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Introduction

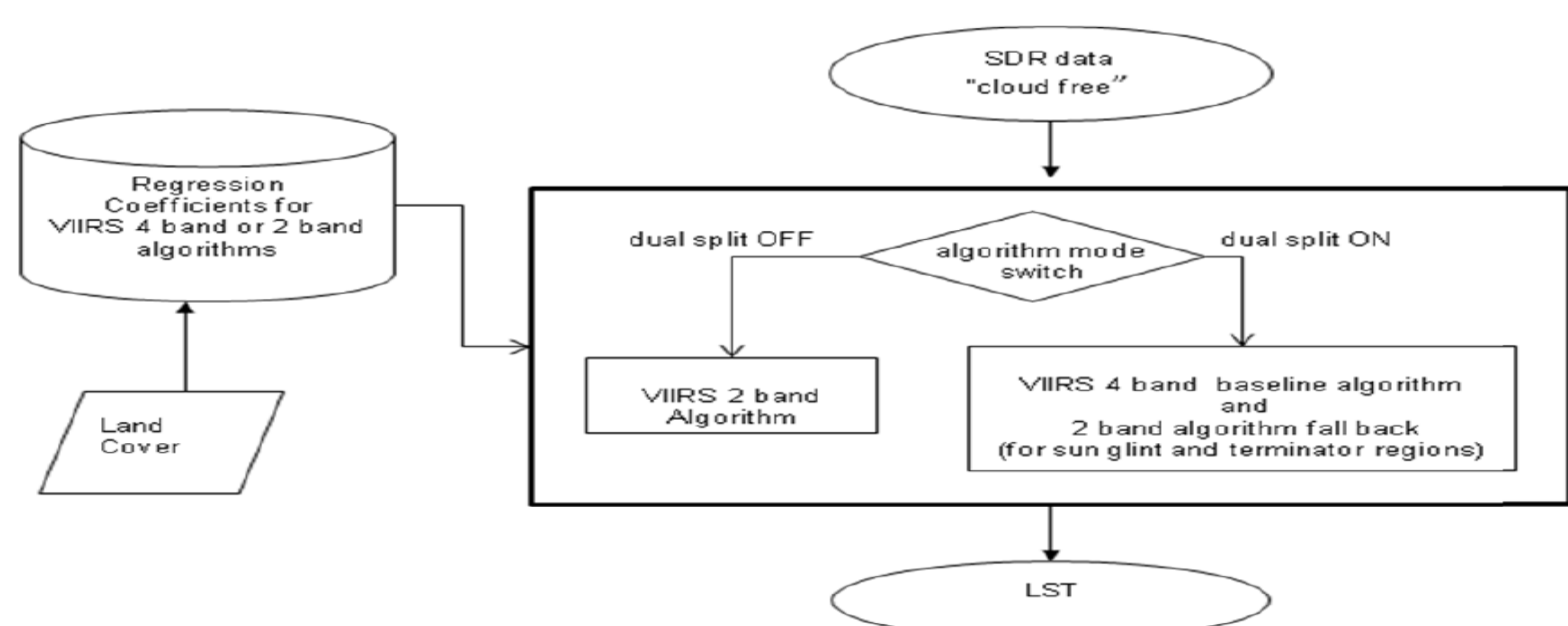
The U.S. Suomi National Polar-orbiting Partnership (S-NPP) satellite is the first and critical step in building up a next-generation satellite system for observing our changing Earth. The Center for Satellite Applications and Research (STAR) at the National Environmental Satellite Data and Information Service (NESDIS) of the U.S. National Oceanic and Atmospheric Administration (NOAA) is developing land surface environmental data record (EDR) products for the S-NPP satellite. Land surface temperature (LST) is one of the land EDRs, which is based on a Visible Infrared Imaging Radiometer Suite (VIIRS) sensor on board the S-NPP satellite, using a split window regression algorithm developed for daytime and nighttime conditions and 17 land surface types defined by the International Global Biosphere Program (IGBP). Maturity status of the S-NPP product generation is defined as beta, provisional and validated versions; the LST beta and provisional productions were started in December 2012 and October 2013, respectively. Recently, an update to the LST provisional version was made to correct possible significant errors due to large brightness temperature differences between the two split window channels mostly in low latitude regions. This poster presents accomplishments and current status of the LST provisional version development and evaluation efforts at NOAA/NESDIS.

S-NPP/VIIRS LST Algorithm

A Split-window Regression algorithm is running for the VIIRS land surface temperature, $T_{s,i}$ production:

$$T_{s,i} = a_{0,i} + a_{1,i} T_{11} + a_{2,i} (T_{11} - T_{12}) + a_{3,i} (\sec\theta - 1) + a_{4,i} (T_{11} - T_{12})^2$$

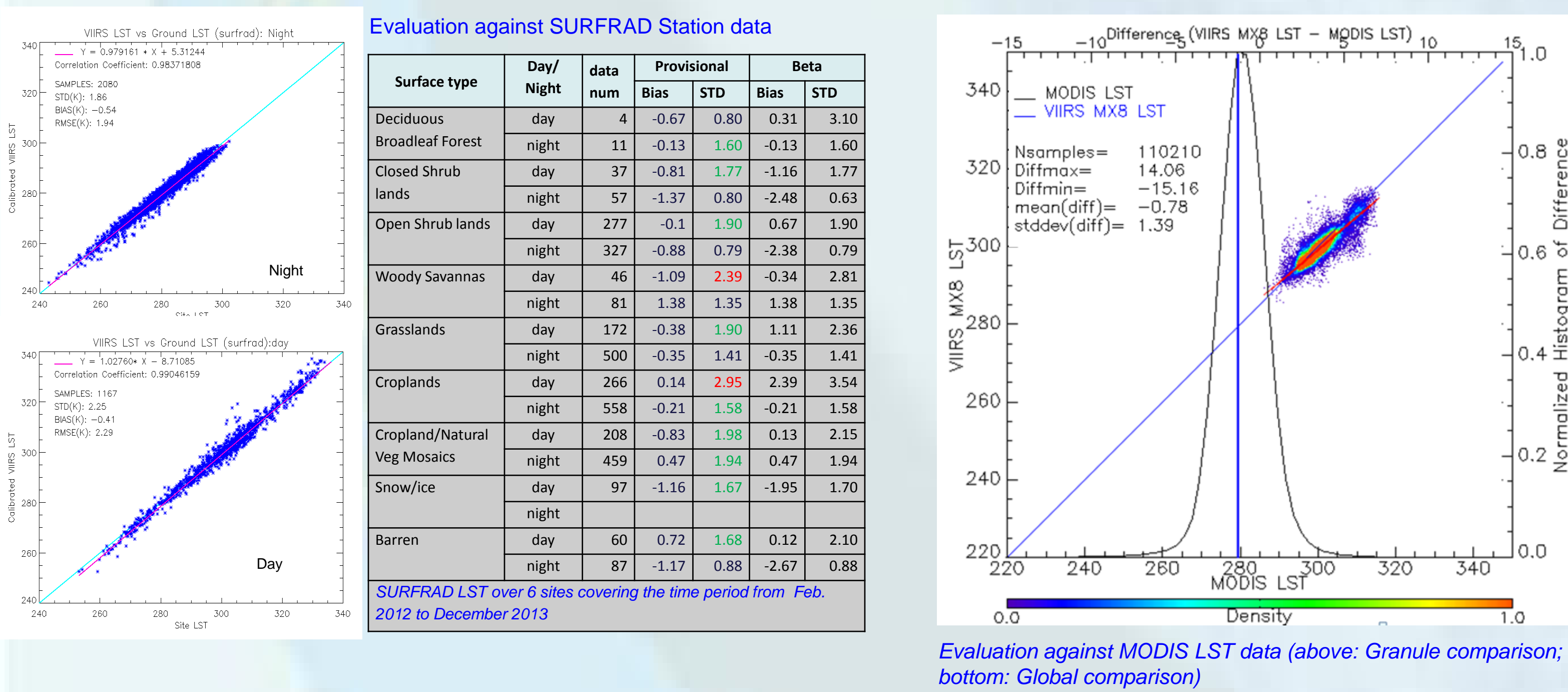
where $a_{k,i}$ are algorithm coefficients; i indicates 17 IGBP surface types; θ is view zenith angle, ϕ is solar zenith angle. T11 and T12 represent the VIIRS sensed brightness temperatures at 11 and 12 micron channels (the split-window).



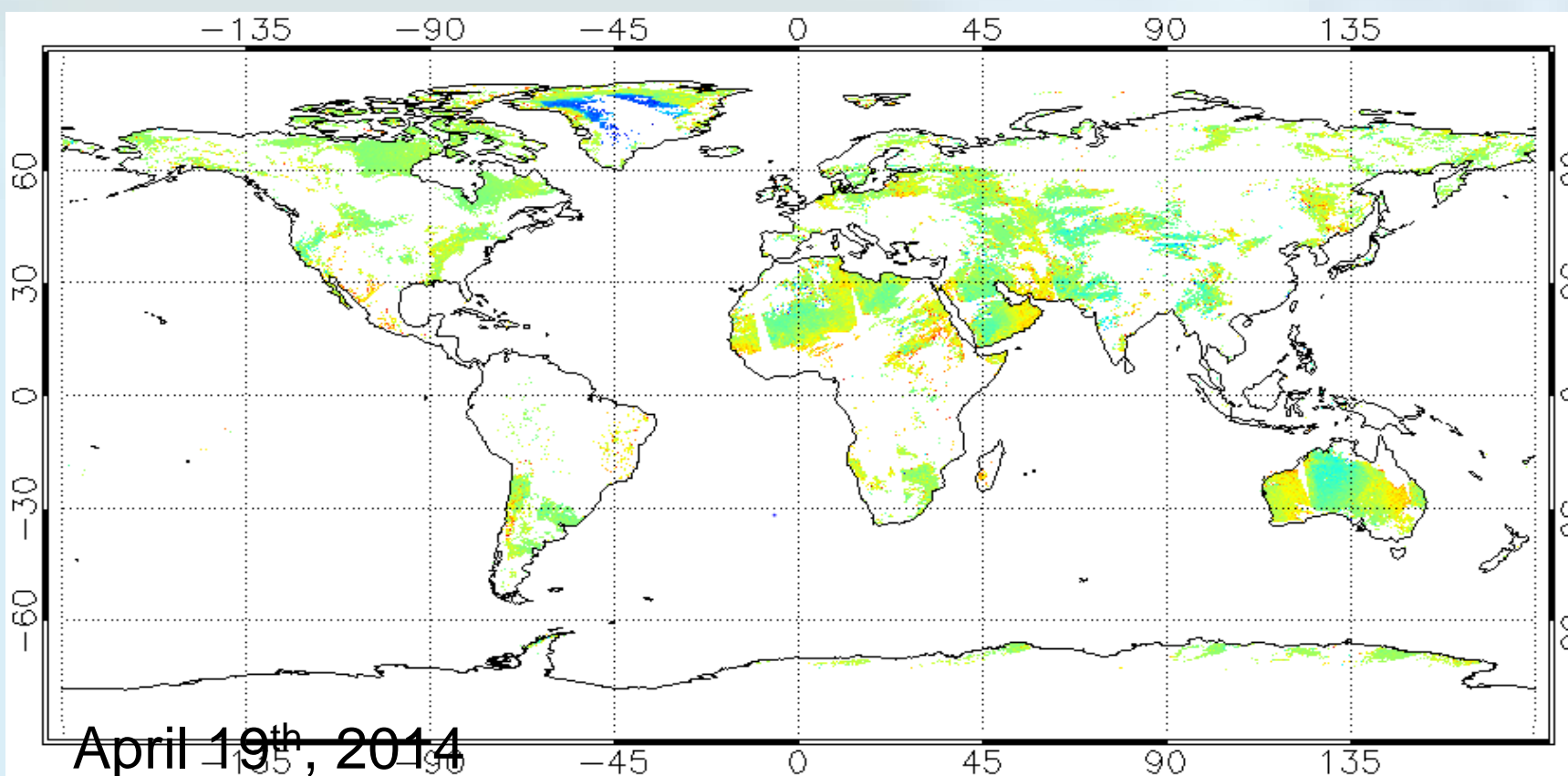
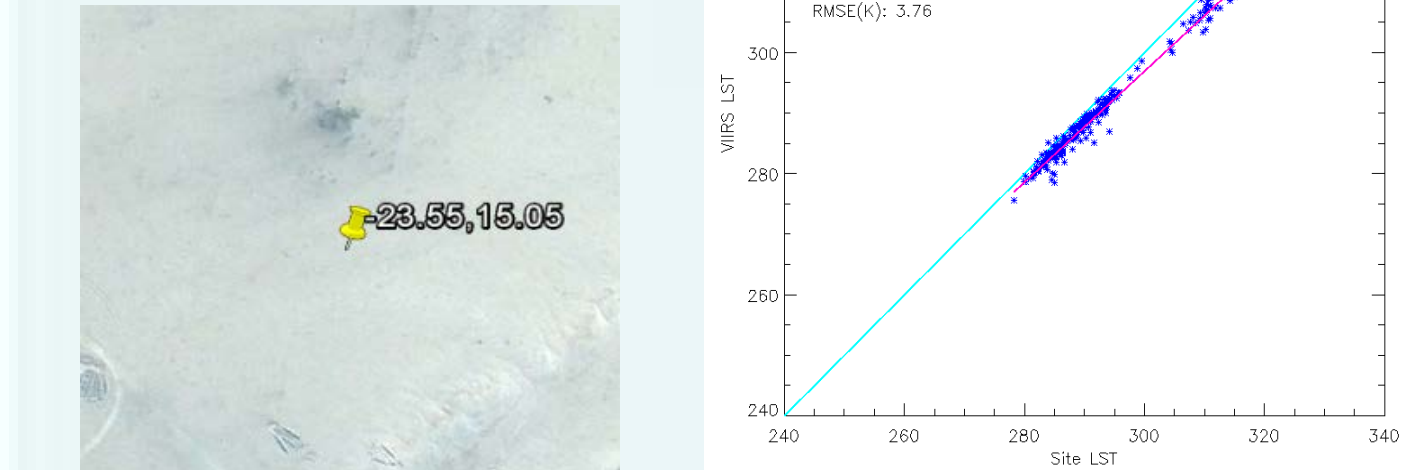
VIIRS LST Processing Chain

Note: the processing chain includes the optional dual split-window algorithm, which is turned off in beta and provisional production

Evaluation



A ground dataset at Gobabeb in Namibia covering the time period of 2012. The data is provided by Frank Goettsche, thanks Pierre for sharing the data.



Future Works

- Algorithm Improvement
 - Emissivity explicit vs. implicit
 - Additional water vapor correction
 - Emissivity correction
- User Promotion: enhance LST product usage in weather forecasting model
- Monitoring tool development
 - Daily/weekly/monthly/year maps and graphics
- Validation methodology study
 - Cross-satellite comparisons
 - Evaluation against ground data
- International cooperation: NOAA-CMA bilateral program -- and product validation subtask; US-Portugal bilateral program -- remote sensing subtask; collaborative tasks with EUMETSAT Land SAF, International Land Surface Temperature and Emissivity Working Group communities.

Summary

- Split Window LST(SWLST) is running for provisional release of the VIIRS LST production
 - Provisional version in production in 10/2013
 - Errors found in 10/2013, switch back to beta in 11/2013
 - Provisional update in production in 04/2014
- Evaluation underway
 - Cross-satellite comparisons
 - Ground data comparisons: Comparisons with SURFRAD LST estimates; Comparisons with individual field data
 - Radiance-base comparisons
 - Monitoring tool in use
- Issues found
 - Algorithm issues: Significant impact from the Type EDR; emissivity impact to LST (vs. to SST)
 - Validation issues: Impact of time difference in cross-satellite comparison; ground data quality, heterogeneity.

S-NPP/VIIRS LST Images on April 9th, 2014

