Ocean salinity

What is the issue?

The salinity of the surface layer of the ocean (the top 100 m) is most heavily influenced by changes in precipitation and evaporation (Josey and Marsh, 2005) and is more variable than deep-sea salinity. Ocean salinity is important through its effect on the density of the water and resultant impacts on ocean circulation. Reduction of sea ice, acceleration of the global water cycle and thawing of ice on land will all modify the oceans salinity. In shelf seas, changes in salinity at the surface would have an impact on the presence or absence of stratification of the water column and on the local circulation.

What has happened and how confident?

In the deep northern North Atlantic and Nordic seas, salinity evolved from a maximum in the 1960s to a minimum in the mid-1990s and, in conjunction with observations of increasing salinity in the tropics, these changes have been suggested to be evidence of a global-scale acceleration of the water cycle (Dickson *et al.*, 2002, Curry *et al.*, 2003). The freshening in northern regions is thought to be consistent with these regions having greater precipitation, although higher run-off, ice melting, advection and changes in the meridional overturning circulation may also contribute (IPCC, 2007a).

(Hátún *et al.*, 2005) suggests that the salinity of the waters in Regions III (Celtic Seas) and V (Wider Atlantic) that feed Region I (the North Atlantic inflow to the Nordic Seas) is influenced by the relative importance of the subtropical and sub-polar gyres (Figure 3.1.3). The salinity of the inflow is strongly correlated to the sub-polar gyre index of (Häkkinen and Rhines, 2004). Direct measurements of the waters of the North Atlantic Current that feed the Nordic Seas and Arctic through Fram Strait have undergone a strong increase in salinity since the mid 1990s, increasing to a maximum in the observed record in 2005 (Hughes and Holliday, 2007, Holliday *et al.*, 2008).

The measurements and trends observed are of high confidence, however, it is not possible to attribute them to climate change, though they are consistent with changes that might be expected given an acceleration of the hydrological cycle.

What might happen?

Changes in precipitation patterns, ocean circulation and ice melt would cause changes in the salinity of the upper ocean. In the OSPAR area, these could be passed onto deep water through the modification of overflow water and the water that it entrains.

The UN Intergovernmental Panel on Climate Change (IPCC) suite of models project, with low confidence, that the Atlantic Ocean north of 60°N will freshen during the 21st century (Wu *et al.*, 2005).

Are there any OSPAR regional differences?

Changes in salinity will be strongly dependent upon location. Salinity in all the regions is strongly associated with ocean circulation, the shelves will be more sensitive to local river run-off and catchment precipitation, while the northern and western areas of Regions I (Arctic Waters) and V are sensitive to changes in the polar ice and freshwater cycle.

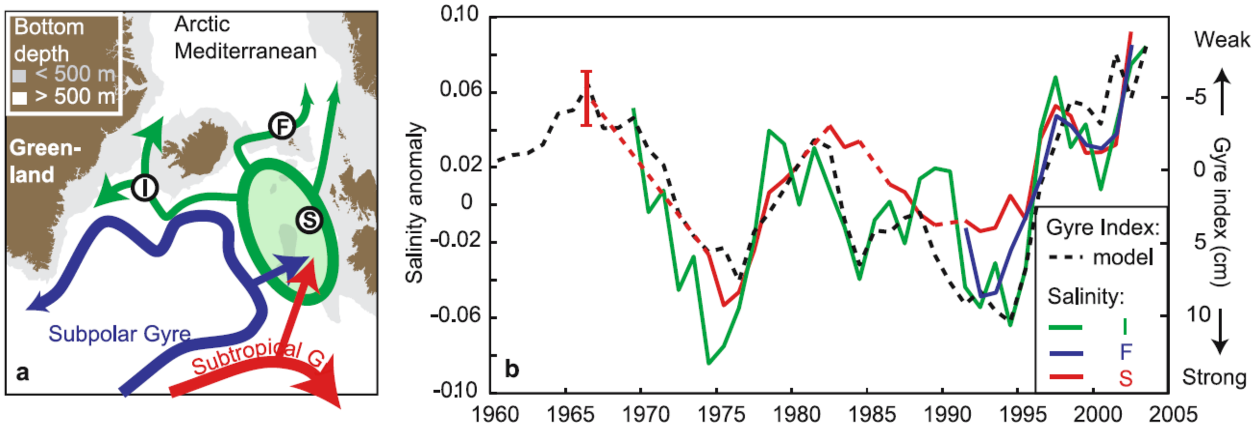

Figure 3.1.3. *(Hátún et al., 2005). Salinity of the inflows to the Nordic Seas the relative contributions of waters from the sub-polar and sub-tropical gyres due to the 'strength' of the sub-polar gyre (Häkkinen and Rhines, 2004)*

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

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