

## ***Interactive comment on “All-sky assimilation of infrared radiances sensitive to mid- and upper-tropospheric moisture and cloud” by Alan J. Geer et al.***

### **Anonymous Referee #5**

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The paper entitled “All-sky assimilation of infrared radiances sensitive to mid- and upper-tropospheric moisture and cloud” by A. Geer, S. Migliorini and M. Matricardi is a very interesting study dealing with the problem of the all-sky assimilation in the infrared spectrum. This topic is now widely studied, but no operational application is now available. The aim of this paper is to show that all sky infrared assimilation is at least as valuable as clear-sky assimilation in the ECMWF system and could be considered for operational implementation. In order to get a clearer signal from the all-sky assimilation, the chosen approach is to focus on the assimilation of 7 water vapor IASI channels either in the clear-sky stream or the all-sky stream.

C1

The authors first expose the all-sky assimilation with the description of the observation operator, the observation errors described in another paper (Geer, 2018), data selection. The quality of simulated all-sky brightness temperatures is then assessed before presenting the results of data assimilation experiments. This all-sky assimilation is first evaluated with the full observing system and then in the absence of the other observations to increase the impact of the assimilated observations. Finally the weight of the observations due to the use of the variational quality control is discussed.

The methodology used in this paper is clear and logical. The authors provide many details and address a lot of issues while making the comparison throughout the paper with microwave all-sky assimilation. This paper should be published with minor revisions.

General comments: I am a bit confused with the assimilation of IASI channels. If it is clear that the test of all-sky assimilation is applied only over the 7 water vapour channels, it is unclear to me if temperature and ozone channels are assimilated in the experiments. However, if I understood well subsection 2.2, temperature and ozone channels are assimilated in clear-sky conditions in the 3 experiments. I think it is important to add this information in Table 3, if it is the case, especially for the No WV7 experiment.

Always related to this issue, what is the impact of the clear-sky and the all-sky assimilation of the 7 WV channels on the assimilation of the other T and O3 IASI channels? Is the number of assimilated T, O3 radiances modified by both clear-sky and all-sky water vapor assimilations?

Specific comments P 3, line 31: Could you please explain more why water vapour channels are not affected by the “zero gradient” problem?

P5 line 30. The paper structure is not announced at the end of the introduction, as usually done.

C2

P6, line 24: Could you please explain more which impact (or not) could have the reduced horizontal model resolution on your results as you said p2 l21 before that increased model resolution allows for cloud simulation to be closer to observation clouds.

Typos: P13, Fig2: Should title of the panel be FG eigendeparture check?

Fig2: it is very difficult to distinguish something in this blue color with this color palette.

P14 line 5: What is the difference range between values of blue over Europe and darker blue over Africa in the area contaminated by aerosols?

P 19, caption Fig. 6: As Fig 5 but . . .

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