Surface radiative fluxes over the pan-Arctic land region: variability and trends

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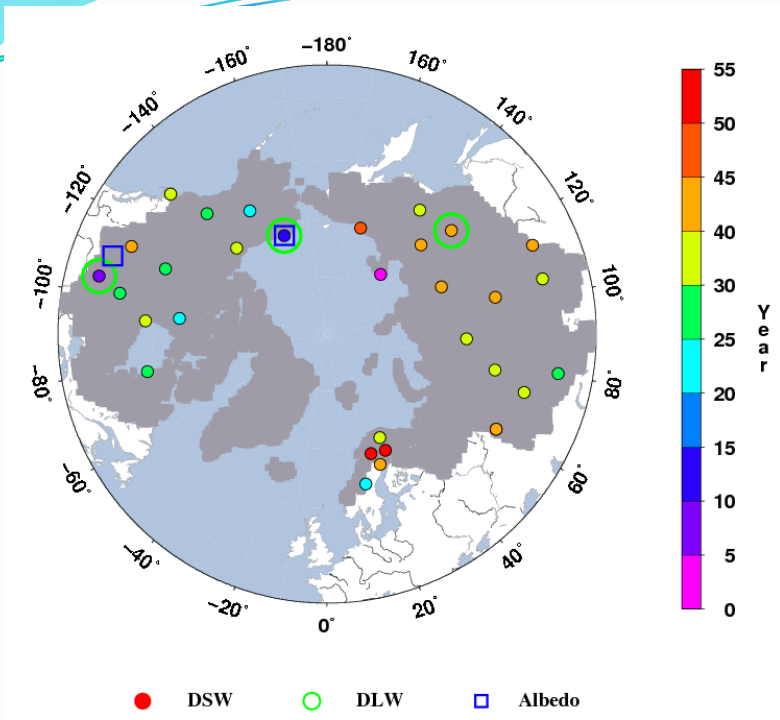
- We evaluated the reanalysis products (ERA-40 and ERA-Interim), satellite product (ISCCP), and land surface model (VIC) off-line simulation against in situ surface radiation measurements.

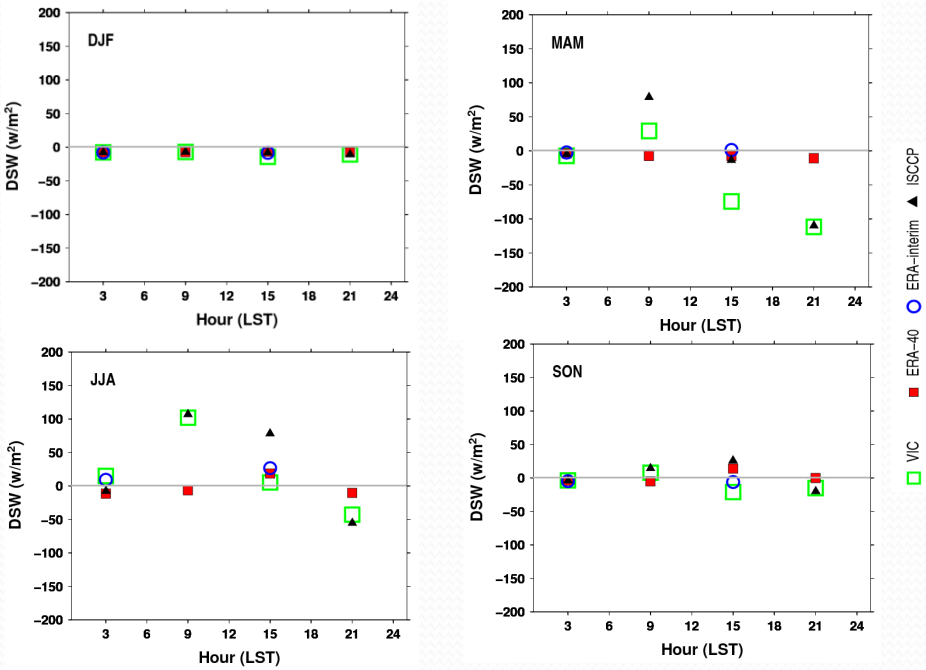
- The temporal, spatial and latitudinal variability of downward shortwave radiation, downward longwave radiation and albedo (abbreviated as DSW, DLW and AL, respectively, hereinafter) from different estimates was compared explicitly for the entire pan-Arctic land region.

- For a few observed stations with long-term DSW records from GEBA, their trends were detected.

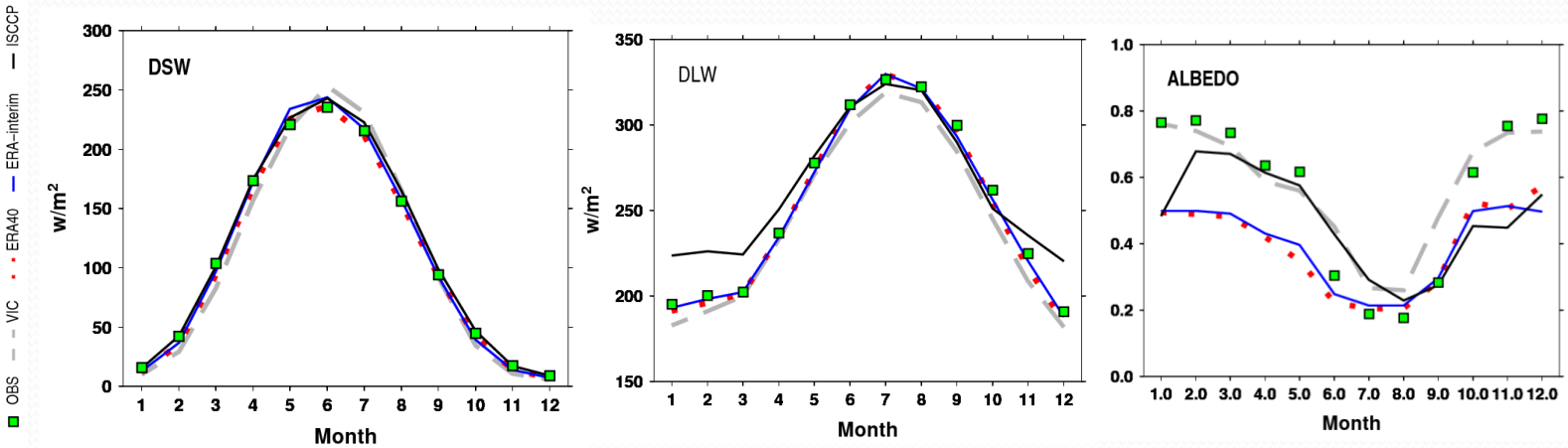
Surface radiative fluxes evaluation



Global Energy Balance Archive (GEBA)

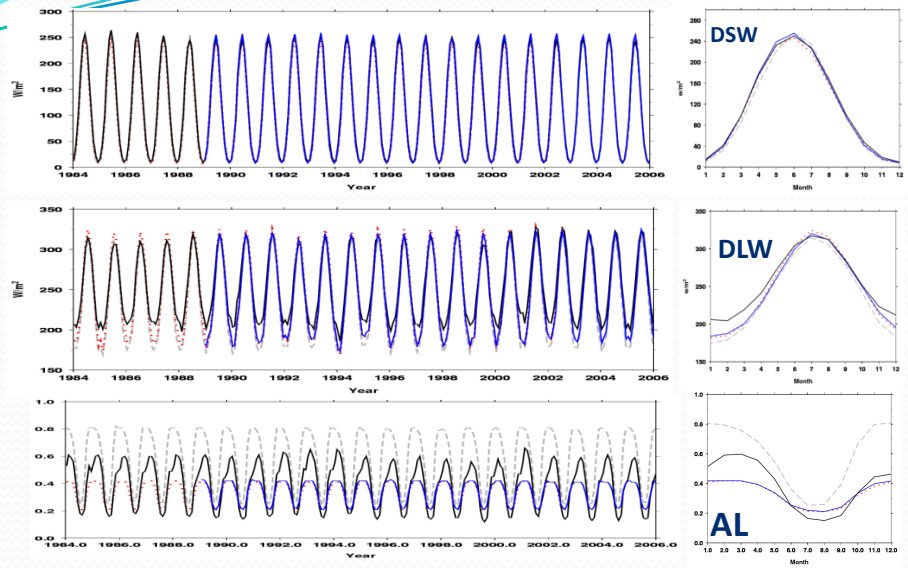


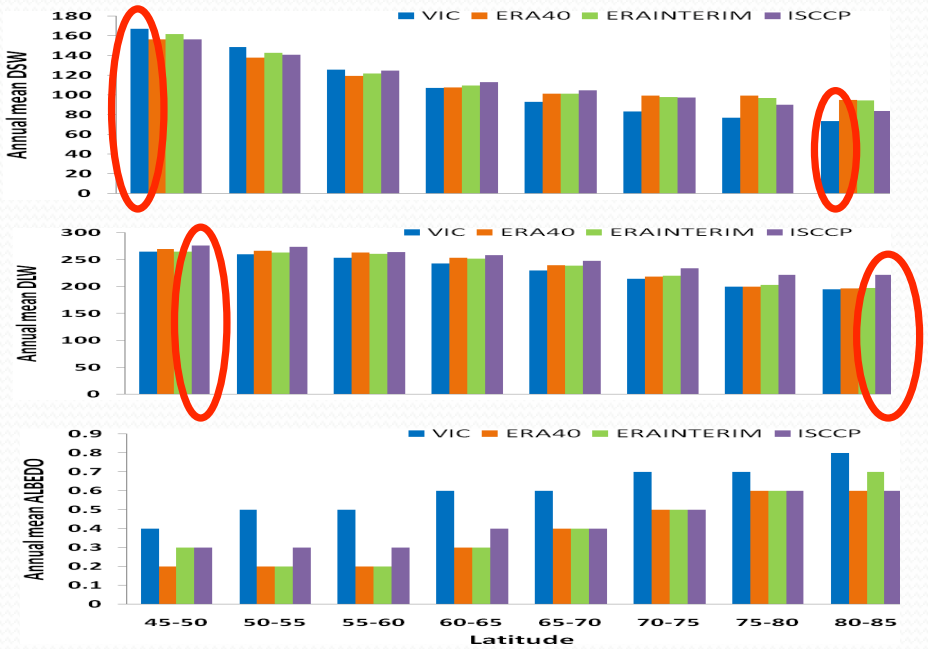
Mean diurnal cycle difference of DSW at Barrow, Alaska

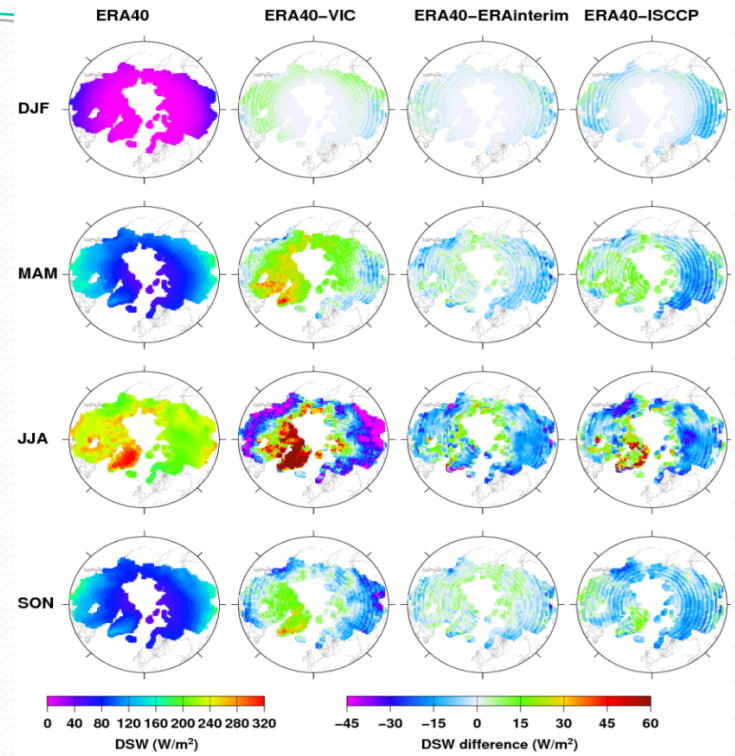


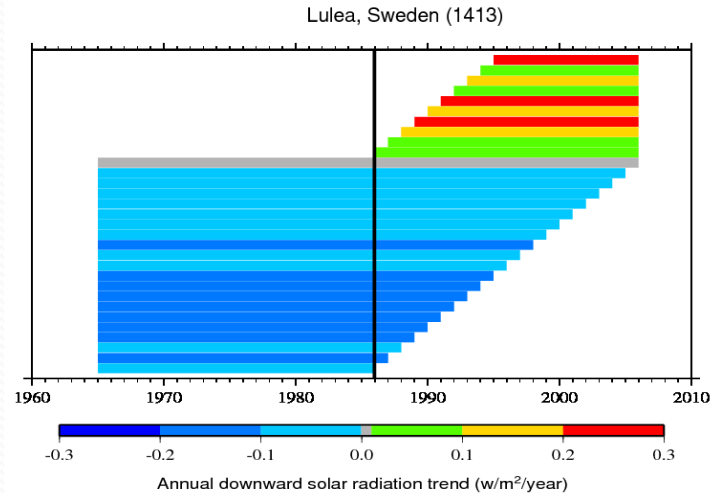
Mean seasonal cycle with observations

Surface radiative fluxes variability and trends









Next steps

- Investigate the temporal variability and trends in snow cover extent over the pan-Arctic from the reanalysis and satellite products.

- Examine if land surface hydrologic model could reveal similar variability and trends.

- Investigate the impact (correlation and sensitivity) on snow cover extent from the dimming/brightening phenomenon in downward solar radiation.

Global water balance: Continental River discharge and reservoir storage

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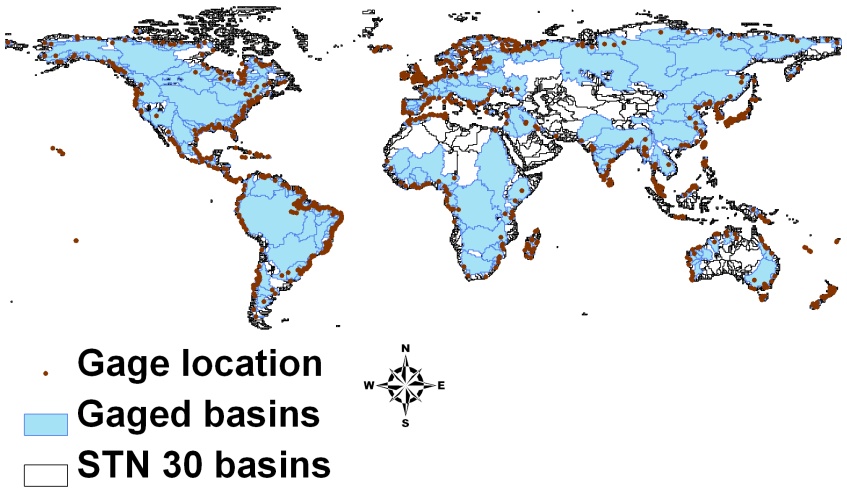
Estimating river discharge

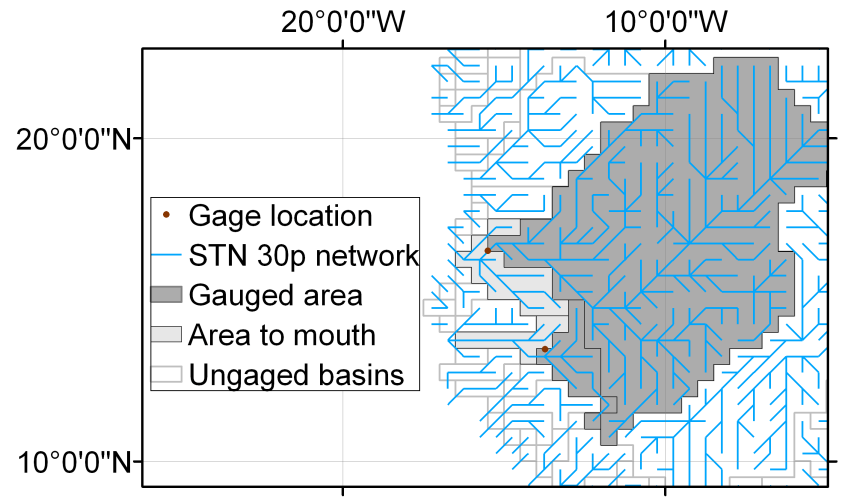
- Dai et al. (2009) used observations from 925 gaging stations, in concert with CLM 3.0 estimates of streamflow, to estimate global river discharge to the ocean
- We are replacing CLM 3.0 with VIC estimates of discharge for scaling observations to unmonitored areas
- We intend to adapt the Biemans et al. (2009) method to produce global estimates of anthropogenic effects on the land surface water budget for NEWS.

River Discharge

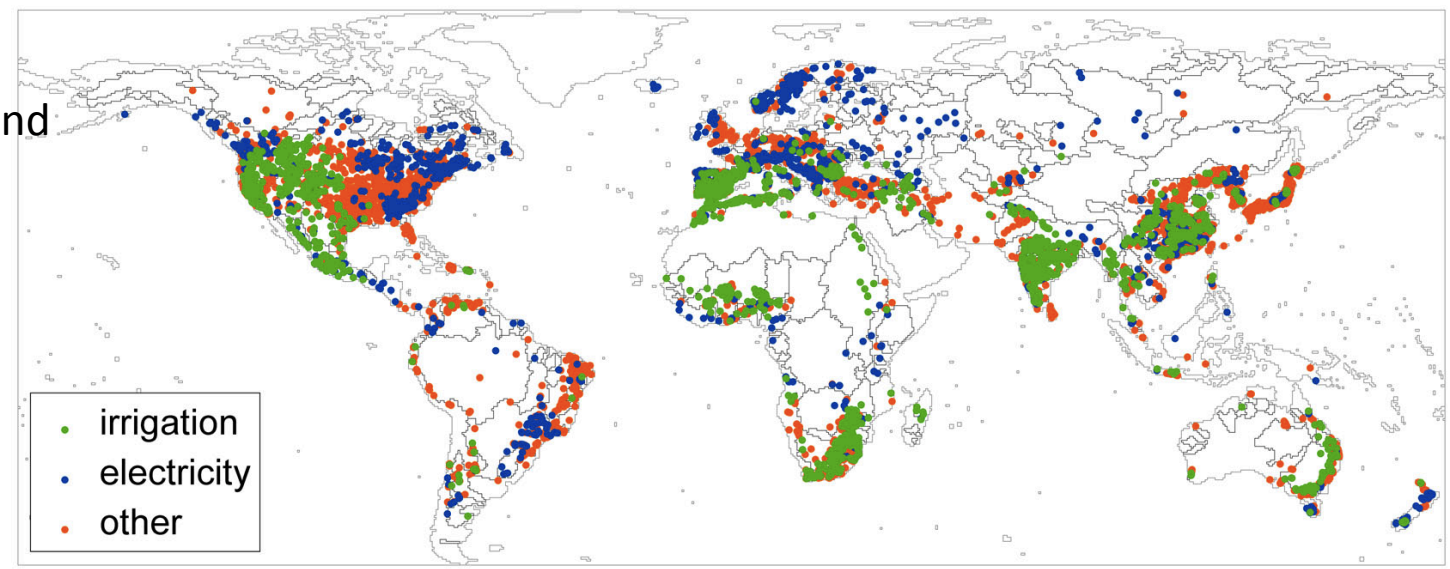
Streamflow Observations



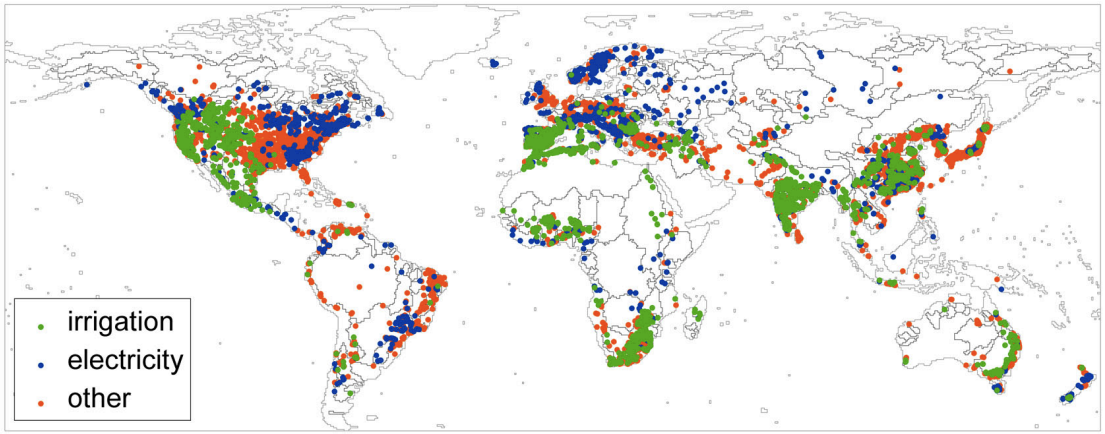
Hydrologic model



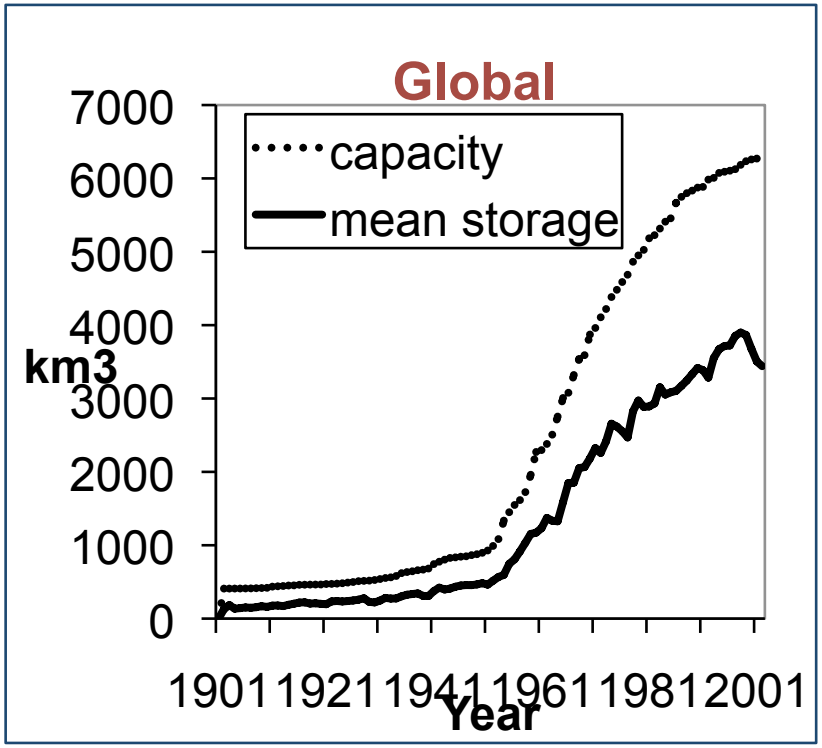
Reservoir Locations and Uses



Location of reservoirs globally



Global reservoir capacity and storage



Next Steps

- Apply the Dai et al. (2009) approach to three VIC model implementations (primary difference in atmospheric forcings) and compare differences
- Examine annual trends and inter-annual to decadal variations in resulting streamflow estimates
- Weigh the effects of reservoir and irrigation withdrawals on these trends and variations