

# Assimilation of GNSS Zenith Total Delay in NAVGEM

Christophersen, Hui<sup>1</sup>; Ruston, Ben<sup>2</sup>; Baker, Nancy<sup>1</sup>

<sup>1</sup> U.S. Naval Research Laboratory, United States of America

<sup>2</sup> Joint Center for Satellite Data Assimilation (JCSDA) at the University Corporation Atmospheric Research (UCAR)

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## Abstract

A new data source from ground-based stations which track global navigation satellite system (GNSS) transmitters has been implemented in the Navy Global Environmental Model (NAVGEM) NRL Atmospheric Variational Data Assimilation System-Accelerated Representer (NAVDAS-AR) system. The observable is the ground-based zenith total delay (ZTD) at each ground station. This ground-based GNSS ZTD represents the tropospheric delay by the propagation of Global Positioning System (GPS) radio L-band signal between the transmitters and the ground stations after correcting for ionospheric effects. The ZTD observation predominantly depends on surface pressure and total precipitable water (TPW) above a ground station. Here, we present the implementation procedure, quality control, single observation test, bias correction scheme and data impact assessment. One of the critical elements in the quality control scheme is to correct for the difference between the observing ground station elevation and the numerical model terrain. A single observation test shows suitable impact that would be expected from this new data source. The ZTD biases are estimated from a six-month experiment run and are generally small in magnitude. The forecast sensitivity to observation impact (FSOI) diagnosis from a three-month experiment shows that the ZTD data, particularly per observation, is impactful. The ZTD data also improves the forecast skill in the Southern Hemisphere beyond three days.