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Title: Uncertainty Characterization of HOAPS-3.3 Latent Heat Flux Related Parameters
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Review:

(General comments)

The authors investigated uncertainty characterization of HOAPS-3.3 latent heat flux (LHF) related parameters. Since latent heat fluxes are one of the main contributors to the global energy budget as they pointed out in their abstract, estimation of uncertainty of LHF is quite important, especially in climate studies. This article is based on Kinzel et al. (2016). However, the paper is not referred in the present introduction. It is curious. The purpose of this article is not so clear for me. I think the purpose of this study is comprehensive estimation of uncertainty characterization of HOAPS-3.3 latent heat flux (LHF) related parameters in addition to specific humidity examined in Kinzel et al. (2016). We can find the word of " inherent" in the title of Kinzel et al. (2016), but cannot the word in the tile of this article. I agree that it is quite welcome to be provided a data set such as HOAPS-3.3 with uncertainty estimates. However, we are interested in whether the estimated uncertainty is common in (satellite) products or inherent in HOAPS-3.3. If the present results are inherent in HOAPS-3.3, the results are useful for only people to use HOAPS-3.3. However, if the results are common in most satellite products, the value of this article is considerably larger. For example, the authors attribute the global minimum during boreal summer 1991 to the Mount Pinatubo eruption. However, we cannot find the minimum in 1991 in other products except HOAPS (Iwasaki and Kubota, 2014, Fig.6 (a)). Therefore, the minimum may be due to the HOAPS retrieval error related to the Mount Pinatubo eruption. Also, since all HOAPS parameters are derived from SSMI and SSMIS microwave radiometers, the sampling errors are expected to be large compared with other products using many kinds of microwave radiometers. As a result, we can easily expect that the uncertainties are different among each satellite product. If possible, we would like to know uncertainties about other products in order to judge whether the estimated uncertainty

for HOPAS-3.3 in this study is common or not. I guess it is not so easy for the authors to estimate uncertainties for other products. If so, I would like the authors to investigate the relation between the uncertainties of HOAPS-3.3 obtained by this study and the differences between HOAPS and other products, pointed out by previous paper.

Also some parts of the paper may be eliminated or reduced. For example, although the second paragraph in the section 5 introduces HOAPS-4.0, I feel the paragraph is not necessary in this section. Moreover, the authors discuss about precipitation in this section, but I think this issue may exceed the scope of this study because they do not carry out uncertainty estimates of HOAPS precipitation here.

It is my opinion that the manuscript needs major revision before it can be accepted for publication. As far as the usefulness of the present results is limited in HOAPS-3.3, it is difficult to accept for AMT publication.

（Specific Comments）

P.1, L.1

" of LHF" --→ " of in situ LHF"

P.3, L.21-27

In this paragraph, we need clear description about characteristics related to uncertainties, of HOAPS LHF product compared with other products obtained by numerous intercomparison studies

P.5,L.16-21

Large El Nino and La Nina occurred in 1997-1998. Therefore, 1997-1998 is a special period. Why did the authors use the data in this period?

P.5,L.33-34

The assumption of a constant relative humidity of 80 % and air-sea temperature difference of 1 K is considerably artificial. To what extent does have the assumption impact on estimation of uncertainty?

P.6,L.25

(2003) ---(2013)

P.8,L.15

In what ways are these features similar?

P.8,L.22 " off the Arabian Peninsula"

We cannot recognize the data off the Arabian Peninsula in Fig. 1. We need the distribution of average qa for this.

P.9 L.11

Is the bin width equal or not? How did you determine the bin width?

P.9, L.17

Why did you choose the different data period between (dqa, dU) and (dqs)?

P. 10, L.4

The average of daily coefficients is applied for estimation of instantaneous LHF uncertainties here. Why are not instantaneous values but daily values applied? Also, is the difference between daily and instantaneous coefficients small or large?

P.10,L.9

Could you explain about the definition of " gridded uncertainty products"?

P.10,L.17

What is a true value for Ec?

P.11,L.19-22

Here, all daily sampling uncertainties are derived as a function of the number. However, sampling error for a daily-mean value depends on not only the number but also observation times.

P.12,L.1-3

We find several geographical words such as " Arctic", " polar" and " inner tropics". However, It is difficult for us to obtain the relation between the ranges of the random satellite retrieval uncertainty and the geographical location from Fig. 1 and Table 1. Also are the values shown in this paragraph consistent with those in Table 1? For example, " 0.3 and 1.8gkg^{-1}" is " 0.7 and 1.8gkg^{-1}" in line 1?

P.12, L. 1-28

Accuracy of in situ data is considerably different depending on used sensors. For example, the accuracy of wind speeds is 1.0m/s or 10% for usual NDBC buoys, while that is 0.3 m/s for TOA buoys. Are these differences between them negligible for the present analysis?

P.14, L. 13

Could you tell me the definition of the climatological total uncertainties (E_{clim})? Are the climatological total uncertainties ($E_{clim)}$ different from the systematic uncertainty?

P.16,L.28

What is the meaning of "isolated time periods"?

P.17,L. 3-19

E_{clim} is considered to be only one value from the meaning of a climatological value. Is it right? If so, I cannot understand the meaning of " respective E_{clim} over the Pacific upwelling regimes reaches 25 W m-2 specifically during boreal spring 1998" " found in line 6-7.

P.17, L.28

"climatological regional wind speeds range between 4.5.-11 m s-1 (fig.4b). As for q_a"

------→ "climatological regional uncertainties in wind speeds range between 4.5.-11 m s^{-1}(fig.4b). As for U"

P.18, L.10

The global minimum during boreal summer 19991 is linked to the Mount Pinatubo eruptions. However, the remarkable minimum can be found in only HOAPS product and cannot be found in other products as shown in Fig. 6(a) of Iwasaki and Kubota (2014). Therefore, the minimum would be related to retrieval model uncertainty. The present analysis can investigate this issue and present its effectiveness by the investigation.

P.18,L. 15

As mentioned before, could you please explain about definition of climatological uncertainty? I cannot catch the meaning of " the 12-month running mean climatological uncertainty". Is a climatological uncertainty defined each month?

P.18, L. 21-P.19,L. 5

In this paragraph, the results by many previous studies are introduced. However, the relation between the results and what Fig.5 shows is not so clear. I wonder this paragraph is necessary.

Fig 2. (c) and Fig. 3. (c)

It is difficult to know the distribution pattern in these figures. How about the change of a color bar?