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Atmospheric Measurement Techniques Discussions

Interactive comment on "The uncertainty of the atmospheric integrated water vapour estimated from GNSS observations" *by* T. Ning et al.

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General comments:

This paper contributes to the Global Climate Observing System (GCOS) Reference Upper Air Network (GRUAN). It comprises and discusses all error sources and components for estimating GNSS Integrated Water Vapour (IPW) uncertainty. Thus it is a good, very basic and necessary work that can be used (and implemented) by all working on and interested in GNSS data analysis for atmospheric research domain. It could be a good point to emphasize that the work is targeted to GRUAN, but applicable much more widely.

The analysis (and the examples) in this paper is restricted to one method of GNSS data

processing only (Precise Point Positioning). However, while looking at a larger research community, the Double Differenced (DD) method (or Network Method) is used as well. The choice of a method depends on user considerations. As both of the methods are widely used, it could be good to mention that the uncertainty analysis is similar for both of them.

Some minor comments/questions:

8821, 8822, Eq. 3-7: Having 3 techniques (A, B named explicitly and probably C expected for the third). For sake of better readability, it could be commented, that the Standard Deviations (SD) can be expressed in a similar way for other combinations (i.e. A-C and B-C) also.

8823, 5: "... is not long enough ..." – any recommendations/suggestions about the time scale?

8824, 8825, Eq. 11-13: Zenith Total Delay (ZTD) and its components ZHD and ZWD should be defined as "l's with indexes" before using of them.

8825 (section 3.1.1): Implementing orbit errors in ZTD uncertainty budget. It is clear that the navigation accuracy depends on satellite constellation. It is mentioned 8838, 25-27: "... worse geometry of the satellites". Wouldn't it be easier to implement a correlation with GDOP values (based on Almanac data known already beforehand) instead of calculating and splitting orbital errors into two components and adding them to the formal ZTD-error?

8826, Eq 15: What is "lamda" – probably, GNSS signal carrier's wavelength?

8826, 8827: using both radial & tangential versus along-track & cross-track feels a bit messy.

8826, 11: What is the "impact factor", the values of tangential and radial components from Eq.15? Tabulated values from Table 2?

Figure 1: Impact factor of orbit errors on ZTD, with "radial (0…1) and tangential (ca 0…0,13) – how they have been added to the ZTD? If knowing the impact factor, it is not explicitly shown how these orbit errors add into ZTD formal errors.

What are the time scales in atmospheric research domain for what we need to know the impact of orbital errors (and its components)? For a short time span it is understandable, but what about making statistics over the month and years? How does it (knowing the orbital error components) affect the result of trends?

8835, 8836 Eq. 24, 25: exponents (E-6) depend on units. Could be good to write explicitly what units are used for all parameters – k3, k2', ...

Interactive comment on Atmos. Meas. Tech. Discuss., 8, 8817, 2015.