Dear Gianpaolo Balsamo,
We would like to thank you for your careful and constructive review of our paper. We have tried to follow all your requests as best as we could and believe that it helped to substantially improve the manuscript. A point by point explanation follows below for your comments:

Main comments:

1) *In "5.4 Evaluation for a single point" at page 7173 there is no mention to the fact that the filtered-Jacobian experiment exhibit larger soil moisture increments in several occasions. Why is that? Was the noisy behaviour simply dampening the Jacobian value in the reference offline runs? Please explain this result.*

<u>Reply:</u> An explanation was added to the revised manuscript:

The large increment for FIL on 14 July corresponds to a heavy precipitation event in the region. In the second half of the month the increments for FIL are often larger than those for REF. It is easily explained by the evolution of the SWI values for W2 (not shown). On the 9th of July the negative increment of REF is much larger than that of FIL. In FIL the noise filtering in the Jacobian prevents the large negative increment. This results in a negative SWI-value for REF, while the SWI value of FIL is just above zero. As a consequence FIL remains sensitive to increments, while in REF the increments for W2 remain near zero as long as the SWI value is negative. The heavy precipitation event of 14 July brings the SWI value of REF above zero again, but on 16 and 19 July this results in a strong negative W2 increment. After that the SWI value of REF remains below zero most of the time, while the SWI value of FIL is positive and thus FIL has larger increments in this period.

The corresponding figure (Fig. 1) is added to this document for the reviewer.

2) *The scores comparison between coupled and offline estimated Jacobian is not made. Are those scores exactly the same? By visual comparison of Figure 15 and 16 this seems the case. If so this is a remarkable result and also a worthwhile comment to be added in 5.4 and the conclusions.*

<u>Reply:</u> The scores are much alike but not exactly the same. To show this, two figures (Fig. 2 and Fig. 3) were added here for the reviewer with the forecast scores for REF and FIL on the same figure for RH2m and T2m. Furthermore, related to comment nr. 3, a table was added to the revised manuscript with the forecast scores averaged over 13 Belgian stations for the coupled and the offline case. A paragraph about the scores comparison between the coupled and offline estimated Jacobian was added to the revised manuscript at the end of 5.4:

<u>The scores of the offline and coupled runs are very similar to each other. In the coupled case the improvement in the filtering (FIL) RH2m scores compared to REF is larger than the improvement in the offline scores (table 2 and figures 15 and 16). This is probably due to the fact that in the coupled case more oscillations are present due to feedback mechanisms between the soil and the atmosphere. Overall the scores of FILcpl are the lowest. For FILcpl, the coupling between the soil and the atmosphere allows a more correct Jacobian calculation and the filtering succeeds in removing the more abundant oscillations.</u>

A few sentences were also added to the conclusions in the revised manuscript:
The T2m and RH2m forecast scores for the offline and coupled approach are very similar. In both approaches the filtering produces similar scores for T2m and a small improvement in the RH2m scores. This RH2m improvement is larger for the coupled approach and in general the coupled, filtered approach gives best forecast scores. However, due to limited computational resources, we still prefer the offline filtered approach which takes a lot less computing time. For example, on the Belgian computer the offline approach of the EKF takes 7 minutes on 6 cpus while the coupled approach takes 52 minutes.

3) *Given the number of stations present is manageable if possible I would suggest adding a table with results for temperature and relative humidity scores supporting the statement at P7173L13-15. I believe this could strengthen the conclusions.*
Reply: We think this is a good suggestion. A table was added to the revised manuscript with the RH2m and T2m forecast scores for the four runs averaged over 13 stations in Belgium. A sentence about this was added to the revised manuscript:
Table 2 shows the T2m and RH2m forecast scores averaged over 13 stations in Belgium for REFofl, FILofl, REFcpl and FILcpl. This shows that, when averaging over 13 stations in Belgium, the filtered runs give a small improvement in scores for RH2m and similar scores for T2m.

4) *In the perspective there is no mention to the possibility of using a different and more realistic vertical discretization for the soil layers (e.g. ISBA-DIF). Is this not envisaged in the future? For instance the irrelevance of wg Jacobians and the dominant weight of the w2 Jacobians in the presented study are also a reflection of the choice of land surface scheme version so maybe adding a comment on those lines would be worthwhile.*
Reply: We agree with this comment. A paragraph about this was added to the revised manuscript:
The results in this paper are specific to the choice of LSM, i.e. the 2-layer IBSA scheme. For example the dominance of the weights of the Jacobians of w2 compared to wg is expected to change when a more realistic vertical discretization of the soil layers is used like in the ISBA-DIF scheme (Boone et al., 2000; Habets et al., 2003).

5) *While the method is applied to the operational ALARO domain it is not clear if the method is expected to be used operationally (or is already) and if yes which of the studied configuration is likely to be considered. A sentence in the introduction (in case already in operations) and conclusion would be a worthwhile clarification.*
Reply: The EKF is not yet used operationally, but it is expected to be in the future. A sentence about this was added to the revised manuscript: **In a next step the filtered offline approach of the EKF soil analysis for SURFEX will be combined with a 3D-var assimilation for the upper-air of the ALARO model. This will be an important step towards the operational use of the EKF which is planned for the future.**

Detail comments:

- *7164 L25: processses –> processes*
Reply: corrected

- *7167L4: jacobian –> Jacobian*
Reply: corrected

- *7169L6: alinged –> aligned*
Reply: corrected

- *7174L12:disapear –> disappear*
Reply: corrected

- *7190Lend-3: finitie –> finite*
Reply: corrected

- *7194 Fig 14; why not plotting figure a with the same x-axis as b,c?*
Reply: The x-axis of figure 14a has been changed so that it is the same as that of b and c.

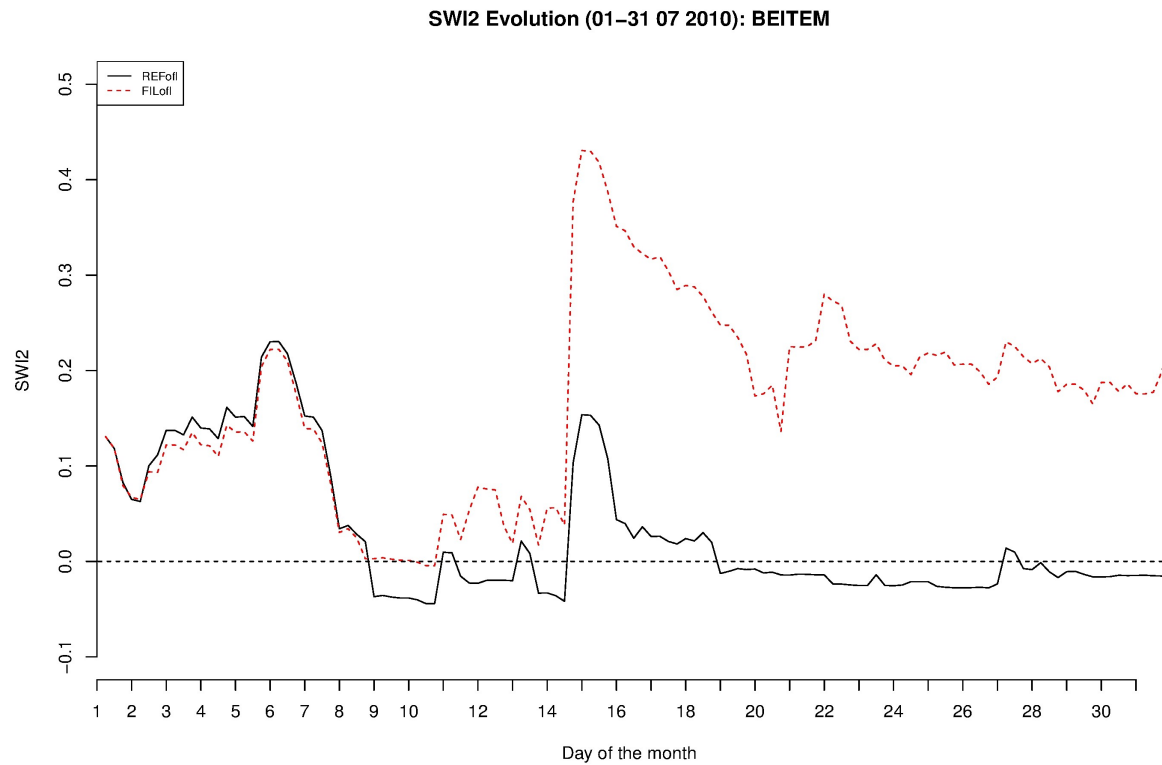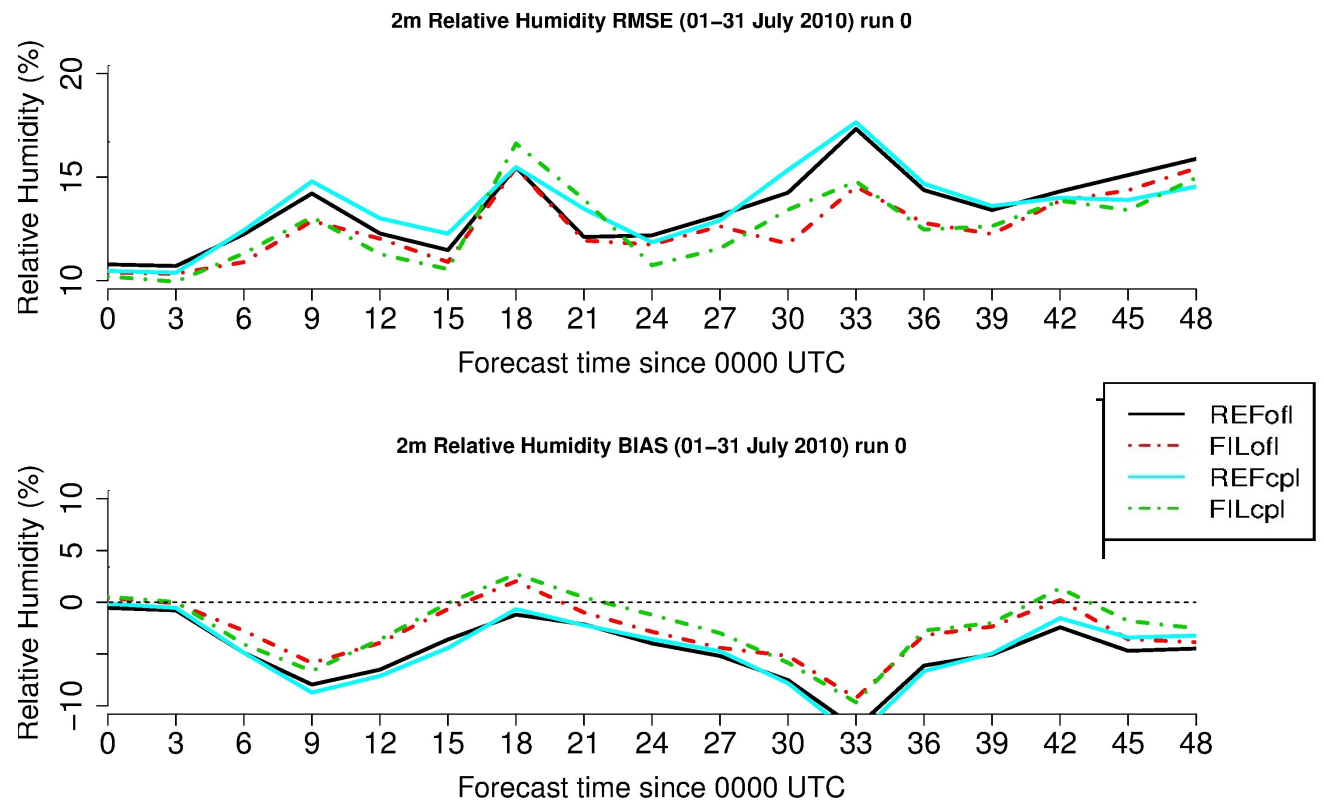**SWI2 Evolution (01−31 07 2010): BEITEM**

Figure 1: Evolution of the Soil Wetness Index of layer 2 (SWI2) for Beitem for REF(black) and FIL(red)

Figure 2: Comparison of RH2m forecast scores between offline and coupled runs.

2m Relative Humidity RMSE (01−31 July 2010) run 0

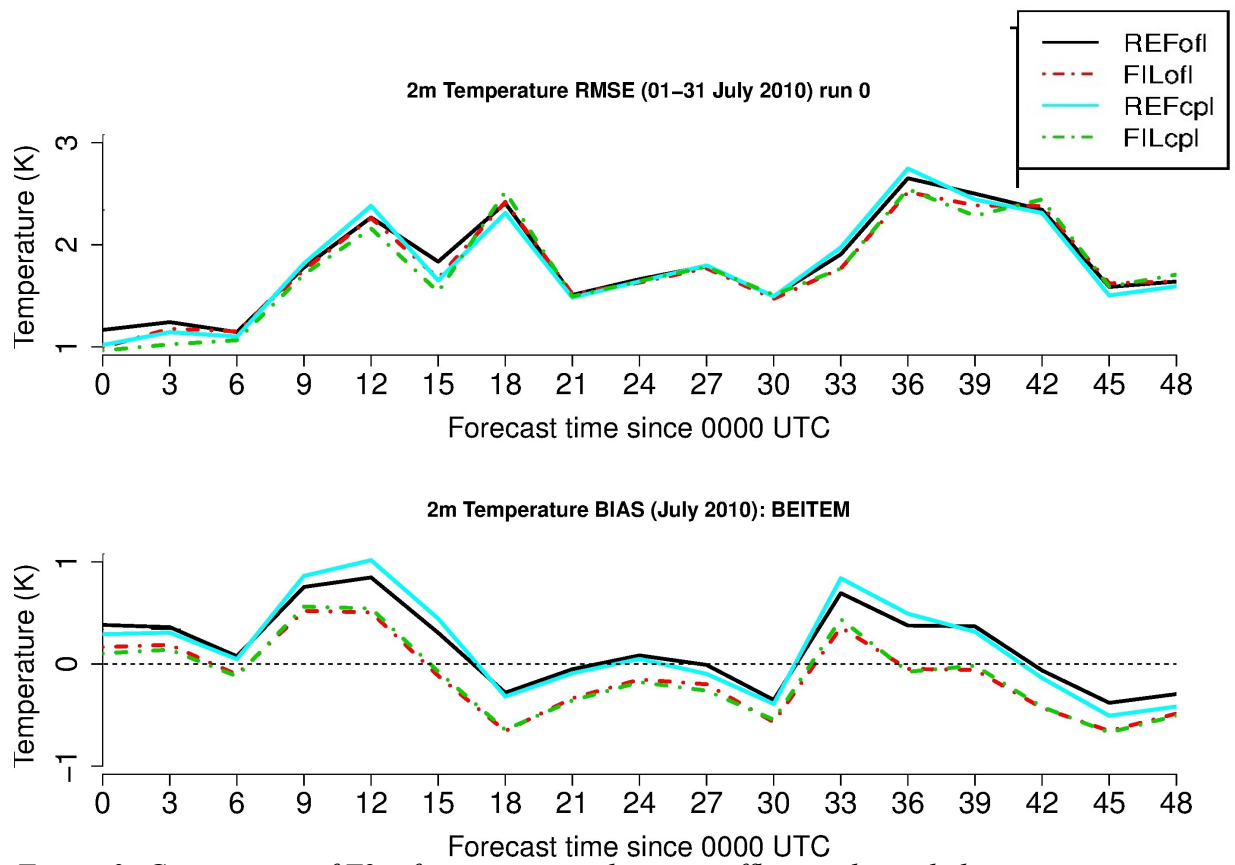**2m Relative Humidity BIAS (01−31 July 2010) run 0**

Figure 3: Comparison of T2m forecast scores between offline and coupled runs.