GEOEdata Data assimilation and ESTimation of references for climate change \textit{InvEstigation}. An overall presentation of the French \textit{GEODESIE} project.

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Overview

Many major indicators of climate change are monitored with space observations (sea level rise from satellite altimetry, ice melting from dedicated satellites, orbits of satellites, etc.) that only geodesy can provide. The current accuracy of these references does not permit to fully support the challenges that the constantly evolving Earth system gives rise to, and can consequently limit the accuracy of these indicators. For this reason, the framework of the Global Geodetic Observing System (GGOS) stringent requirements are fixed to the International Terrestrial Reference Frame (ITRF) for the next decade: an accuracy at the level of 1 mm and a stability at the level of 0.1 mm/yr. This means an improvement of the current quality of ITRF by a factor of 5-10.

Improving the quality of the geodetic references is an issue which requires a thorough reassessment of the methodologies involved. The most relevant and promising method to improve this quality is the direct combination (Combination at Observation Level – COL) of the space-geodetic measurements used to compute the official references of the International Earth Rotation and Reference Systems Service (IERS). The GEODESIE project aims at (i) determining highly-accurate global and consistent references (time series of Terrestrial Reference Frames and Celestial Reference Frames, of Earth’s Orientation Parameters, and orbits of Earth’s observation satellites) and (ii) providing the geophysical and climate research communities with these references, for a better estimation of geocentric sea level rise, ice mass balance and on-going climate changes. Time series of sea levels computed from altimetric data and tide gauge records with these references (orbits of satellite altimeters, Terrestrial Reference Frames and related vertical velocities of stations) will also be provided.

The geodetic references will be essential bases for Earth’s observation and monitoring to support the challenges of the century. The geocentric time series of sea levels will permit to determine highly-accurate global and consistent references (time series of Terrestrial Reference Frames and Celestial Reference Frames, of Earth’s Orientation Parameters, and orbits of Earth’s observation satellites) and (ii) providing the geophysical and climate research communities with these references, for a better estimation of geocentric sea level rise, ice mass balance and on-going climate changes. Time series of sea levels computed from altimetric data and tide gauge records with these references (orbits of satellite altimeters, Terrestrial Reference Frames and related vertical velocities of stations) will also be provided.

Geodetic references are essential, not only for the sea level rise monitoring and understanding, but also for Astronomy, Geophysics, etc.

Project Team

The team of the GEODESIE project is made of 23 people from six different institutes/laboratories.

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Objectives and Issues

The GEODESIE project aims at:

- demonstrating all the potentialities of direct combinations of space-geodetic observations to derive the geodetic references needed to support the challenges in Earth’s observation and monitoring, by taking into account all the data available since the advent of space geodesy and all the possible links between the four space-geodetic techniques (GNSS, DORIS, LRR-SLR and VLBI), in a specific data assimilation framework;
- providing references to the geophysicists, oceanographers and climate research communities;
- providing to all space-geodetic techniques (orbits, terrestrial reference frames and related vertical velocities of stations);
- strengthening the position of the team (and, by extension, of the French Group of research of geodetic space – GRUS) as an international leader expert on combinations at the observation level;
- preparing the future arrival of space missions such as GRASP and e-GRASP.

Issues that the project will address:

- Space data. All the space-geodetic data available between the beginning of the eighties and the end of 2016. Standard data models required over the whole period.
- Links between techniques and frame definition. Use of space ties provided by the multi-technique satellites. Direct usage of the data of the Inertial Measurement Units to compute local lags. Use of the new types of measurements (VLBI/BSX) for possible contribution of the GNSS to the definition of the terrestrial frames.
- Data assimilation. Method 7 Stochastic modelling/evolution 7 Data weighting 7
- Evaluation of references. Validation of all technical and scientific choices by simulations. Complete evaluation of the computed references with external data and models.

Data

The GEODESIE project is on Twitter: @GEODESIE_ANR.

The Website of the project will be available soon, through the Website of the Form@Ter solid Earth French centre, : https://www.egu2017-7742/session/g2.2/ Egugeneralassembly2017-egu2017-7742-session-g2.2