

## ***Interactive comment on “Uncertainty Characterization of HOAPS-3.3 Latent Heat Flux Related Parameters” by Julian Kinzel et al.***

**Anonymous Referee #2**

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Uncertainty estimates should be provided by every gridded product, although only a few products do. This study provides uncertainty estimates for the HOAPS2.2 latent heat flux and flux-related variables, which is certainly a positive step forward. The definition of uncertainties in this manuscript, however, is different from the definition commonly used in literature. It is not clear how instantaneous and climatological uncertainties are related to systematic, random, and sampling uncertainties. The use of “climatological uncertainties” is particularly atypical. In addition, the long-term upward trend of latent heat flux seems erroneous from the perspective of the global water budget.

Main comments are provided as follows.

Page 5, Line 10, “... the pixel-level HOAPS-3.3 data in sensor resolution is used...”.

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What are the spatial and temporal resolutions of the pixel-level HOAPS-3.3 data?  
Which nine sensors are used in the pixel-level HOAPS-3.3 climatology?

Page 5, Line 15: what is the temporal resolution of qa retrievals? And at what height?

Page 5, Line 32: which surface pressure data are used in computing LHF?

Page 5, Line 33: “... surface air temperature, which is estimated by assuming a constant relative humidity of 80 % (Liu et al., 1994) and air-sea temperature difference of 1K”. How accurate is this assumption? During winter cold air outbreaks over the western boundary current regions, the air-sea temperature differences can exceed 10 K. In this case, the assumption will lead to a bias in air temperature. How is surface air temperature compared to the in situ dataset?

Page 6, Line 1: Provide a map showing the spatial distribution of in situ (ship and buoy) reference data density over the global domain.

Page 6, Lines 4-5: Does the reference dataset include the 1996-97 period that is used in training qa algorithm?

Page 7, Lines 28-29: The “instantaneous and climatological uncertainties” are not explained. How are they related to systematic, random, and sampling uncertainties?

Page 8, Line 10: Definition of water vapour path?

Page 8, Lines 11-14: It seems that HOAPS qa is wet biased in the tropical wet zone and dry biased in the subtropical dry zone. The bias pattern seems to be similar to GSSFT v3 qa product (Prytherch et al. 2014, Int. J. Climatol.; Jin et al. 2015, J. Atmos. Ocean. Technol.).

Page 8, Lines 21-22: Indeed, the 1-D bias analysis is not sufficient. Please provide a figure showing the global pattern of the mean differences between HOAPS and the reference data. Need to discuss the uncertainty pattern in terms of humidity regimes.

Page 8, Line 24: “Recall that the aim is to characterize uncertainty and not bias pat-

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terns". The sentence is confusing. Bias is one kind of uncertainties.

Page 10, Eqs (2)-(3): Which figures are produced from Eqs.(2)-(3)?

Page 10, Line 10: Why only random satellite retrieval component, not the total random uncertainty, is computed?

Pages 10-11, sections 3.4-3.5: The two sections are not directly related to any figures. Suggest to revise and combine.

Page 13, Line 10: Fig.2 is regarded as a 2-D representation of the error bar magnitude of Fig.1a. A figure showing the global pattern of HOAPS3.3 - minus -in situ needs to be provided to help interpret Fig.2.

Page 13, Fig.2: The instantaneous random uncertainty map of qa (Fig.2a) has a pattern similar to the uncertainty map of qa produced by OAFlux (Yu et al. 2008, OAFlux technical report), though HOAPS3.3 has a much larger magnitude.

Page 14, Line 3: In addition to Table 2, please add a zonal-mean average of the monthly mean sampling uncertainties to show the latitudinal distribution of the uncertainties.

Page 14, Line 13: How is Eclim defined? Please provide a mathematical expression of Eclim.

Page 14, Line 15: "Figures 3a-e can also be treated as the systematic uncertainty distribution". What is the relation between Figures 3a-e and the mean difference map of HOAPS3.3 minus in situ? See comment Page 13, Line 10. The maps shown in Figures 3a-e are not bias patterns, as bias has both positive and negative signs. What is the meaning of the systematic uncertainty?

Page 18, Line 5: "On average, it increases by roughly 4.5 W m-2 (4.7%) per decade...". Which term gives rise to this large increase, qa - qs or U? The continuing increase in LHF during the "hiatus" period in the 2000s does not seem realistic from the perspective

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of the global water budget balance (see Robertson et al. 2014, J.Clim).

Page 19, Line 14: Remove the sentence. Aren't the uncertainty estimates supposed to be a common practice for all gridded products?

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