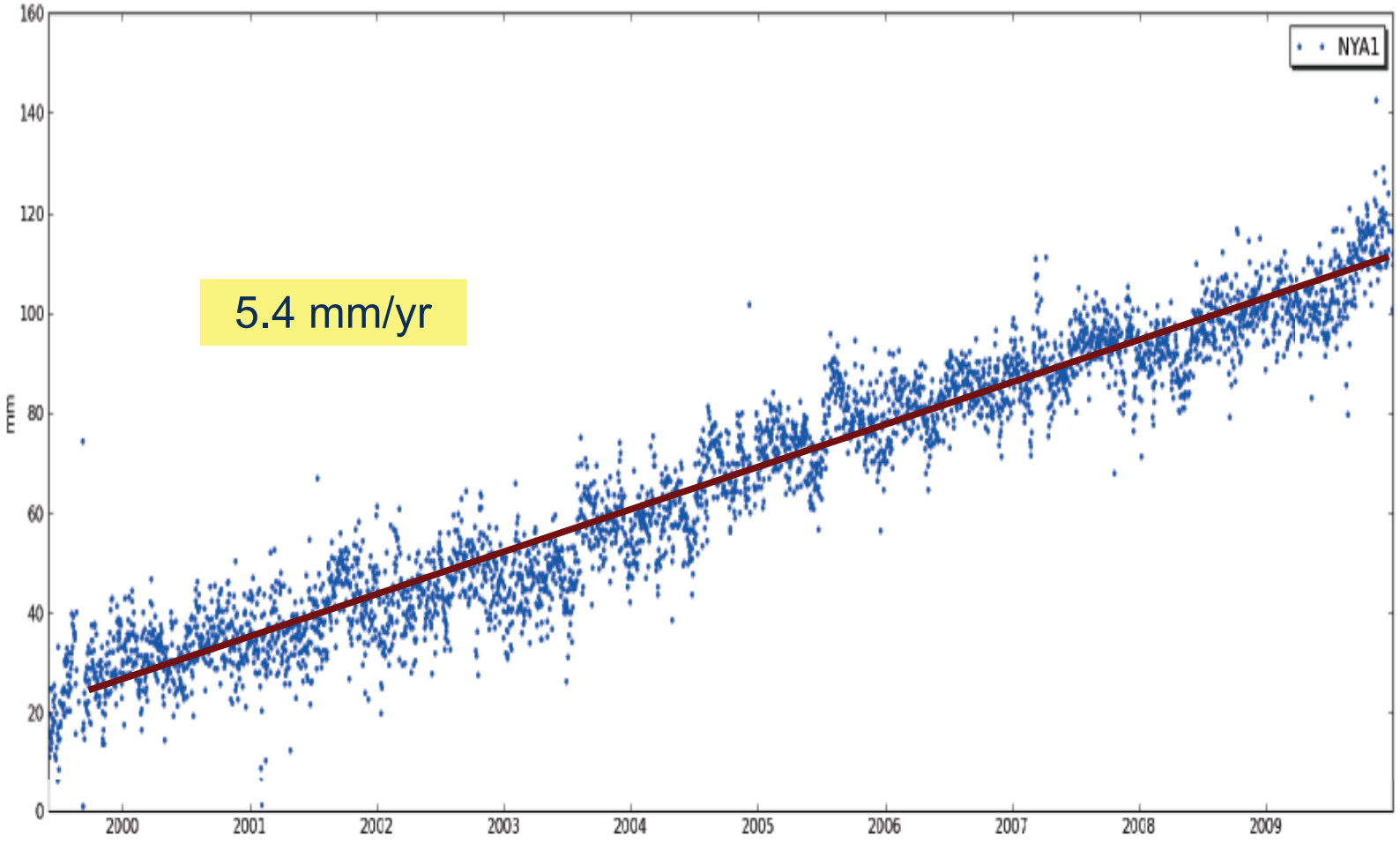


AG (1998-2007)
-7.41 nms^{-2}/yr

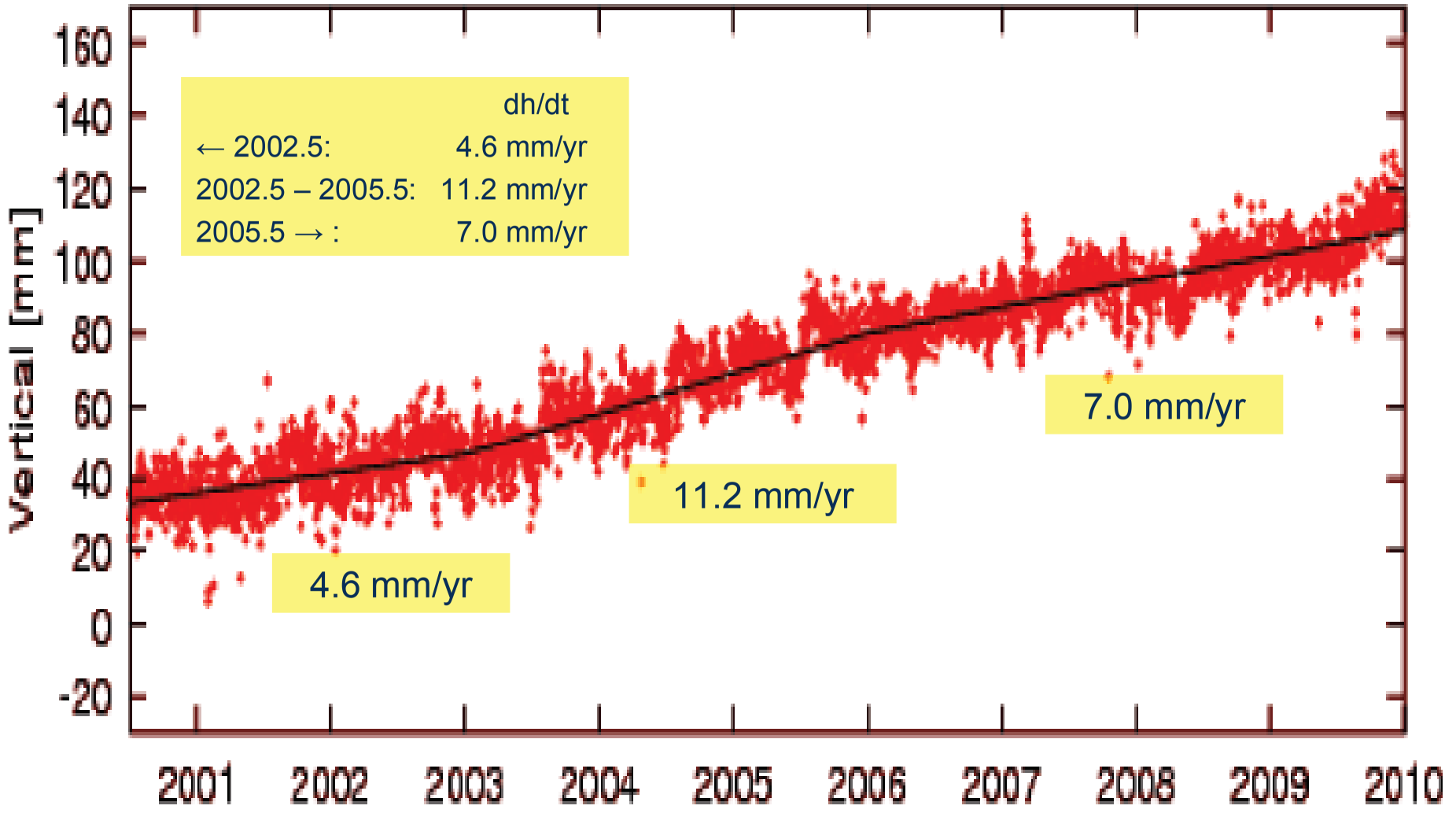
CHANGE IN GRAVITY FROM SG DATA



TREND IN GPS DATA

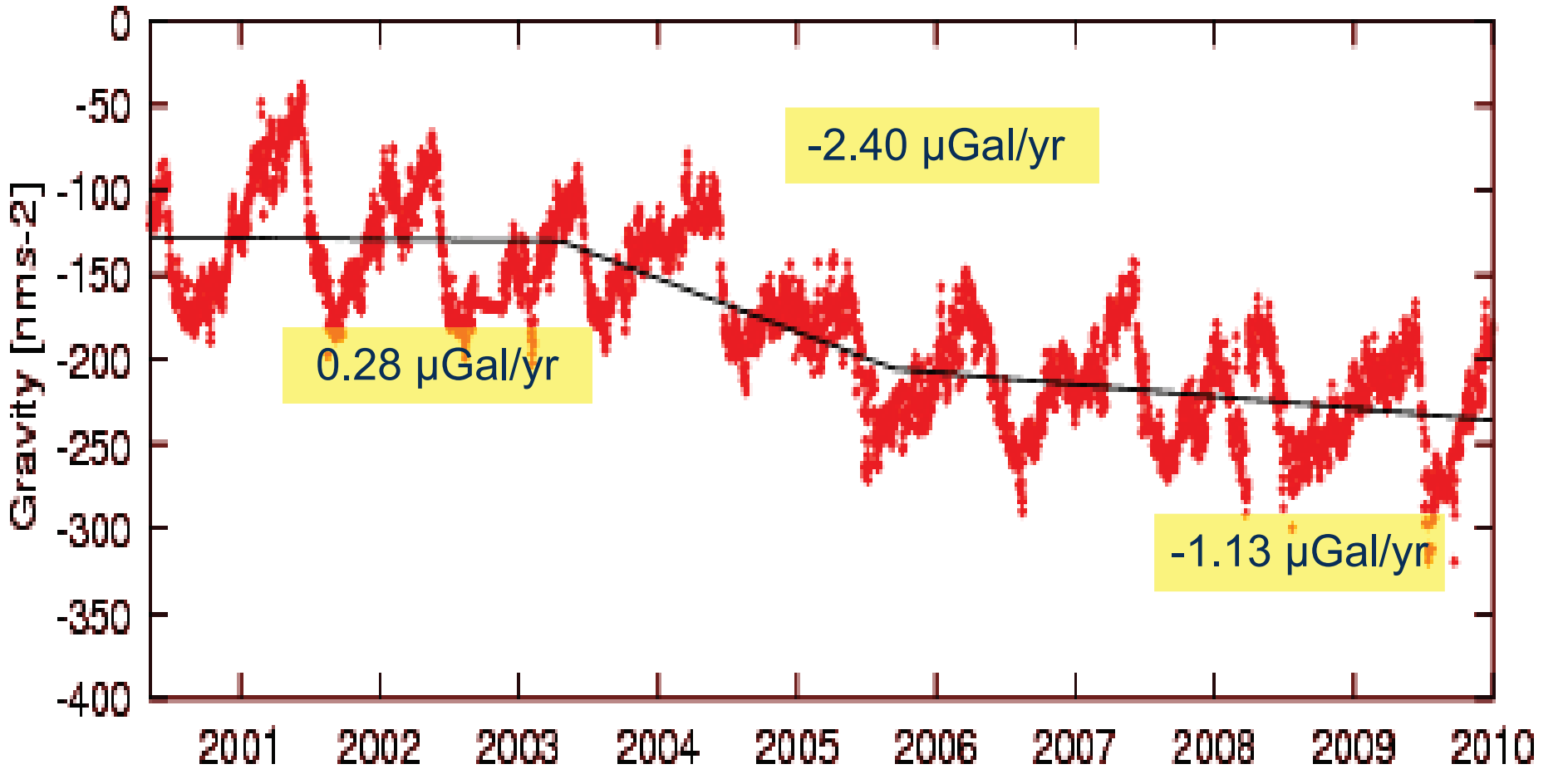


TRENDS IN GPS DATA



CHANGE IN dg/dt (SG)

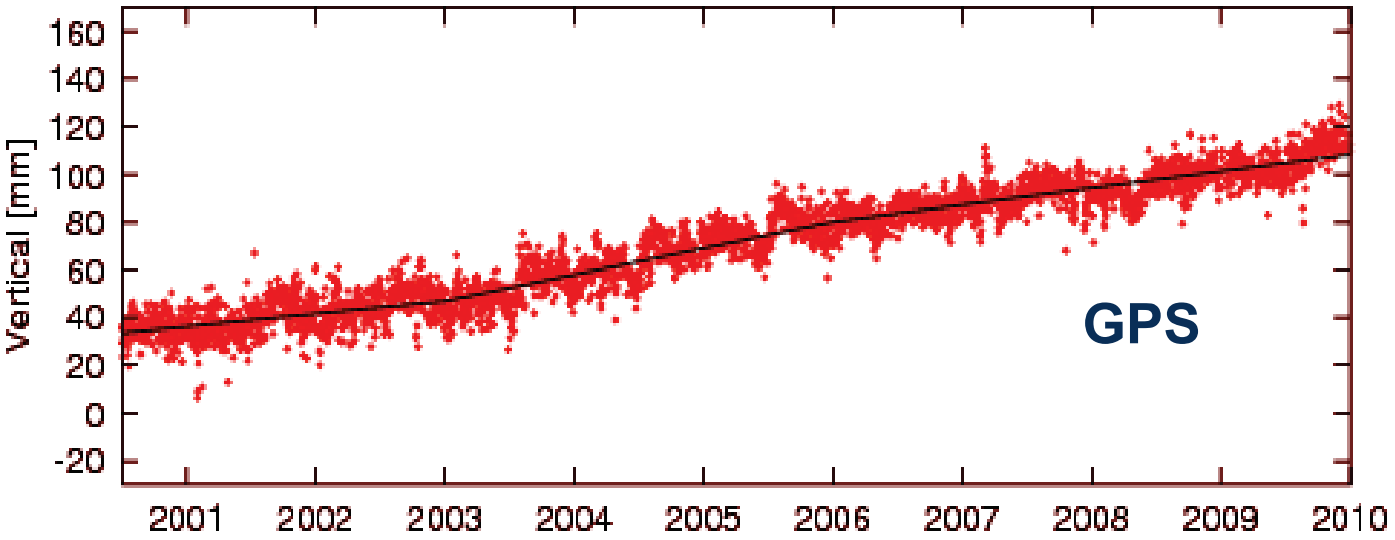
	dg/dt
← 2002.5:	0.28 µGal/yr
2002.5 – 2005.5:	-2.40 µGal/yr
2005.5 → :	-1.13 µGal/yr



OBSERVATIONS OF MASS BALANCE

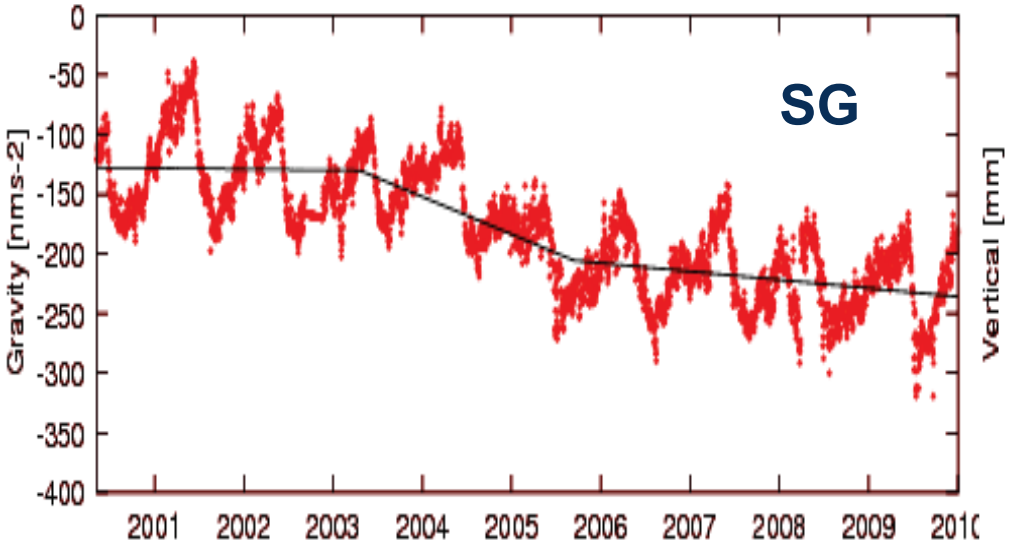
MASS BALANCE [m]	2000.5-2002.5	2002.5-2005.5	2005.5-2009.5	Total
	0.29	-0.38	0.02	-0.06

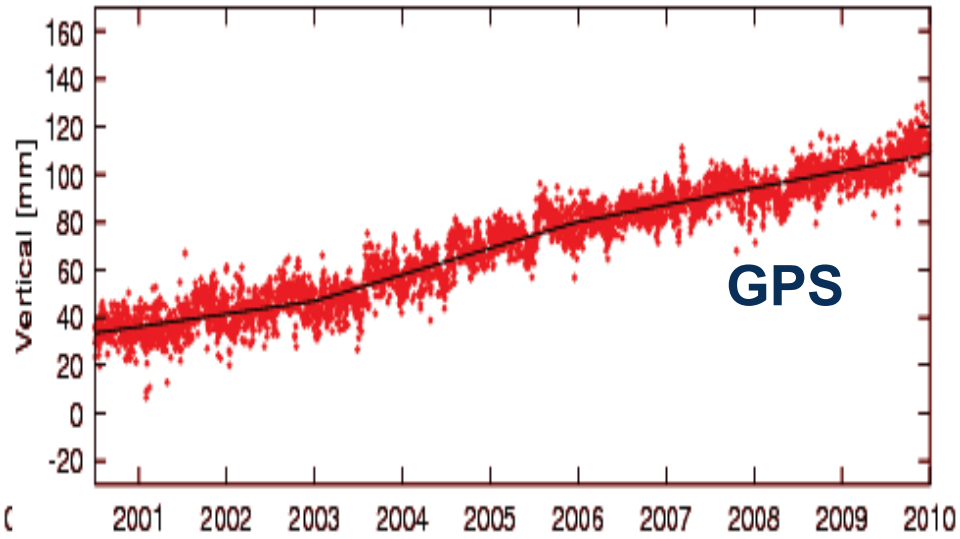
Predicted	2000.5-2002.5	2002.5-2005.5	2005.5-2009.5	Total
GPS [mm/yr]	2.3	8.1	4.7	5.40
SG [μGal/yr]	-0.5	-2.0	-1.1	-1.25



PREDICTED AND OBSERVED GPS AND SG

	2000.5-2002.5	2002.5-2005.5	2005.5-2009.5	Total
Measured				
dh/dt [mm/yr]	4.6	11.2	7.0	8.50
dg/dt [μGal/yr]	0.3	-2.4	-1.1	-1.20
Predicted				
dg/dt [μGal/yr]	-0.5	-2.0	-1.1	-1.25
dh/dt [mm/yr]	2.3	8.1	4.7	5.40



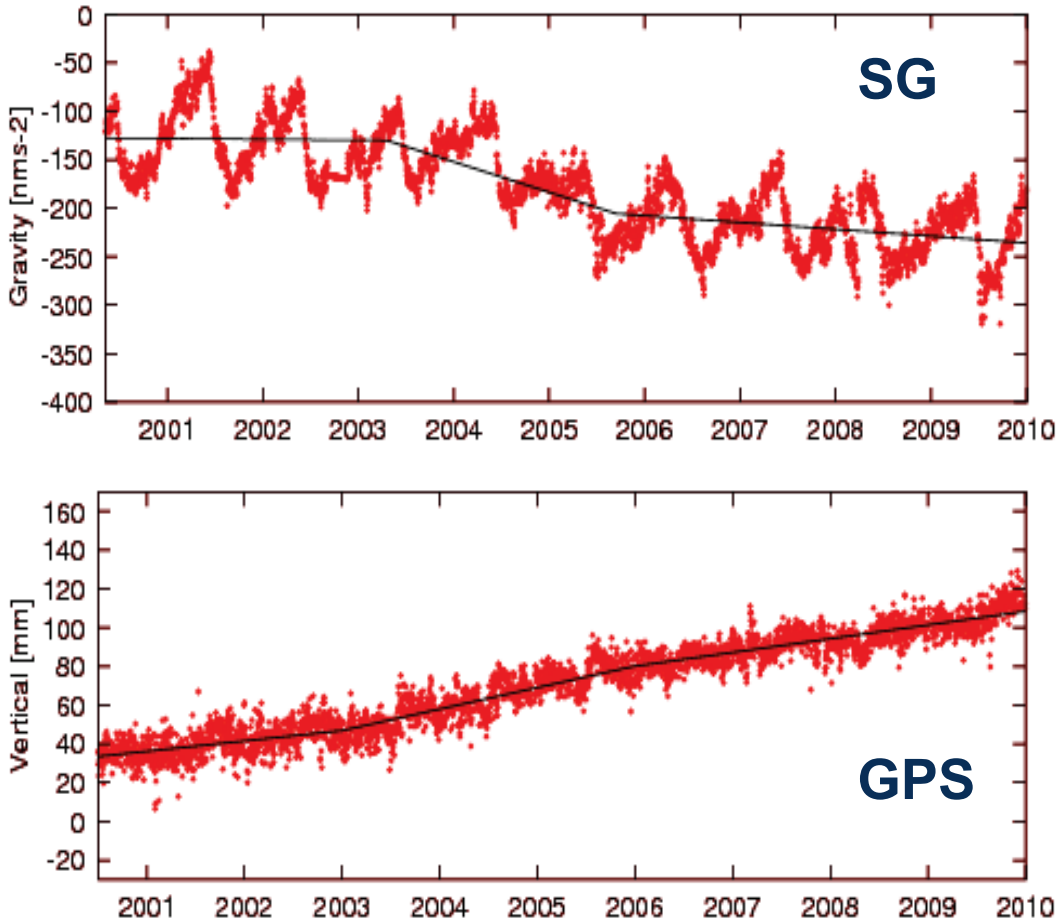


UNMODELLED GPS AND SG

- Ratio -0.07 μGal/mm
- Indicating
  - over predicted geometrical uplift
  - Geometrical reference frame give to large values

SUMMARY

Present Day Ice Melting is clearly visible!



SG and GPS is correlated