NPP VIIRS Land Surface Temperature EDR

validation using NOAA's observation network

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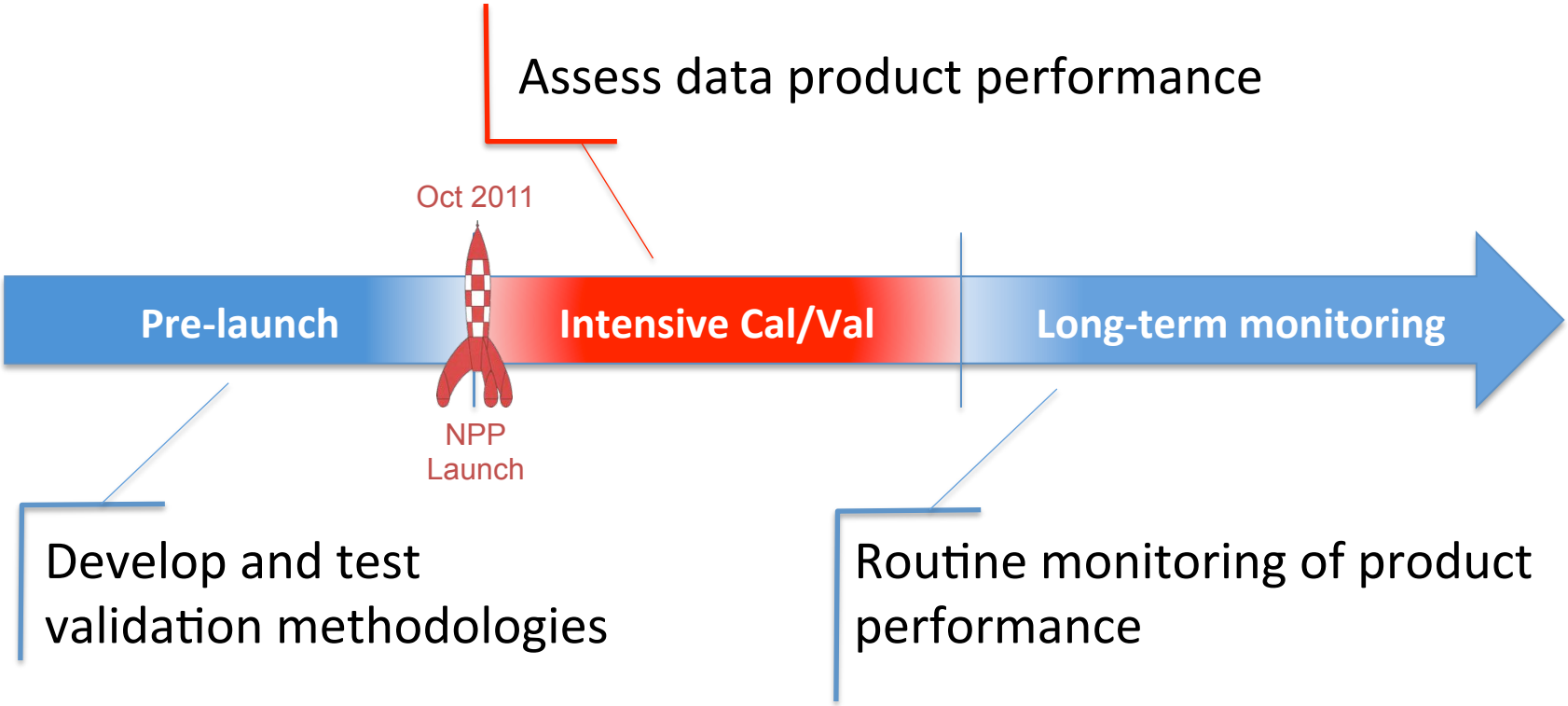
AMS Annual Meeting – January 2013

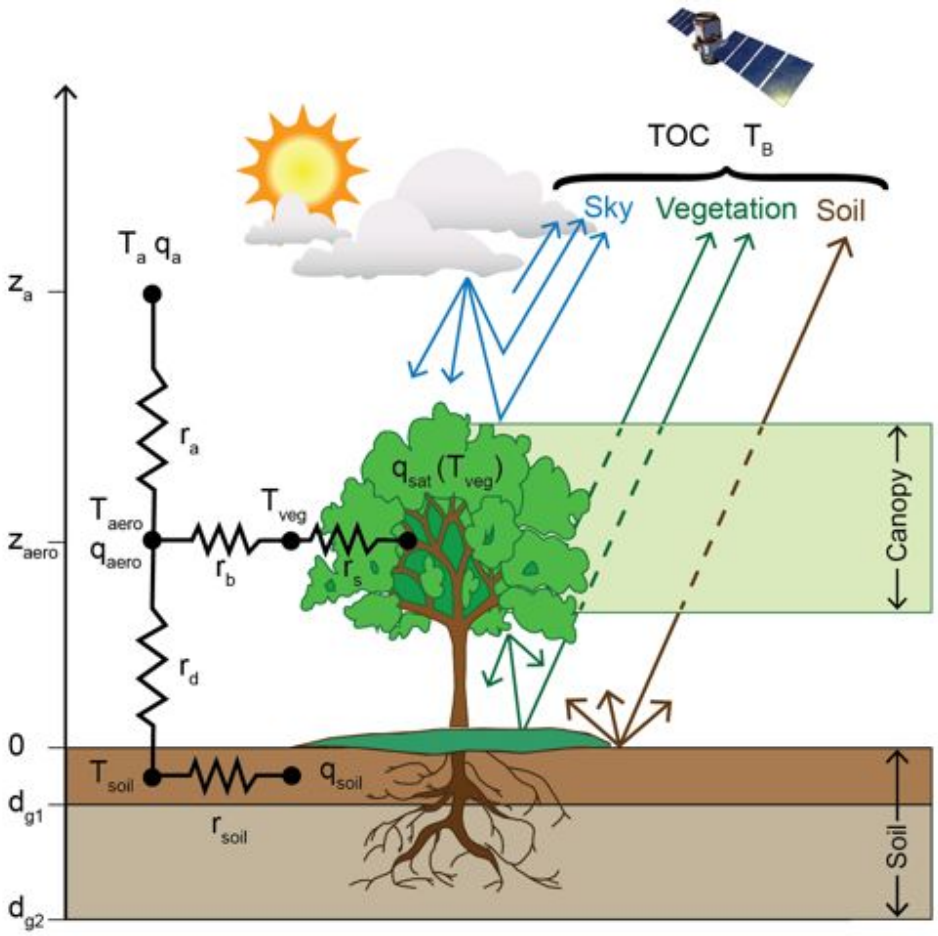
Context

JPSS program	Joint Polar Satellite System
NPP satellite	National Polar-orbiting Partnership
VIIRS sensor	Visible/Infrared Imaging Radiometer Suite
Land EDR	Environmental Data Record
LST EDR	Land Surface Temperature EDR

Calibration/Validation phases



Land Surface Temperature - Definition



LST = Air / Aerodynamic / Radiative / Radiometric / Thermodynamic

$$\frac{dT}{dt} = C_T(R_n - LE - H - G)$$

VIIRS LST Retrieval Algorithms

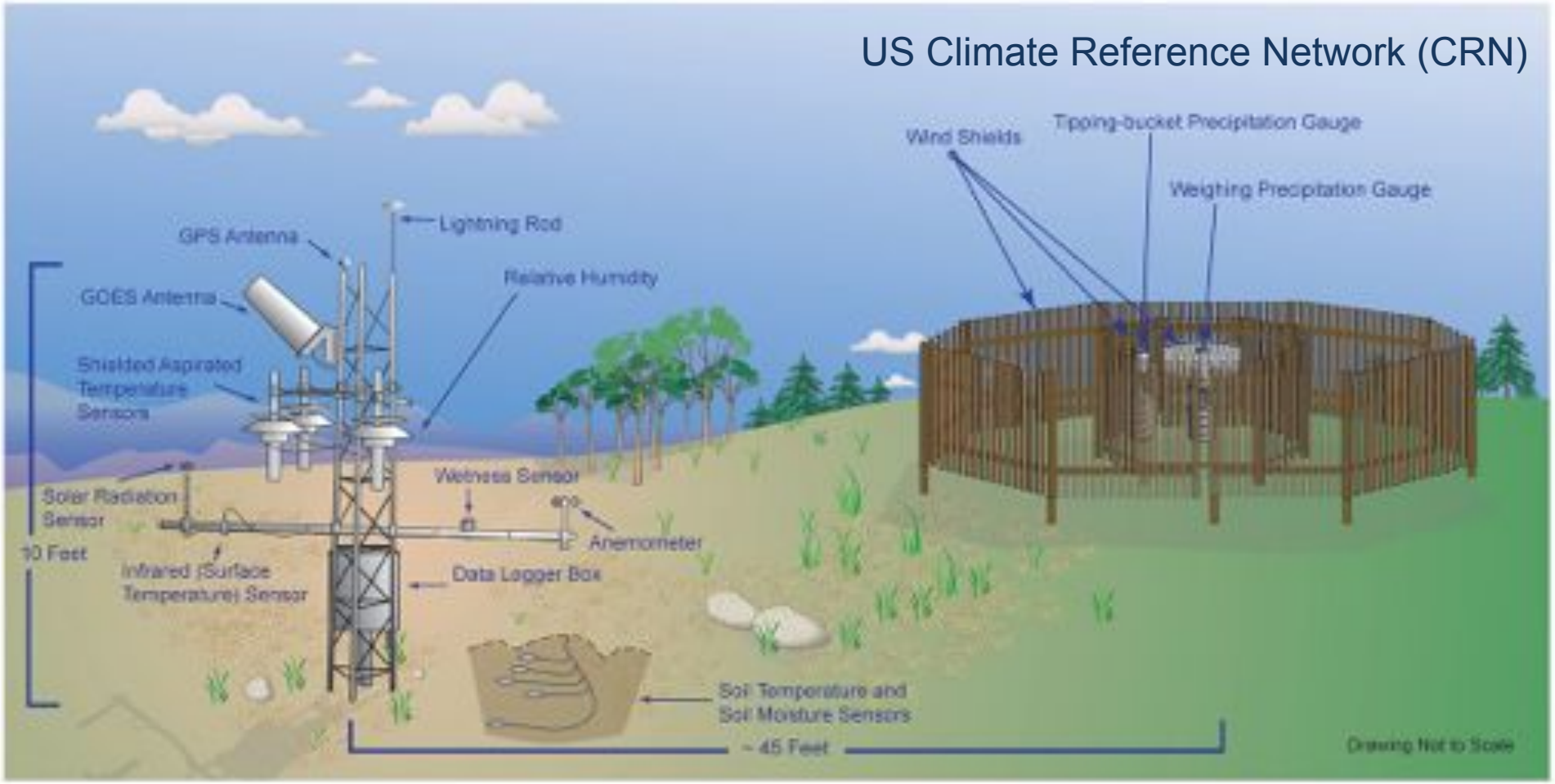
- Based on Split Window method
  - Require a statistical representation of atmospheric profiles and surface conditions

$$LST = a_1 + a_2 T_{11} + a_3 (T_{11} - T_{12}) + a_4 (\sec\theta - 1) + a_5 (T_{11} - T_{12})^2$$

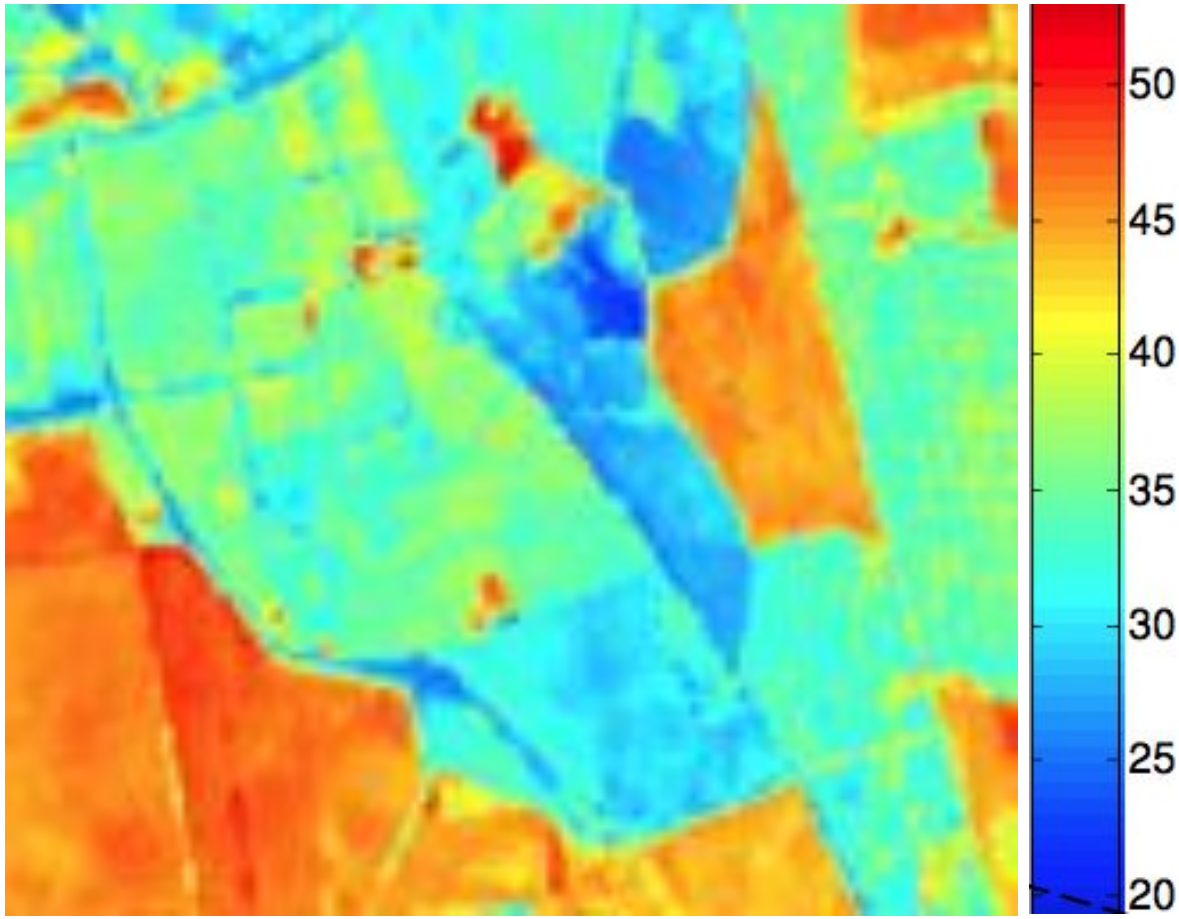
- Requirements: 1.4K accuracy & 2.5K precision

- Goal: Quantify the accuracy and precision of the EDR
  - Comparison with heritage data: Aqua/MODIS (see Liu's talk at 4:45)
  - Comparison with ground reference

Comparison with “Ground truth”

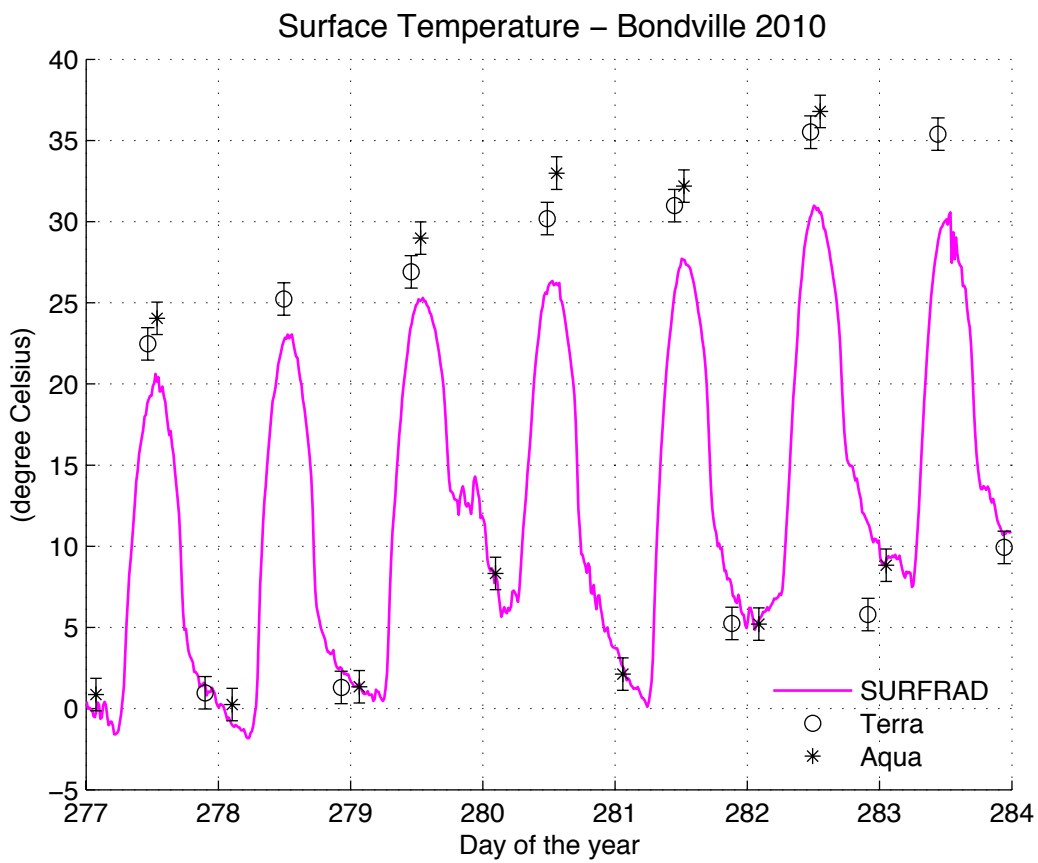


LST spatial variability



Courtesy of Dominique Courault (INRA, France)

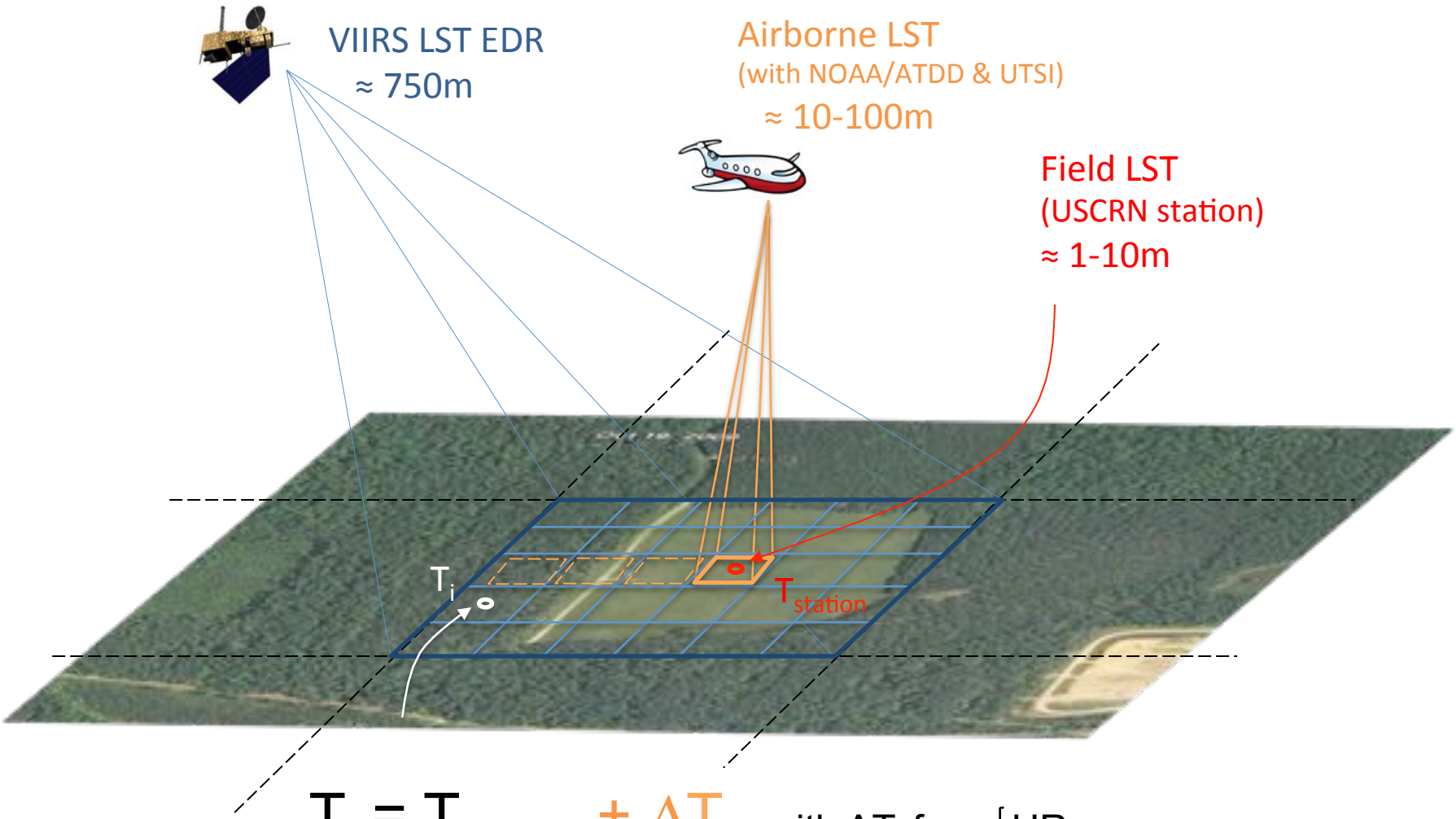
Field *vs.* Satellite



Could such discrepancies be information?

Scaling methodology

Guillevic et al., RSE, 2012

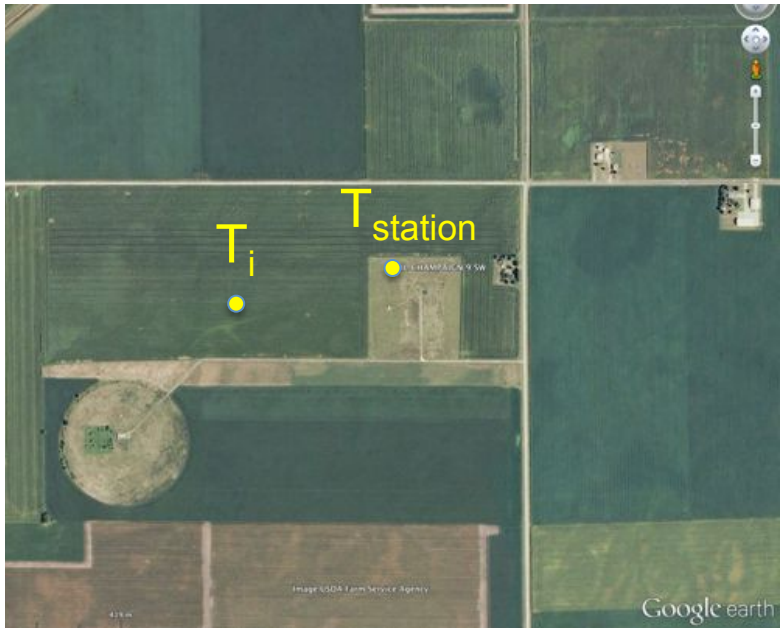


$$T_i = T_{station} + \Delta T_i$$

with ΔT_i from
- HR maps (LAI, emissivity)
- Land surface model

Spatial vs. temporal variability

Bondville/Champaign, IL



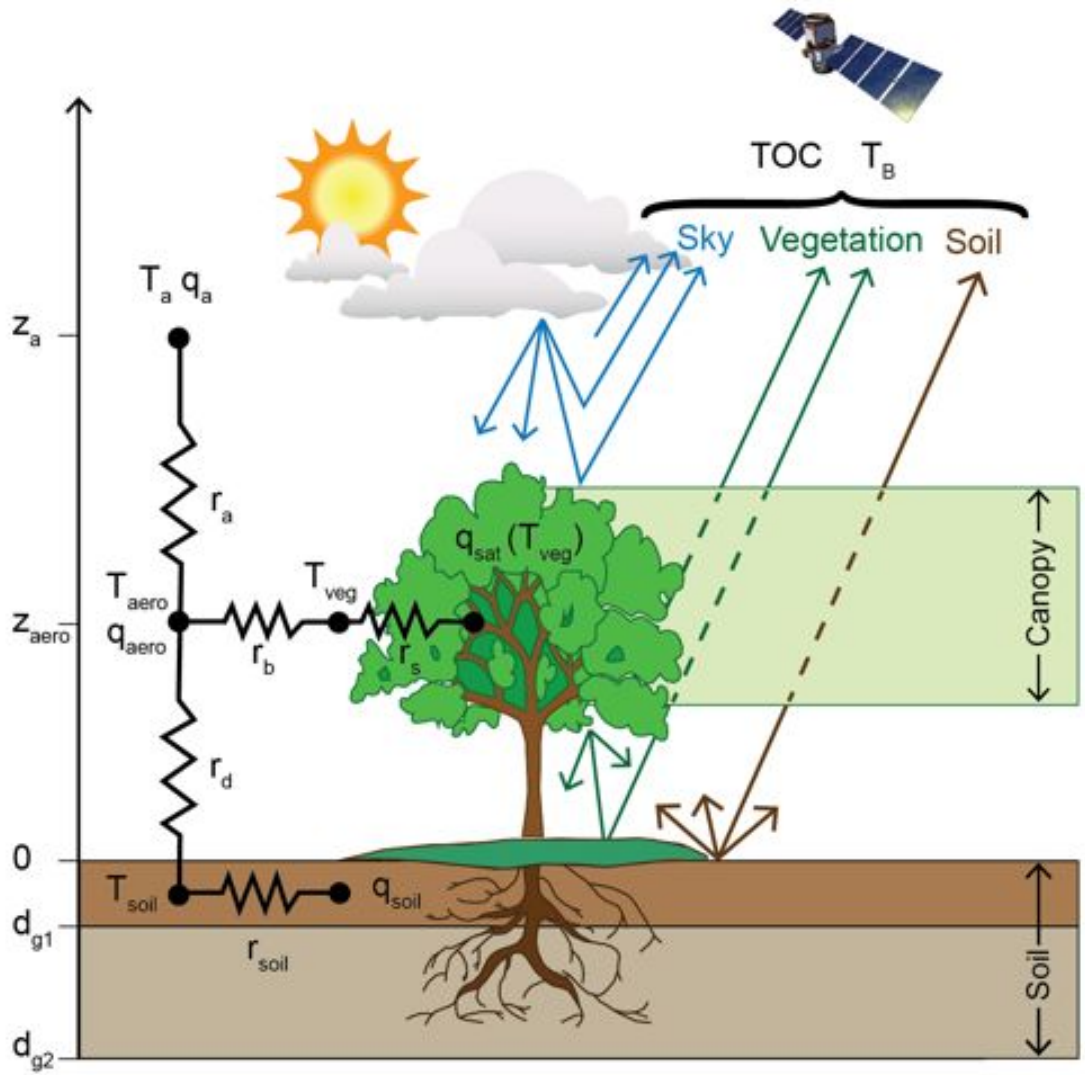
Before the harvest

After the harvest

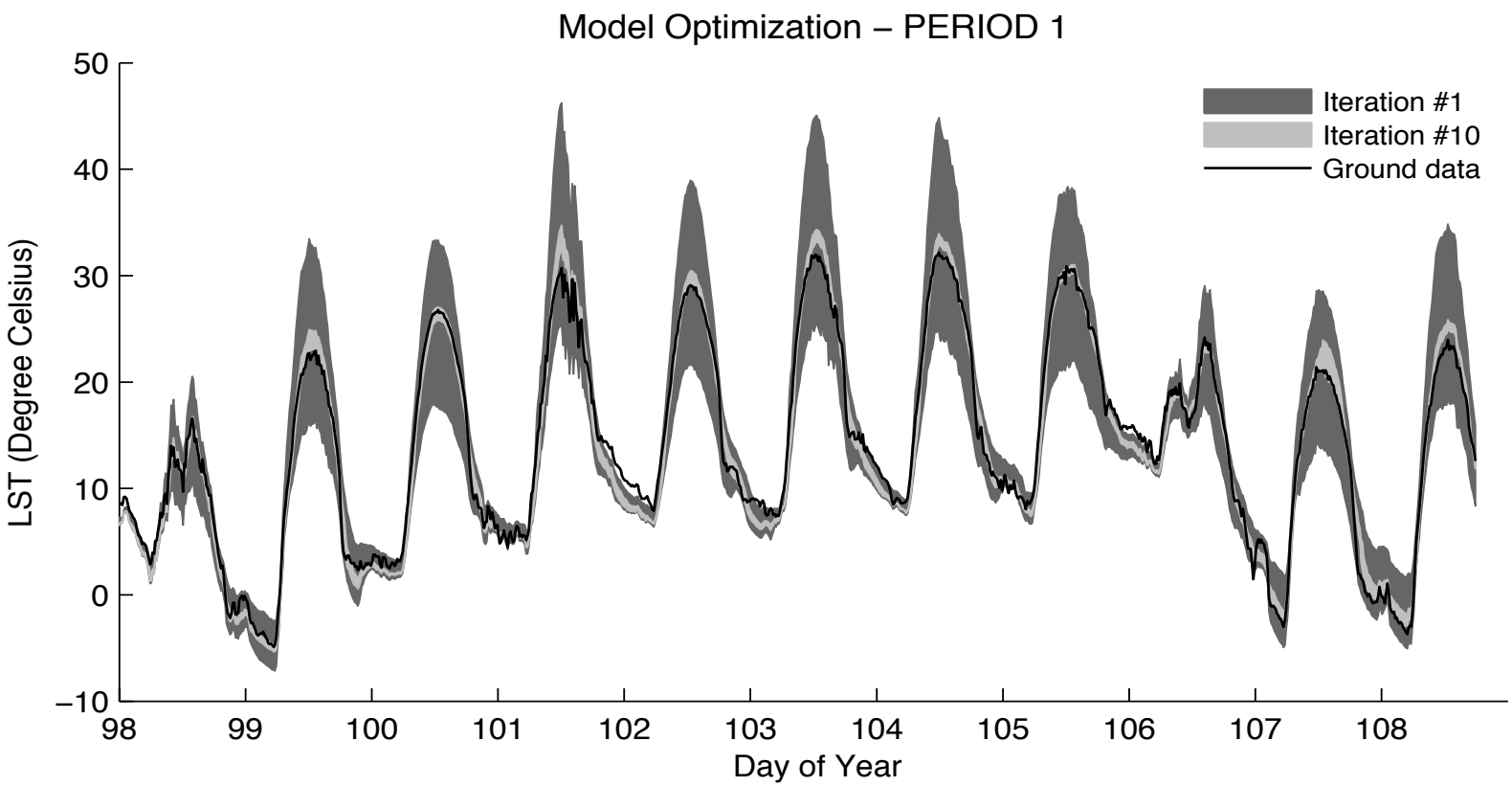
$$T_i = T_{station} + \Delta T_i$$

SETHYS Land Surface Model

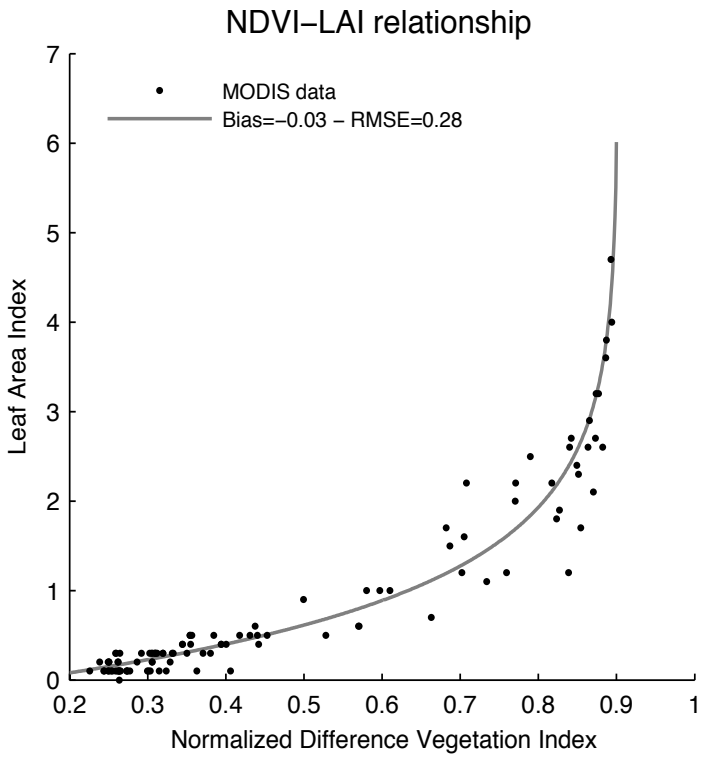
Coudert *et al.*, RSE, 2006

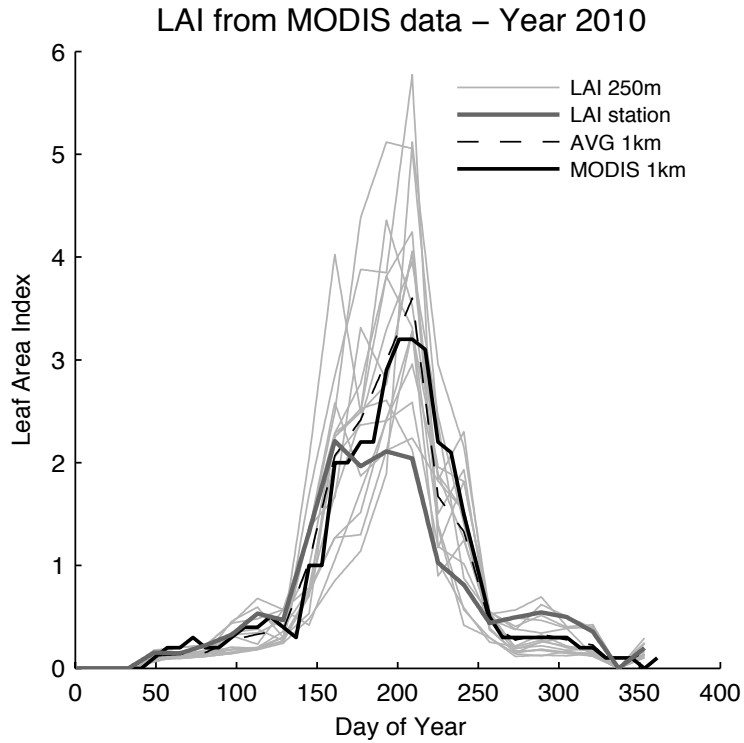


Model Optimization

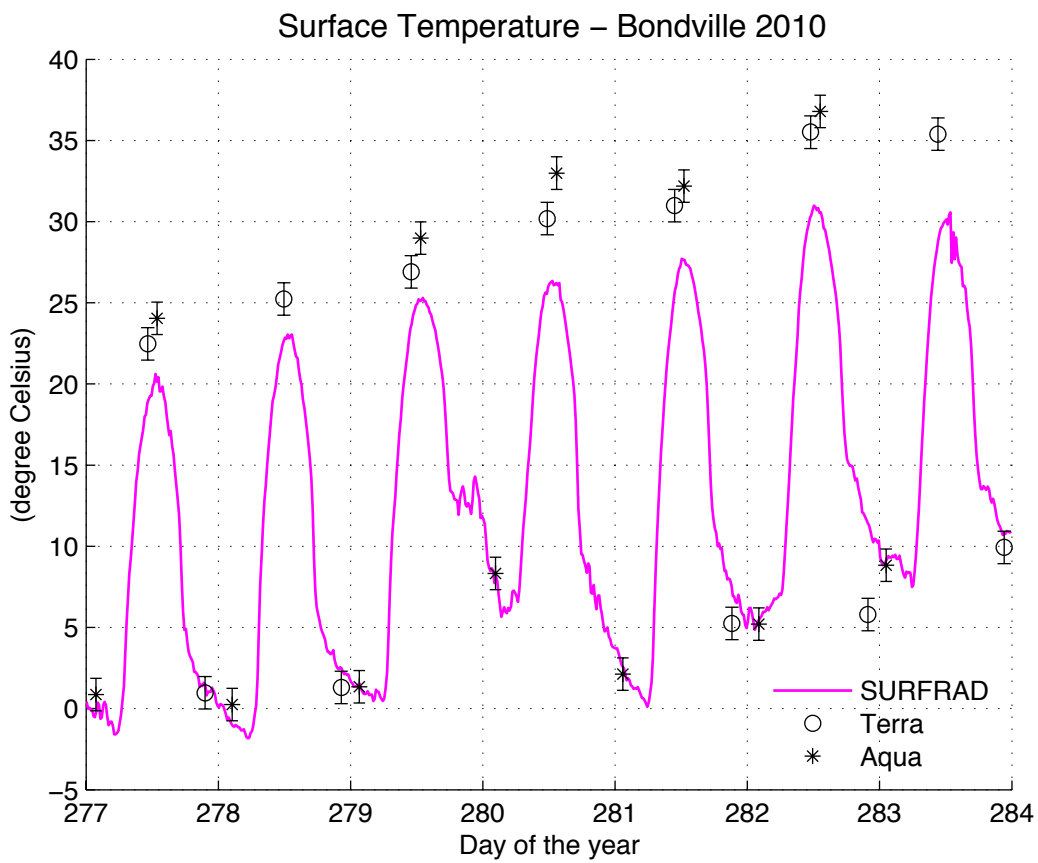


Vegetation variability within a pixel



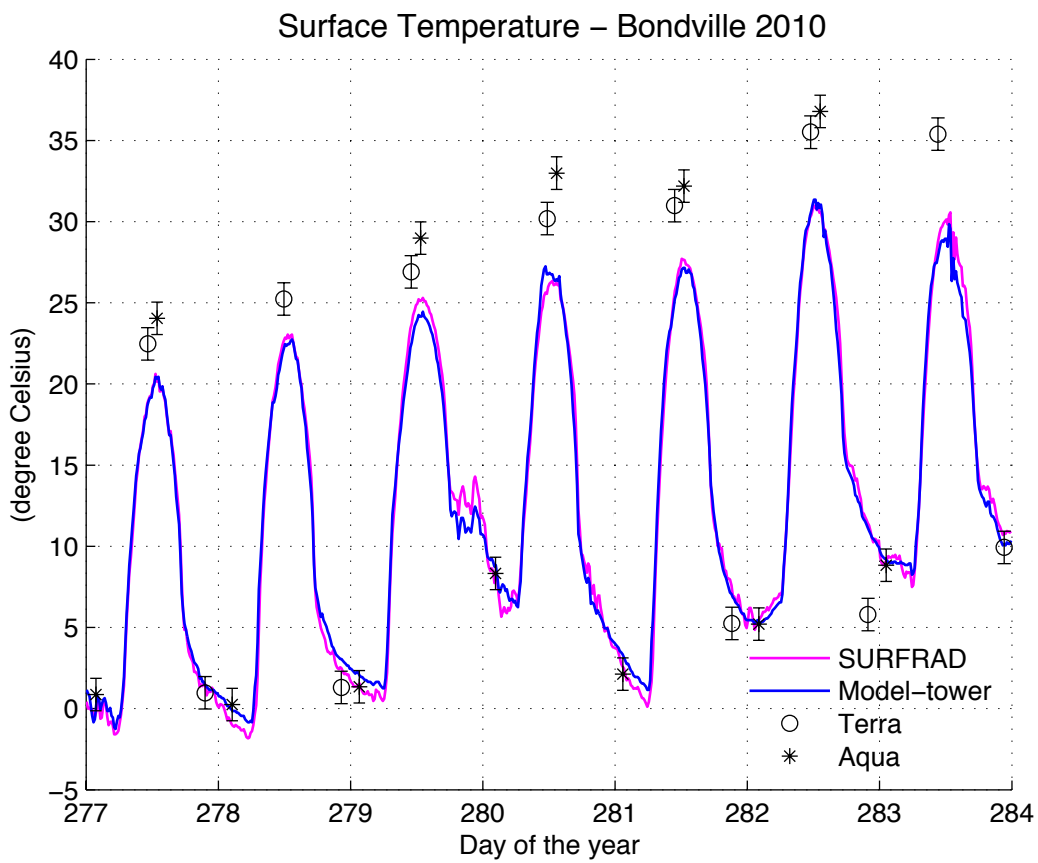


Scaling methodology



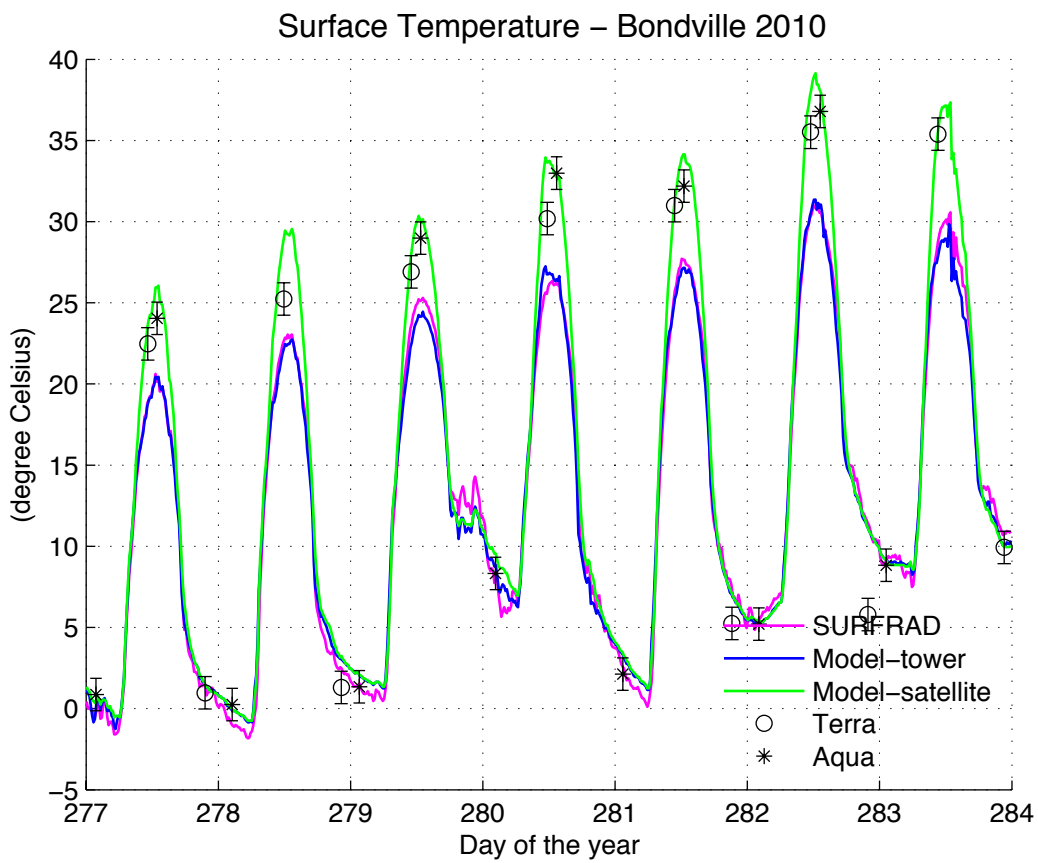
1) Reference = Ground-based measurements

Scaling methodology



2) Land Surface Model adjustment

Scaling methodology



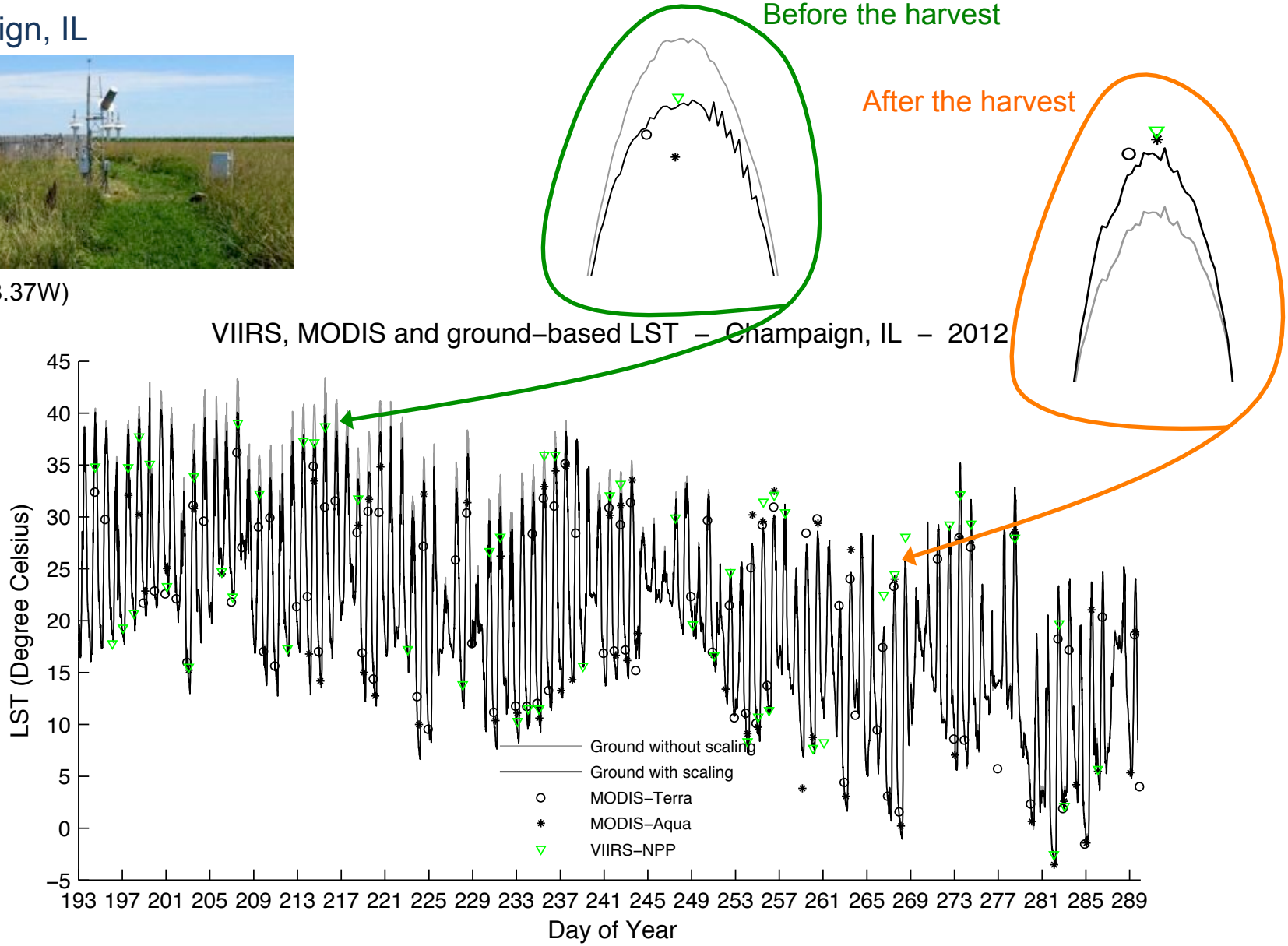
3) Extrapolate the LST using HR information

VIIRS LST EDR validation

Results

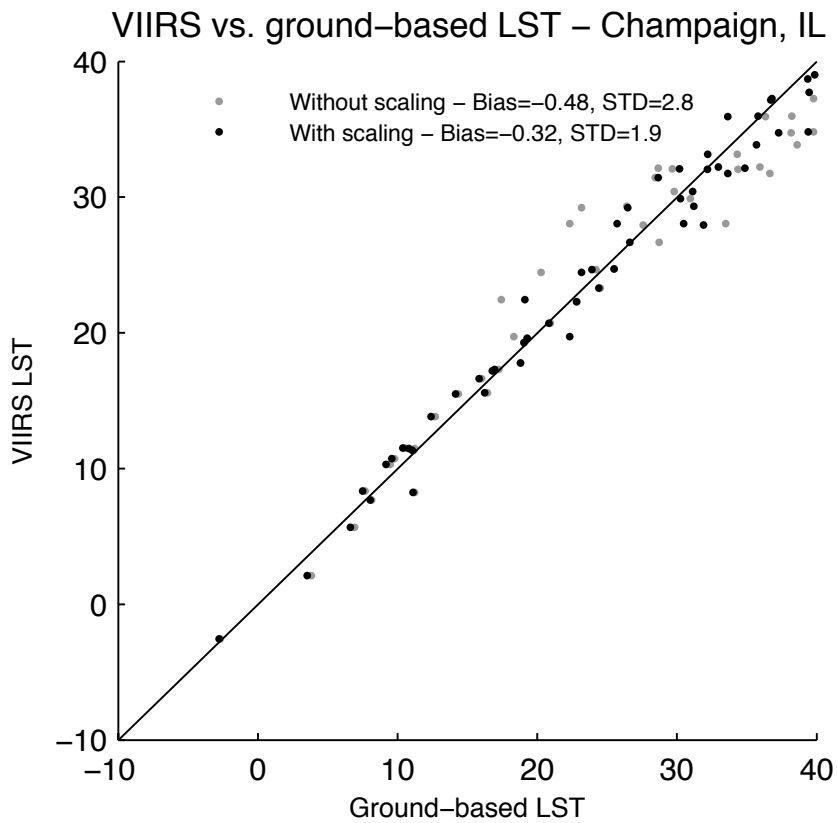
Champaign, IL

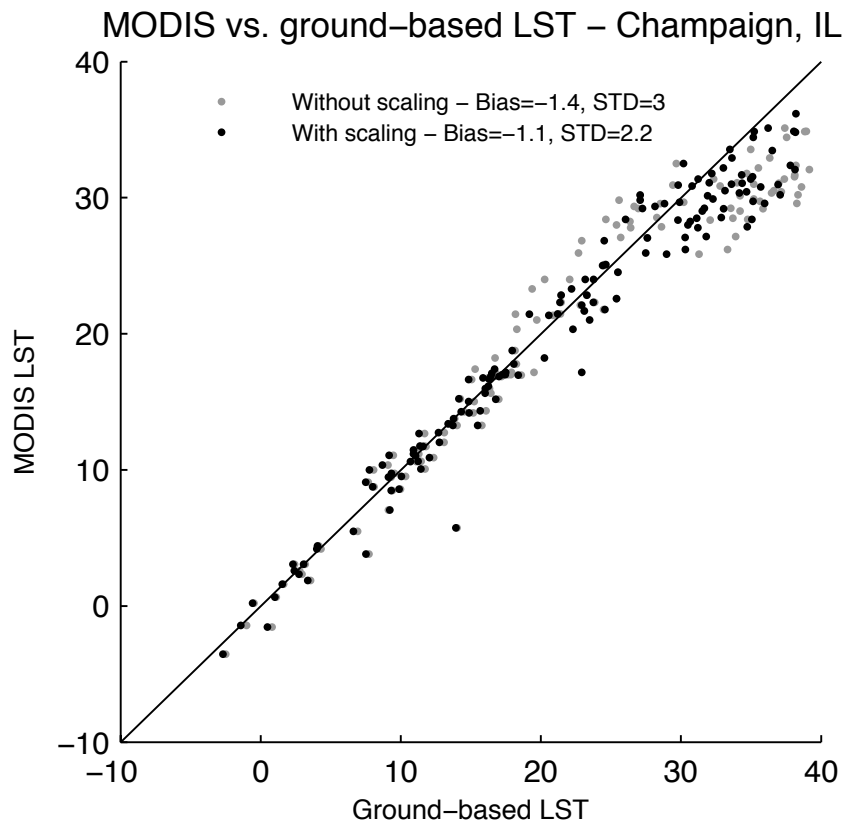
(40.05N, 88.37W)



VIIRS LST EDR validation

Results





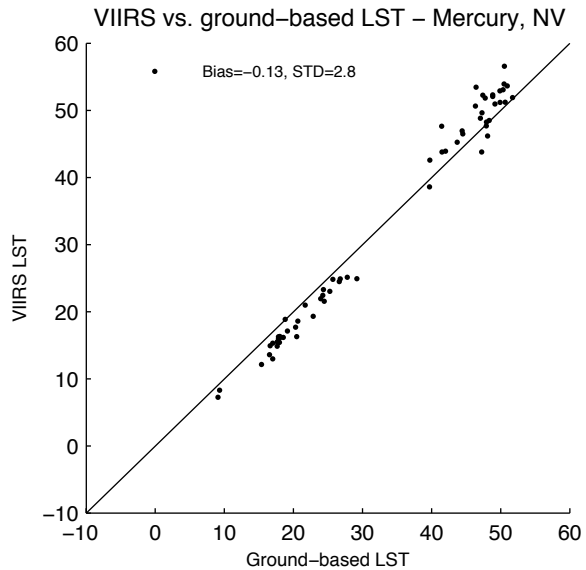
		Bias	RMSE
VIIRS	Satellite vs. Station	-0.5	2.8
	Satellite vs. Scaled-up data	-0.3	1.9

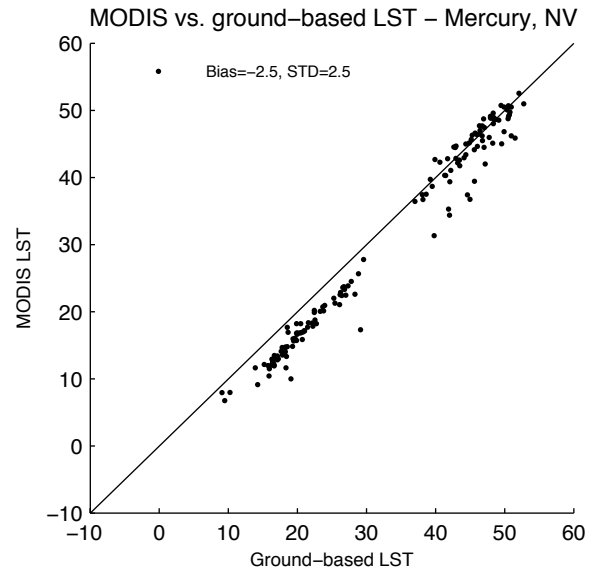
VIIRS LST EDR validation

Results

Mercury, NV

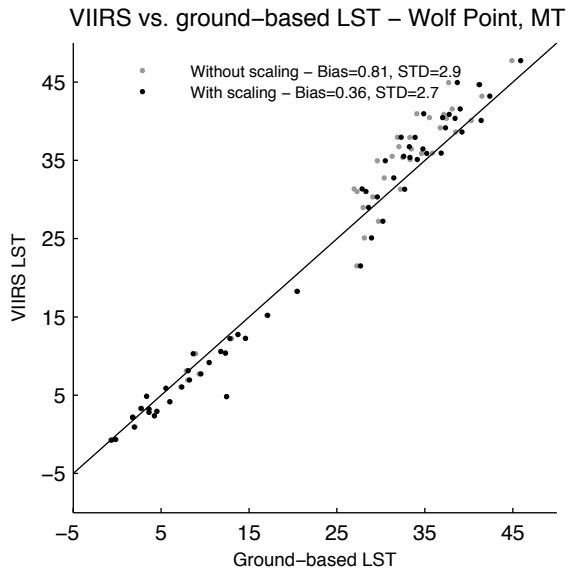
(36.62N, 116.02W)

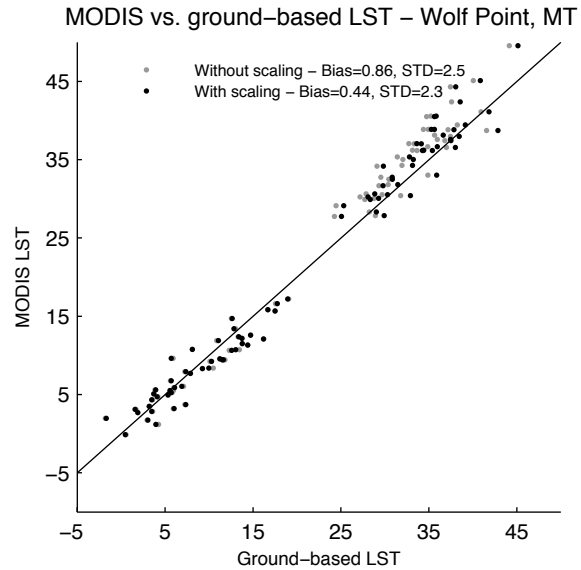




Wolf Point, MT

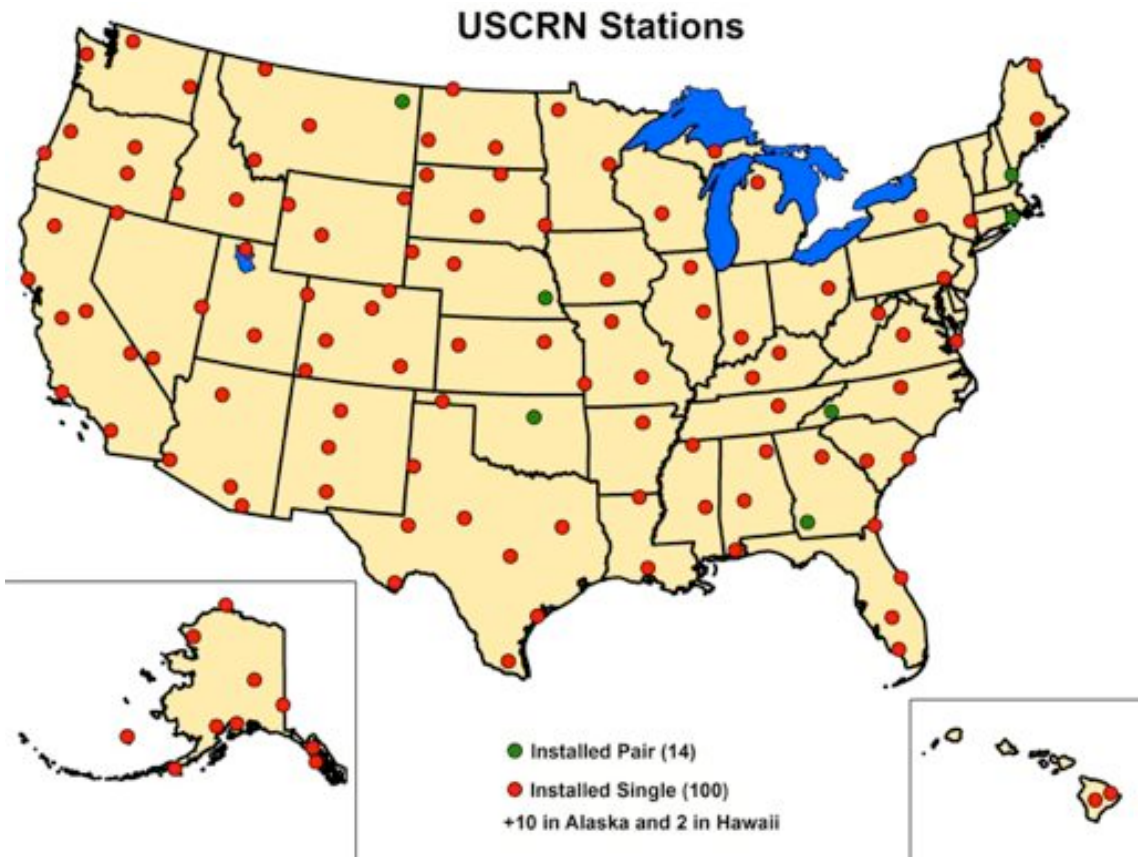
(48.31N, 105.1W)





Long-term routine product monitoring

- Next step -



Routine validation over 25 USCRN stations

Main collaborations

- NOAA/STAR and NOAA/ATDD
- NASA LPEATE
- Jet Propulsion Laboratory, NASA
- Karlsruhe Institute of Technology, Germany
- Laboratoire des Sciences du Climat et de l'Environnement (CEA/LSCE), France
- Institut National de Recherche Agronomique (INRA), France
- University of Valencia, Spain
- University of Leicester, UK