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Comment on acp-2021-1050

Anonymous Referee #2

Referee comment on "The representation of the trade winds in ECMWF forecasts and reanalyses during EUREC⁴A" by Alessandro Carlo Maria Savazzi et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2021-1050-RC2>, 2022

Review of

The representation of winds in the lower troposphere in ECMWF forecasts and reanalyses during the EUREC4A field campaign

By Alessandro Savazzi et al.

In this study Savazzi et al. make use of the recently acquired wealth of wind-related observations in the Western Tropical Atlantic during EUREC4A to assess systematic forecast errors in lower-tropospheric winds over the ocean. They focus on ECMWF IFS (re)analyses and forecasts in the lower 5 km of the troposphere. In addition to a very thorough comparison with available wind profiles observations (radiosondes, dropsondes, lidar), the authors also conducted several sensitivity experiments using the IFS and explore the impact of data assimilation as well as the role of convective momentum transport and 'new moist physics' on the modelled wind biases and rmse.

The authors have done a great job at exploiting the very rich EUREC4A dataset and designing a clever model-observation intercomparison strategy that is worthy of publication by itself. Some of the sensitivity experiments are relevant for the work (impact of data assimilation, role of CMT) while others, i.e. pertaining to the new moist physics, leaves the reader with the impression that the paper may be trying to cover too much ground overall.

Overall, I consider that the paper should be published *in fine*, provided that the authors consider taking into account the suggestions and general comments below.

General comments

1/ The overall quality of the English could be improved by reducing lengthy sentences and repetitions in many parts of the MS. Please try to trim the text to improve the readability. A lot of expressions used are not plain English and should be reworded...

2/ Additional near-surface wind measurements were conducted during EUREC4A, such as ship-borne kite-based observations, or even saildrone measurements... Did you consider including these in your analysis? And if so, why did not you use them in the end?

3/ Can the authors elaborate on the generalization of their results in the abstract and conclusion? And to what extent their results can be representative of other regions of the world?

4/ Why haven't you looked at the vertical component of wind as well? This should be feasible using the dropsonde data released from the DLR Falcon 20 while it was performing the circles east of Barbados, using a strategy designed to observationally assess large scale vertical motion in the domain covered by the circle.

5/ Some of the conclusions drawn in the paper, especially the ones pertaining to model physics are based on comparisons of momentum budget modelled and derived from observations. The methodology for the latter is described in a paper that is under preparation, and hence not yet published and not citable... The authors should describe here what is behind the observed tendencies as derived in Nuijens et al., 2021.

6/ The authors discuss the impact of the so-called 'cumulus friction effect' on the modelled wind profiles systematic errors. Can you elaborate on the role of oceanic waves in shaping the lower tropospheric wind profile over the ocean? How is this accounted for in ECMWF' IFS? Is the reported near-surface excessive easterly flow of the IFS (Belmonte Rivas and Stoffelen, 2019) due to friction induced by the sea state?

7/ The rationale behind the sensitivity experiments pertaining to the 'new moist physics' in the paper is not so clear and the conclusion that you draw from them regarding the role of tropical convection on the winds in the Barbados region is over-interpreted... I would suggest to remove it or make it much more consistent than it is now.

8/ The authors discuss the impact of large scale dynamical forcing on the wind profiles in the vicinity of Barbados... How are tropical atmospheric waves accounted for in ECMWF' IFS? Can their interaction with the mean flow impact the wind profile in the lower troposphere? Could they contribute to the systematic errors in the IFS (re)analyses and

forecasts?