The comments of the referee are indicated in black and the answers of the authors in blue.

Anonymous Referee #1
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The manuscript presents interesting modeling results of the AMOC variability in control and transient experiments for some periods during the last millennium. AMOC variability is found to be stronger in the transient experiments. The manuscript also shows the impact of AMOC variability on the North Atlantic ocean circulation and the associated atmospheric response, especially the Scandinavian SAT response. The manuscript contributed to the literature of simulated climate variations of the last millennium with a novel focus on AMOC variations. The results would be to attractive to the communities studying both the climate of the last millennium and the modern climate. I recommend the manuscript be accepted for publication in the journal "Climate of the Past" after minor revisions to issues outlined in the following specific comments.

1, The model employed in this work is the low resolution configuration of CCSM3. The manuscript should discuss the model biases in the 1990AD control simulation, especially in the North Atlantic ocean circulation, and how these model biases would affect the results of AMOC variability, the mechanism, and the climate impact. For example, does the 1990AD control simulation has a realistic spatial distribution of mixed layer depth in the North Atlantic? Does simulated deep convection in the Labrador Sea and Nordic Sea realistic compared to modern observations?

The major model biases in the North Atlantic Ocean are now explicitly stated in section 2. Note that Yeager et al. (2006) gives a detailed evaluation of the 1990 control simulation with the low resolution configuration of CCSM3. Therefore, we only briefly discuss the major biases of the ocean.

Added (p. 1272 l. 13): “Compared to observations the simulated climate exhibits some major biases in the North Atlantic basin which will likely have an impact on the AMOC: the path of the NAC is too zonal, the northward heat transport is reduced, and the sea ice coverage is overestimated (Yeager et al., 2006). In addition, some deep water formation regions are not correctly represented, i.e. the convection region in the Labrador Sea is displaced to the southeast and the mixing in the Greenland-Iceland-Norwegian (GIN) Seas is unrealistic low (Bryan et al., 2006). Nevertheless, the low-resolution CCSM3 has proven to provide useful information about the mechanisms of AMOC variations (d'Orgeville and Peltier, 2009; Renold et al., 2010; Yoshimori et al., 2010).”

2, How do the mechanism of the AMOC variability in this study compared to previous proposed mechanisms of AMOC variability?

The comparison of the mechanisms to earlier studies has been extended (see comment 1 for referee 2).

3, The manuscript should discuss some comparison of the simulated AMOC variations during the last millennium with available paleo reconstructions of AMOC variations over the same period.

Unfortunately, no direct AMOC reconstructions are available for a comparison. Still to treat this suggestion with caution, a discussion of the SST reconstructions of Kristensen et al. (2004) and Sicre et al. (2008) has been added in the revised version (see last

comment for referee 2).

4, As discussed in the end of the manuscript, millennial oscillations of the AMOC may be responsible for the Medieval warm period and the little ice age. How do the modeling results fit in with this scenario?

The AMOC variations found in this study lead to regional changes which can not explain large-scale phenomena as the Medieval Warm Period and the Little Ice Age (note that we are aware that the spatial extend of the Medieval Warm Period is still under debate). Thus, our simulations do not support the hypothesis of Broecker (2000) and Denton and Broecker (2008). This point has been clarified in the discussion.

Changed (p. 1290 l. 1-4): " Based on several terrestrial and marine proxy records Broecker (2000) and Denton and Broecker (2008) hypothesised that millennial oscillations of the AMOC strength may be responsible for the Medieval Warm Period-Little Ice Age variation, which is not supported by our results."