National Aeronautics and Space Administration

Postdoc Research

Cloud-based Global River Modeling in the SWOT Era

Author: Manu Tom, JPL Postdoctoral Fellow (329F)
Advisor: Cedric David (329F)
Collaborators: Kevin Marlis (398F), Thomas Huang (398F), Arnaud Cerbelaud (329F), Jeffrey Wade (329F)

Background

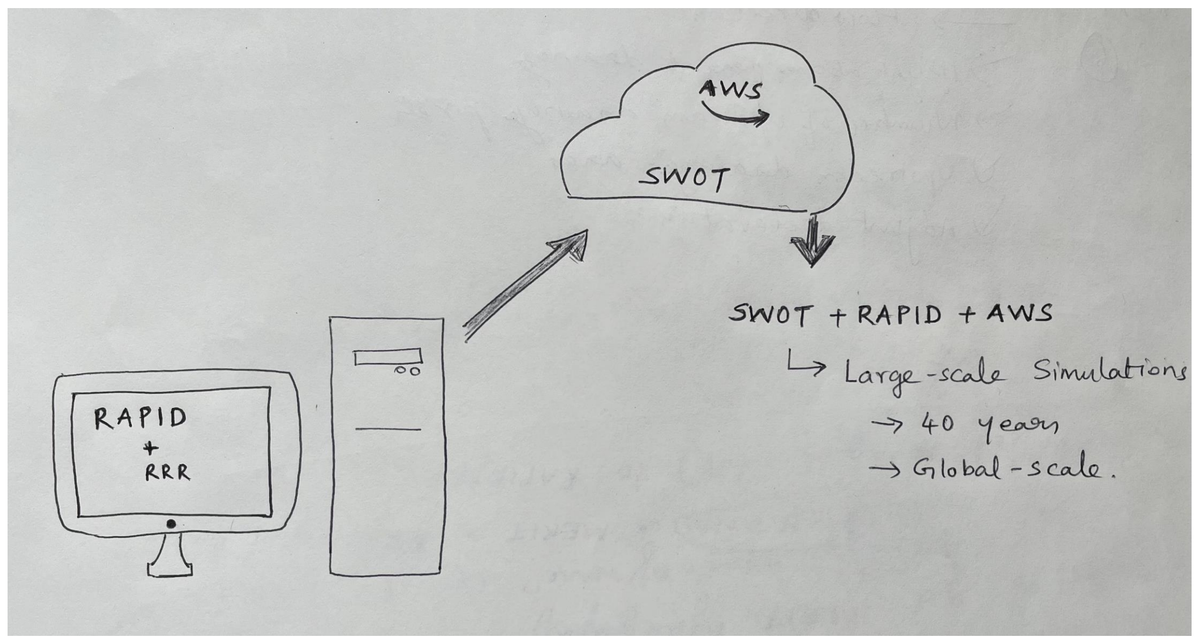
- Recent satellite missions such as Surface Water and Ocean topography (SWOT) delivered massive data volumes to Earth science community: SWOT is expected to transform both oceanography and hydrology
- This sheer amount of data and the need for planet-scale simulations has necessitated the migration and storage of data to cloud-based computing platforms

Objectives

SWOT data and model under one roof:
Deployment of analytical systems closer to the petabytes of data available in the cloud for the development of Earth system digital twins aimed at addressing global-scale scientific questions

Approach and Results

- We target to deploy the NASA RAPID (Routing Application for Parallel computation of Discharge) river model in the Amazon Web Services (AWS) framework where the SWOT data resides
- River discharge will not be directly measured by SWOT, and instead be estimated from the direct observables: river width, water surface elevation, water surface slope
- Global-scale analysis (4 decades)



Significance of Results/Benefits to NASA/JPL

- SWOT river discharge is expected to have significant impact on water cycle studies, water resources management, water-related disaster mitigation, water quality monitoring, and climate change & biodiversity studies
- Our investigation will underline the combined advantages of open-source development, containerization techniques, and streamlining of intricate data processing workflows. These elements collectively pave the way for providing NASA-scale river modeling as a cloud-based service

Future Work

Improving global a priori river discharge for SWOT hydrology: Largest source of SWOT discharge bias is the first guess in river discharge

- Fine historical modeling, and near real-time concurrent modeling to improve SWOT priors (and reduce SWOT discharge bias)
- Development and validation of a numerical system for more accurate discharge priors in support of SWOT

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Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

www.nasa.gov

Clearance Number: CL#00-0000

Poster Number: PRD-E-027

Publications and Acknowledgements:

Manu Tom, Cedric David, Kevin Marlis, and Thomas Huang, Cloud-based Global River Modeling in the SWOT Age, submitted to *AGU Chapman Conference: Remote Sensing of the Water Cycle: Sensors to Science to Society*, Hawaii, Feb 2024

Cedric David, **Manu Tom**, Kevin Marlis, and Thomas Huang, River modeling as a service on the cloud in support of digital twins for Earth's rivers in the era of SWOT, submitted to *AGU Fall Meeting*, San Francisco, Dec 2023

Author Contact Information: ***626-786-1609, manu.tom@jpl.nasa.gov***