Importance of the Earth-Moon system for reducing uncertainties in climate modelling and monitoring

Summary of the Proposal submitted on 10/31/2009 to Chaire Pierre de Fermat for a research project between scientists visiting hosting laboratories (LEGOS/CERFACS/CLS/Mercator) in Toulouse, Région Midi-Pyrénées, France.

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The project corresponds to the development of a new research concept in the Toulouse labs and JPL groups that have been involved for several decades now in climate monitoring from space, and in coupled modelling of the ocean/atmosphere/land/ice system. In addition to concrete applications in both disciplines that should be obtained by the end of 2011, the research tasks proposed here aim to develop teams in both countries that will share challenges and progress on this subject for longer-term collaboration.

The project corresponds to a major shift in modelling the ocean and climate evolution in order to better benefit from the ocean monitoring from satellites orbiting the Earth. The CNES/NASA altimetric missions are challenged today by the IPCC recommendations of the previous assessment report (2007) for decadal climate predictions due in 2013. Thanks to missions monitoring Ocean Vectors Winds (OVW) and Earth gravity field (GRACE), the benefit of using altimetric data to improve the modelling of climate events such as El Niño is now transformed into the need of monitoring the sea level rise due to global warming and to land/ice melting. Current altimeter missions, GRACE and scatterometric missions provide sea level, mass and OVW data sets that bear uncertainties due to the traditional assumption of separating tidal and climate signals in models. Based on results that detect the ocean/climate sensitivity to the (Moon-Earth-Sun) alignments at periods ranging from weeks to decades, the proposed tasks consist in introducing some of the luni-geo-solar forces into ocean models. Our “moon-synchronous approach” will reduce some of the major aliasing currently unresolved. Our experiments will be diagnosed by computing the 3 components of the Ocean Angular Momentum for the Length of the Day and polar motions. Introducing these forces in climate models is likely to facilitate the interhemispheric exchange of heat and salt in climate models.