

### Specific comments:

1- Is the location of the water forcing selected because of biases in the water formation and deep convection regions of the model, like in Msadek and Frankignoul (2009)? Would be good to have a brief description of model biases in the model section.

2- The mechanism described here does not include ice melting and atmospheric variability, in which increased temperatures in the subpolar regions could decrease salinity through ice melting of precipitation. For example, some studies suggest that a stronger heat transport would decrease salinity in the northern seas by increasing precipitation (Timmermann et al., 1998). It seems that these mechanisms play a secondary role here, but some explanation is needed in the text.

3- A better discussion on the timescales of variability would strengthen the paper. For example, some models show that the relationship between AMOC strengthening and temperature response in the Arctic would take about 3-4 years (Huck et al., 1999; te Raa and Dijkstra, 2002), and the delay between the salinity and temperature responses through Rossby wave mechanisms would generate different decadal variabilities, with the longer (40-70 years) linked to salinity anomalies. The time delay between the adjustments has been recognized to be greatly responsible for the multidecadal variability (c.f., Lee and Wang, 2010). In a nutshell, a better description of the baroclinic adjustment mechanisms is needed here.

### Minor Comments:

The word entrainment is generally associated with vertical movements of waters into the upper layers or mixed layer. It makes more sense to use the word horizontal advection or similar for the transport of NAC waters into the SPG.

p. 264, l.22 It would make it easier to understand the equilibrium experiment (1) if the authors described how the strength of the freshwater forcing was varied (varying  $\pm 1$  mSv every 1 mSv).

p. 262: l.1 NAO is the main "northern hemisphere" mode of wind stress variability.

p. 266 l.7 I would say NAC transports subtropical instead of tropical waters. Subtropical waters are known to have higher salinity through strong E-P fluxes and NAC is northern part of the subtropical gyre.