

**Authors Response  
to  
Reviewer II comments  
on  
manuscript  
acp-2017-567  
Data assimilation of GNSS Zenith Total Delays from a Nordic processing centre  
by  
Lindskog, Ridal, Thorsteinsson and Ning**

**September 2017**

Dear Reviewer II,  
We are very thankful for quick and excellent comments. We have taken action to all suggestions and comments. See our responses below in blue. The comments and suggestions were well in accordance with the ones made by a separate Reviewer. We have updated the paper based on the feedback and we feel that we have benefitted from the comments by Reviewer I. The modifications will appear in the revised paper to be submitted shortly after 26 September. The constructive comments and suggestions made by the two anonymous Reviewers were greatly appreciated and we have made a note of that in the Acknowledgements of the revised manuscript.  
Best Regards  
Magnus, Martin, Sigurdur and Tong



## Reviewer II comments and responses

### General Comments

This paper is reasonably well written and I find its topic quite interesting in the context of limited-area mesoscale model Data Assimilation.

Anyway, I feel there are a few issues that might deserve a closer look, as discussed in the detailed comments below.

Thank you for your generally positive view on the manuscript and for your constructive comments that are well in line with the comments of Reviewer I. We have revised our text, and suggestions and detailed responses can be found below.

### Specific Comments

#### Introduction

- A so extended explanation of the model used could not be so necessary here due to it is done later in Section 3.

We totally agree and related comments came also from Reviewer II. We have therefore removed several sentences concerned with NWP setup details and made sure these are instead covered in the NWP setup section.

- When it says “and GNSS ZTD from 28 receiver stations are assimilated operationally in MetCoOp” could be explained a little more.

Good suggestion. We have added the following text to explain a bit more about the 28 receiver stations that were assimilated operationally into the MetCoOp system:  
'These 28 receiver stations have been selected from the rather few receiver stations over the MetCoOp domain. Often these are supersites, processed by several centres for comparison purposes. MetCoOp operationally uses data processed by the Met Office in the United Kingdom and by the Royal Observatory of Belgium.'

#### Section2:

-The writing (wording) of this section should be revised.

Thank you, we have revised the section.

#### Section4:

-More clarification of the different experiments should be made, for example when talking about A, B or D experiments comment that they are all using 100km thinning, when the experiments are from A, C or D they are using a constant offset, etc. Maybe a table with all the experiments and properties could help.

This is an excellent suggestion. We have added a number of sentences describing what is in common between experiments in different studies. However, in our opinion, after adding these sentences, it is not necessary to add an additional Table to the manuscript describing the experiments. The newly added sentences are: ' Note that in all experiments of studies A, C, and D only one predictor in the form of an offset value was used. In all experiments in studies B and D a 100 km thinning distance was used. All experiments in studies A, B and C used the operationally used B matrix and all experiments in studies B, C and D used the NGA1 data set, processed with the Bernese approach.'

-Why do you specify the experiment name just on A1, A2, and A3 cases ?

Thanks for pointing this out. It was a mistake and it was inconsistent. We have chosen to remove the specification of experiment names also from A1-A3, since we think these are not needed.

#### Section5:

-The Case study Section was clearly explained but may be not enough to show the improvement of using one thinning distance or other. Supporting those graphics with the use of SAL verification method for example could result in a more complete description of the chosen case study.

We appreciate this comment and also another Reviewer had similar thoughts that supporting graphics would be beneficial. We therefore included one additional Figure in the manuscript showing gauge-adjusted precipitation. Due to the phase error, we have chosen to shift the accumulation period for one hour as compared with the accumulation in the forecasts. We believe that this Figure has improved the illustration of the case study and thank the Reviewer for his suggestion. We have also added text in the case study section related to the newly added Figure. Finally we have modified the radar Figure to show gauge-adjusted accumulated precipitation, rather than instantaneous precipitation as before. Regarding SAL verification, we think that it would be mainly beneficial for an extended period and not just for the one case. Based on that and the fact that we already have several different verification approaches applied in the manuscript we chose not also to include SAL verification

### **Technical Corrections**

#### Introduction

-There are several repeated “they”

Thanks, at one point 'they they' was replaced by 'they' and at another point we simply removed 'they', since it was not needed. Now 'they' appears only once or twice in the section.

-Statistics instead of statistics

Corrected.

#### Section2:

-NGAA name should be mentioned at the beginning.  
It is now mentioned at the beginning of section 2.

-ZTD instead ZTDs  
Modified as suggested.

-NRT: explanation is needed when it is used for the first time  
Abbreviation is defined the first time it is used. One sentence has been added in order to give a brief explanation about what near real time means in E-GVAP.

2.2. The title could be changed to NGA1 product/ dataset, not just NGA1  
As suggested, we have modified the title from 'NGA 1' to 'NGA 1 dataset'.

2.3 The same  
As suggested, we have modified the title from 'NGA 2' to 'NGA 2 dataset'.

2.4 Please review the wording. Receiver instead of reciever  
The section has been partly re-written and 'Reciever' is corrected to 'receiver'.

### Section3:

-assimilation instead of assi milation  
Corrected.

-data assimilation instead of data assimilations  
Corrected.

-...control variable vorticity, unbalanced divergence, ... review that sentence  
We have now modified the sentence and split it into two sentences, to make it easier to read.

-alleviate instead of elevate  
Corrected.

-Last paragraph: review the writing  
Thanks, we have now reviewed and improved the wording in the last paragraph of section 3.

### Section5:

5.2- Review the first sentence writing  
Thanks, we have now modified the sentence and split it into two sentences, to make it easier to read.

5.3.-

-H+12 and H+24 instead of +12 and +24

*Thanks for making us aware of inconsistency between text here and in Figures 6, 8, 9 and 10. However we prefer to write the forecast ranges as '+12 and +24 h'.*

-Fig 6: H+12 instead of +12

*Thanks for pointing this out, but again we prefer to write the forecast ranges as '+12 and +24 h'.*

-“For forecasted variables other than humidity...”, review this sentence

*The sentence has been modified to be clearer.*

-“.. in the form of NGA1...”, it is not a 'form' but a product or dataset.

*Modified as suggested.*

-Review the writing of the last part of the section

*As suggested we have reviewed the writing of the last part of the section now modified at some places to make the text clearer and easier to read.*

-Fig 8, 9 and 10: H+12 and H+24 instead of +12 and +24

*Thanks for pointing this out but again we prefer to write the forecast ranges as '+12 and +24 h'.*

5.4- Figure 12: 2016 instead 2026

*Corrected.*