Anonymous Referee #2

The authors thank the reviewer for the comments which have improved the paper. The reviewer's comments are shown in red and the authors response shown in black.

In Figures 1 and 2, I recommend adding a third column which plots differences between

the versions.

A third column has been added to theses plots showing the differences, note that the plot style has changed slightly due to change in python plotting libraries.

New figure above, old figure below

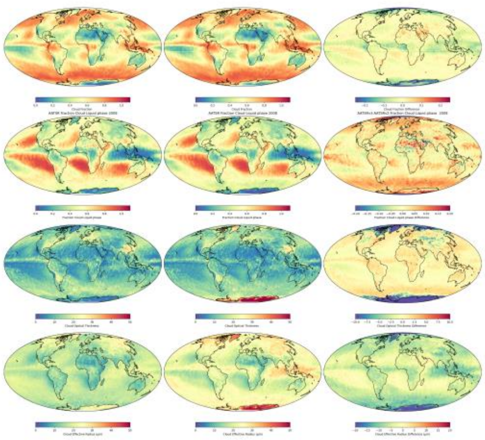

**Figure 1.** Examples from 2008 of Level-3C (yearly average) Cloud_cci AATSR V3 (left), V2 (middle) and difference of V3-V2 (right). From the top: cloud fraction (CFC), liquid cloud faction (CPH), cloud optical thickness (COT) and cloud effective radius (CER),

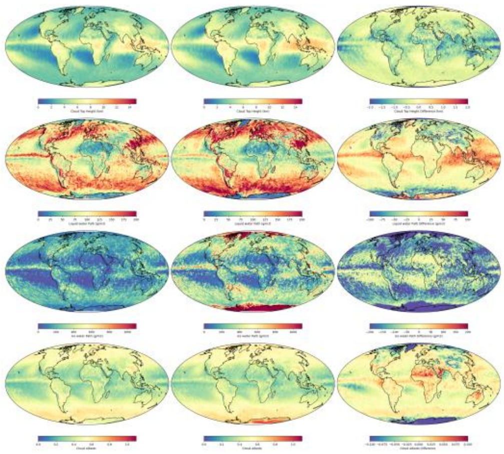

**Figure 2.** As Fig. 1 but for cloud top height (CTH), liquid water path (LWP), ice water path (IWP) and cloud albedo (CLA).

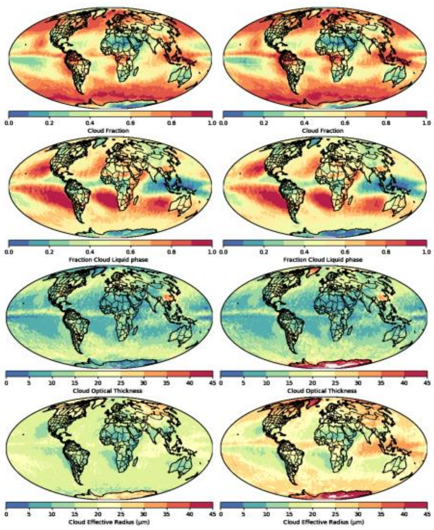

**Figure 1.** Examples from 2008 of Level-3C (yearly average) Cloud_cci AATSR V3 (left) and V2 (right). From the top: cloud fraction (CFC), liquid cloud faction (CPH), cloud optical thickness (COT) and cloud effective radius (CER),

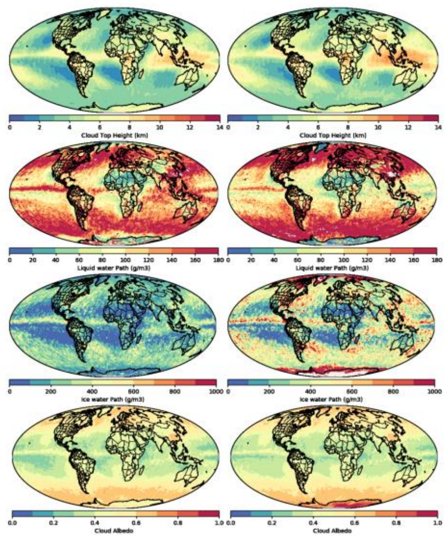

**Figure 2.** As Fig. 1 but for cloud top height (CTH), liquid water path (LWP), ice water path (IWP) and cloud albedo (CLA).

Table 3 contains a bunch of metrics that I don't know what they are. I think it would be good to give a one-sentence definition of KSS, hit rate, and POD.

The text has been clarified with the additional text below

The Hanssen-Kuiper skill score (KSS), an often used skill score [Hansen 1965] is defined as KSS = TPR-FPR where TPR is fraction of pixels correctly identified as cloud and FPR is the fraction of pixels wrongly identified as cloud. probability of detection (POD), the fraction of pixels identified correctly as clear from 61% to 76%.

Line 181 (and rest of paragraph): I don't know what "cost" is referring to, so "cost less

than 5" makes no sense. Line 188: they state here that thin multi-layer clouds are retrieved as the weighted

average of the two layers. It would be useful to say if this situation is flagged in the data

or if there's some mechanism to screen the data for this.

This section has ben clarified with the additional text below.

The cost is an out put of the optimal estimation retrieval scheme and is the result of the squared deviations between the measurements and the forward model (which in this scenario is a single layer of cloud) and the retrieved state vector and the a priori state vector, weighted by an associated covariance matrix. Essentially it is an indicator if the observed measurements were a good fit to the forward model. Cost less than 5 indicates the measurements fit the model well. A higher cost would indicate we are viewing cloud form multiple layers, for example.

From line 221 to the end of the section: they discuss hear the uncertainty of the radiative flux estimates. Does uncertainty here refer to precision or accuracy? Also, are the

values given for CERES (5.4 and 4.6 W/m2) the uncertainty for the global average or

at a grid point?

The authors found a bug in the code that calculated the difference between V3 and the CERES data. As the global coverage varies with season (i.e no data in the polar winters) for the AATSR data, the data is now only compared with CERES when both instruments report data. The data has been reprocessed and the numbers in the table have been updated accordingly. The change to the numbers between -60 and 60 latitude was negligible however the change to the value encompassing -90 to 90 has changed considerably nearly all the comparisons with CERES data have improved . The text has been modified accordingly in the section 'Comparison of radiative fluxes'. All except the LW BOA down ( all sky and clearsky) agree within the CERES uncertainty estimates. The LW BOA estimates are of the order (2.8% allsky and 3.8% clearly) just outside the range of the CERES uncertainty. It is hypothesised that the assumed cloud base height is systematically biased in the AATSR data set. This will be re-evaluated in future versions.

The revised plots are shown below and referenced to the previous plots

New figure below

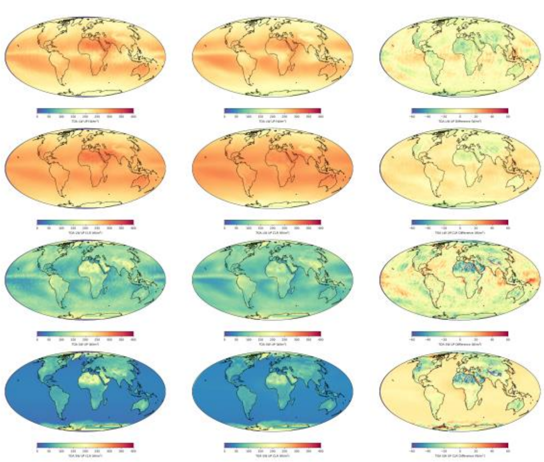

**Figure 4.** Examples of Level-3C (yearly average for 2008) Cloud_cci AATSR V3 (left column), CERES (middle column) and difference CERES-AATSR (right column) global maps of fluxes from top to bottom $LWF^{up}_{TOA}$, $LWF^{up}_{TOA}$clear, $SWF^{up}_{TOA}$ and $SWF^{up}_{TOA}$clear

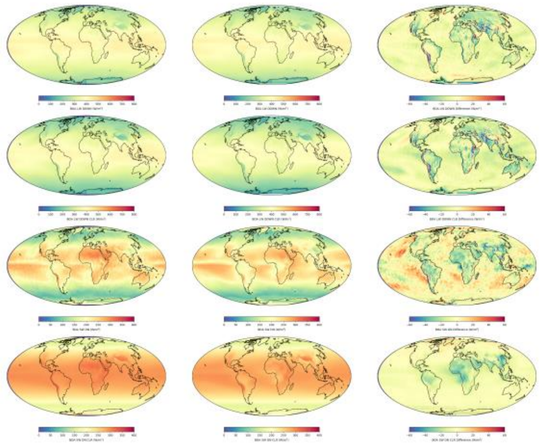

**Figure 5.** Examples of Level-3C (yearly average for 2008) Cloud_cci AATSR V3 (left column) and CERES (middle column) and difference CERES-AATSR in the right column global maps of forcing from the top to the bottom, $LWF^{down}_{BOA}$, $LWF^{down}_{BOA}$clear, $SWF^{down}_{BOA}$, $SWF^{down}_{BOA}$clear

Old figures below

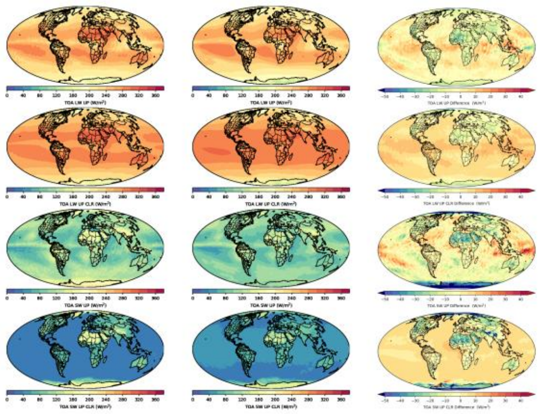

**Figure 4.** Examples of Level-3C (yearly average for 2008) Cloud_cci AATSR V3 (left column), CERES (middle column) and difference CERES-AATSR (right column) global maps of forcings from top to bottom $LWF^{up}_{TOA}$, $LWF^{up}_{TOA}$clear, $SWF^{up}_{TOA}$ and $SWF^{up}_{TOA}$clear

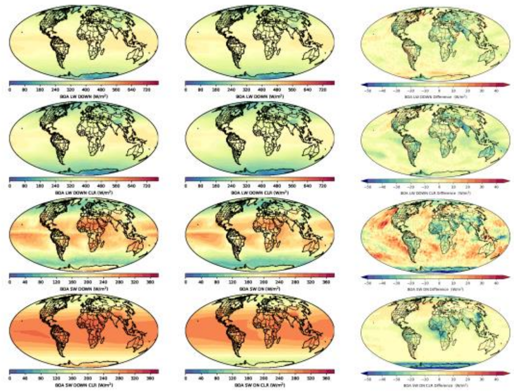

**Figure 5.** Examples of Level-3C (yearly average for 2008) Cloud_cci AATSR V3 (left column) and CERES (middle column) and difference CERES-AATSR in the right column global maps of forcing from the top to the bottom, $LWF^{down}_{BOA}$, $LWF^{down}_{BOA}$clear, $SWF^{down}_{BOA}$, $SWF^{down}_{BOA}$clear

New tables shown here

**Table 6.** Multi-annual (2003-2012), zonal averaged broadband shortwave and longwave fluxes (SWF, LWF) at the top-of-atmosphere (TOA) inferred from the Cloud_cci AATSR V3 dataset. Two latitude ranges, -60° to 60° (top) and -90° to 90° (bottom), are presented. The values are compared with the equivalent values from the Clouds and Earth Radiation Energy System (CERES) Energy Balanced and Filled (EBAF) fluxes. All values are given in $Wm^{-2}$. The differences and relative differences are also reported.

| TOA flux comparison with CERES | | | | |
|---|---|---|---|---|
| | $LWF^{up}_{TOA}$ | $SWF^{up}_{TOA}$ | Clear $LWF^{up}_{TOA}$ | Clear $SWF^{up}_{TOA}$ |
| Cloud_cci ATSR-2/AATSRv3 | 245.8 | 104.4 | 268.7 | 47.5 |
| CERES EBAF Ed 4.1 | 244.1 | 98.70 | 273.9 | 48.8 |
| Difference | -1.7 | -5.7 | 5.2 | 1.3 |
| Rel. difference | 0.7% | 5.7% | 1.9% | 2.7% |
| Cloud_cci ATSR-2/AATSRv3 | 235.7 | 113.7 | 235.7 | 61.7 |
| CERES EBAF Ed 4.1 | 233.4 | 108.8 | 233.4 | 63.3 |
| Difference | -2.3 | -4.9 | -2.3 | 1.6 |
| Rel. difference | 1.0% | 4.5% | 1% | 2.5% |

**Table 7.** As for Table. 6 but for the bottom-of-atmosphere (BOA).

| BOA flux comparison with CERES | | | | |
|---|---|---|---|---|
| | $LWF^{down}_{BOA}$ | $SWF^{down}_{BOA}$ | clear$LWF^{down}_{BOA}$ | clear$SWF^{down}_{BOA}$ |
| Cloud_cci ATSR-2/AATSRv3 | 364.5 | 191.8 | 335.7 | 255.5 |
| CERES EBAF Ed 4.1 | 354.4 | 190.0 | 323.9 | 250.4 |
| Difference | -10.1 | 1.8 | -11.2 | -5.1 |
| Rel. Difference | 2.9% | .9% | 3.5% | 2.0% |
| Cloud_cci ATSR-2/AATSRv3 | 335.7 | 180.2 | 303.2 | 240.7 |
| CERES EBAF Ed 4.1 | 326.5 | 179.0 | 292.2 | 237.6 |
| Difference | -9.2 | -1.2 | -11.0 | -3.1 |
| Rel. Difference | 2.7% | .7% | 3.8% | 1.3% |

Old tables for reference

**Table 6.** Multi-annual (2003-2012), zonal averaged broadband shortwave and longwave fluxes (SWF, LWF) at the top-of-atmosphere (TOA) inferred from the Cloud_cci AATSR V3 dataset. Two latitude ranges, -60° to 60° (top) and -90° to 90° (bottom), are presented. The values are compared with the equivalent values from the Clouds and Earth Radiation Energy System (CERES) Energy Balanced and Filled (EBAF) fluxes. All values are given in $Wm^{-2}$. The differences and relative differences are also reported.

| TOA flux comparison with CERES | | | | |
|---|---|---|---|---|
| | $LWF^{up}_{TOA}$ | $SWF^{up}_{TOA}$ | Clear $LWF^{up}_{TOA}$ | Clear $SWF^{up}_{TOA}$ |
| Cloud_cci ATSR-2/AATSRv3 | 246.3 | 104.4 | 268.7 | 61.9 |
| CERES EBAF Ed 4.1 | 244.2 | 98.70 | 273.9 | 63.6 |
| Difference | -1.9 | -5.7 | 5.2 | 1.63 |
| Rel. difference | 0.8% | 5.7% | 1.9% | 2.6% |
| Cloud_cci ATSR-2/AATSRv3 | 234.9 | 114.0 | 255.1 | 47.5 |
| CERES EBAF Ed 4.1 | 225.1 | 104.2 | 248.9 | 48.7 |
| Difference | -9.9 | -9.8 | -6.2 | 1.2 |
| Rel. difference | 4.4% | 9.4% | 2.4% | 2.7% |

**Table 7.** As for Table. 6 but for the bottom-of-atmosphere (BOA).

| BOA flux comparison with CERES | | | | |
|---|---|---|---|---|
| | $LWF^{down}_{BOA}$ | $SWF^{down}_{BOA}$ | $clearLWF^{down}_{BOA}$ | $clearSWF^{down}_{BOA}$ |
| Cloud_cci ATSR-2/AATSRv3 | 364.6 | 192.2 | 335.3 | 255.7 |
| CERES EBAF Ed 4.1 | 354.4 | 190.4 | 323.9 | 250.3 |
| Difference | -10.26 | 1.9 | -11.4 | -5.4 |
| Rel. Difference | 2.9% | .97% | 3.5% | 2.1% |
| Cloud_cci ATSR-2/AATSRv3 | 334.1 | 181.3 | 301.7 | 241.3 |
| CERES EBAF Ed 4.1 | 306.8 | 176.0 | 272.7 | 232.6 |
| Difference | -28.4 | -5.3 | -29.1 | -8.7 |
| Rel. Difference | 9.2% | 3.0% | 10% | 3.8% |

Captions of Fig. 4 and 5. The captions refer to "forcing", but they really mean are fluxes. This should be changed

This has been fixed