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IPPP GPS for tracking loading deformations induced by the storm Xynthia

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Xynthia was a violent windstorm that progressed over Western Europe between the 27th of February and the 1st of March 2010. The huge low-pressure system (pressure drop of 40 mbar and storm surge of 1.5 m at La Rochelle tide gauge) crossed France from the southwest to the northeast over the course of about 20 hours. In this study, we first investigate the detailed spatial and temporal characteristics of the Xynthia storm. Then we analyse the effect of this storm on sub-daily 3D GPS (Global Positioning System) position time series computed with the iPPP (integer fixed ambiguity Precise Point Positioning) GINS-PC software method using the REPRO 2 products for about 100 stations of the French GNSS permanent network (RGP). We compare the GPS observations with the predicted time series derived from different geodynamical models for non-tidal atmospheric, oceanic and hydrological loading effects. These predicted time series are computed using different environmental data sets. For atmospheric pressure we used the ECMWF (the European Centre for Medium-Range Weather Forecasts) or MERRA (Modern-Era Retrospective Analysis for Research and Applications) pressure fields. Concerning the ocean's response we use different hypotheses such as inverse barometer (IB), non-IB or a dynamic ocean's response to winds and pressure forcing applying 2 Dimensions Gravity Waves model (MOG2D). We perform a spatial analysis to study the different behaviour of the coastal and inland sites. This study allows us to identify the ocean's dynamics on the continental shelf during the passage of this fast moving low pressure system. For comparison, these analyses are also performed for calm periods.