Geophysical Research Abstracts
Vol. 13, EGU2011-6385-1, 2011
EGU General Assembly 2011

Issues related to the computation of atmospheric de-aliasing products

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Satellite missions which explore the Earth gravity field require the removal of short term mass variations in the atmosphere, because these mass changes cause time variant gravity field forces acting on the orbiting satellites. The determination of accurate atmospheric gravity field coefficients (AGC) is indispensable to avoid aliasing effects, thus the known part of the mass variations has to be modeled and corrected with respect to the mean state. In this study we apply new methods for the determination of the AGC, focusing on the vertical distribution of the density in the atmosphere. We use pressure level and surface pressure data from the European Centre for Medium-Range Weather Forecasts (ECMWF), reduced to the ETOPO5 topography to obtain a stable and consistent reference surface for all datasets. EGM96 is introduced to overcome some otherwise necessary assumptions regarding the gravity field of the solid Earth, and a 2D-reference atmosphere was realized with ERA40 data for the ETOPO5 topography.

To calculate the AGC the vertical integration-approach is widely used, which implies big demands on data storage and CPU capacity. On the other hand the surface pressure approach is fast and only one field has to be stored, but it does not meet the accuracy requirements of modern satellite missions. Therefore we developed a third method using the surface pressure and the centre of mass of the actual atmospheric column, which leads to an improvement of about 40% at the second degree, smaller improvements about some percentages at low and high degrees, but no improvement in middle degrees. Further developments and improvements of this method are presented.