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Title: Observation of Transient Measurement with a Silica long base Tiltmeter

Abstract

Tilt measurements allow us to observe the crustal flexure which is produced by a large range of loading processes, such as hydrological or atmospheric loadings, or tectonic loading or the weight of the moving water column during tsunamis. Proposing a detailed process at the origin of transient events requires much more minute observations than are available today. Most of the predictions for the amplitude of these transient signals point out that very weak signals must be indeed detected. It is ever more difficult for the smallest events which could be numerous at depth. An instrumental resolution much better than $0.1 \mu\text{rad}$ is required at least for the strain. This is clearly out of reach for both GPS and inSAR approaches. Our objective is to obtain tiltmetric data with a resolution better or equal than $0.001 \mu\text{rad}$, and long term precision ranging from $0.1 \mu\text{rad}$ to $0.01 \mu\text{rad}$ by year. We have developed a silica long base tiltmeter to study hydrological load or pressure effect and to study the seismic cycle. We show the results of two 100 m silica water tube tiltmeters which were installed in a mine in the French Vosges massif in the framework of a hydrology research project and too tectonic research. This instruments show a remarkably good stability ($0.0065 \mu\text{rad}$ by month) and a low noise level (of the order of $0.00001 \mu\text{rad}$). Toroidal and spheroidal free modes of the Earth were observed after the two last major events on Sumatra. In the same project we installed 4 others tiltmeters stations. In the Morbihan to study the confined aquifer of Ploemeur or to study the hydrological Karst effect in the Larzac area (Herauld) or Calern (Alpes Maritimes). The Last tiltmetric station is in the North Chile in the seismic gap zone. On this station we are able to observe the tsunamis wave produced by the last Tocopilla earthquake (M7.8), many cosismic signal and we think, we are able to observe the tectonic load.