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GPS and DORIS evidence for a very slow subsidence of Tahiti Island

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A decade of GPS (Global Positioning System) and DORIS (Doppler Orbitography and Radiopositioning Integrated by Satellite) observations were analyzed to monitor the vertical displacement of the Tahiti Island. The local network consisted of co-located two GPS stations (THTI and TAH1) and a DORIS beacon (PAQB). While DORIS weekly series of station positions were computed by the IGN/JPL group (Institut Géographique National and the Jet Propulsion Laboratory) using GIPSY-OASIS II software, two different GPS processing modes were adopted.
In the first one, GPS data from 20 IGS (International GPS Service) stations located in and around the Pacific plate were processed using GAMIT-GLOBK software in its standard three-step approach. We estimated station coordinates, tropospheric zenith delays, horizontal gradients, and orbital and earth orientation parameters (EOP) parameters. The regional quasi-observations have been combined with quasi-observations from an analysis of GPS data from over 300 stations performed by the MIT group (Massachusetts Institute of Technology). The GPS solution was realized in a global reference frame by estimating a 14-parameter transformation between our loosely constrained GPS analysis and the known ITRF2005 positions and velocities of 46 IGS stations.
In the second one, only THTI and TAH1 data have been reduced with respect to the precise point positioning PPP mode of GIPSY-OASIS II software using the new JPL final clocks and orbits. Each daily solution was aligned to the ITRF2005 reference frame. Solid earth and polar tide corrections following the IERS Conventions 2003, ocean loading corrections using the FES2004 ocean tide model, antenna phase center models, and the Vienna Mapping Fucntion VMF were taken into account in both softwares.
Before estimating velocities, time series were cleaned to remove outliers and analyzed for their noise properties, periodic signals and earthquake and antenna jumps. The GPS and DORIS vertical velocity fields were very consistent and revealed a very slow subsidence at the level of -0.3 mm/yr which is barely significant but in a good agreement with the lower range of coral reef stratigraphy rate estimated at -0.25 mm/yr. Results were sensitive to the reference frame scale factor.