# The effects of snow cover on gravimetric observations in Trysil, Norway

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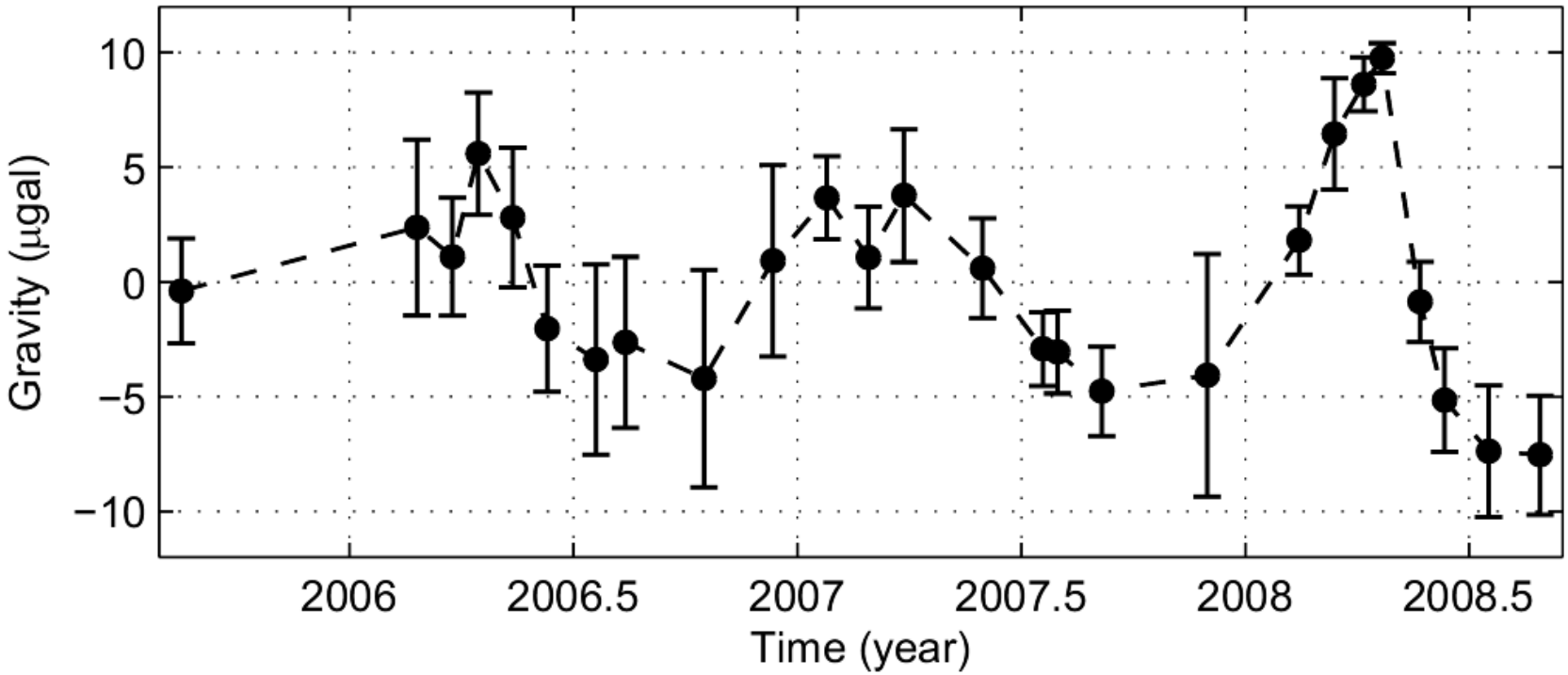
# AG time series in Trysil



# The attraction from ground water

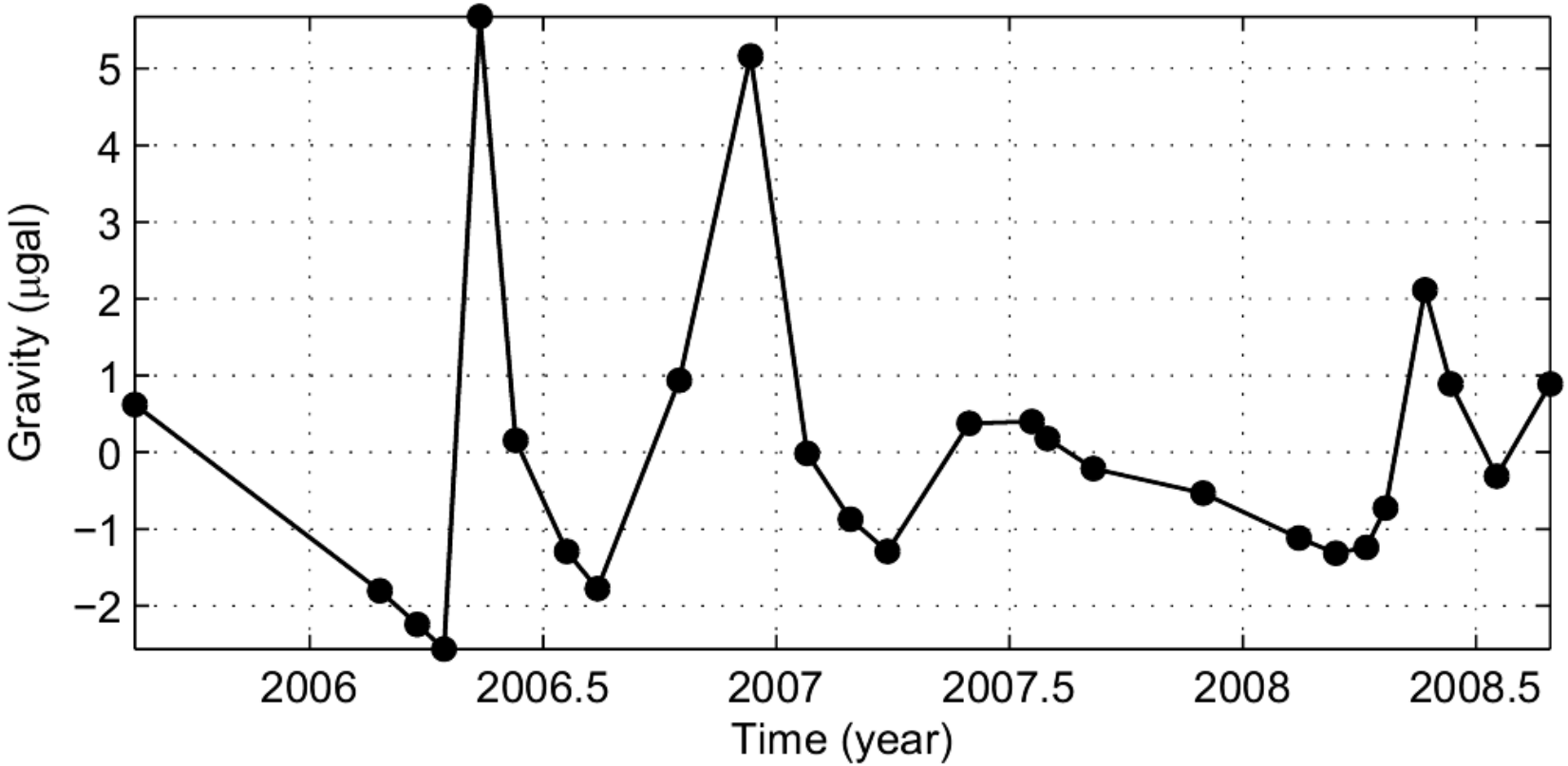
- Consider a cylinder of water
  - radius = 500 m;
  - we measure depth to water level
    - Typically 20 m; range = 3.36 m

$$gw_i = 2\pi G \rho_{water} P \cdot \left[ b + \sqrt{a^2 + (c_i - b_i)^2} - \sqrt{a^2 + c_i^2} \right]$$

- Porosity of rock P = 6% determined from no-snow data and minimized WRMS of the observed gravity series.

# The attraction from ground water

- Gravity vs. groundwater ⇒ correlation -0.16
- Data without snow cover ⇒ correlation 0.63



# Snow loading

- Newtonian attraction from local snow ($\leq$ 200 m)
- Regional effects (radius $\leq$ 200 km)
  - Attraction from the snow
  - Elastic response of the earth's surface due to the load of the snow
- Data from snow depth readings at weather stations in southern Norway
- Snow density calculated from 1km x 1km gridded data by NVE (water directorate)

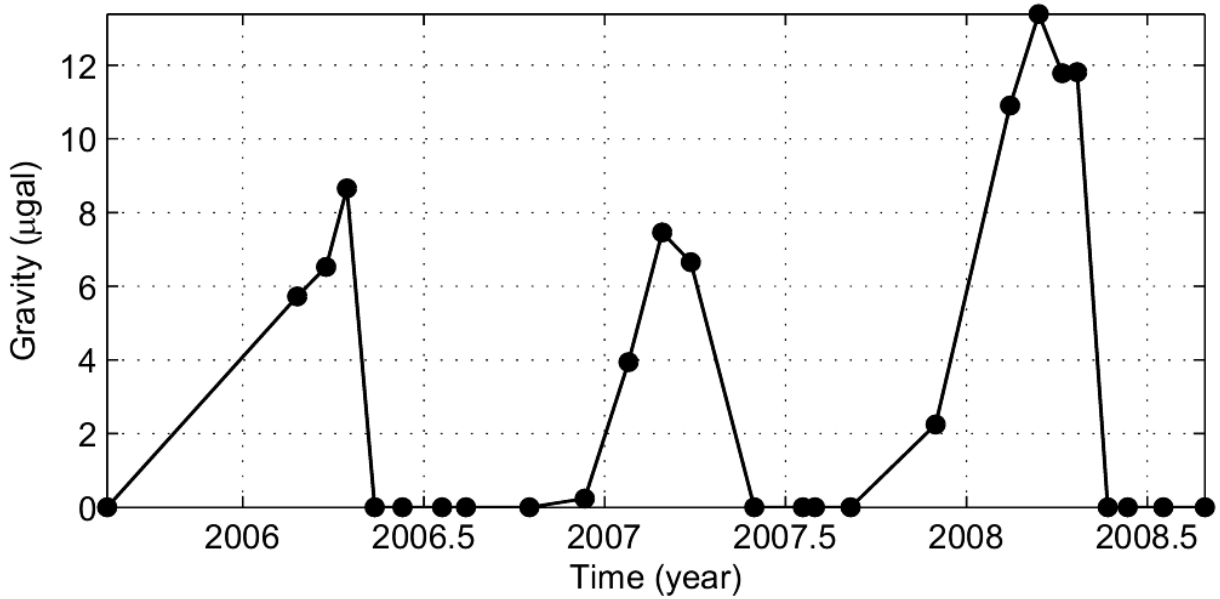
# Attraction from local snow

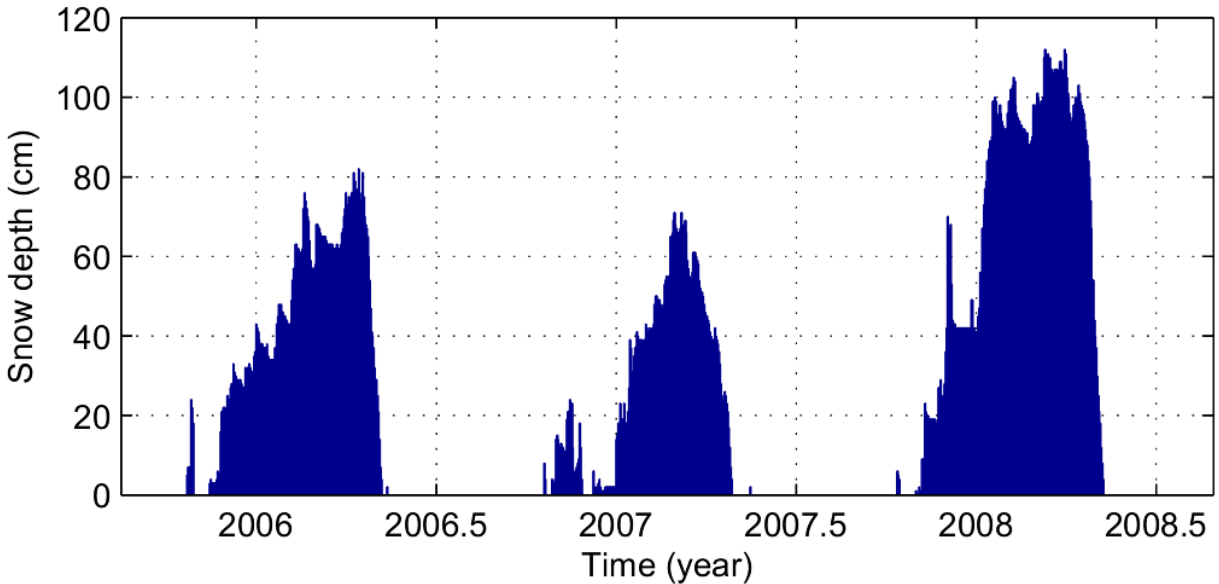
- A Digital Terrain Model was established by GPS-measurements out to 200 m
  - Spacial resolution 1m x 1m
  - The height was calculated at each grid point
  - A rectangular prism was formed around each grid point
- The vertical component of the gravitational force from a prism j at time i

$$sl_{i,j} = G \frac{m_{i,j}}{l_j^3} \cdot \left(h_j - h_0\right)$$

Summing over all prisms gives the total gravitational effect of the local snow at time i

# Attraction from local snow

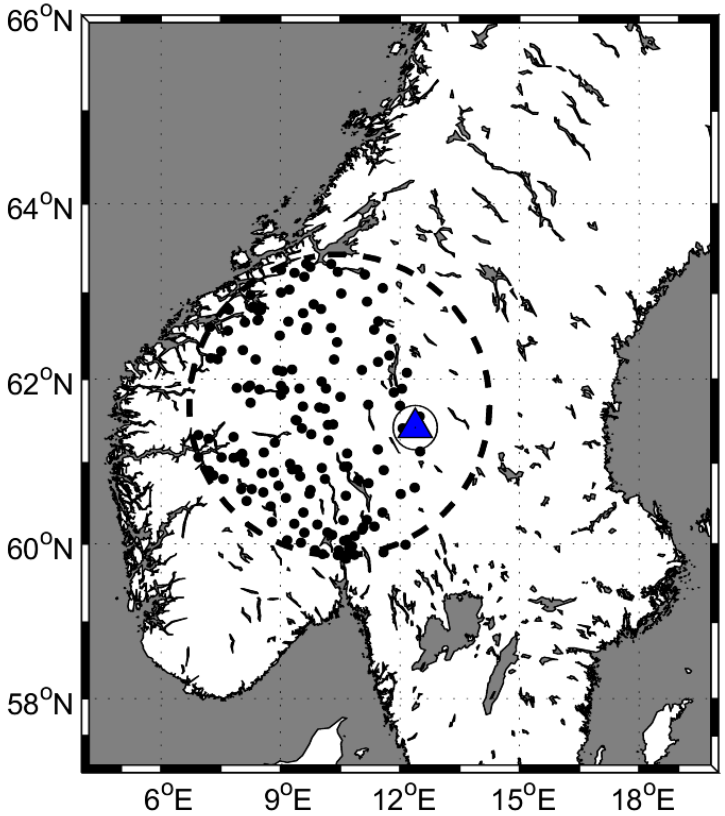


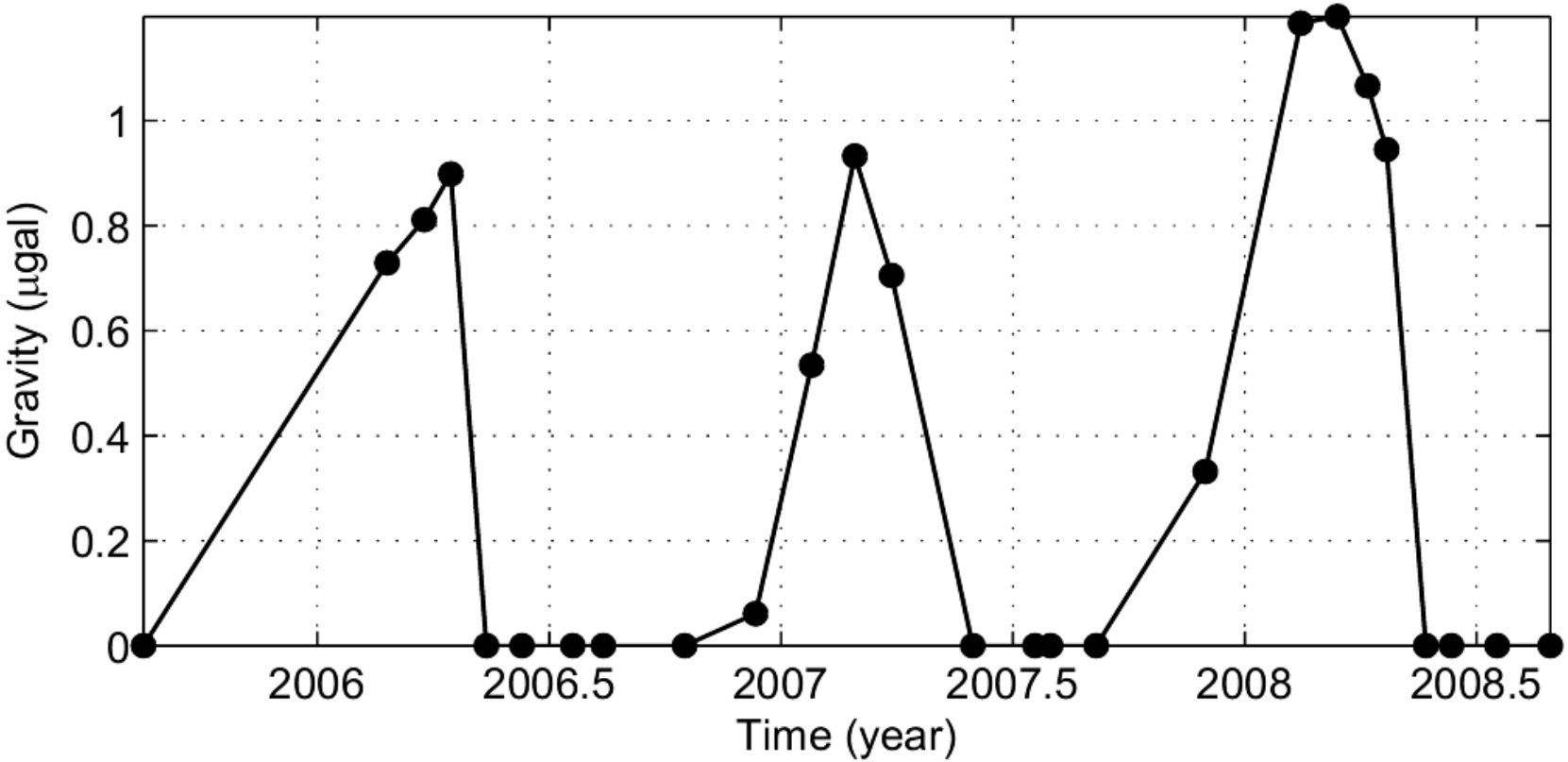
# Regional snow loading

- Green's function approch

$$sr_i = \sum_j G(\psi_j) m_{i,j}$$

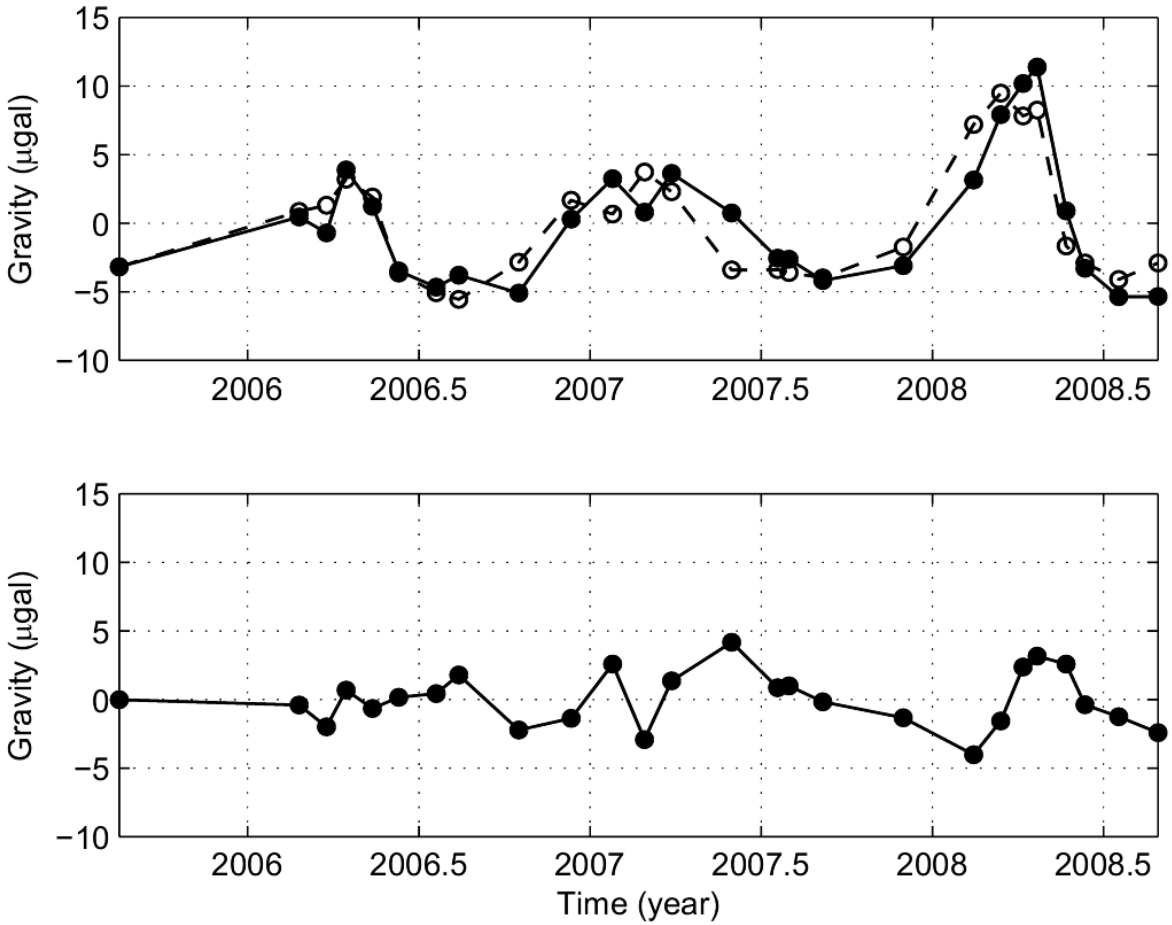


# Regional snow loading



# Observations and model

- Remove linear trend from gravity time series using no-snow data only
- Compare to model (water + snow)
- Model recreates overall pattern of observed gravity time seris (corr=0.90)




Model reduces wrms of gravity series from 7.2 µGal to 2.8 µGal.

58% is due to snow model; 90% of that is local snow model