The authors have properly responded to my comments and suggestions (except for one point, see below). In particular, it is instructive to see that non-Gaussian pdf's are generally less accurate, from the point of view of reliability and resolution, than Gaussian ones.

I recommend acceptance of the paper, provided a number of additional corrections and modifications are made. I list them below in approximate order of decreasing importance. Some of these comments or suggestions below could have been made on the first version of the paper, but I did not do so because I considered them of lesser importance.

The line numbers below are those in the file which contains explicitly the latest modifications made the authors. ***Bold face*** *characters are only meant to highlight the changes I suggest, and are of course not to be included in the final corrections.*

The one point on which the authors have not responded correctly is the reference to *one of the three horizontal wind components* (ll. 470-471 and 711-712). The horizontal wind has two components, not three. The reference to the paper by Satoh *et al*. is not sufficient. Either you explain clearly what the unusual quantity you consider exactly is (and why you have chosen it for your diagnostics), or else you remove panel 10c (and possibly replace it by a panel relative to another quantity).

Ll. 392-395, Change text to *Kalman filters provide, under the Gaussian and linear additive assumption, the minimum variance estimator, which then coincides with the maximum likelihood estimator*.

L. 280-282, *The members of the upper side cluster at the 159th cycle generally become stable in the forecast step, and their instability is mitigated in the model*. Sentence is difficult to understand. Where is all that you say visible (and first of all the *upper side cluster*, which has not been alluded to before) ? No stability is actually visible on Fig. 10a, where the value of $d\theta_e$ is everywhere negative.

Ll. 450-451, *Although the frequency of non-Gaussian PDF seems to depend primarily on the density of observations, it also seems to reflect the contrast between the continents and oceans (see Fig. 8)*. I have two comments about this sentence.

- *Although the frequency of non-Gaussian PDF seems to depend primarily on the density of observations* This does not seem to have been shown, let alone mentioned, before.

- *it also seems to reflect the contrast between the continents and oceans (see Fig. 8)*. This too does not seem to have been mentioned before, nor does it seem to be visible on Fig. 8.

Ll. 118 and 121. The values you give there are inconsistent. There is no simple proportionality between the mean number of elements in a sample that are beyond a given threshold (l. 118), and the probability that there is at least one element in the sample that is beyond the threshold (l. 121). More precisely, if $p(\sigma)$ is the probability that a given element is within the threshold σ, and N is the size of the sample (here, N = 10240), the mean number of elements beyond the threshold is $N(1\text{-}p(\sigma))$, while the probability that there is at least one element beyond the threshold is $1\text{-}(p(\sigma))^N$. Please check and correct as necessary (I mention that the value 0.59% you give on l. 121 is consistent with the value 5767 you give on l. 165 for a sample with size 10^6. So I think it is the values you give on l. 121 that are correct).

And the sentence starting l. 119, *Namely, …*, whether correct or not, only repeats what has just been said. Remove it in any case.

Figures 8 and 9. D_{KL} is defined for ensembles, *LOF* for individual ensemble elements. How has the frequency shown in Fig. 9 been defined ? On ensemble elements taken individually, or on ensembles in which one element at least has *LOF* value > 8 (or still something else) ?

L. 264, *… and especially the frequency in South America is over 95%,* .. It is apparently over 95% elsewhere than in South America (see panel 8c over the tropical area south of Asia).

Ll. 111-112, *… large KL divergence* D_{KL}***, as well as large skewness and kurtosis, shown*** *in Fig. 2b.*

Ll. 168-169, the sentence starting *For the LOF method, ...* announces something that is discussed in detail ll. 230-248. Modify it to *For the LOF method, we choose k = 20 and, as discussed below in Section 4, the threshold value LOF = 8.0.*

And change the sentence l. 247 starting *Based on the results, …* to *Based on these results, and as already said in Section 2, we adopt LOF = 8 ….*

L. 653 *… for* $d\theta_e$ ***(see text for definition)*** *from … .*

L. 658, add at end of caption *(the cross shows the location of the point considered in panel a).*

Ll. 233-234, *… should not be divided into outliers because the small cluster may…* → *… should not be considered as consisting of outliers because it may ….*

Ll. 403-405, *These results suggest that the non-Gaussian PDF be mainly driven by precipitation processes such as cumulus parameterization …* → *These results suggest that the non-Gaussianity is mainly caused by precipitation processes such those associated with cumulus convection, … .*

Ll. 266-267, change to *… the intensity of non-Gaussianity,* ***as evaluated by other measures,*** *is also weak … .*

L. 240, Remove sentence starting *Hereafter, …* (already said ll. 168-169)

L. 111, ***one or*** *several members ...*

L. 122, *Since the outliers appear too frequently …* → *Since ~~the~~ outliers appear ~~too~~ frequently …*

Ll. 156-157, change to *… depends on the data set, as shown by Breunig et al. (2000), who suggested …*

L. 304, *As shown in Fig. 8a, …* → *In agreement with what has been seen on Fig. 8a, … .*

L. 315, *… (Fig. 14****, crosses)*** *… .*

Ll. 23-24, *… correspond well with …* → *… is similar to …*

Ll. 398-399, *… to represent the non-Gaussian PDF which is more vulnerable to the sampling error.* → *… to identify the possible non-Gaussianity of PDFs, which may be difficult to detect in the presence of sampling error.*

L. 23, *… the non-Gaussian PDF is caused by …* → *… non-Gaussianity is caused in those PDFs by …*

Similarly, l. 432, *… the non-Gaussian PDF …* → *… non-Gaussianity …*

L. 436, *The members with their instabilities mitigated …* → *The members with reduced instabilities …*

L. 221, *… correspond to each other.* → *… tend to coincide.*

Ll. 79-80, *without contaminated* → *without contamination*

L. 117, *… draws from **a** Gaussian PDF, …*

L. 478, *… we would have an abundance of non-Gaussianity.* → *… we would presumably have more frequent occurrence of non-Gaussianity.*

L. 503, *… is remained as …* → *… remains as …*

P. 40, caption of Figure 8. Although it is said in the text, it might be good to mention explicitly here that the crosses indicate the locations of observations.

L. 222, *… grid point B (35.256°N, …* This figure corresponds to an accuracy of about 100 *m*, totally meaningless with a grid with 48 points in the meridional direction, corresponding to a resolution of about 400 *km* (the same remark applies elsewhere).