

Interactive comment on “Comparing high-latitude thermospheric winds from FPI and CHAMP accelerometer measurements” by Anasuya Aruliah et al.

Anonymous Referee #1

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Dear Editor, I have reviewed the paper by Aruliah et al. titled “Comparing high-latitude thermospheric winds from FPI and CHAMP accelerometer measurements.” The paper describes polar observations from FPIs and the CHAMP satellite. Observations from different instruments are compared and discrepancies discussed. It is important to the community to understand the differences between the FPI and CHAMP observed thermospheric winds. CHAMP winds are known to be larger than the FPI measurements. While the cause for such discrepancy may be unknown at the moment, at least, we should know how the two sets data are different. Hence, the paper is very important and should be considered for publication. It can be a good reference for future users of the two data sets. The paper in the current form, however, has some significant issues

C1

need to be addressed.

1. The paper somehow lost focus. It got into too many sub-topics: FPI (old) -FPI (new) differences, HWM87-HWM90 differences. I think for the purpose of understanding the CHAMP and FPI difference, we should avoid using very old data. If the topic were the long-term trend, then we should examine long data string. The value of this paper is on the CHAMP and FPI comparison.

2. The section L67-89 has some major issues. The thermospheric dynamics is governed by the momentum, energy, and continuity equations. It cannot be expressed in the formulas listed in the section. CHAMP's larger winds do not necessarily lead to larger temperatures. Smaller FPI winds are not always connected to the lower temperatures. We cannot use temperature to verify wind values.

3. I am lost in the section L279 – L316. I understand that the CHAMP cross-track winds are not aligned with the eastward direction on the ground. The angle is different for the ascending and descending nodes. The angles are ± 7.2 deg and ± 13.3 deg for KEOPS and Longyearbyen (ascending and descending). So the obvious thing to do is to compare separately the ascending and descending nodes. Use the ground based meridional and zonal components to compute the wind value along the direction of CHAMP cross-track measurement (mostly to add the contribution from the meridional winds). I don't understand why that was not done. I do not see an argument to let me believe that I can ignore the viewing angle difference between the ground based zonal wind and CHAMP cross track winds. So I suggest the authors use the ground based FPI data to form the wind values along the CHAMP cross-track direction to do a direct comparison. Or alternatively, using the CHAMP ascending and descending node measurements to remove the contribution from the meridional wind and compute the zonal wind. Hopefully, that would give you better comparison between the FPI and CHAMP observations.

4. Figure 7 should be the focus of the paper. I really don't see much value having two

C2

HWM model runs results shown here. You only need one. The FPI (Alaska) probably does not add much and more like a distraction. The old and new FPI comparison should be discussed in a different paper, you can have inter-annual variations here.

5. The solar minimum data are not very useful since there are no CHAMP observations.

6. I think the conclusion should be clearer that the CHAMP winds are overestimated. As the paper points out that the CHAMP winds are almost the same magnitude as ion drift at Kiruna, which is incorrect.

7. While Aruhiah et al. 2005 reference is listed for the instrument information. It will be a great help to give a short paragraph on the two FPIs (gaps, aperture size, detector, from which year to which years) given that instrument upgraded over the years.

Minor

1. In the comparison section, the FPI (Alaska) was used, but there is no mention of it in the abstract and earlier instrument description. It should be added to the abstract, if it is to be used. Personally, I think the data should be dropped.

2. Many the figures have very low resolution and are difficult to read.

3. Figure 5, the FPI from one direction has error bars and the other does not. Why?

4. L 444 to LL448. 'During the 1980s and 1990s we used state-of-the-art UCL designed and built Imaging Photon Detectors (McWhirter et al., 1981) and then EMCCDs (Andor iXon 887/885) were installed around 2005 (McWhirter, 2008). The revolution over the last 30 years in ...' Was the UCL FPI running with the imaging photon detector from 2001 to 2003, it is not clear in the paper. That is why I ask for a more detailed instrument description to be added.

5. I do not see Harris 2001 paper (L554) in the reference. Or the reference date is wrong? It is not 2017, should it be 2001?

6. Equ. 5 is wrong. It does not match the two references.

C3

7. There should be some discussion on hypothesis C (L520).

8. Why is the HWM model run not included in Figure 8 comparison for Kiruna?

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