



## **Influence of the atmosphere on the evaluation of the geopotential from global models on the surface of the Earth: implications for the realization of a World Height System**

Jaakko Mäkinen

Finnish Geospatial Research Institute FGI, Department of Geodesy and Geodynamics, Masala, Finland  
(jaakko.i.s.makinen@gmail.com)

Outside the atmosphere, the potential of a standard atmosphere can with high accuracy be approximated with the potential of a surface layer with the same mass, independently of the scale height of the atmosphere. Not so when the potential is evaluated on the surface of the Earth. In a spherically symmetric approximation and assuming a scale height of 7.6 km, the potential at zero height is in a back-of-the-envelope calculation 0.12 percent less than the potential of the surface layer. This corresponds to a difference of -1.2 ppb in the total geopotential evaluated on the surface of the Earth, the equivalent of a difference of +8 mm in height. Using a realistic atmospheric and Earth model, the difference is not constant. This has obvious implications for the geopotential values associated with a World Height System. The question has in fact already been extensively analyzed in the context of geoid determination.