



The sensitivity of GNSS measurements in Fennoscandia to distinct three-dimensional upper-mantle structures

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This poster will present the results of Steffen & Wu (2014).

The sensitivity of GNSS measurements in Fennoscandia to nearby viscosity variations in the upper mantle is investigated using a three-dimensional finite element model of glacial isostatic adjustment (GIA). Based on the lateral viscosity structure inferred from seismic tomography and the location of the ice margin at the last glacial maximum (LGM), the GIA earth model is subdivided into four layers, where each of them contains an amalgamation of about 20 blocks of different shapes in the central area. The sensitivity kernels of the three velocity components at 10 selected GNSS stations are then computed for all the blocks.

We find that GNSS stations within the formerly glaciated area are most sensitive to mantle viscosities below and in its near proximity, i.e. within about 250 km in general. However, this can be as large as 1000 km if the stations lie near the center of uplift. The sensitivity of all stations to regions outside the ice margin during the LGM is generally negligible. In addition, it is shown that prominent structures in the second (250–450 km depth) and third layers (450–550 km depth) of the upper mantle may be readily detected by GNSS measurements, while the viscosity in the first mantle layer below the lithosphere (70–250 km depth) along the Norwegian coast, which is related to lateral lithospheric thickness variation there, can also be detected but with limited sensitivity.

For future investigations on the lateral viscosity structure, preference should be on GNSS stations within the LGM ice margin. But these stations can be grouped into clusters to improve the inference of viscosity in a specific area. However, the GNSS measurements used in such inversion should be weighted according to their sensitivity. Such weighting should also be applied when they are used in combination with other GIA data (e.g., relative sea-level and gravity data) for the inference of mantle viscosity.

Reference:

Steffen, H. and Wu, P.: The sensitivity of GNSS measurements in Fennoscandia to distinct three-dimensional upper-mantle structures, *Solid Earth*, 5, 557-567, doi:10.5194/se-5-557-2014, 2014.