Reviewer #2

This is an excellent manuscript, almost ready to publish.

It addresses a topic that is currently at the forefront of GNSS meteorology: The use of ZTD delay gradients estimated from GNSS data in numerical weather prediction models via data assimilation, on top of assimilation of ZTD.

By consideration of both a dense and a sparse GNSS network dataset, it is demonstrated that assimilation of ZTD gradients (which are cheap to obtain) improves the resulting analyses in a way that would otherwise require a denser network (which is in most cases expensive to obtain) if only ZTD is assimilated.

A few things should be improved:

Specify in more detail the type and amount of "conventional data" that was assimilated.

Thank you for the comment. We have now clarified the type and amount of conventional data used in the experiments.
Please refer to **Lines 170 to 174**.
"To improve the analysis, we assimilated a set of conventional observations in addition to the GNSS observations. The conventional observations included a network of SYNOP stations across Europe. Radiosonde measurements offered a detailed view of the atmospheric thermodynamic structure at launch points. In order to maintain simplicity within the DA system, we limited conventional datasets to SYNOP surface observations and radiosondes. The number of observations ranges from 1029 to 1225 for SYNOP stations and 4 to 35 for radiosondes."

In line 73. Consider changing to: "..only source of GNSS moisture data..", unless the conventional data did not include any humidity data.

Thank you for the comment. The sentence has been corrected. Please refer to the second comment from reviewer #1.

Figure 2 is confusing. As I understand the text DA is done every 6 h. I take it is done simultaneously for the different types of observations (depending on the experiment), using a 6 h old forecast from the previous run with that experiment as first guess.
But why are then the conventional observations represented by tilting arrows, and the GNSS data by vertical. Somehow horisontal is time in the figure, but the arrows are separate in time then.
I would expect there to be a "DA 2" in the box named 20130506 06 UTC, a "DA 3" in the box named 20130506 12 UTC, and so forth.

Thank you for the comment. We have now changed the Figure 2 as per the reviewer's comments.
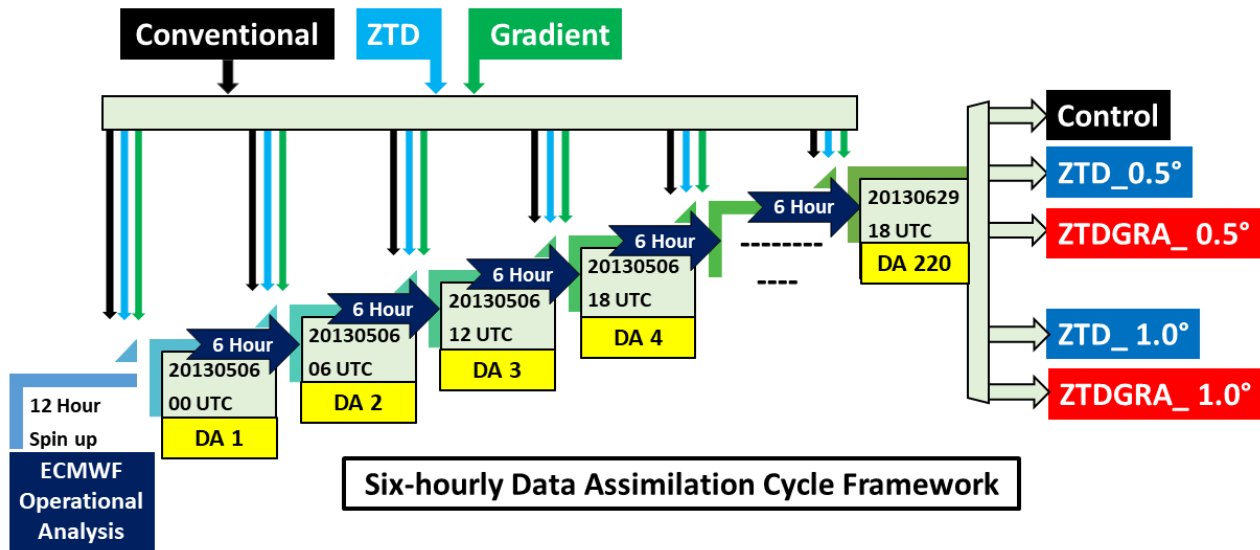
Figure 2. Schematic of the 3D-Var Six-hourly DA cycle initialized from the ECMWF operational analysis. Five experiments with different setups are performed in two sets. The first set comprises a control run assimilating conventional data, a ZTD_0.5° run assimilating ZTDs on top of the control run, and a ZTDGRA_0.5° run assimilating ZTD and TGs on top of the control run. These experiments are conducted with the observations from the (dense) 0.5-degree station network. The second set runs are ZTD_1_0° and ZTDGRA_1_0° with the assimilation of observations from the (sparse) 1-degree station network.