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Employing data from Numerical Weather Models in Space Geodesy

Daniel Landskron, Janina Boisits, and Johannes Böhm
Vienna University of Technology, Wien, Austria (daniel.landskron@geo.tuwien.ac.at)

Numerical Weather Models (NWMs) have become an important tool for understanding and quantifying the influence of the troposphere on electromagnetic signals. On their way from space through the lowest layer of the Earth's atmosphere, electromagnetic signals are delayed and bent as a result of their interaction with dry gases and water particles. Thus, the troposphere represents a significant error source in modeling the signal propagation, which is absolutely necessary for gaining the highest-possible precision of space geodetic techniques.

In this presentation, we will give a general overview on how TU Wien utilizes the information of NWMs by the ECMWF in order to design correction models for the tropospheric delay of space geodetic measurements. Since the emergence of the Vienna Mapping Functions 1 (VMF1) and the Global Mapping Functions (GMF) in 2006, many new and refined models relying on NWM information have been developed at TU Wien, peaking at the publication of the Vienna Mapping Functions 3 (VMF3) and Global Pressure and Temperature (GPT3) this year. All these models are tailored for techniques measuring in the radio wave spectrum, such as Global Navigation Satellite Systems (GNSS), Very Long Baseline Interferometry (VLBI) or Doppler Orbitography and Radiopositioning Integrated by Satellite (DORIS). Recently, however, a new model referred to as VMF3 optical (VMF3o) has been developed for modeling the impact of the troposphere on Satellite Laser Ranging (SLR) measurements, a space geodetic technique measuring with visible light.

How is the information from the NWMs condensed into the models? How can these models be used? What is the difference between them? Which model is most suitable for which purpose? This presentation is about to give current and potential future users a guideline on the purpose and the importance of troposphere delay modeling using information from NWMs in the analysis of space geodetic techniques.