Monitoring Water Storage Dynamics in the Brazilian Pantanal by Using Remote Sensing Data

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ABSTRACT: The Pantanal region comprises one of the largest non-forested wetland in the world. About eighty percent of the Pantanal floodplains are submerged during the rainy seasons, however the flooded area might decreases to just twenty percent of the total area of Pantanal in the dry season. This region is characterized by an active sedimentary basin with a great number of faults. Movements along these faults cause subsidence on blocks within the vast Pantanal area, generating depressions that are susceptible to flooding, and might create space for sediment storage. After a long period dominated by arid conditions in the Late Pleistocene, the Pantanal area has been subject of episodes of intense humidification and increasing fluvial discharge in the Early Holocene, which resulted in important modifications in the extant drainage system. Nowadays, this region is characterized by the occurrence of thousands of small lakes especially in the region of the Taquari Mega-fan. A few is known about the dynamics of the soil water storage within this vast region due to the lack of field sample data. However, in the last decades, advances in orbital remote sensing have provided novel information for monitoring the amount of water stored in soils, with special attention to the GRACE (Gravity Recovery and Climate Experiment) and SMAP (Soil Moisture Active Passive) satellite missions. The GRACE mission takes into account the correlation between earth's crust movement and the amount of water stored in soils, whereas the SMAP mission makes a direct correlation between a series of geophysical data from active and passive remote sensors and the water stored in soils for the first 100 cm soil depth. In this study we carried out a series of correlations between GRACE and SMAP data to evaluate the capacity of SMAP dataset in substitution of GRACE data, since the SMAP data is provided with temporal resolution of about three hours and spatial resolution of 3km, while the GRACE data has a temporal resolution of 1 month and spatial resolution of 500km. Thus, in order to compare the two databases, the SMAP images were resampled according to a 2nd degree polynomial interpolation to matches the spatial resolution of the GRACE images. We considered values measured at the same period from April 2015 to December 2015. After processing the data we obtained coefficients of correlation above 0.5 to all measured months with the lower correlation for August (0.51) and the higher correlation for December (0.95). Therefore, the movement of the crust measured in GRACE data is well correlated to the amount of water in the first 100cm. The highest values of water equivalent height (cm) and water storage were observed in April 2015 (11.8 cm and 23%, respectively), whereas the lower values where observed in September 2015 (-11.9 cm and 18%, respectively). Finally we highlight that the results presented in this research are not conclusive, however our findings gives a first indication of the potential of SMAP data on modeling soil water storage in Pantanal region.

Key Words: GRACE, SMAP, Soil Moisture, Pantanal.