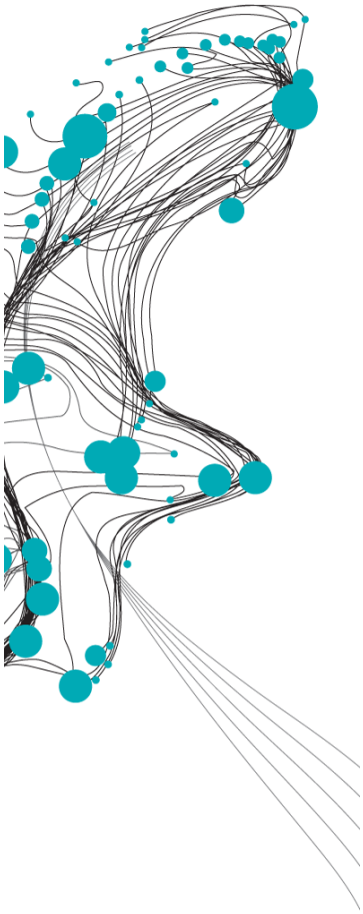
THE EFFECT OF ARCTIC PRECIPITATION CHANGES ON THE ATLANTIC MERIDIONAL OVERTURNING CIRCULATION



In this research the effect of an increase in precipitation on the Atlantic meridional overturning circulation (AMOC) is studied. The processes involved that lead to a weakening of the AMOC, like the change in sea surface salinity, mixed layer depth and sinking are described and explained. This research is done because the IPCC expects an increase in precipitation of more than 50 % in some parts of the Arctic region with the RCP 8.5 scenario.

This study continues on the research performed by Bintanja & Selten (2014). They have performed model runs in which the precipitation above the Arctic Ocean is changed. The change in precipitation in the model runs range from a -50 % decrease to a +300 % increase of precipitation above the Arctic Ocean north of 70 °N. The model runs are performed with the coupled atmosphere (IFS), ocean (NEMO) and sea ice model (LIM) EC-Earth. The used version is 2.3 with a 1 degree resolution.

Density profiles near the convection regions in the Labrador Sea and Nordic Seas show that a layer with relatively fresh surface water will form on top of the ocean. This results in a decrease of convection. For the Nordic Seas this means that the deeper layers will be less dense, which results in less overflow at the Greenland Scotland ridge. In the Labrador Sea the fresh layer results in small mixed layer depths, which affects the amount of sinking.

It turns out that around 85 % of the Atlantic meridional overturning circulation is formed by sinking the North Atlantic Ocean in the control run. The most important sinking regions are the region west of Great Britain and the sinking as a result of overflows at the Greenland Scotland ridge. The sinking region west of Great Britain is not in line with observations, this has to be investigated in future research. If the precipitation increases, the sinking as a result of the overflow at the GS ridge and the sinking west of Great Britain are decreasing the most. Therefore most of the decrease in AMOC strength because of an increase in precipitation in the Arctic can be contributed to these regions.

If the precipitation is only increased in the region above 80 degrees north instead of 70 degrees north, the average value of the mixed layer depth in the Nordic Seas is less affected, also the sinking in the North Atlantic Ocean decreases less with an increase in precipitation. The cause of this is that the precipitation is not directly increased above the convection region in the North Atlantic Ocean. For the strength of the AMOC it does not matter whether the precipitation is increased above 70 degrees north of 80 degrees north.

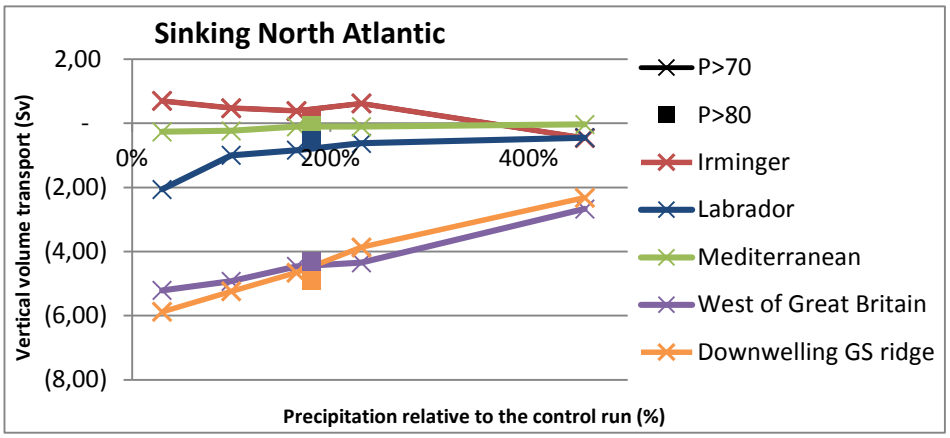


Figure 1: Sinking in the North Atlantic Ocean (Sv)

Bintanja, R. & Selten, F., (2014) Future increases in Arctic precipitation linked to local evaporation and sea-ice retreat. *Nature, 509,* 479-482. doi:10.1038/nature13259

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