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How well can we estimate the water and energy budgets across northern Eurasia?

T.J. Troy, E.F. Wood, and J. Sheffield

Princeton University, Department of Civil and Environmental Engineering, Princeton, NJ, United States (tjtroy@princeton.edu)

A major goal of the Northern Eurasia Earth Science Partnership Initiative (NEESPI) project is quantifying the seasonal mean cycle and interannual variability of the water and energy cycles across northern Eurasia. Significant uncertainties exist in such a quantification, in large part due to the sparseness of the in situ observational network. The spatial limitations of the in situ observational network can be bridged through the use of hydrological models, global reanalysis products, and remote sensing. Through the use of multiple data sources, we have estimated the components of the terrestrial water budget across the NEESPI domain. Precipitation is estimated using gauge observations, reanalysis products, and remote sensing products for basins below 60ºN. Evapotranspiration is estimated in three ways: from the VIC land surface hydrologic model forced with the Sheffield et al. (J. Climate, 2006) global forcing dataset, from remote sensing retrievals based on a Penman-Monteith approach, and from an atmospheric water budget approach using reanalysis products for the atmospheric convergence and storage terms and our best estimate for precipitation. Terrestrial water storage changes, including surface and subsurface changes, are estimated using estimates from both VIC and the GRACE remote sensing retrievals. From these components, discharge can then be calculated as a residual of the water budget and compared with gauge observations to evaluate the closure of the water budget. For the energy cycle, we compare energy budget components from remote sensing retrievals, reanalysis products, and the Sheffield global forcing dataset. Through the use of these largely independent data products, we estimate both the mean seasonal cycle of the water and energy budget components and their uncertainties across the NEESPI domain.