06/30/2013 PROGRESS REPORT

Award Number: NA10NES4400001
Award Period: 07/01/2010 - 06/30/2014
Project Title: The Development of a 20-Year Database of Ocean Surface and Near-Surface Properties Suitable for Climate Analysis
Recipient Name: Florida State University
FSU PI: Mark Bourassa
Reporting PI: Carol Anne Clayson (at WHOI)

The new SeaFlux web page continues to gain users. In addition in the last six months we have uploaded the uncertainty analysis, which is now available for use by the community. The SeaFlux dataset is now being used by several groups (that we have seen) for analysis and comparison with model reanalysis data. This is the current version 1.0 dataset. The paper describing the version 1.0 data has been submitted, reviewed, and we are currently working on revisions for this paper. As noted previously, this version covers just the 1998 through 2007 time period, which was the time frame for which we had the CSU brightness temperatures available.

In the last six months we have had to replace the postdoc who was working on the project (Gauher Shaheen) with a previous graduate student at FSU who did his Ph.D. work on surface fluxes, Jeremiah Brown. That has entailed some additional spin up time and was a main factor in requesting a no-cost extension. On the positive side Jeremiah is an expert programmer and has already cleaned up and prepared in an organized fashion the code preparatory to working with NOAA for delivery.

<u>Year 3 goals as listed in proposal:</u>

- Complete gridded U, Qa, Ta fields
- Complete calculations of surface flux fields
- Complete estimation of uncertainties, errors

(1) Complete gridded U, Qa, Ta fields

We have been working with the neural net (NN) retrievals to attempt a one neural net weighting for all of the SSM/I satellites. Our initial results indicated that it might not be possible (for the reasons discussed below). However, after further consultation with Chris Kummerow and Wes Berg, their belief is that the many of the differences shown below are due to the EIA variability. Therefore we are currently resetting up the matches to be run with EIA-adjusted brightness temperatures. If the statistics of these adjusted TBs are similar to those shown below, then we will have to create separate NNs. It should be noted that we have now analyzed the Wentz and CSU brightness temperature data sets, and the statistics are similar for each of them (see below). Therefore we are choosing to work with the CSU brightness temperatures solely.

As shown in the figures, there seem to be real differences between the characteristics of the non-EIA adjusted TBs that affect retrievals of the near-surface properties. As shown in Figure 1, creating a weighting based on the F13 satellite matchup database provides similar error characteristics when applied to F14 and F15, but NOT F10 or F11. The reverse is also true, when a weighting based on the F11 satellite matchup database does roughly as well for F10 but much worse for F13/14/15. It should be noted that the error characteristics, while slightly different in actual value, have very similar patterns for the Wentz SSM/I calibrated brightness temperatures (Figures 3 and 4). We are re-doing this analysis using the EIA-adjusted TBs. If this does not improve the statistics, we will then be creating a matchup database for the F8/10/11 satellites and another one for the F13/14/15. This then will be the final version that we will use for the full 20 year database.

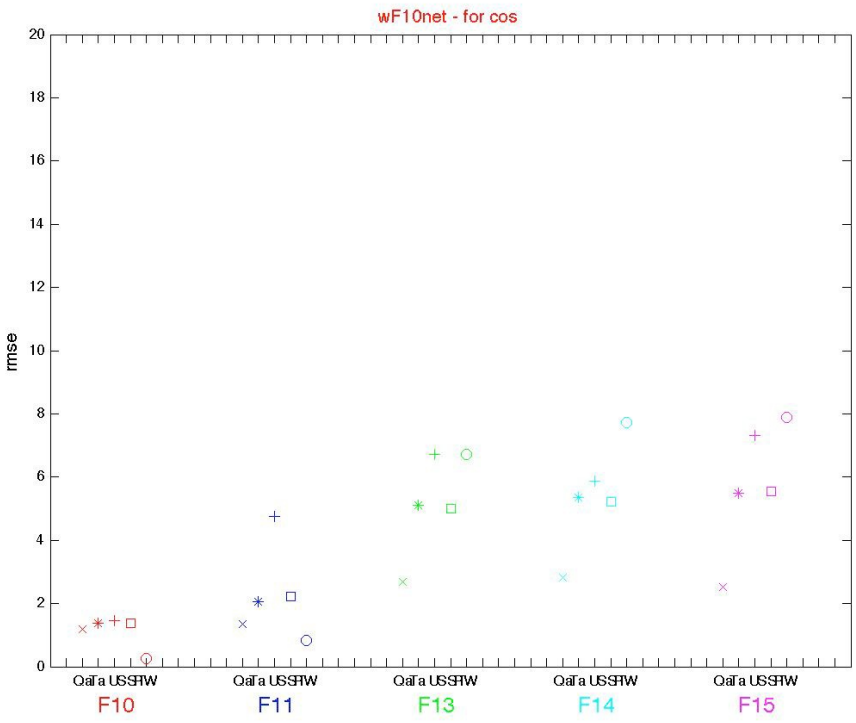

Figure 1. Root-mean-square errors using the CSU Brightness Temperature Database. The NN weighting for this version is calculated using the matchup database from F10 only. These weights are then applied to the F10, F11, F13, F14, and F15 satellites. + indicates winds, o indicates precipitable water, x indicates air temperature, * indicates sea surface temperature, and the specific humidity is indicated by the squares.

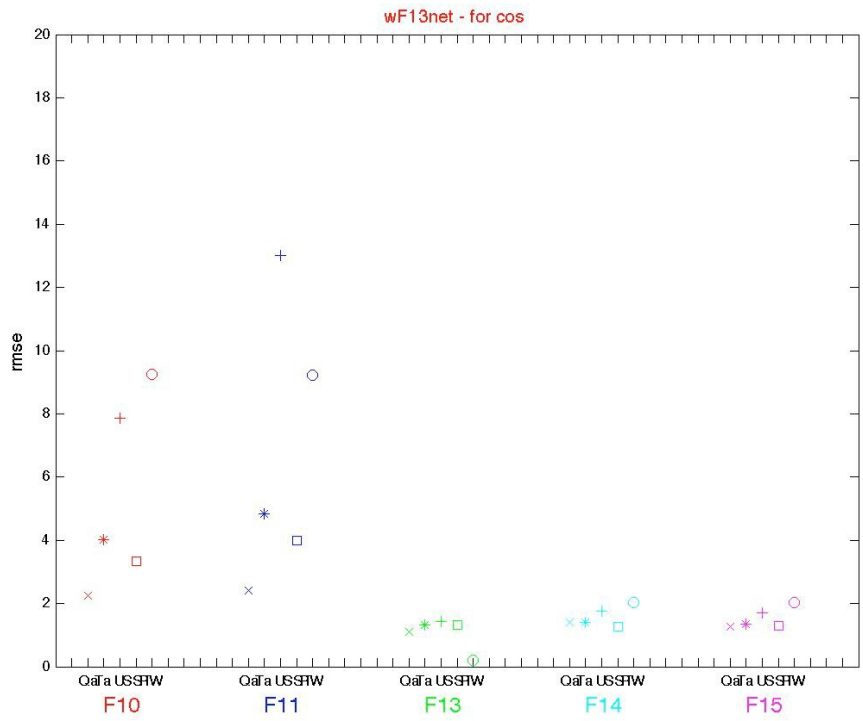

Figure 2. As in Figure 1 but using the matchup database from F13 only.

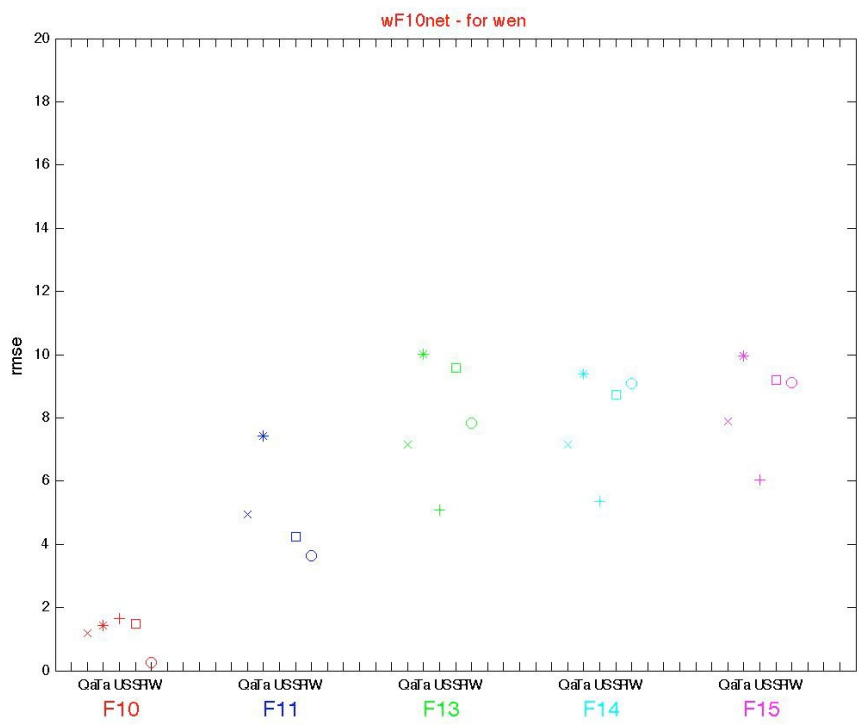

Figure 3. As in Figure 1 but using the Wentz brightness temperatures and the F10 matchup database.

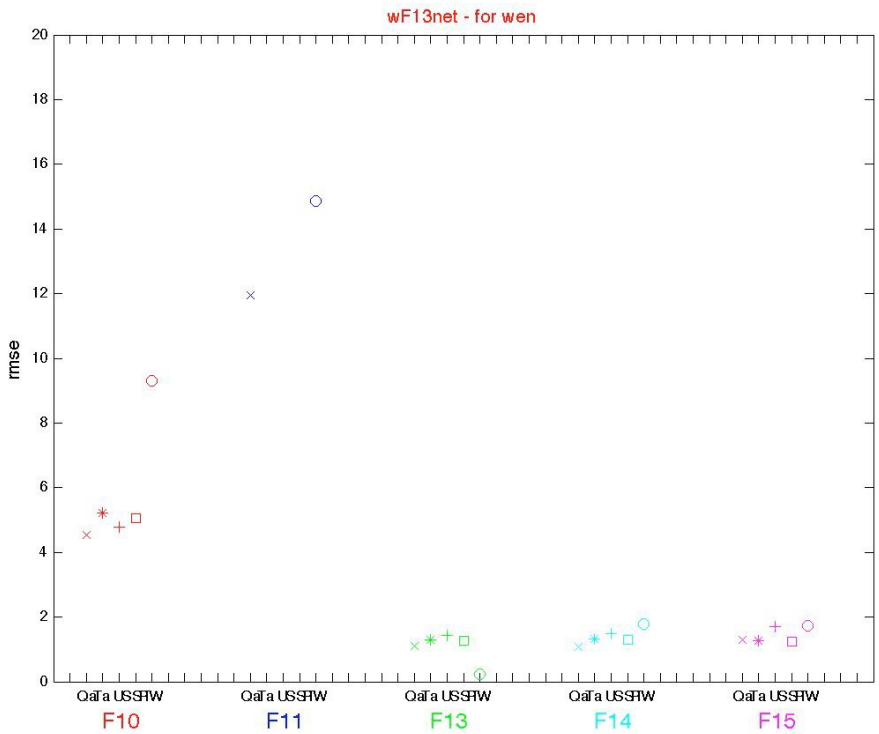

Figure 4. As in Figure 1 but using the Wentz brightness temperatures and the F13 matchup database.

The goals for the next few months then are to finish the new neural net retrieval algorithms, and process the swath-level fields for the entire SSM/I time record. The resulting swath-level fields will then be gridded.

(3) Complete calculations of surface flux fields, and (4) complete estimates of uncertainties, errors

These two tasks will make use of the full 20 year gridded dataset described above, and will be a feature of the next six month's effort.

Papers we anticipate finishing within the next six months:
(1) The new version of the ocean model, with a focus on how such issues as length of daylight affect diurnal SSTs
(2) The new parameterization of diurnal warming

As noted above we have finished the paper about the SeaFlux dataset version 1.0. For this paper we have done an extensive uncertainty analysis of the original SeaFlux dataset, using propagation of errors, and will use the same comparison dataset and techniques for analysis of

the full 20-year product. A few examples of the uncertainties for Version 1.0 are shown in Figures 5, 6, and 7. The comparisons and those for the other parameters as shown in Figure 5 are used as inputs for the analysis of the total uncertainties as shown in Figures 6 and 7.

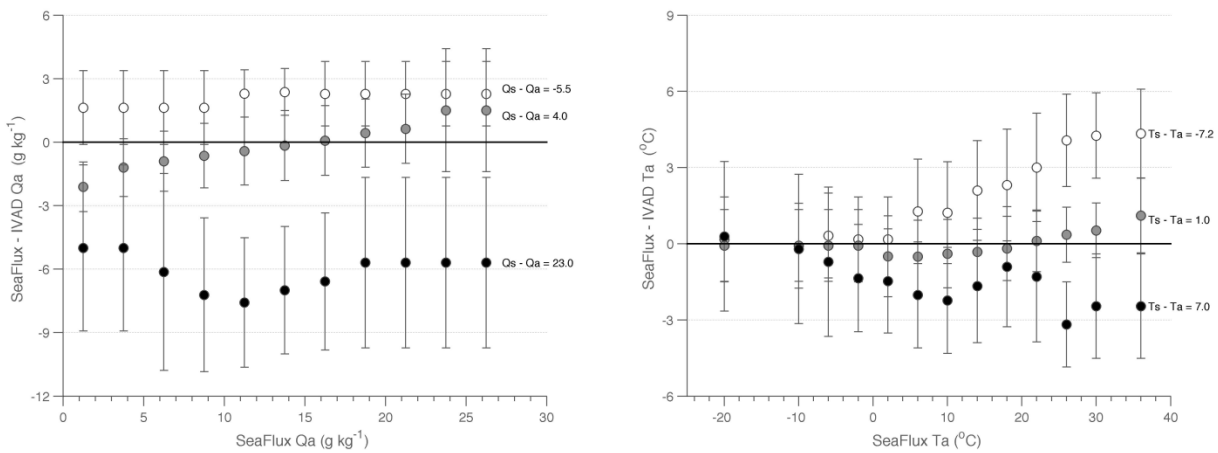

Figure 5. Biases and standard deviations of the SeaFlux Version 1.0 dataset in comparison with the ICOADS-value added dataset.

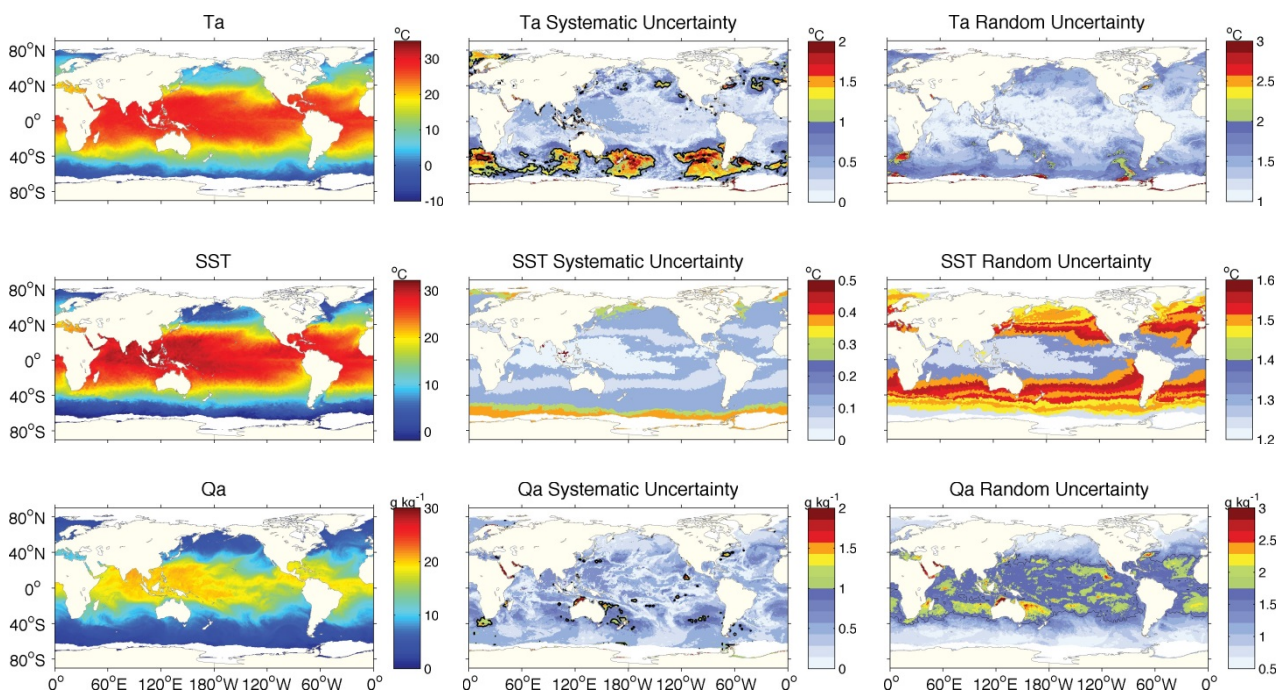

Figure 6. Fields of Ta, SST, and Qa from 00Z 01 June 2001 and the associated systematic and random uncertainties. The contour lines for the Ta systematic uncertainty is at 1°; for the Qa systematic uncertainty the contour line is at 1 g kg^{-1}.

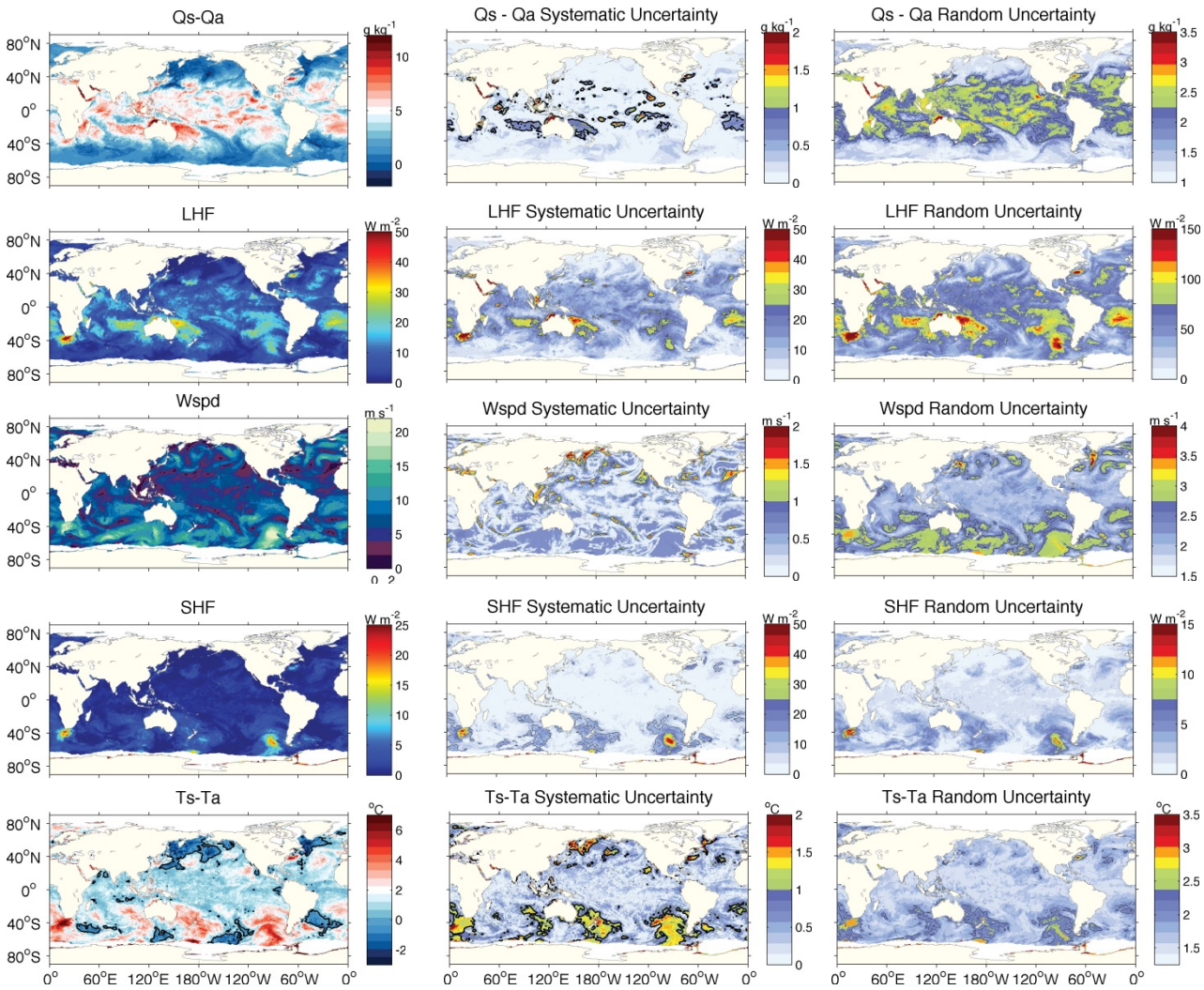

Figure 7. Fields of Qs-Qa, LHF, Windspeed, SHF, and Ts-Ta from 00Z 01 June 2001 and the associated systematic and random uncertainties. The contour lines for the Qs-Qa systematic uncertainty is at 0.5 g kg^{-1}; for the Ts-Ta systematic uncertainty the co

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Recipient Name:	Florida State University
FSU PI:	Mark Bourassa
Reporting PI:	Carol Anne Clayson (at WHOI)

The new SeaFlux web page continues to gain users. Uses of the SeaFlux dataset are now showing up in the published literature. The paper describing version 1.0 of the data has been revised and is currently under review. As noted previously, this version covers just the 1998 through 2007 time period, which was the time frame for which we had the CSU brightness temperatures available.

Year 3 Goals as listed in proposal

- Complete gridded U, Qa, Ta fields
- Complete calculations of surface flux fields
- Complete estimation of uncertainties, errors

(1) Complete gridded U, Qa, Ta fields

Previously we had been working with the neural net (NN) retrievals to attempt a one neural net weighting for all of the SSM/I satellites. Our initial results indicated that it might not be possible; however as discussed in the previous progress report in discussions with C. Kummerow and W. Berg (providers of the CSU CDR on SSM/I brightness temperatures) there was some evidence that this was due to EIA variability. Thus, in the last six months we have re-done the matches to encompass the EIA-adjusted brightness temperatures. This enabled us to be close to fully successful in allowing a common NN retrieval for all the satellites. The one exception is F8, and this is due to the very incomplete 85GHz channel recordings. Thus, for F8 we determined that we would create its own NN retrieval that does not include the 85 GHz channels. The error characteristics for the F8 retrievals are higher than for the other satellites due in part to the increased noisiness of the brightness temperatures. Thus the inclusion of EIA adjustments moved us past the difficulties with the varying satellites and we now have a successful retrieval methodology.

All NN retrievals are now complete for the years of 1988 through 2007. The swath level retrievals of winds, air specific humidity, and temperature, are complete. The sea surface temperature field based on the Reynolds with the diurnally-varying component is complete for these time periods as well.The goals for the next few months then are to grid the swath level fields and then to interpolate using the MERRA-based interpolation methodology we used for SeaFlux version 1.0. It should be noted that we are also communicating with NOAA and have

shared example code, example NetCDF files, and have registered our database on the ATRAC system. We are currently working on a draft version of the ATBD.

(2) Complete calculations of surface flux fields, and (3) complete estimates of uncertainties, errors

Once the fields are gridded and interpolated, the calculation of the surface flux fields will be the next step. This is actually one of the last time-consuming tasks to be done, and all the code is ready for this processing.

The last step will be to make the uncertainties fields, and use some of these results in the ATBD document (which will discuss differences between this version of the data set and Version 1.0 as published).

These two tasks will make use of the full 20 year gridded dataset described above, and will be a feature of the next six month's effort.

As noted above we have finished revising the paper about the SeaFlux dataset version 1.0. For this paper we have done an extensive uncertainty analysis of the original SeaFlux dataset, using propagation of errors, and will use the same comparison dataset and techniques for analysis of the full 20-year product. A few examples of the uncertainties for Version 1.0 are shown in Figures 1, 2, and 3. The comparisons and those for the other parameters as shown in Figure 1 are used as inputs for the analysis of the total uncertainties as shown in Figures 2 and 3.

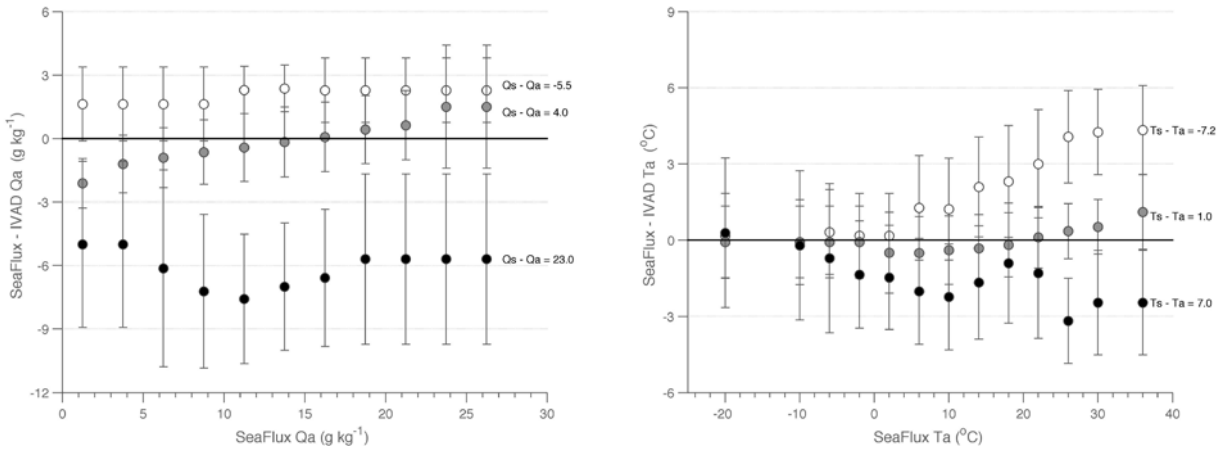


Figure 1. Biases and standard deviations of the SeaFlux Version 1.0 dataset in comparison with the ICOADS-value added dataset.

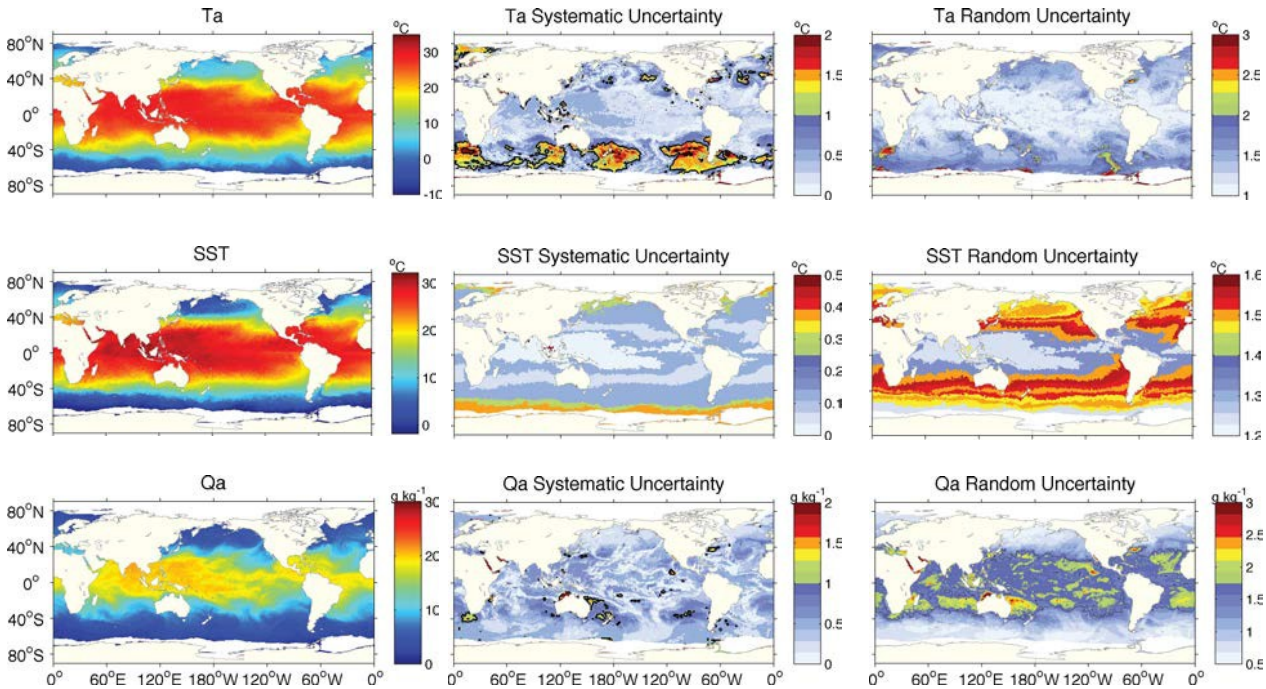
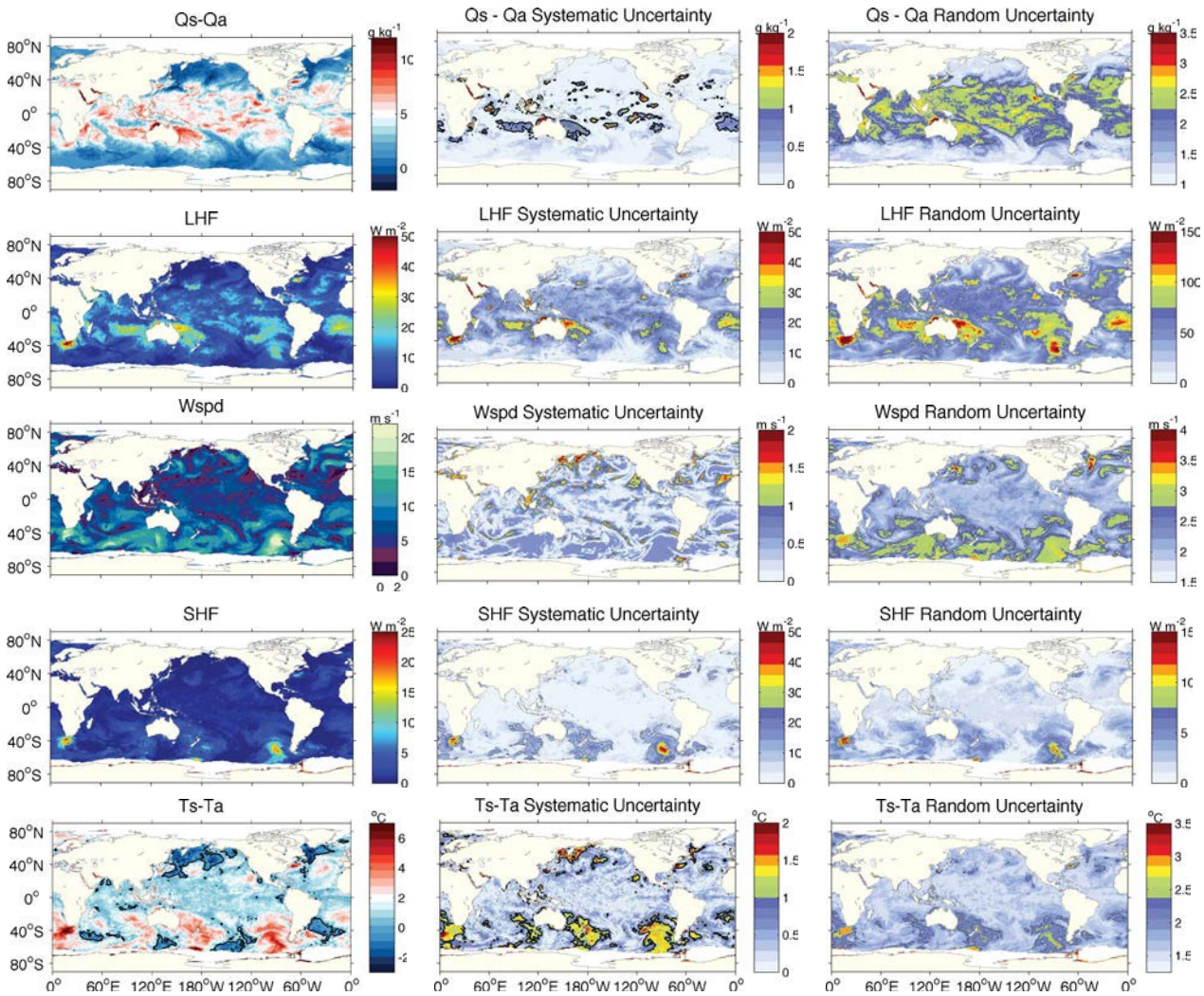


Figure 2. Fields of Ta, SST, and Qa from 00Z 01 June 2001 and the associated systematic and random uncertainties. The contour lines for the Ta systematic uncertainty is at 1°; for the Qa systematic uncertainty the contour line is at 1 g kg^{-1}.



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Recipient Name:	Woods Hole Oceanographic Institution
PI:	Carol Anne Clayson

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<u>Year 3 goals as listed in proposal</u>

- Complete gridded U, Qa, Ta fields
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(1) Complete gridded U, Qa, Ta fields

The gridded fields of the surface parameters of U, Qa, and Ta are now complete. In the past three months we have also re-done the NN for the diurnal warming parameterization, as it was clear that the previous version did not cover enough of the parameter space, and was not robust enough for all cases. The new NN for diurnal warming is now complete, and the SST fields are being redone with this new diurnal warming parameterization. It should also be noted that the new parameterization also uses the HOAPS precipitation fields, so that the precipitation is now consistent from 1988 through 2007 (version 1.0 of the dataset used the GPCP daily, which only extends back through 1998). The interpolation of the fields of U, Qa, and Ta, are for the first 10 years of the dataset; within the next week the final 10 years should also be completed.

It should be noted that we are also communicating with NOAA and have shared example code, example NetCDF files, and have registered our database on the ATRAC system. We are currently working on a draft version of the ATBD, and have been working with NOAA to bring that to conclusion.

(2) Complete calculations of surface flux fields, and (3) complete estimates of uncertainties, errors

We are currently processing the gridded, interpolated fields for the surface fluxes. Once the gridded, interpolated fields are completed for all 20 years, the surface flux fields will take roughly another week to finish.

The last step will be to make the uncertainties fields, and use some of these results in the ATBD document (which will discuss differences between this version of the data set and Version 1.0 as published).

These two tasks will make use of the full 20 year gridded dataset described above, and will be a feature of the next six month's effort.

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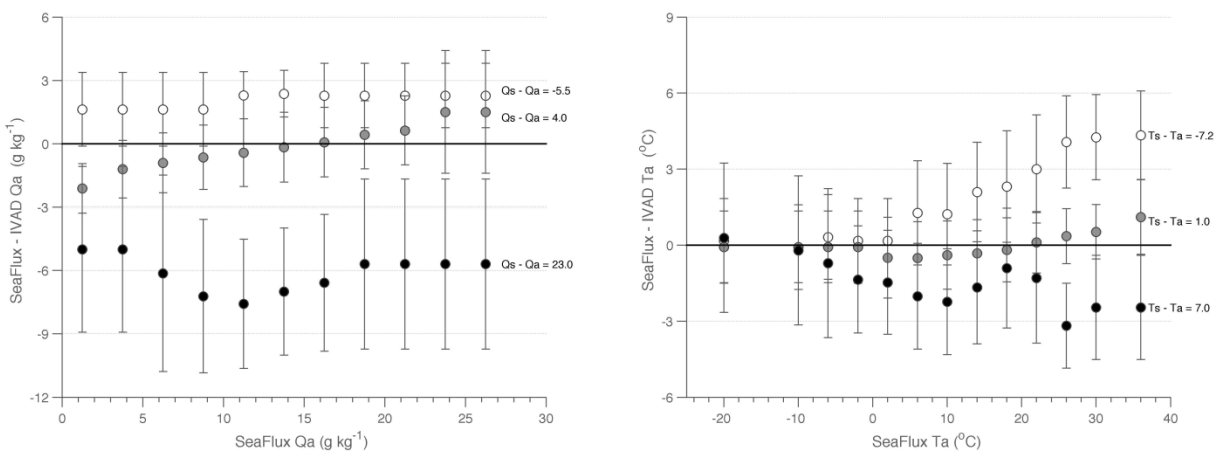
Calculations of uncertainties and errors for the new dataset will follow a similar pattern, but with some improved statistical techniques.



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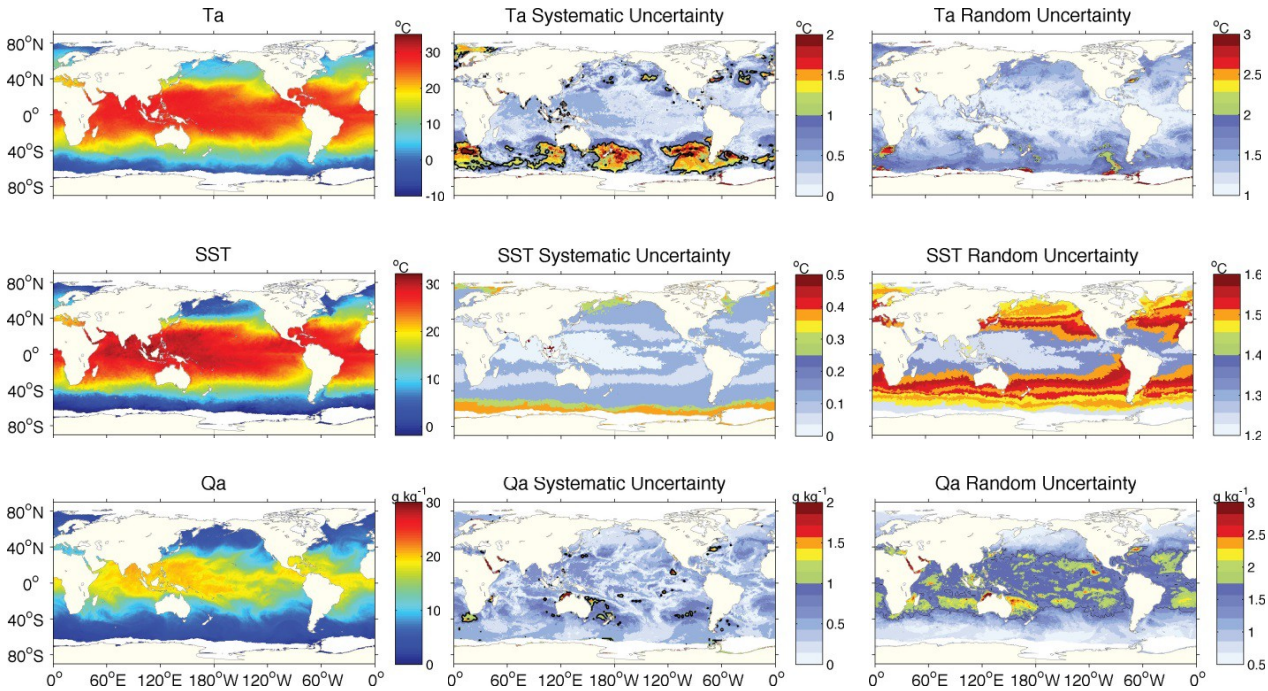

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