Anonymous Referee #1
General comments:
This is a modeling study of the radiative effect of upper-tropospheric (UT) clouds on TTL temperature and moisture. Different from most previous studies of the same topic that used 1D model, the authors employed a full-fledged 3D WRF model in "tropical channel" configuration. They first showed that the WRF model in this setting can reasonably simulate the TTL water vapor distribution and cloud radiative effect (CRE). Then, they compared the control run with an experiment in which UT cloud radiative effects (UTCREs) are turned off. It was found that in the UT below TTL (from 215 – 150 hPa), UTCRE induces warming and moistening; inside the TTL (150-80 hPa), however, UTCRE leads to cooling and dehydration. The authors diagnosed the causes of these different responses. Overall, this is a solid study and a comprehensive analysis. I only have a few points to contend.

1."Tropical channel" configuration: I don't quite understand the advantage of this approach. Saving computer time? Minimizing extratropical influence? I think the authors should cite some previous publications using a similar approach to back them up
The tropical channel configuration allows for a realistic depiction of tropical circulation in the UTLS, which is quite important to understand the dehydration in the UTLS. Comparing to a global run at high resolution, the tropical channel configuration can save some computer time. This configuration can also minimize extratropical influence in the model simulation. For example, it can avoid the model simulated high bias of TTL water vapor at mid-latitude of Southern hemisphere (figure not shown). This high bias of TTL water vapor is also shown in the GEOS-5 reanalysis data, which are produced by a global data assimilation system (Jiang et al 2010). Some Madden-Julian oscillation (MJO) related studies (e.g. Ray and Zhang 2010; Ray et al 2011) have shown that the tropical channel configuration can reproduce the initiation and gross features of MJO events. Citations are added in the text.

2. Simulated LWCF (Fig. 3): based on Fig. 3, I am a little concerned that this model configuration may not capture the cloud field very well. Besides, they are supposed to evaluate the model performance in simulating UT clouds, not all clouds as done in Fig. 3. A quick comparison with CALIPSO UT cloudiness may help.
We have compared model simulations with the MLS observed ice water content (IWC). Similar to Wu et al. (2011, JGR), the model simulations capture the spatial distribution of clouds. However, the magnitude of the simulated IWC is much smaller than the MLS observed one because the Grell 3D cumulus parameterization doesn't produce cloud/ice water content on the grid-scale (50 km). So it is not fair to compare model-resolved IWC with observations. However, the cloud radiative effect (CRE) is calculated from cloud fraction (not cloud water content) in the WRF radiative code and thus CRE represents the total radiative effects of both parameterized and resolved clouds. We can see that the CRE is reasonably reproduced in the model simulation. Considering that our study focuses on the radiative effect of UT clouds, it is reasonable to compare the simulated CRE with available observational-based dataset.

In balance, the manuscript appears to me as acceptable for publication after some minor revisions. Specific comments are given below.
Specific comments:
1. (p4662, Line 26) Clarify which months are "moist phase" and which are "dry phase".
They are clarified per your suggestion.

2. (p4664, 1st paragraph) Equation 1 shows that UTCRE will lead to changes in both temperature and vertical velocity. But how it is partitioned between the two is not obvious. The authors go through some hand-waving arguments to explain the observed changes in Fig. 5. It may work better to simply plot the three terms individually as a function of height, which is worth a thousand words.
3. (p4664, 1st paragraph) There should also be a water vapor budget equation to accompany the discussion. And it would be nice to plot various budget terms for water vapor to show how the hydration and dehydration are maintained.
We agree with the reviewer that an explicit illustration of the temperature and water vapor budget terms will greatly help to explain the relative roles of physical processes. However, we did not save the tendency terms in the daily model outputs from this multi-year simulation due to storage limit and the tendencies inferred from the saved grid-scale state variables carry some uncertainties, especially because part of the convective clouds are parameterized. We added a time series of the difference between the saturation vapor pressure and actual water vapor in Figure 6, which coarsely represents the relative role of thermodynamic and dynamic terms. Our explanation of the physics in Section 5 goes from the simple one-dimensional thermal energy balance perspective to 3-dimensional dynamic and thermodynamic balance view. We admit the discussions without budget analysis are not optimal but we hope we have offered a coherent picture, albeit not quantitatively. Given the simulations were conducted at 50 km horizontal resolution and UT clouds are partly parameterized, an accurate quantification of cloud radiative effects may rely on future investigations with a cloud-resolving resolution (~ at 1km).

4. Vertical water vapor transport in Fig. 6: is it total transport or transport by mean vertical motion? Note that total transport = transport by mean motion + transport by eddies. Fig. 7 seems to be discussing eddy effects.
It is the difference of water vapor transport between the WRF CTRL and UTNR simulations. It is clarified in the caption of Fig. 6.

5. (p4665, lines 4-7) I don't see any contradiction between sign change in vertical velocity and persistently enhanced vertical transport. Note that the budget term corresponding to the vertical transport measures the vertical gradient of the product of q and w: - d(qw)/dz. w could change sign but d(qw)/dz could still stay the same sign.
This part is revised in the text. Thanks.

References:
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