Review of "Transports and budgets in a ¼ global ocean reanalysis 1989-2010" by Haines et al. (os-2011-85)

The authors analyzed meridional heat and freshwater transports from a ¼-degree eddy permitting global ocean reanalysis product on global and basin scales in relation to temporal change in storage, surface fluxes used to force the model, and the assimilation increments. The time-mean heat and freshwater transports were found to be in overall agreement with previous estimates based on linear inversion from hydrographic data with the exception of the tropical and subtropical Atlantic where the heat transport is too weak. A comparison of heat transport components at 26N with published estimates based on the RAPID-array and auxiliary data suggest that the low heat transport was related to mid-ocean current distribution. The results are helpful to understand the skill of this ocean reanalysis product in representing large-scale heat and freshwater transports, which is important for related applications. The authors' effort to analyze assimilation increments as a way to understand the source of model deficiencies (including that of forcing) is highly commendable and sets an excellent example for the assimilation community.

Major comment: clarification is need in terms of the interpretation of regional assimilation increment. For globally integrated budgets (e.g., Fig.2 and 6), the assimilation increments reflect corrections of bias in global heat and freshwater fluxes as discussed by the authors. For regional budgets (e.g., Fig.3 and 7), however, the assimilation increments cannot be unambiguously attributed to corrections of surface heat and freshwater fluxes (as the authors implied). This is because regional assimilation increments could also be correcting for errors in lateral transports (which could be related to error in the wind). For example, the meridional heat transport at 26N of the Atlantic was related to the distribution of mid-ocean current (page 272, lines 26-27). If the northward transport is too weak and the assimilation requires the model to fit the heat content north of 26N, part of the assimilation increment could be compensating for the weak northward heat transport across 26N. Another example is Fig.5, the assimilation increment could be compensating for errors in wind forcing that cause the mis-representation in the location of the Gulf Stream and North Atlantic Current rather than correcting for errors in surface heat and freshwater fluxes.

Given the above concern for the interpretation of regional assimilation increment, clarification is also needed for the statement "the budgets of heat and freshwater can be consistently explained despite the presence of "unphysical" data assimilation terms" (lines 23-25 of page 273 in "Summary and conclusions"). The meaning of "consistently explained" is very vague here.

Minor comments:

Fig. 2 and 6: it's difficult to distinguish the blue and black curves.

Page 270, line 8, “also also”.

Figure 8 caption: “Also shown at the annual mean section based estimates … from Bryden et al”: The results of Bryden et al. were based on synoptic sections, not annual mean.

Page 271, lines 21-24 “It is interesting that the annual mean values in 1992…in the figure” needs clarification (see the previous comment).

Page 274, line 11, “arevery”.