Anonymous Referee #2
Wu et al. present the results of a modelling study of the effects of clouds on water vapor in the tropical tropopause layer. The model they use is a 'tropical channel' version of WRF, and the experiment they perform is evaluation of the differences of the model state when cloud radiative effects are included/excluded. The study address a very important problem, and the setup of the experiment seems appropriate for the problem at hand. However, I have a number of concerns that need to be addressed in the revised version. These are:

(i) The paper rather casually states that the cloud radiative effects leads to enhanced "vertical ascent" (e.g. P4656/L11). Conventional wisdom holds that inhomogeneities in the radiative properties of the atmosphere impact vertical motion on a scale that is related to the scale of inhomogenity. So, one would expect that the clouds in the tropics may lead to in-cloud heating, but that, since one would expect the tropical average diabatic upwelling to be set by the large-scale forcing, tropical average temperatures increase (what you indeed observe), such that the tropical average radiative heating changes little (because the cloud-heating is largely compensated by the enhanced emissions from the warmer atmosphere). There is some discussion of this point (e.g. P4665/L10ff), but this point needs to be clarified,
Thanks for your suggestion. It is clarified in the conclusion.

and the first figure I'd like to see is the diabatic heat budget (with all terms, not just the cloud radiative heating as shown in Figure 4; and for the tropics as a whole) of the model runs. Without this information, it is difficult for me to assess this paper. (I agree that Figure 7 gives the impression of enhanced vertical motion - if this is the case, then this is important and the paper needs to explain what is happening.)
The Figure 4a is radiative heating rate with all terms for the WRF CTRL and UTNR runs. The Figure 4b is the difference of radiative heating rate with all terms between the WRF CTRL and UTNR runs. It is corrected in the text.

(ii) I was rather confused by the description of the model setup. For instance, it is said that ERA-Interim provides "north-south" and "lower boundary" conditions (P4659/L16), but: (1) We're not told at what level the "lower boundary" is, is this the surface (and you take surface data from Interim), or somewhere in the troposphere?
Yes, we take surface data from Interim. It is clarified in the revised text.

(2) On the previous line it is said that "periodic boundary conditions is used in the east-west direction" (I don't understand).
In the zonal direction, the computational domain is global coverage with period boundary conditions.

(3) The boundary conditions are updated every 5 days - what is happening during these 5 days?
During these 5 days, the boundary conditions are constant.

(4) Which fields from Interim are used? Temperature, winds, moisture, others?
The variables include temperature, winds, moisture, pressure, etc.

The paper casually states (line 11ff) that the WRF model is run not centered at the equator because of a "high bias in the Southern Hemisphere... which appears to be related to poor representation of the stratospheric circulation in this version of WRF". I can't see any reason why the Southern hemisphere should be better/worse than the Northern hemisphere, and I need to be convinced that this problem does not reflect a deeper problem with the whole experimental setup.

Comparing to MLS, the high bias of 100 hPa water vapor at the Southern hemisphere is also shown in the GEOS-5 model which is a global data assimilation system (Figure 1 in Jiang et al. 2010). It might indicate a common problem in simulating the stratospheric dynamics and lack of accurate boundary conditions across general circulation models. .

Minor comments:

P4664/L9: This sentence makes no sense to me; a warming does not increase the threshold of ice formation, and a larger advective water flux does not necessarily lead to a moistening - it also depends on the response of the sink term.

A warming decreases the tendency of ice formation in UT, which is the sink term. In the meantime, there is a larger advective water flux, which is the source term. So both the source and sink terms lead to a moistening. It is clarified in the text.

Reference:

Jiang, J.H., H. Su, S. Pawson, H.C. Liu, W. Read, J.W. Waters, M. Santee, D.L. Wu, M. Schwartz, N. Livesey, A. Lambert, R. Fuller, and J.N. Lee, "Five-year (2004-2009) Observations of Upper Tropospheric Water Vapor and Cloud Ice from MLS and Comparisons with GEOS-5 analyses," *J. Geophys. Res.* 115, D15103, doi:10.1029/2009JD013256, 2010.