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Global 3-d weather models for the atmospheric correction of gravity time series

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The use of 3-dimensional weather models allows for an effective reduction of atmospheric effects in gravity time series. In the past the BKG service Atmacs (Atmospheric Attraction Computation Service) provided 3-d atmospheric correction time series only for European stations of the International Geodynamics and Earth Tide Service (IGETS, formerly Global Geodynamics Project, GGP), which are based on the high resolution regional model COSMO-EU of the German Weather Service (DWD).

The provision of 3-d density data from the global weather models GME (20 km resolution) and most recently ICON (13 km resolution) by the DWD now allows the computation of 3-d atmospheric correction time series for all IGETS stations worldwide. Due to the triangular grid structure, a different procedure for mass elements close to the computation point is necessary. By increasing the spatial resolution towards the computation point by linear interpolation of the grid values, the use of a point mass approach became possible with an approximation error below 0.3 nm/s^2. This approach also allows to consider horizontal density gradients and a tilted model surface of the innermost cells.

By means of a variance reduction at different frequency bands a significant improvement of the atmospheric correction can be demonstrated at many IGETS stations.

The limited temporal resolution of recently 3 hours can be improved by the user by including local air pressure records using a remove-restore technique. Atmospheric correction time series are online available at http://atmacs.bkg.bund.de.