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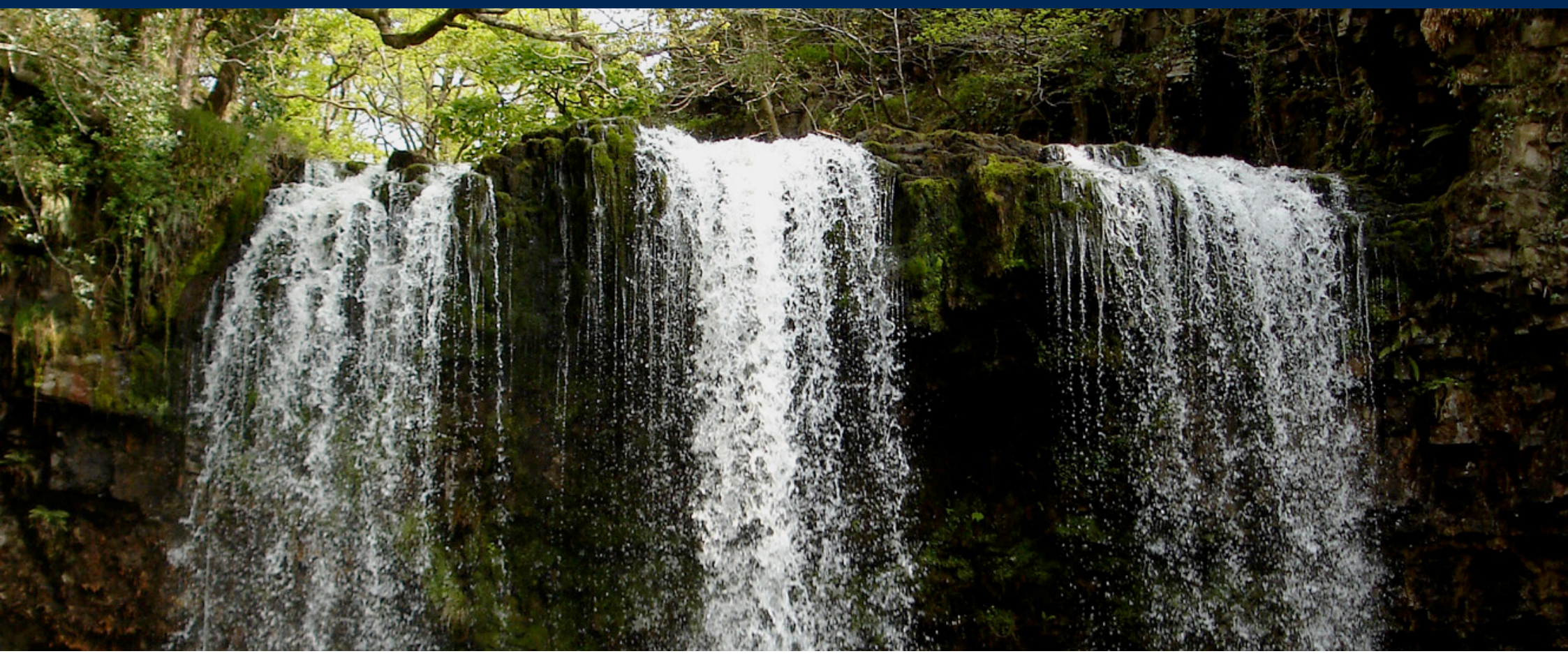

With Researchers from around the World

RA3 Zoom Series | The variability of water storage and fluxes over large tropical river basins from multi-satellite observations and their impacts on the land-ocean continuum

Speaker: Fabrice Papa, Institut de Recherche pour le Développement (IRD), LEGOS-France

Date: Tuesday, November 11th at 15h00 Stockholm time, Zoom: https://stockholmuniversity.zoom.us/j/8295564699

Terrestrial waters, despite being less than 1% of the total amount of water on Earth's ice-free land are essential for life and human environment. They play a primary role in the global water and carbon cycles, with significant impacts on climate variability. A better characterization of their distribution and dynamic over the whole globe is therefore of highest priority, including for the management of water resources. However, despite their importance, basic questions are still opened such as: what are the spatio-temporal variations of the fluxes and storages of continental freshwater across scales and how do they interact with climate and the anthropogenic pressure? Those questions are specifically important for the Tropics which are now facing growing demands for freshwater availability. Firstly, using multi-satellite observation techniques, we will quantify the global variations of monthly surface water extent (at 25km spatial resolution) over ~25 years (1992–2015) and assess their recent changes both in terms of climate variability and anthropogenic pressure. For large river such as the Amazon, the Ganges-Brahmaputra (G-B) or the Congo, we further combined our surface water extent estimates with hundreds of radar altimeter-derived water level time-series and DEM data to derive the spatio-temporal variability of surface freshwater storage (SWS). Over the Amazon for instance, we show that the annual amplitude of SWS variations is of ~1,200km^3 and contributes to ~50% of the Gravity Recovery And Climate Experiment (GRACE)-derived total water storage variations (TWS). During the 2005 exceptional drought, we estimate that the SWS deficit over the entire Amazon basin in October was about 70% as compared to other years. While over G-B we found similar contributions of mean annual variation in SWS to TWS as for the Amazon, over the Congo this contribution is smaller, around 20%. Over the Amazon, the SSW variations are then used to decompose the GRACE-derived TWS and to isolate the variations groundwater storage and show that it contribute to ~30% of GRACE-derived (TWS).

Additionally, using radar altimetry observations, we quantify for these large rivers their long term discharge, providing an unprecedented sources of information on the dynamic of the fresh water fluxes to the ocean. We will illustrate the impacts of G-B and Irrawaddy rivers on the Bay of Bengal ocean dynamic.

Finally, we will discuss the future of hydrology from space with the launch in 2022 of the Surface Water and Ocean Topography (SWOT, NASA-CNES) satellite, which in synergy with the current deployment of the COPERNICUS Sentinel program, will offer an unprecedented view of continental freshwater dynamic on Earth.

Dr Fabrice Papa is a research Director at the Institut de Recherche pour le Développement (IRD-LEGOS, France) and has focused his research on satellite remote sensing of the Earth and its application to study the global water cycle. His main interests are the use of multi-satellite observations to understand continental hydrology and its interactions with the ocean, climate variability and global changes, particularly in tropical regions. He is a member of the Science Team (ST) of the NASA-CNES satellite Surface Water and Ocean Topography (SWOT) and co-leads the SWOT Working Group on River Science. After receiving his PhD from the University of Toulouse, France in 2003, he was employed at the NASA-GISS laboratory at Columbia University, NY, USA until 2010, when he joined IRD. From 2012 to 2017, he was on deputation at the IRD-IISc Joint International Laboratory in Bangalore, India. He is currently on IRD deputation at the University of Brasilia in Brazil.

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