Atlantic meridional overturning circulation

What is the issue?

The Atlantic meridional overturning circulation (MOC) is driven by changes in the temperature and salinity of surface water as it moves north in the Atlantic. The cooling of warm Atlantic waters as they move towards the North Pole leads to the sinking of dense waters, which then pass south, eventually supplying all the oceans of the world with deep water. North-western Europe benefits from the regional warming provided by this current. As the circulation requires water to be made dense in northern latitudes, freshwater input has the potential to slow or stop it in its current form if the water becomes too fresh and therefore too light to sink.

What has happened and how confident?

Continuous direct measurements of the MOC have only become possible recently and these show that day to day variability is high (Cunningham *et al.,* 2007). This variability is high compared to the previous discrete hydrographic observations, which had been suggested as evidence of a slowing of 30% in the Meridional Overturning Circulation (MOC) since the early 1990s (Bryden *et al*., 2005).

What might happen?

Whilst the UN Intergovernmental Panel on Climate Change considered it in its Fourth Assessment report 'very likely' (greater than 90% chance) that the MOC will slow down during the next century (with models predicting an average 25% decrease under SRES scenario A1B), temperatures are still expected to increase in the region as the signal from greenhouse warming will overcome any associated cooling effect. This weakening of the MOC has been suggested to be a result of an increase in high latitude temperatures and precipitation (reducing surface water density).

Are there any OSPAR regional differences?

The local temperature response to change in the MOC is strongest in Region I (Arctic Waters).

➥ *Go to the full QSR assessment report on impacts of climate change (publication number 463/2009)*

References

Bryden, H. L., Longworth, H. R., and Cunningham, S. A., 2005. Slowing of the Atlantic meridional overturning circulation at 25ºN. Nature, 438, 655-657

Cunningham, S.A., Kanzow, T., Rayner, D ., Baringer, M.O., Johns, W.E., Marotzke, J., Longworth, H.R., Grant, E.M., Hirschi, J.J-M., Beal, L.M., Meinen, C.S. and Bryden, H.L., 2007. Temporal Variability of the Atlantic Meridional Overturning Circulation at 26.5°N. Science 317 (5840), 935. doi:10.1126/science.1141304

IPCC, 2007a. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., Qin, D., Manning, M., Chen, Z., Marquis, M., Averyt, K.B., Tignor, M. and Miller, H.L. (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 996 pp.