

Interactive comment on “Statistical downscaling of water vapour satellite measurements from profiles of tropical ice clouds” by Giulia Carella et al.

Anonymous Referee #2

Received and published: 7 March 2019

Review of manuscript ESSD-2018-138 : "Statistical downscaling of water vapour satellite measurements from profiles of tropical ice clouds"

This manuscript deals with fine-scale water vapor retrievals derived from a combination of satellite instruments using a downscaling technique. The paper is well structured and should be published after some more details and explanations given to help the readers understanding the methodology and its limitations. My main concerns are as follows:

- The need for fine scale observations of the vertical structure of water vapor is clear and well justified. But I probably missed a major thing reading the manuscript: from

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Figures 8 and 9, it seems to be more of a horizontal downscaling of the SAPHIR RH product than a vertical downscaling of it. Please clarify this either in the introduction or in the results. As I said, I might have missed something but I may not be the only one when reading your work.

- The results shown on Figure (8e) indicate that the differences between the predicted RH and the RH estimated from SAPHIR can be quite large. It seems that Figure (8e) is not commented at all in the text but it needs explanations. Can the differences be explained by representativeness errors between the CALIOP lidar and the SAPHIR radiometer?

- The results shown in Figure 9 where RH estimated from SAPHIR and the predicted RH are on the top each other seem to indicate there is a bias between the two, especially in the lower layers. Could you please comment on this? In the paragraph page 11 where these results are presented, there is a comment on the variance of the predicted RH but not on its bias.

- In the Data section on CALIPSO data, it is shortly explained that the noise on the profiles has been reduced using a Principal Component Analysis to keep only 90% of the variance. Why 90%? Would have the results fundamentally changed if you hadn't done this filtering?

Minor comments:

- Figure 1 shows a case of January 2nd in 2017 but the rest of the examples are for July 2013. Is there a way you could update Figure 1 to show the same meteorological situation all along the manuscript?

- Page 2, line 29 : "These detailed profiles are observed all over the globe" => Isn't SAPHIR observing the Tropics only? Please correct this sentence.

- Page 5, line 8, "3.1 SAPHIR-CALIPSO co-location" => The period of the study is not mentioned here but that we be good to know at this stage and not only later in Section

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- Page 5, line 23 : "reconstructed" => reconstructed

- Page 10, line 32 : "on the distance from the cost" => coast

Interactive comment on Earth Syst. Sci. Data Discuss., <https://doi.org/10.5194/essd-2018-138>, 2019.