Geophysical Research Abstracts
Vol. 19, EGU2017-963, 2017
EGU General Assembly 2017

Comparison of GNSS integrated water vapor and NWM reanalysis data over Central and South America

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Integrated water vapor (IWV) derived from Global Navigation Satellite Systems (GNSS) and Numerical Weather Models (NWM) reanalysis data were compared in order to assess the consistency between the different datasets over the extended geographical region of Central and South America. The investigation was performed for the seven-year period between 2007 and 2013. We analyzed two different reanalysis: the European Centre for Medium-Range Weather Forecast (ECMWF) reanalysis data (ERA Interim) and the Modern-Era Retrospective analysis for Research and Applications (MERRA2) from the National Aeronautics and Space Administration (NASA). The statistical analysis of the differences was performed in 110 GNSS sites (GPS +GLONASS), although the most interesting results came from the 73 sites which have more than 5 years of data. The study of the spatial distribution of the differences in the selected area involves different climate types, from polar to tropical, and it is characterized by large temporal variability of the integrated total humidity content. The inter-comparison was also performed on several time scales: from hours to years.
In this study, not only the IWV values given by the different reanalysis where compared with the respective GNSS derived values but also the numeric integral of the IWV. This is nothing but the total vertically integrated water vapor of a unit air column each station but considering its real geopotential height. To that end, multilevel data from each reanalysis was also used.
Moreover, the scarce coverage of operational radio sounding stations is noticeable in large areas of the selected region. Hence the contribution of IWV-GNSS is essential to improve the weather understanding. Considering that the atmospheric water vapor has a highly variable and complex distribution which knowledge is essential for weather prediction and local meteorological studies, this study aims to provide IWV-GNSS observations able to be assimilated by operational weather centers for both, prediction and simulation, as well for improving regional modeling.