

Response to anonymous Referee#2

We thank the reviewer for the useful comments and suggestions which will certainly improve the manuscript. Next, all specific comments and technical corrections have been answered. Besides, in most of them, the re-written sentences (in quotations) follow the answers. If accepted, the changes will be included in a revised manuscript.

Specific comments

After reading the abstract one gets the impression that the authors compared the following experiments (set-up 1):

- control,
- control plus extra radiosonde data,
- control plus extra satellite data,

and that the authors then found a strong beneficial impact when satellite data are assimilated. Although it is not explicitly said there's a certain risk that the naive reader then might conclude that the extra satellite data are more beneficial than the extra radiosonde data.

However, when reading the main paper including the conclusions chapter it seems that the authors assessed the following set of experiments (set-up 2):

- control,
- control plus extra radiosonde data,
- control plus extra radiosonde data plus extra satellite data.

When the latter (set-up 2) is true,

- can the authors please modify the text of the abstract, maybe in the following way:

When in addition to extra radiosonde data also more/enhanced satellite data are assimilated...

Set-up 2 is the one used in this work, and the abstract will be modified as suggested by the reviewer. Also, as recommended by referee#1 this sentence can be re-phrased in a more quantitative sense. The affected sentences will be re-written as:

“The results obtained show that extra radiosondes have an overall positive impact on the forecasts (average improvement of all upper air variables and vertical levels studied is 3.6%). When in addition to extra radiosonde data also enhanced satellite data are assimilated, the overall forecast skill is almost doubled. However, a distinct behaviour is found between PREVIEW and MEDEX cases. While for MEDEX cases the improvement is slight, for PREVIEW cases is significant (average improvements of 1.7% and 8.9% respectively for the experiment with enhanced satellite data).”

- can the authors please explain/motivate why they have chosen this set-up 2 and not

set-up 1 or the following full set-up 3:

- control,
- control plus extra radiosonde data,
- control plus extra satellite data,
- control plus extra radiosonde data plus extra satellite data.

Why set-up 2 and not set-up1 or set-up 3?

The present paper deals with the impact of targeted observations on the forecast of some high impact Mediterranean events, derived from two field campaigns. Three experiments are carried out in an operational context, taking into account the existing composite observation system and the observation usage in the data assimilation systems. The main goal is to test the impact of the targeted observations available in these campaigns. In PREVIEW and MEDEX, only extra radiosondes were deployed as targeted observations. Then, initially we compared EXP-RS (control plus extra radiosonde data) with EXP (control). The number and location of extra radiosondes are rather different from case to case, and in some cases, extra radiosondes only partially sampled sensitive regions, because targetable stations were mostly located over Western and Central Europe. Sensitive regions located over Europe were correctly sampled, but this was not the case of those over oceanic regions. Due to some difficulties, ATOVS data are not assimilated over land in most operational data assimilation systems. With EXP-ATOVS2 (control plus extra radiosonde data plus extra satellite data) we seek to test the potential **additional** improvement obtained with an enhanced sampling of the sensitive regions located over the oceanic areas to complement (not to replace) the extra radiosondes launched in the continent and in some cases a few remote islands and ships. At any case, we agree that it would be interesting to test the single impact of the enhancement of satellite data assimilated over the sensitive sea areas with respect to control as a further step of this study.

In order to further clarify the experiments set-up, section 2.1 “Experiment Description” has been re-written as follows:

The first paragraph of section 2.1:

“Three experiments have been conducted over the two different periods of 2008 (PREVIEW and 2009 (MEDEX) field campaigns. They are carried out in an operational context taking into account the existing composite observation system and the observation usage in the HIRLAM data assimilation system. The assimilation cycle started one week before for spin-up reasons.”

The last paragraph of section 2.1:

“The number and location of extra radiosondes were rather different from case to case during the field campaigns, and very often, they only partially sampled the sensitive regions. The third experiment, EXP-ATOVS*2, aims to investigate other data targeting strategies in HIRLAM DA, in particular a non uniform data thinning for the satellite data located in the target region, following the work of Bauer et al. (2011) with the ECMWF global model. With EXP-ATOVS2 we seek to test the potential additional improvement obtained with an enhanced sampling of ATOVS data located in the sensitive regions over the ocean and sea areas to complement the extra radiosondes mostly launched in Europe. EXP-ATOVS*2 experiment assimilated the same observations as EXP-RS but, in the sensitive areas, it allowed a double density of satellite data to influence the analysis (a minimum distance of 0.45°, close to the original AMSU-A data resolution). Some changes in the screening algorithms of the DA system were implemented accordingly.”

When the first (set-up 1) is true page 7, lines 26 and 27 need to be rewritten and also the third bullet point in the conclusions chapter (page 26, lines 12 to 14).

As set-up 1 was not used, no changes are introduced.

Page 30 (P2810) , line 15 and 16:

The sentence "In this study we have not addressed the influence of errors on the determination of the target areas." is unclear and requires rephrasing. Which errors influencing the determination of target areas do the authors think of? Do the authors want to say that the influence of potential differences due to application of differing sensitive area calculation/prediction methods was not addressed in this study? This is at least another potential explanation for the differences observed between MEDEX and PREVIEW cases.

Yes, that is true. For this reason the sentence can be rephrased as you pointed out:

"The influence of potential differences due to application of differing sensitive area calculation/prediction methods was not addressed in this study".

We also agree that, in principle, this might be another potential explanation for the differences observed between MEDEX and PREVIEW cases. However, we do not give a high confidence to this hypothesis, because (as it is explained in detail in the response to discussion comments of Referee#1) in most of the PREVIEW cases, the request of extra radiosondes was guided by SVs, and only in a few cases, the "lead user" selected a larger area to include not only SVs but also ETKF sensitive regions.

Page 27 (P2807), line 7:

Please check whether "radiosonde" can and should be inserted. "A positive impact due to targeted radiosonde observations is ..."

We agree in inserting the word "radiosonde" in page 27, but also, in the abstract as follows: "A positive impact due to targeted radiosonde observations is therefore observed in all variables and the addition of enhanced satellite observations is able to double it."

Technical corrections

page 3 (P2783), line 13: Please check whether "data-sparse areas" is better than "sparse data areas". Ok

page 6 (P2786), lines 15 and 16: the 'Global Telecommunication System' (GTS)
Ok

page 7 (P2787), line 26: replace "that" by "as" Ok

page 8 (P2788), line 10: Shouldn't this better read "the region where the high-impact weather was expected to take place"? Ok

page 13 (P2793), line 25: maybe insert "level": "At surface level there..." Ok

page 14 (P2794), line 8: maybe insert "actually": "...the regions actually affected..." Ok

page 14 (P2794), line 20: "driving factors" instead of "driven factors" Ok

E.g. page 15(P2795), line 2 but several occurrences in the paper: "aircraft" is singular and plural Ok

page 16 (P2796), line 25: replace "sensitive" by "sensitivity"

The expressions "sensitive maps" or "sensitive regions" are used several times throughout the manuscript, and we do not see the benefit of replace it by "sensitivity".

page 16 (P2796), line 25: replace "into" by "in" Ok

page 25 (P2805), line 27: insert "of": "...a set of observing..." Ok