Geophysical Research Abstracts
Vol. 14, EGU2012-9894, 2012
EGU General Assembly 2012

Using GPS and GRACE data to assess Solid Earth elastic parameters at regional scale.

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We propose a way to combine GPS and GRACE data for regional scale cross check and validation especially of the most commonly used PREM (Preliminary Earth Reference Model). In form of h and k Love numbers, global PREM is very often used to simulate elastic rebound due to present-day ice mass loss, to derive the mass distribution produced by the observed GRACE time series, and it is also used for atmospheric loading correction both in GPS and in GRACE dealiasing products.
GRACE data provide load estimates, usually given as water equivalent mass distribution, from which one derives the Earth elastic response, by convolution with suitable elastic green functions, relying on selected Earth model and related layering and elastic parameters. We calculate at regional scale the time series of monthly uplift associated with the mass redistribution observed by GRACE implementing the high resolution technique previously tested and used in literature to calculate uplift over the Alps caused by glacier shrinkage.
By comparing the periodic signal coming from GPS vertical time series with the uplift signal generated by the monthly mass distribution from GRACE data, we find a very good correlation for the majority of the GPS stations. Remarkably, we find that the calculated uplift shows periodic behaviours with amplitudes that match those of the GPS stations, depending on the Earth model used and especially on the elastic parameters of the mantle.
We tested this method over the region of the European Alps and we show that global PREM, in that region, produces simulated uplift which overestimates the observed amplitude by 60%.
So, by tuning the elastic parameters of the mantle we derive a more suitable regional Earth model for the Alps. The same approach can be applied in all those other regions, such as Greenland and Antarctica, where mass balance is of critical importance.