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GEOdetic Data assimilation and EStimation of references for climate change InvEstigation. An overall presentation of the French GEODESIE project

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Many major indicators of climate change are monitored with space observations (sea level rise from satellite altimetry, ice melting from dedicated satellites, etc.). This monitoring is highly dependent on references (positions and velocities of ground observing instruments, 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, in 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 better apprehend (i) the drivers of the global mean sea level rise and of regional variations of sea level and (ii) the contribution of the global climate change induced by anthropogenic greenhouse gases emissions to these drivers. All the results and computation and quality assessment reports will be available on a Website designed and opened in the Summer of 2017.

This project, supported by the French Agence Nationale de la Recherche (ANR) for the period 2017-2020, will be an unprecedented opportunity to provide the French Groupe de Recherche de Géodésie Spatiale (GRGS) with complete simulation and data processing capabilities to prepare the future arrival of space missions such as the European Geodetic Reference Antenna in SPace (E-GRASP) and to significantly contribute to the GGOS with accurate references.