Contribution of environmental forcings to US runoff changes for the period 1950–2010

Objective

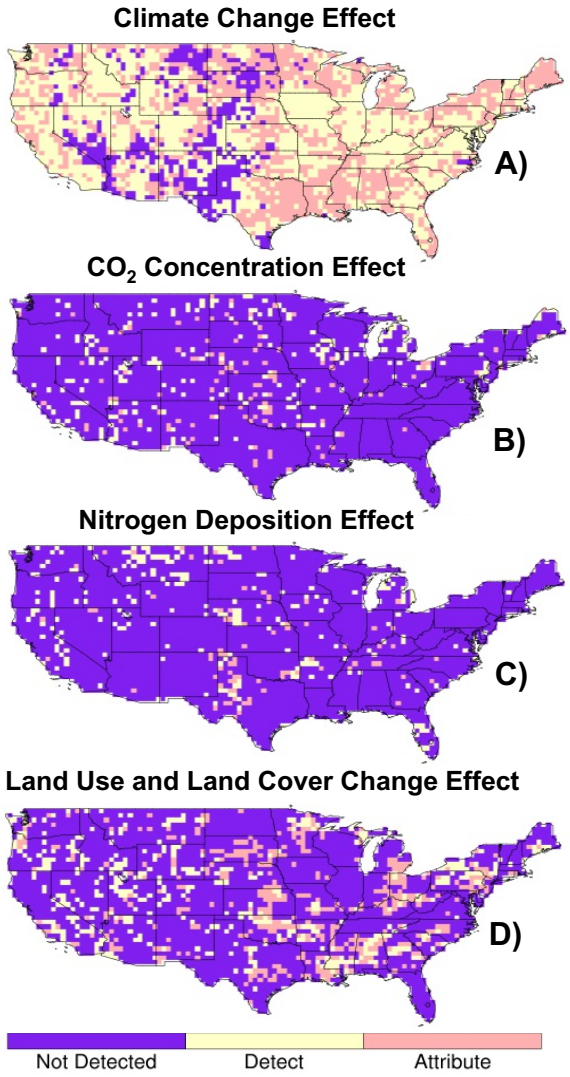
- Long-term gridded WaterWatch runoff observations and factorial ensemble simulations from the Multi-scale Synthesis and Terrestrial Model Intercomparison Project (MsTMIP) were used to quantify the natural and anthropogenic controls on US runoff changes for the period 1950-2010.

New Science

- Annual runoff observations had heterogenous patterns of change regionally in the US. The eastern two-thirds of the US has seen significant and insignificant increases in annual runoff while the western one-third had a greater significant decrease.
- Autumn runoff significantly increased for the northern and southern regions and the US as a whole. Northern and southern runoff also significantly increased for the winter season. For the west, there was a significant decrease in summer runoff.
- Changes in observational runoff were detected in climate change only simulation for all of the seasons and regions studied (A). While the changes in observational runoff could be detected in and attributed to CO_2 concentration (B), nitrogen deposition (C), and land use and land cover change (D) for certain cases, results were not consistent enough regionally and seasonally to draw any major conclusions.

Significance

- We detected the changing trends and clarified the environmental driving mechanisms for the US runoff during the 1950-2010 period.
- We succeeded in applying single-factor land surface model simulations to conduct detailed detection and attribution (D&A) analysis in order to address the causality of changes in US runoff.



Spatial patterns of D&A scaling factors. Not detected (purple) denotes a scaling factor whose corresponding 95% confidence interval was less than zero or included zero. If the 95% confidence interval was greater than zero but did not include one, the forcing was detected (yellow). A positive confidence interval was labeled as attributed (pink) if it included one.

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