

We would like to thank the reviewers for their time to review this manuscript and helpful suggestions to improve the manuscript. The reviewers questions are highlighted in bold, and the modifications to the manuscript in red. Figures 6 and 7 have been recomputed with a smaller number of elevation angles, and new colors have been chosen for figures 6, 7 and 9 to 13. To answer to reviewer 2 comments, original figures 9 to 15 have been modified. We hope that the improvement we brought to the figures will now fit the reviewer comments to make the manuscript suitable for publication.

#### **Reviewer 1 comments :**

**Figure 16 - it is well known that the radiometer could resolve ground-based inversions but poor in depicting elevated temperature inversions. What would be the value added by 1DVAR?**

The main improvement from 1DVAR can be expected above 1 km altitude but for the two cases shown in the paper, the 1DVAR performs slightly better than regressions even below 1km. For the stable case (deep near surface temperature inversions), both 1DVAR and regressions can resolve the temperature inversions but the best accuracy is found with the 1DVAR particularly below 1 km altitude. For the cloud-based temperature inversion, the 1DVAR retrieval resolves better the inversion than the regressions. With both configurations (from the AROME background or the radiosonde), the inversion is more pronounced and closer to the radiosonde. Figures 9, 12 and 13 show that the value added by the 1DVAR is mainly above 1 km altitude where the RMSE stays within 1 K whereas it reaches 3 K with regressions.

**One of the scientific objectives of the paper is to study the performance of radiometer in deep valley. However, the results look like similar observations have been reported for flat terrain as well. Which unique features of the measurements of the radiometer have been shown in the paper?**

In such complex terrain we could have expected the measurements to be affected by surrounding mountains and one major result of this study is to show that MWR observations are not affected in such a narrow valley even going down to 5° elevation angles. In fact, previous papers deploying MWR in truly complex terrain are not abundant, from our knowledge only three : Kneifel et al 2010, Cimini et al 2011 and Massaro et al 2015. The study of Kneifel et al 2010 does not investigate the temperature profile retrievals and the radiometer is deployed at the mountain top above the crest.

In Cimini et al 2011, the terrain is more complex but the 1DVAR is investigated with a global NWP model at a 10 km horizontal resolution and only one elevation angle in addition to the zenith. The radiometer measurements do not go lower than 15° elevation angle which significantly limits the possible perturbation from surrounding mountains.

Massaro et al 2015 deploys the instrument in a valley with a free viewing angle up to 28 km whereas the Passy valley is only 5 to 6 km long in the Passy direction. This is also the first time, from our knowledge, that the instrument was operated scanning in two directions. In addition, Massaro et al 2015 only focussed on regressions without any comparison with the 1DVAR algorithm and the temperature gradients were smaller compared to what was observed during Passy. The study has thus shown that microwave radiometers are suitable for very complex terrain where mountains at less than 5 km from the instrument do not affect the quality of the measurements even if very low elevation angles are used (down to 5.4 °) , in particular during cold pool events.. This is also the first time that 1DVAR retrievals in a very complex terrain are evaluated using forecasts from a convective scale model.

**What new features have been found for retrieval at an elevation angle/boundary layer**

**scans?**

This study confirms that low elevation angles can be used in a complex terrain. The improvement brought by low elevation angles is equivalent to what was found in previous studies on flat terrain.

To summarize these comments, the following sentence has been added to the introduction :

**To that end, this is the first time that a MWR has been deployed in such a narrow valley (less than 5 km between the closest mountain slope and the instrument) with measurements going down to 5 ° elevation angle during which 1DVAR retrievals are performed from a convective scale model.**