Geophysical Research Abstracts
Vol. 21, EGU2019-18810, 2019
EGU General Assembly 2019

Global High-resolution River Discharge Modeling for SWOT Mission: Long-term Analysis and Near Real-time Implementation

Peirong Lin (1), Hylke Beck (1), Yuan Yang (2), Colby Fisher (1), Dai Yamazaki (3), Michael Durand (4), Renato Frasson (4), Cedric David (5), Tamlin Pavelsky (6), Colin Gleason (7), Konstantinos Andreadis (7), Eric Wood (1), and Ming Pan (1)

(1) Department of Civil and Environmental Engineering, Princeton University, Princeton, New Jersey, USA, (2) 2State Key Laboratory of Hydroscience and Engineering, Depart of Hydraulic Engineering, Tsinghua University, Beijing, China, (3) Institute of Industrial Science, The University of Tokyo, Tokyo, Japan, (4) School of Earth Sciences, The Ohio State University, Columbus, Ohio, USA, (5) Jet Propulsion Laboratory, California Institute of Technology, Pasadena, California, USA, (6) Department of Geological Sciences, University of North Carolina Chapel Hill, North Carolina, USA, (7) Department of Civil and Environmental Engineering, University of Massachusetts, Amherst, Massachusetts, USA

The Surface Water and Ocean Topography (SWOT) mission is expected to revolutionize river discharge estimation globally and a series of discharge algorithms have been developed to retrieve discharge from interferometer measurements. Due to the nature of the estimation problem (e.g. unknown channel geometry), the skill of these discharge algorithms will strongly depend on the quality of the a priori discharge that is estimated separately. Therefore, building a global best-quality a priori discharge database is critically important and urgently needed for the mission.

However, spatio-temporally continuous global river discharge across the full spectrum of stream orders remains poorly constrained, despite a long history of gauging and modeling. Here we present a carefully designed large-scale hydrologic/hydrodynamic modeling effort (VIC/RAPID) to estimate global discharge at very high resolutions:

(1) The 0.1° global precipitation forcing (MSWEP V2.1, recently published) optimally combines gauge-, reanalysis-, and satellite-based data. (2) A set of global runoff characteristics maps (i.e. runoff at various exceedance probability percentiles) trained from machine learning are used to constrain model runoff estimation in two ways: model parameter calibration and percentile-wise bias correction. (3) The underlying hydrography for river routing, including 2.94 million river flowlines and unit catchments, is derived from the most comprehensively corrected global 3 arc-second (∼90 m) MERIT-Hydro product.

The modeling results over the historical period (35+ years) are evaluated against >14,000 gauges globally, showing that 32% (64%) of them have a Kling-Gupta Efficiency (KGE) ≥0.6 (0.2), and 34% have a percentage bias within ±20%. The data record, albeit with local uncertainties, represents the best-constrained global river discharge simulation using the state-of-the-art datasets and modeling practice. Near real-time implementation of this a priori discharge estimation system is being developed and tested for the production phase of the SWOT mission.