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# Improving the Long-Term Stability of Atmospheric Surface Deformation Predictions by Mitigating the Effects of Orography Updates in Operational Weather Forecast Models

Robert Dill, Inga Bergmann-Wolf, Maik Thomas, and Henryk Dobslaw
GFZ, Helmholtz Centre Potsdam, 1.3 Earth System Modelling, Potsdam, Germany (dill@gfz-potsdam.de)

The global numerical weather prediction model routinely operated at the European Centre for Medium-Range Weather Forecasts (ECMWF) is typically updated about two times a year to incorporate the most recent improvements in the numerical scheme, the physical model or the data assimilation procedures into the system for steadily improving daily weather forecasting quality. Even though such changes frequently affect the long-term stability of meteorological quantities, data from the ECMWF deterministic model is often preferred over alternatively available atmospheric re-analyses due to both the availability of the data in near real-time and the substantially higher spatial resolution.
However, global surface pressure time-series, which are crucial for the interpretation of geodetic observables, such as Earth rotation, surface deformation, and the Earth's gravity field, are in particular affected by changes in the surface orography of the model associated with every major change in horizontal resolution happened, e.g., in February 2006, January 2010, and May 2015 in case of the ECMWF operational model.
In this contribution, we present an algorithm to harmonize surface pressure time-series from the operational ECMWF model by projecting them onto a time-invariant reference topography under consideration of the time-variable atmospheric density structure. The effectiveness of the method will be assessed globally in terms of pressure anomalies. In addition, we will discuss the impact of the method on predictions of crustal deformations based on ECMWF input, which have been recently made available by GFZ Potsdam.