Opportunity Title: Global River Modeling and Data Assimilation
Opportunity Reference Code: 0168-NPP-NOV23-JPL-EarthSci

Organization National Aeronautics and Space Administration (NASA)

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Application Deadline 11/1/2023 6:00:59 PM Eastern Time Zone

Description The observation of rivers from space has benefitted from over 25 consecutive years of nadir altimetry observations. Past satellite missions include joint NASA and CNES (the French space agency) efforts such as TOPEX/Poseidon (1992-2006) (Fu et al., 1994) and its sister missions Jason-1 (2001-2013) (Ménard et al., 2003), Jason 2 (2008-current) (Lambin et al., 2010), and Jason-3 (2016-current) (Dumont et al., 2016). The separate series of nadir altimetry missions from the European Space Agency (ESA) consisting of ERS-1 (1991-2000), ERS-2 (1995-2011), EnviSat (2002-2012), and Sentinel-3 (2016-current) have similarly contributed to the observation of terrestrial hydrologic features (Donlon et al., 2012). Interestingly, all of these missions were initially designed to observe ocean topography, not rivers and lakes. However, because of its technological capabilities, nadir altimetry has also allowed for the estimation of water heights in continental hydrologic features when the satellites ground tracks intersect with the largest rivers. Such locations are often referred to as virtual gauges and measured water heights have traditionally been used with stage-discharge relationships to estimate river flow. Note that these virtual gauges of rivers and lakes have all been merely by-products of oceanography missions. The Surface Water and Ocean Topography (SWOT) mission (Alsdorf et al., 2007; Biancamaria et al., 2016), currently scheduled for launch in April 2021, is a joint pathfinder effort between the oceanography and hydrology communities, and is expected to observe unprecedented two-dimensional images of the location and height of terrestrial water bodies with a large increase in spatial resolution and in temporal frequency, a clear step forward compared to existing nadir altimetry missions. However, recent research has revealed limitations in our ability to compute accurate spatial and temporal averages in river height and discharge from the traditional NASA Level 2 remote sensing data products that provide hydrologic estimates only at times and locations of the satellite measurements. This limitation not only applies to the expected measurements of SWOT, it also inhibits the utility of past nadir altimetry data. We have also developed a suite of relevant capabilities - e.g. high-performance river models with uncertainty quantification - for the creation of new algorithms using data assimilation (Level 4) and in doing so, we have demonstrated a positive impact on data product quality. Here we encourage applicants to NASA's Postdoctoral Program to propose innovative research ideas to advance three major connected research efforts: 1) the development of new Level 4 algorithms using data assimilation to fill in the blanks in space and in time between remotely sensed estimates of surface water while decreasing uncertainty, 2) the global application of such new algorithms to existing and upcoming space-based estimates of surface water height and flow, and 3) the quantification of the value of such Level 4 algorithms with respect to the traditional Level 2 algorithms that only provide hydrologic estimates at the times and

locations of remote sensing retrievals. Note that we promote the use and development of NASA's existing software, including the RAPID river routing model (David et al., 2011, 2016) (https://github.com/c-h-david/rapid and its associated pre/post-processing toolbox (https://github.com/c-h-david/rrr). The successful NPP candidate(s) will work together with Dr. Cédric H. David and other members of JPL's Terrestrial Hydrology group to develop new capabilities resulting in publications in the open literature.

References:

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Location:
Jet Propulsion Laboratory
Pasadena, California

Field of Science: Earth Science

Advisors:
Cedric H. David

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Applications with citizens from Designated Countries will not be accepted at this time, unless they are Legal Permanent Residents of the United States. A complete list of Designated Countries can be found at: https://www.nasa.gov/oiir/export-control.

Eligibility is currently open to:

- U.S. Citizens;
- U.S. Lawful Permanent Residents (LPR);
- Foreign Nationals eligible for an Exchange Visitor J-1 visa status; and,
- Applicants for LPR, asylees, or refugees in the U.S. at the time of application with 1) a valid EAD card and 2) I-485 or I-589 forms in pending status

Eligibility Requirements

- **Degree:** Doctoral Degree.