C10: Arctic Ocean response to freshwater and wind perturbations
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A conceptual model of the Arctic Ocean
The Arctic Ocean is represented by an upper fresh layer of thickness and a saline deep layer. The outflow is assumed to be geostrophically controlled, and the upwelled Atlantic water is parameterized using either a constant diffusivity or a constant energy input.

Response of the upper ocean currents and freshwater height
Increasing freshwater input leads to a widening and slowdown of the Beaufort Gyre and freshwater pool. All experiments but the PW show anomalous freshwater height changes in opposite direction to the perturbation. Changes in wind stress are not symmetrical.

Sensitivity experiments with MITgcm
In a set of experiments we change the runof (R), precipitation (P), Pacific Water (PW) and Beaufort Gyre winds (BG) by up to 30-50%. Simulations over the period 1978-2013 are compared to a control experiment AR.

Response of central Arctic Ocean stratification
Upper layer (Polar Mixed Layer and halocline) freshening, Atlantic layer warming and Polar Deep Water cooling for increasing freshwater and winds.

Precipitation over Barents Sea warms Atlantic layer
Changes in precipitation over the Barents Sea lead to shallower convection and lower heat loss of inflowing Atlantic Water. Increasing the BG winds also leads to similar warming, increased sea-ice export.

Freshwater height response MITgcm vs conceptual model
For increasing runoff and/or precipitation MITgcm follows the expected conceptual model freshwater height, but with a lower sensitivity. Changing the winds and inflowing Pacific Water is of the order of the +/- 50% runoff and precipitation experiments.