Response to the remarks of both reviewers and to editor's comments

In the revised version, the schematic Fig. 5 was removed. This change was made in response to the main criticism of both reviewers. We also included some new text, primarily following the recommendations of Peter Haynes (editor) (see lines L111-L118 in the revised version). We believe that by taking this approach, our point is now formulated more clearly, and we avoid any potential confusion that might arise from a simplified schematic figure. We extend our gratitude to Peter Haynes for moderating this issue. There are still a few minor comments from reviewer 1, which are addressed below.
Minor comments:

1. *I am still a little puzzled why Type B water vapor (Fig. 4) is so much higher than A or M in the forward trajectory case. The explanation given in lines 125 to 141 suggests the following. Looking at Fig. 2b, the type B trajectory was dehydrated maybe 12 days earlier than sampled and since no further dehydration takes place after sampling the water vapor theoretically remains at LDP value – however the water vapor amount is larger than MLS. In the "full Lagrangian" you start 60 days earlier and run the trajectory 120 days forward. Then you get good agreement. This means that the measured water (the start of the B forward trajectory) is too high. There are two possibilities (1) the instrument is biased relative to MLS (2) some mixing took place with wetter air before it got to where it was sampled. In any event, perhaps the authors could expand on this dilemma somewhat. I found the discussion 133-142 inadequate.*

   Yes, we agree that the results concerning type B are indeed surprising. Although also potential errors in the instruments or reanalysis-based simulations could play a role, we think that the most likely explanation for the high-bias of type B trajectory water vapor are moist small-scale features. These small-scale features are observed by the in-situ instrument but not by MLS. As they appear unimportant to explain the large-scale distribution as observed by MLS, we conclude that these features are not relevant for the large-scale water vapor budget. Mixing may also play a role in smoothing out such moisture-rich structures. However, as no enhancement was detected in the MLS observations, it only strengthens our statement that these structures are likely on a small scale and not relevant for the large-scale water vapor budget. In response to the reviewer's criticism, we have slightly revised the paragraphs between L129 and L151 The question of why the "full Lagrangian" reconstruction based on the LDP 2-3 weeks before the observation performs so well is discussed in the final paragraph of the "Discussion and conclusions" section.

2. *In L10 ...LDP mixing ratios*

   was done

3. *In L14 add Dessler et all. (2013)*

   was done

4. *In L17 In particular.. This sentence is awkwardly worded and somewhat confusing.*

   This sentence was reformulated, see L16-20

5. *In L24 "for the large-scale SWV distribution" how about "in order to reconstruct the large-scale.."*

   was replaced

6. *Fig. 1 caption ...(see text and Table 1 for details)*

   was included

7. *Fig. 2, I presume that the square is the starting point of the back and forward trajectories. Please say that in the caption. Shouldn't there be two squares on Fig. 2a? Or are they on top of each other?*

   additional sentence was included. It is correct that both squares in Fig. 2a are on top of each other.

8. *L87 "which implies ice mixing ratios larger that 0.1 ppm", As I noted in the previous review, the CALIPSO doesn't detect ice mixing ratios. The mixing ratio is parameterization based on Heymsfield in situ data and is inferred.*

   The sentence was reformulated following the recommendation

9. *Fig. 4 caption "As the ice clouds resolved by CLaMS-Ice are mainly driven by the experienced (produced) by the lowest temperatures."*

   The sentence was reformulated, see L88-90

10. L135 Fueglistaler et al. (2014) used ERAi data. Are the biases the same?

    We use the citation Fueglistaler et al. (2014) to apply his scaling factor between the CPT and the corresponding water vapor. In Fueglistaler et al. (2014) there is no comparison with in-situ data and, consequently, ERA-I bias was not calculated.

11. L143 in situ

    was done