



The Version 3 NASA MEaSUREs CAMEL Products and its developments

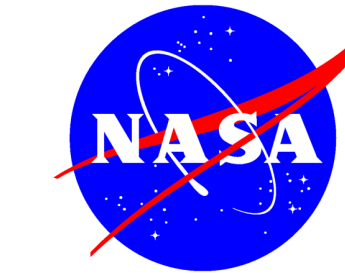


Eva Borbas*, Michelle Loveless*, Glynn Hulley**, Robert Knuteson*, Kerry A. Cawse-Nicholson**, and Simon Hook**

*Space Science and Engineering Center, University of Wisconsin – Madison, WI, USA

** NASA Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA, USA

Contact: Eva.Borbas@ssec.wisc.edu

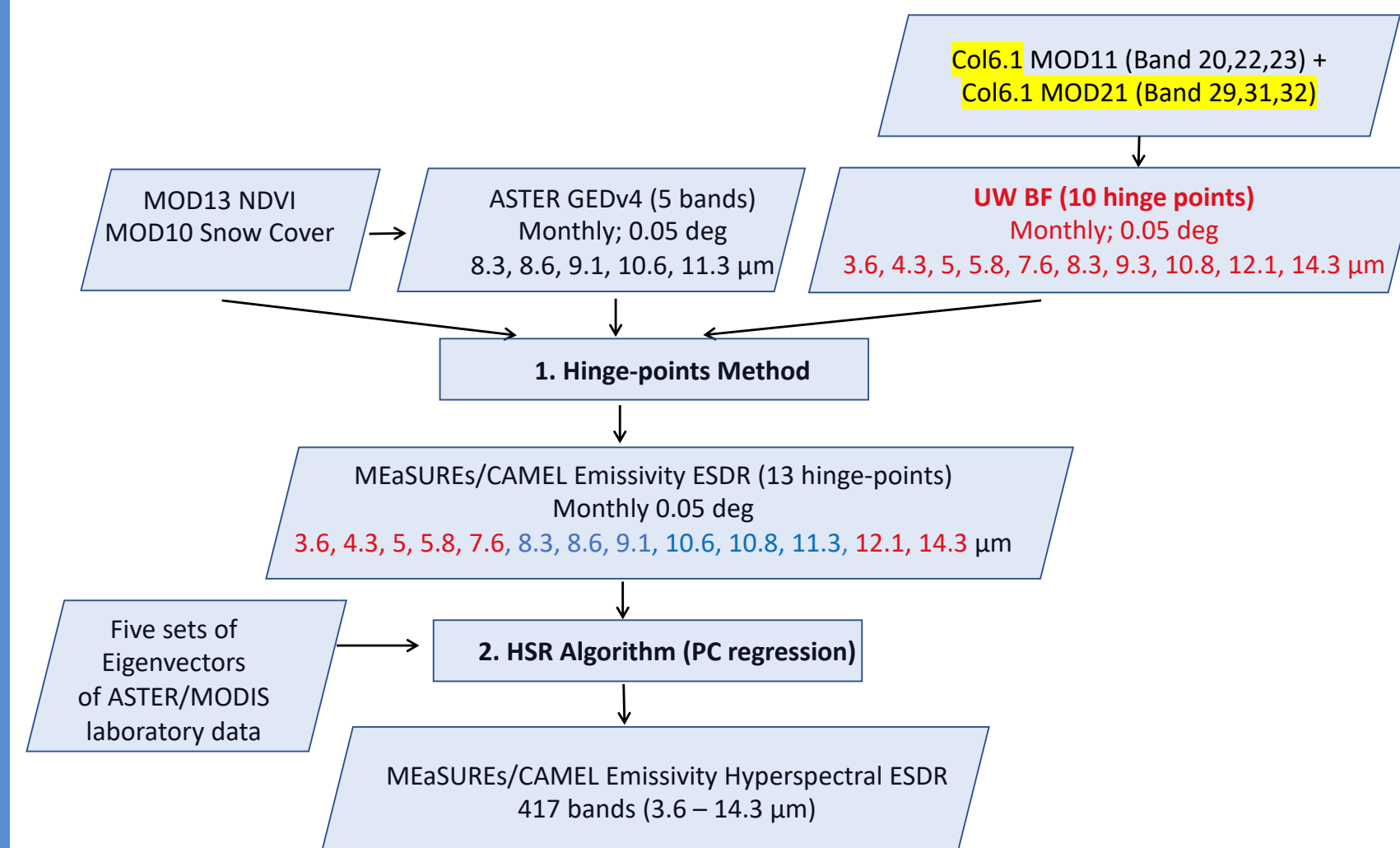


ABSTRACT

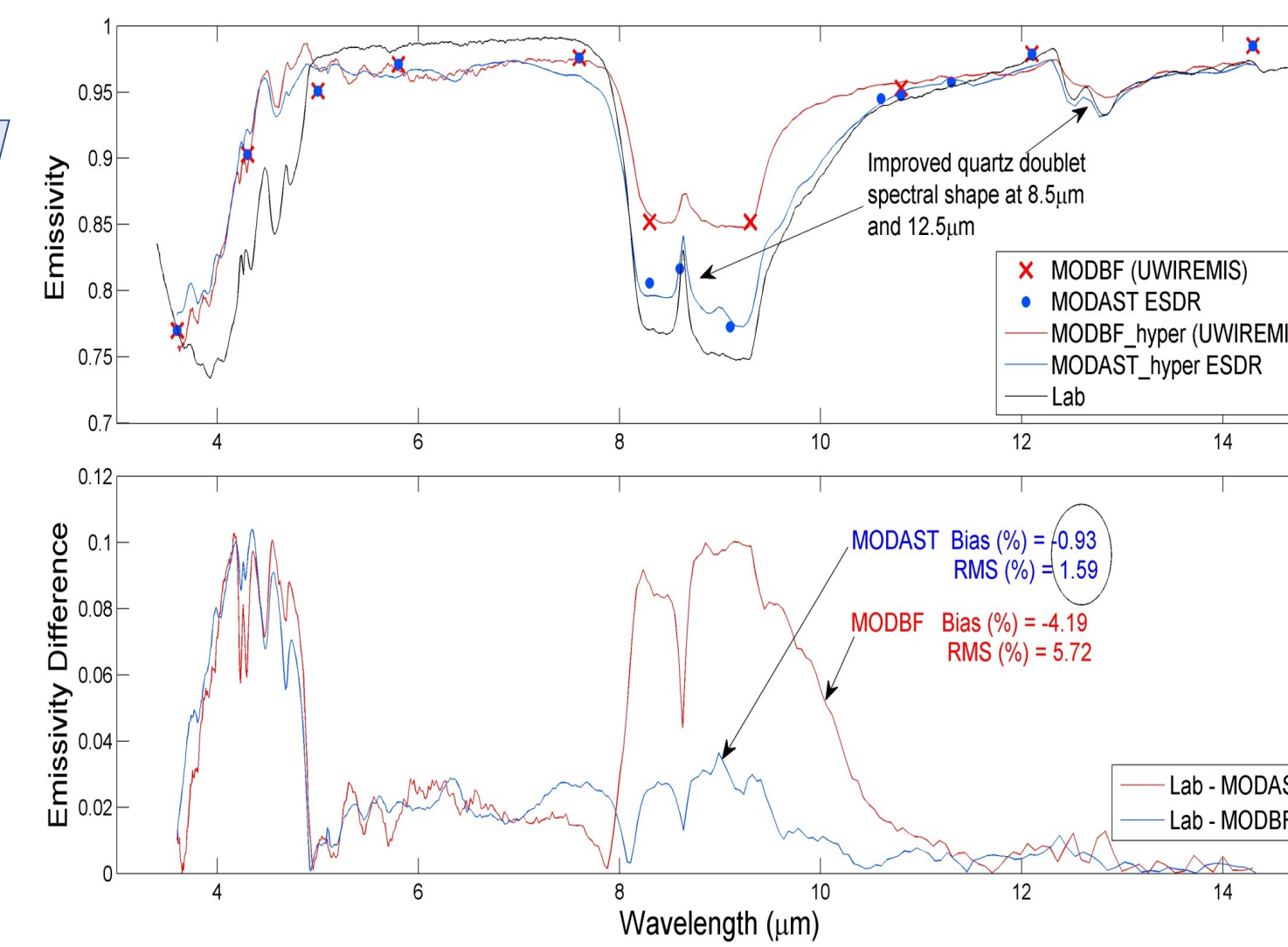
As part of a NASA MEaSUREs Land Surface Temperature and Emissivity project, the University of Wisconsin, Space Science and Engineering Center, and NASA's Jet Propulsion Laboratory have developed a global monthly mean emissivity Earth System Data Record (ESDR). The Combined ASTER and MODIS Emissivity Over Land (CAMEL) ESDR was produced by merging two current state-of-the-art emissivity datasets: the UW-Madison MODIS Infrared emissivity dataset (UWIREMIS) and the JPL ASTER Global Emissivity Dataset v4 (GEDv4).

The dataset includes monthly global data records of emissivity, uncertainty at 13 hinge points between 3.6–14.3 μm , and Principal Components Analysis (PCA) coefficients at 5-kilometer resolution for 2000 to 2021. A high spectral resolution algorithm is also provided for High Spectral Resolution (HSR) applications. CAMEL has been implemented in the RTTOV forward model for immediate use in numerical weather modeling and data assimilation. This poster presents its status and current developments.

METHOD



LEFT: MEASURES CAMEL Emissivity ESDR flowchart.



RIGHT: Comparison of the CAMEL emissivity ESDR (blue), the UW Baseline Fit and High Spectral Resolution Database (red), and laboratory spectra (black) of sand samples collected over the Namib desert for January 2004. The unified CAMEL emissivity ESDR product results in significant improvement over the UW Baseline Fit (MODBF) product when compared to in situ measurements.

STATUS

CAMEL includes three product files for each month:

- Emissivity on 13 hinge points
- PCA coefficients for HSR emissivity application
- Emissivity Uncertainties

HSR (High Spectral Resolution) algorithm in Fortran and MATLAB is provided

Additional products (email to Michelle.Loveless@ssec.wisc.edu)

- Broadband Emissivity
- CAMEL Climatology

Part of the EUMETSAT RTTOV model

<https://nwp-saf.eumetsat.int/site/software/rttov/>

CAMEL V1 (2000 - 2016) - released in July 2017

CAMEL V2 (2000 - 2016) - released in April 2019

partially snow-covered scenes have been improved with additional laboratory sets

CAMEL V3 (2000 – 2021) - will be released soon; beta version is available for testing.

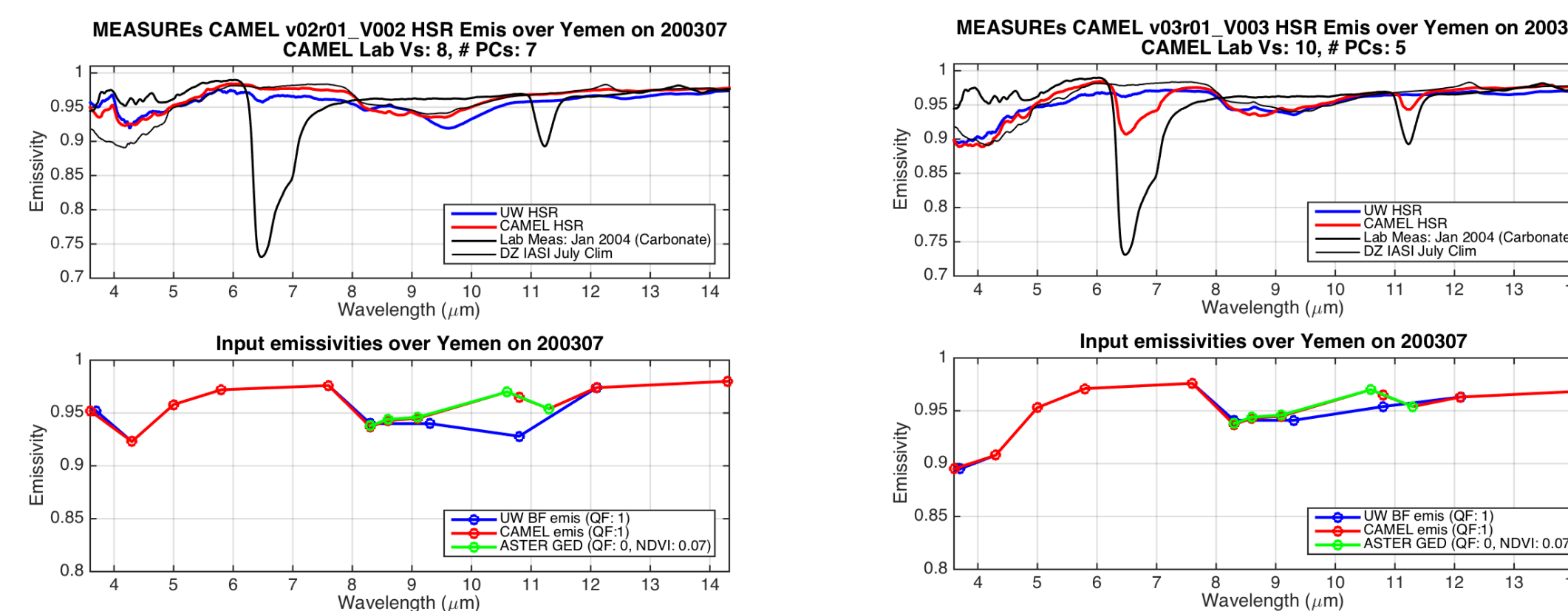


IMPROVEMENTS

The input of the UWIREMIS dataset required for producing CAMEL is the MODIS MxD11C3 monthly mean emissivity products. The climate quality of the UWIREMIS dataset is affected by changes in the quality of the MOD11 products over time. The discontinuation of the C4.1/5 MOD11C3 products and the bug in the C6 products required a transition to the newer MxD21 emissivity products. These problems have been fixed for MODIS Col 6.1 (Released 2021). The transition from MOD11 (CAMEL V1/v2) to the combination of Col 6.1 MOD11 and MOD21 for CAMEL v3 improves the product accuracy and reduces systematic and time-dependent errors.

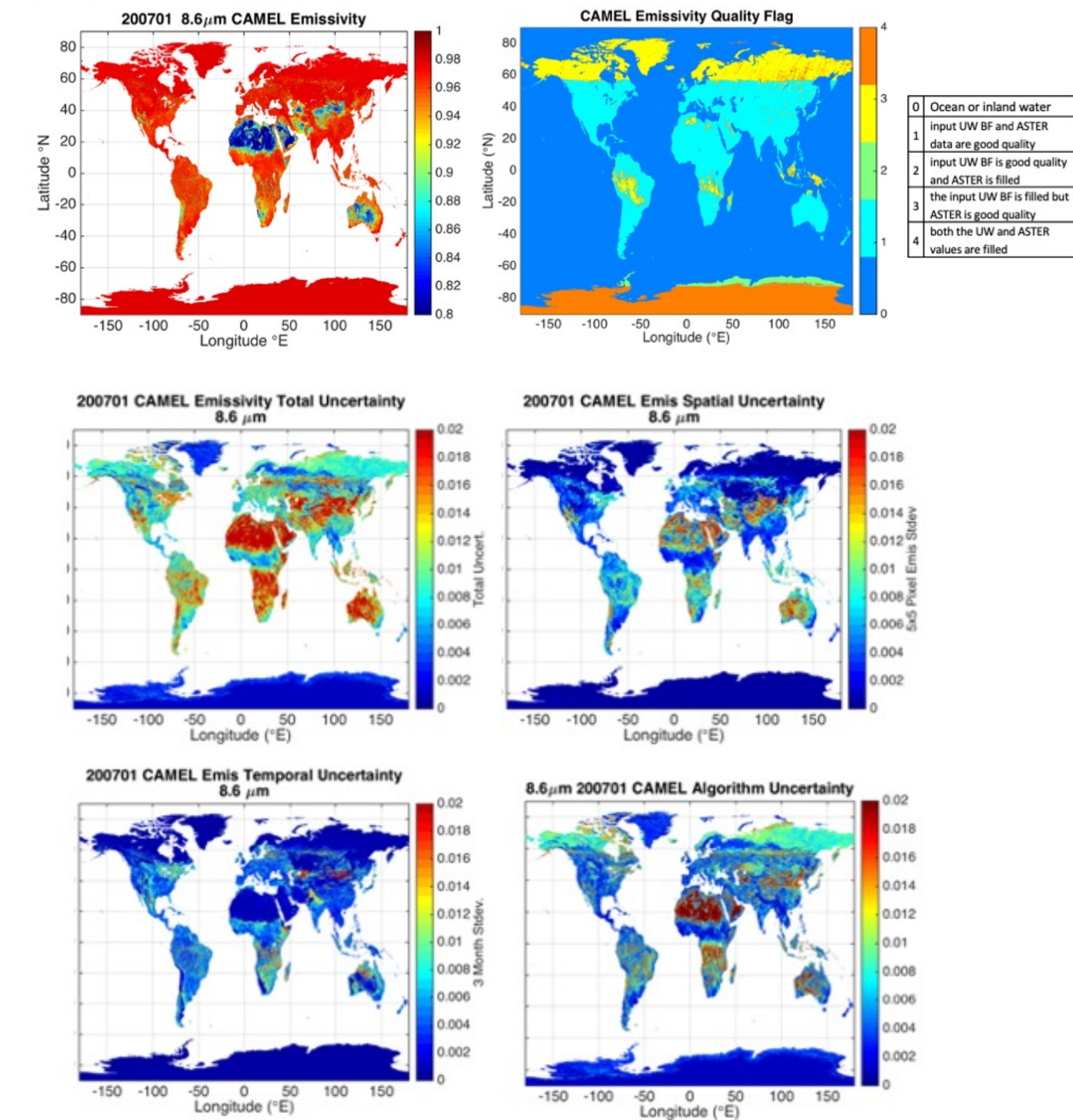
VALIDATION

The MEASURES CAMEL products are routinely validated with ground-based emissivity measurements over locations with different surface types. Validation over Yemen is shown here.

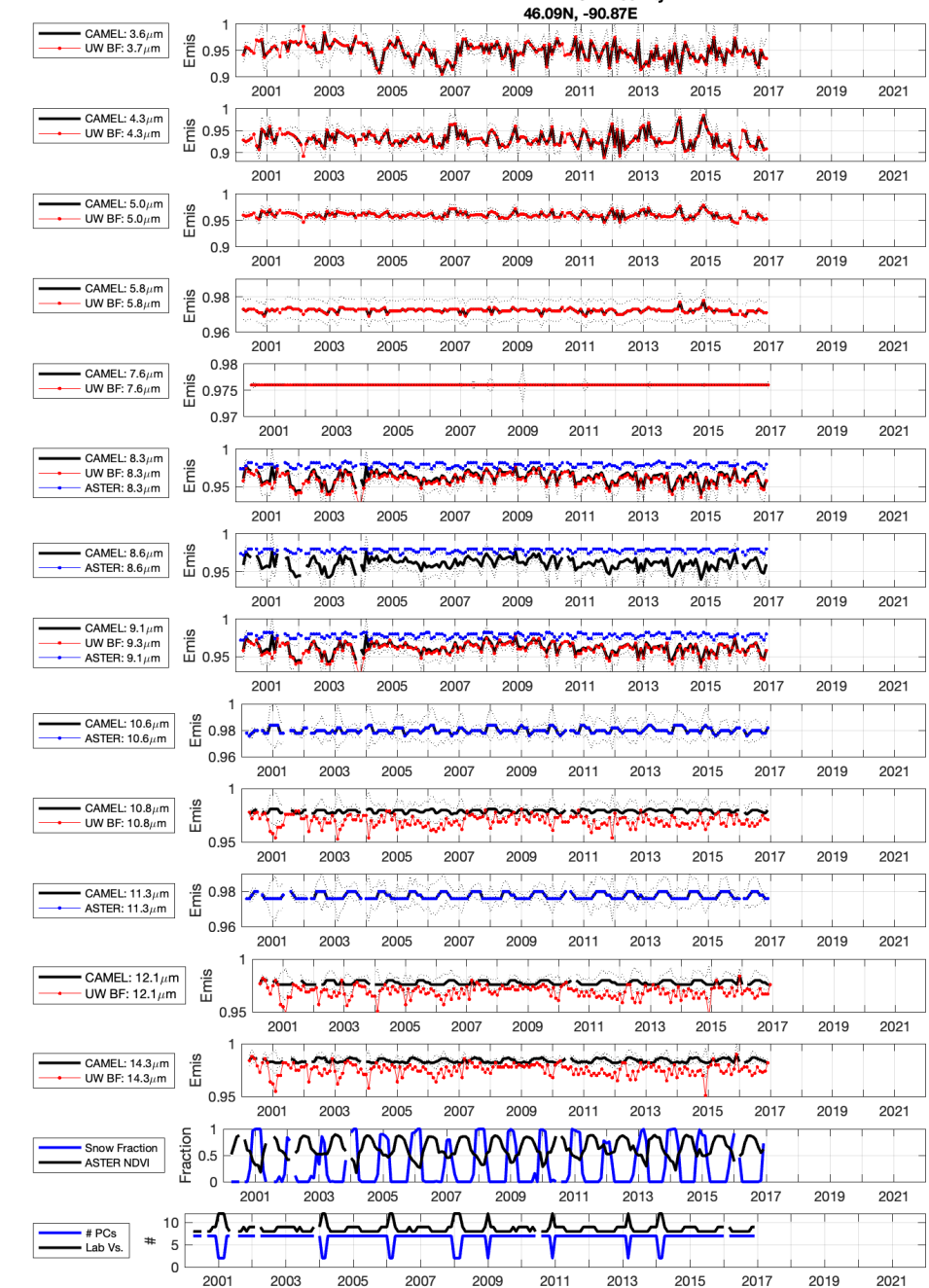


CAMEL V002 (left) and V003 (right) emissivity (red) at 10 hinge point (bottom) and high spectral resolution (top) are compared to its input UW Baseline Fit (UW BF, blue) and ASTER GED (green) emissivity over Yemen (19.15N, 55.57E) for July 2003. Laboratory measurements of the sample from the site (thin black) and the IASI Climatology (DZ IASI, bold black) are also plotted on the top figures.

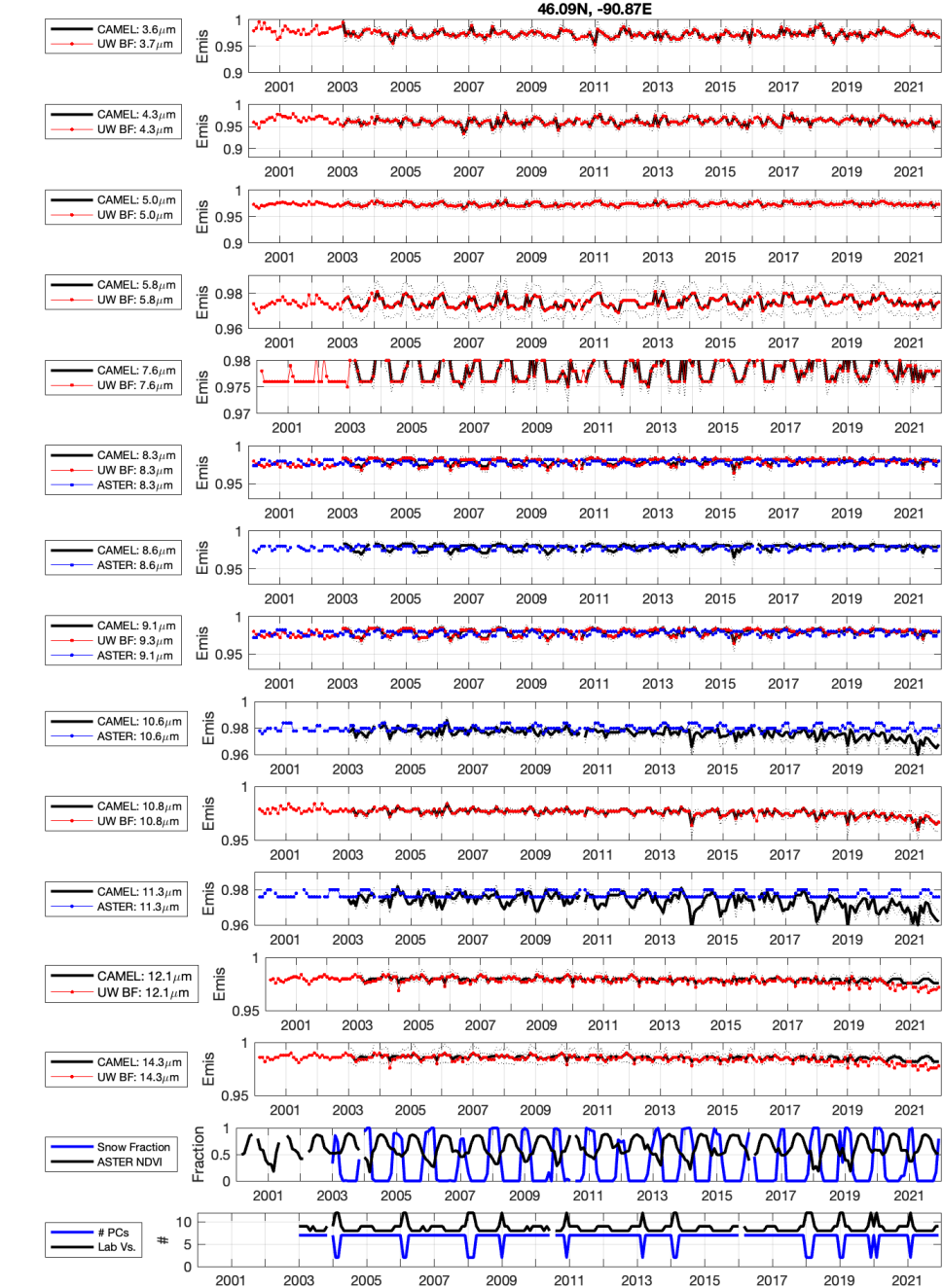
SAMPLE PRODUCTS



Version 2



Version 3



Timeseries of CAMEL V2 (left) and V3 (right) emissivity over Parkfalls, Wisconsin.

SUMMARY/ FUTURE PLANS

- The input of the CAMEL V3 is the latest UW Baseline Fit emissivity, which is based on the combination of the Collection 6.1 MOD11 (Band 20, 22, 23) and MOD21 (Band 29, 31, 32) emissivity data.
- CAMEL V3 has a stricter land/sea mask due to the MxD11 change from Col 4.1 to Col 6.1.
- The CAMEL V3 emissivity - based on the cross-talked corrected Col6.1 MODIS data - shows fewer unphysical trends; hence the uncertainties are significantly reduced.
- In the future, using MODIS Col7 L1B data with the a2 calibration coefficient correction, the artifacts at 8.6 μm (Band 27-30) will be reduced.
- We will continue the CAMEL by extending the record with VIIRS emissivity data from VNP21 (2011) and VJ121 (2018) beyond the expected MODIS and the 5-band mode ECOSTRESS (2018) emissivity beyond the ASTER lifespan.

REFERENCES

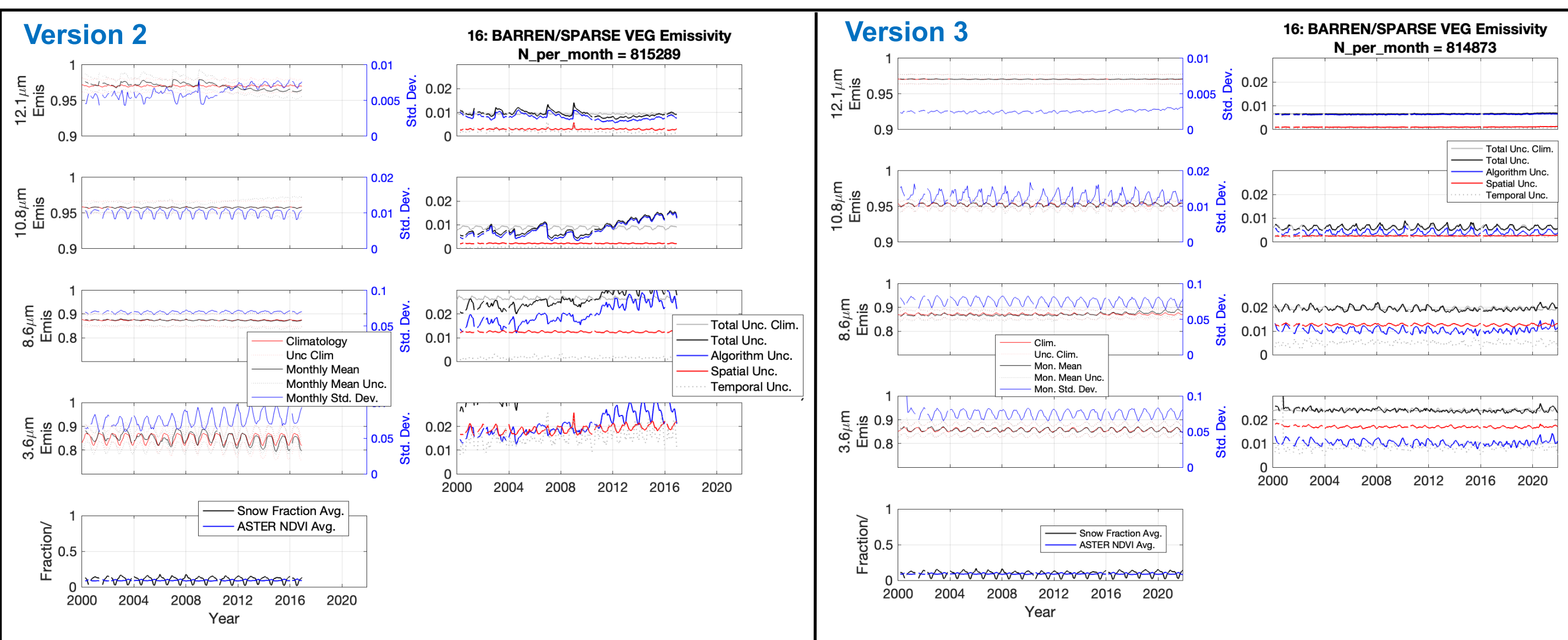
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Timeseries of CAMEL V2 and V3 emissivity (left panels) and uncertainties (right panels) over IGBP type Barren/Sparse Vegetation.