PRELIMINARY STUDIES OF THE APPLICATION OF GNSS TO PRECIPITATION NOWCASTING

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ABSTRACT

The presence of water vapor along the path traversed through the atmosphere by the signal from satellites of the Global Navigation Satellite System (GNSS) constellation to the ground-based receivers causes a delay in propagation which, for geodesic application, normally has to be minimized. However this delay, if estimated with relative precision, can be converted into Integrated Water Vapor (IWV) values. The most important characteristics of these values are: good quality, high temporal resolution and minimum degradation arising from the influence of clouds, rain or other weather condition. The GNSS data collected during CHUVA campaigns have permitted the building of long and uninterrupted temporal series of IWV, which have made possible the study of the application of GNSS to precipitation nowcasting in very short-term (smaller than 1 hour). This new GNSS application is based on the assumption that the IWV-GNSS series contain a signature in the signal that can be used to predict the occurrence of strong precipitation. This GNSS application require IWV values with maximum quality, consequently, several improvements in the GNSS data processing was investigated to generate the most precise IWV series during the CHUVA experiments. The IWV values from radiosondes and radiometer were used as reference

in this process. Some new methodologies were used in this process, such as suitable model of Ocean tide loading deformations effect; coefficient upgraded of the antenna phase center , station coordinate well-determined and correctly fixed. Another experiment was carried out to determine the most appropriated elevation mask of the GNSS satellite to generate the best IWV results. The results show that the 25º of elevation mask is better than low elevation, because the bias of the IWV-GNSS values decreases significantly. A new methodology of the GNSS data processing has been developed to correct the leap in the IWV series in the final of day, in which several subsequent processes are used. IWV series are compared with precipitation measurements from rain gauges and radar observations. Several manners were used to determine the precipitation series from Radar data. The results show that IWV values present the excessive increase during periods that precede strong precipitation and a temporal unconformity can be observed in the correlation coefficient between the series. The wavelet method has been used to characterize the pattern of this temporal unconformity. The aim of this work is to present the evolution of the research about this theme, and some preliminary results in each of the activities listed above will be presented and discussed.