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Response of Arctic sea level and hydrography to hydrological regime change over boreal catchments

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Changes in freshwater influx into the Arctic Ocean are a key driver of regional dynamics and sea level change in the Arctic waters. Low-salinity surface waters maintain a strong stratification in the Arctic.
This halocline largely shields the cool polar surface water and sea ice from the warmer waters of Atlantic origin below and, hence, inhibits vertical heat fluxes of heat, salt and nutrients. Recently observed changes in the freshwater content of the upper Arctic Ocean raise the question of the effect of these changes on the region. Changes in the freshwater budget affect regional steric sea level, but also the modified ocean dynamics may change sea level through mass transports within the Arctic.
One component of the freshwater budget is continental runoff. The hydrological regime of river runoff appears to be non-stationary. There is both interannual variability and a significantly positive trend since the 1970s. The decreasing Arctic sea-ice cover may be a possible reason for the non-stationary behavior of runoff, especially in coastal and marginal seas. The decrease of sea ice due to global warming would lead to cloud formation and, indeed, increased precipitation. During the warmer season, increased precipitation would lead to more discharge of freshwater to the Arctic shelves and basins.
The observational record of discharge into the Arctic Ocean, however, is still too sparse to address important science questions about the long-term behavior and development of Arctic sea level and climate. Given the insufficient monitoring from in situ gauge networks, and without any outlook of improvement, spaceborne approaches are currently being investigated. In this contribution we assess the long-term behavior of monthly runoff time series obtained from hydro-geodetic approaches and explore the effects of interannual runoff variability and long term trends on ocean model simulations.