Review of "Development of time-varying global gridded Ts-Tm model for precise GPS-PWV retrieval", by Jiang, Ye, Lu, Liu, Chen and Wu

General comments

This is a nice article that I enjoyed reading.

The authors use ERA Interim data for the years 2009 to 2012 to determine surface temperature, Ts, and weighted mean temparature, Tm, with a time resolution of 6 hours for a global grid with resolution 0.75 x 0.75 degrees. Based on this, static, linear Ts-Tm relations are deduced for each gridpoint, as well as linear Ts-Tm relations that on top include annual, semiannual and diurnial variations (modelled with cosines). The global properties of these data sets are shown.

Secondly the performance of these two models, as well as of the Bevis formula and a latitude related model is compared to Tm data from 758 radiosonde stations for the year 2016. It is concluded convincingly that with a few exceptions the ERA Interim gridded Ts-Tm model including annual, semiannual and diurnial variations is superior to the other sources of Tm in the comparison.

In connection with publication of the article the authors will make available to the community their model.

The material deserves publication.

There are some unclear points, figures that can be improved, etc., calling for a revision of the article.

The English is not good. When making their revision the authors should have a person with good command of English in scientific writing help them.

Some aspects to consider in a revision
Consider using the term integrated water vapour, IWV, instead of PWV.

Section around line 65: Is it well established that global empirical Tm models without Ts components are less good? If so give some references. If not, include some of them in your comparisons of different sources of global Tm. We want to know whether your dataset is the best global set for Tm estimation around for the moment, or just better than other Ts-Tm based sets.

Notice that in numerical weather prediction one in general uses GPS ZTD, not PWV. PWV is important for climate monitoring, and for meteorologists doing weather forecasting combining information from weataher prediction models and observations.

around line 100: Did you take into consideration that water vapour pressure (and density) varies approximately exponentially with height when doing the integral in eq. 4. It is not likely to have a large impact, but the fewer RS levels you have access to, the larger the effect. 5 levels is not a lot.

around line 120: "geoid height" should be "geometric height". The reference surface doesn't matter for the integral.

around line 150: There are several places where text is not properly separated, here E180. etc., text of

figure 3 is another example.

Figure 1. It is hard to see properly the RS circles. Consider making the figure little bit larger, and draw a thin black line around the RS circles, in order that one can see them also where they agree with ERA.

At many places in the text and in the figures units are missing.

Figure 6: Are the colors plotted in a particular order, such that for example large rms will be plotted on top of small rms? If so, do a check that plotting in the opposite order yield almost similar plots. Otherwise enlarge.

Regarding the RS ERA comparisons. Is anything done to handle altitude offsets between RS surface and ERA surface?

Around line 280. At 10.82 % of the sites inclusion of the time variations in ERAI resulted in a poorer results. That indicates ERAI has particular problems at these locations. If you plot them on a map, do you see any systematics in their location?

Around line 310. The pressure used to determine ZHD should be the pressure at the GNSS antenna level, not surface pressure. Did you do something to correct for height offsets, or is the barometer installed at the same altitude as the GNSS antenna at these locations?
Similarly the Tm integral should in principle run from the antenna level and up, not from the surface. In almost all cases that is not likely to create problems, but there will be locations where the difference between the surface altitude of ERA and the altitude of a GNSS site is huge. I'm not familiar with the location of IGS sites, but for GNSS reference sites in general the altitude difference can be more than 1000 m between a GNSS site and an NWP model with higher horisontal resolution than ERAI

Around line 385: It would nice if in the final article you could add an extra line with a link to your dataset. It seems very useful to many people :-)