Geophysical Research Abstracts
Vol. 18, EGU2016-11874, 2016
EGU General Assembly 2016

Garonne River monitoring from Signal-to-Noise Ratio data collected by a single geodetic receiver

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GNSS-Reflectometry (GNSS-R) altimetry has demonstrated a strong potential for water level monitoring through the last decades. Interference Pattern Technique (IPT) based on the analysis of the Signal-to-Noise Ratio (SNR) estimated by a GNSS receiver, presents the main advantage of being applicable everywhere by using a single geodetic antenna and a classical GNSS receiver. Such a technique has already been tested in various configurations of acquisition of surface-reflected GNSS signals with an accuracy of a few centimeters. Nevertheless, classical SNR analysis method used to estimate the variations of the reflecting surface height h(t) has a limited domain of validity due to its variation rate dh/dt(t) assumed to be negligible. In [1], authors solve this problem with a "dynamic SNR method" taking the dynamic of the surface into account to conjointly estimate h(t) and dh/dt(t) over areas characterized by high amplitudes of tides. If the performance of this dynamic SNR method is already well-established for ocean monitoring [1], it was not validated in continental areas (i.e. river monitoring).
We carried out a field study during 3 days in August and September, 2015, using a GNSS antenna to measure the water level variations in the Garonne River (France) in Podensac located 140 km downstream of the estuary mouth. In this site, the semi-diurnal tide amplitude reaches $\sim$5 m. The antenna was located $\sim$10 m above the water surface, and reflections of the GNSS electromagnetic waves on the Garonne River occur until 140 m from the antenna.
Both classical SNR method and dynamic SNR method are tested and results are compared.

[1] N. Roussel, G. Ramillien, F. Frappart, J. Darrozes, A. Gay, R. Biancale, N. Striebig, V. Hanquiez, X. Bertin, D. Allain : "Sea level monitoring and sea state estimate using a single geodetic receiver", Remote Sensing of Environment 171 (2015) 261-277.