Notes on Paper: Impact of uncertainties of GOCE gravity model on crustal thickness estimates – M van der Meijde (2020)

Introduction-

* GOCE issues due to disparities in resolution between urban and rural areas, linked to volume of terrestrial data collected.
* Advantage of full covariance matrices is that they enable to properly reflect spatially varying errors due to different data quality or observation geometries.
* Most Moho estimate approaches are purely mathematical and only a few are based on actual validation using estimates from other sources and/or expert knowledge.
* Uncertainty estimates for derivation of the depth of the Moho discontinuity vary therefore widely, ranging from around 1km, or less, for mathematical estimates, up to 6km, or more, in case of validation with other Earth science-based observations.
* Most studies give a single value for the uncertainty, independent of the location of the estimate and the data models used. Few provide a spatial estimate of the variability of the Moho models.
* It might be very tricky to make a full uncertainty estimate of the depth of the Moho discontinuity due to the variable input models, different inversion techniques, and the inherent non-uniqueness of the inversion of gravity data.

Data and Methods-

* GOCE TIM5 release is a set of spherical harmonic coefficients parametrizing the global gravity field up to SH degree 280, and the corresponding uncertainty estimates in terms of the full covariance matrix.
* The inversion results in a simple two-layer model with Moho topography ad the interface and assumes that the entire gravity signal is caused by Moho topography. The effects of surface topography have been removed by a Bouguer correction and this correction has also been applied for sediment basins.
* Maybe ask to read Van der Meijde (2013) paper

Results and Discussion-

* Error realizations have been added to the gravity field and then inverted for crustal thickness. The model differences are, generally very smooth and show a clear gradient over the continent. This gradient is not directly a result of the error realizations but show the impact of these error variations fitting of the Fourier surface through the data and is therefore directly related to the modelling approach used.
* Alternative modelling approaches will most likely not show this same pattern but something that fits with the chosen modelling approach for these studies.
* Have both commission and omission errors, that is the omitted high-frequency signals that are not observed by gravity missions due to limited spatial resolution.
* Observed that the total absolute maximum sensor error can contribute up to 5% of the gravity signal, but in most cases 2% or less.