Early results from LakeFlow: an algorithm to integrate lakes into river discharge estimates

George Allen, Jida Wang, Huilin Gao, Ryan Riggs, Craig Brinkerhoff, Katie McQuillan, Safat Sikder

LakeFlow uses river-lake mass conservation to estimate river inflows and outflows of lakes

 $\delta V = Q_{in} - Q_{out} + \frac{Q_l}{E} - \frac{E}{E}$

- δV change in lake volume
- Q_{in} lake inflow
- Q_{out} lake outflow
- Q_l lake lateral inflow (modeled)
- *E* evaporation (modeled)

- ${\boldsymbol{\mathcal{Q}}}$ River discharge
- *V* Lake storage *i* Lake inflow
- o Lake outflow
- *n* Manning's hydraulic roughness
- A_o Unobserved cross-section area
- W River width (wetted)
- S Hydraulic slope
- E Lake evaporation
- *l* Lake lateral inflow



Riggs et al. (2023) Geophys. Res. Lett.



Modified from Durand et al. (2023) Wat. Resour. Res.

Testing LakeFlow using 1-day orbit SWOT data

- First results on the Connecticut River Reservoir, MA during April 2023
- SWOT input:
 - Rivers (lake inflows & outflows): slope, width, wse, d_x_sec_area
 pulled from hydrocron
 - Lakes: wse, area, d_storage
 downloaded manually
- Other inputs:
 - Lake evaporation (DLEM, Zhao et al., 2024)
 - Lateral inflow (GEOGLOWS, Sanchez et al. 2021)
 - SWORD priors: *n*, median *Q*
- LakeFlow outputs:
 - Inflows
 - Outflows



Connecticut River Reservoir, MA





Testing LakeFlow using 1-day orbit SWOT data



Outflow

Discharge (cms)

Testing LakeFlow using 21-day SWOT orbit data



