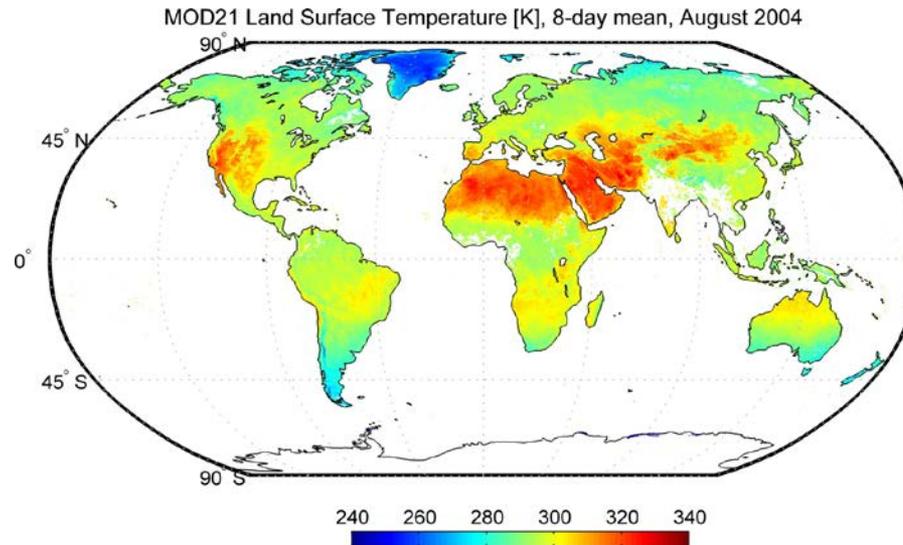


Land Surface Temperature and Emissivity Projects at NASA JPL



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Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA

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Outline

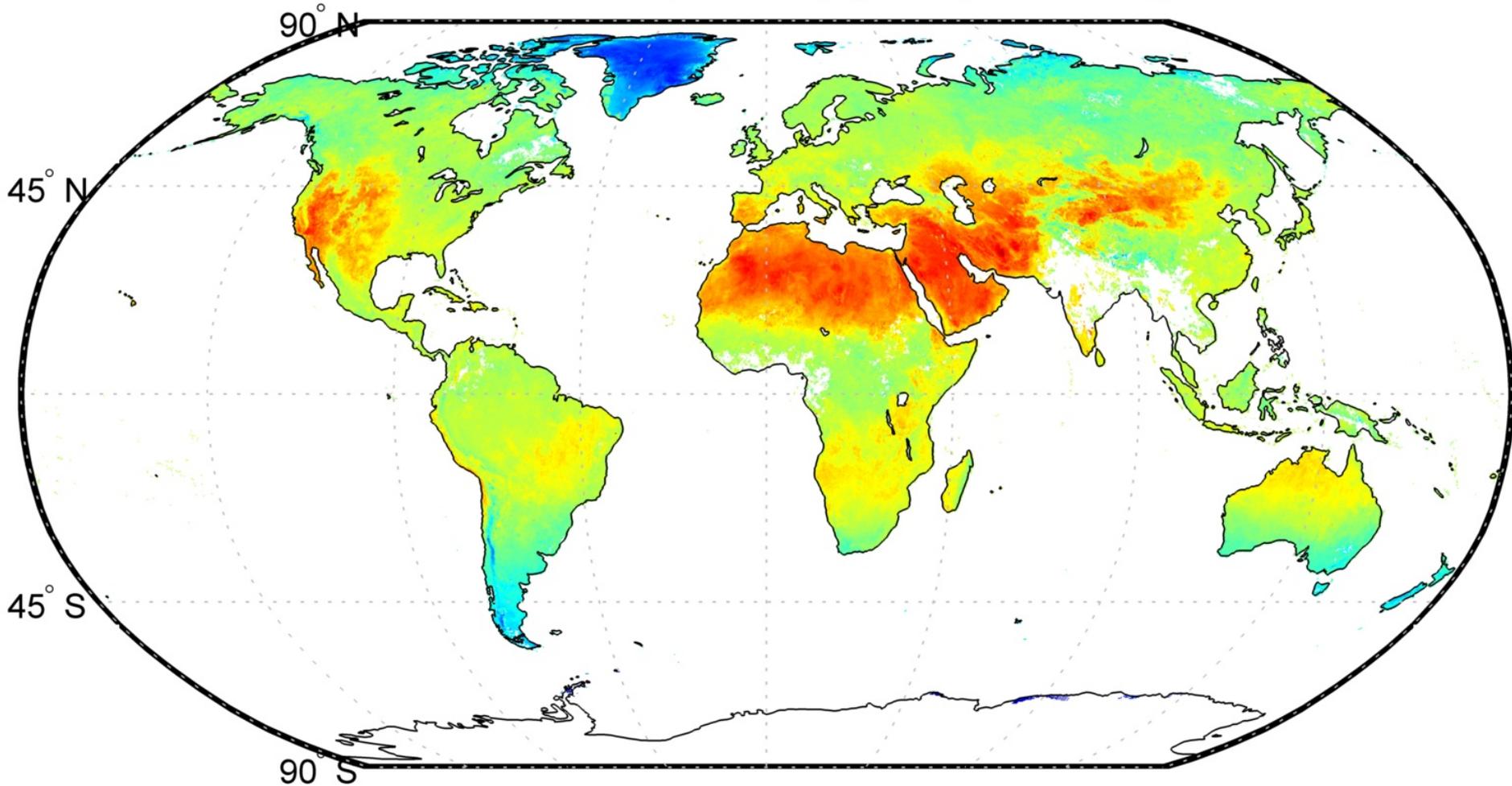
- MOD21 LST&E Product (Collection 6)
- ASTER Global Emissivity Database (GED)
- NASA MEaSUREs LST&E Products

Current MODIS LST&E Products

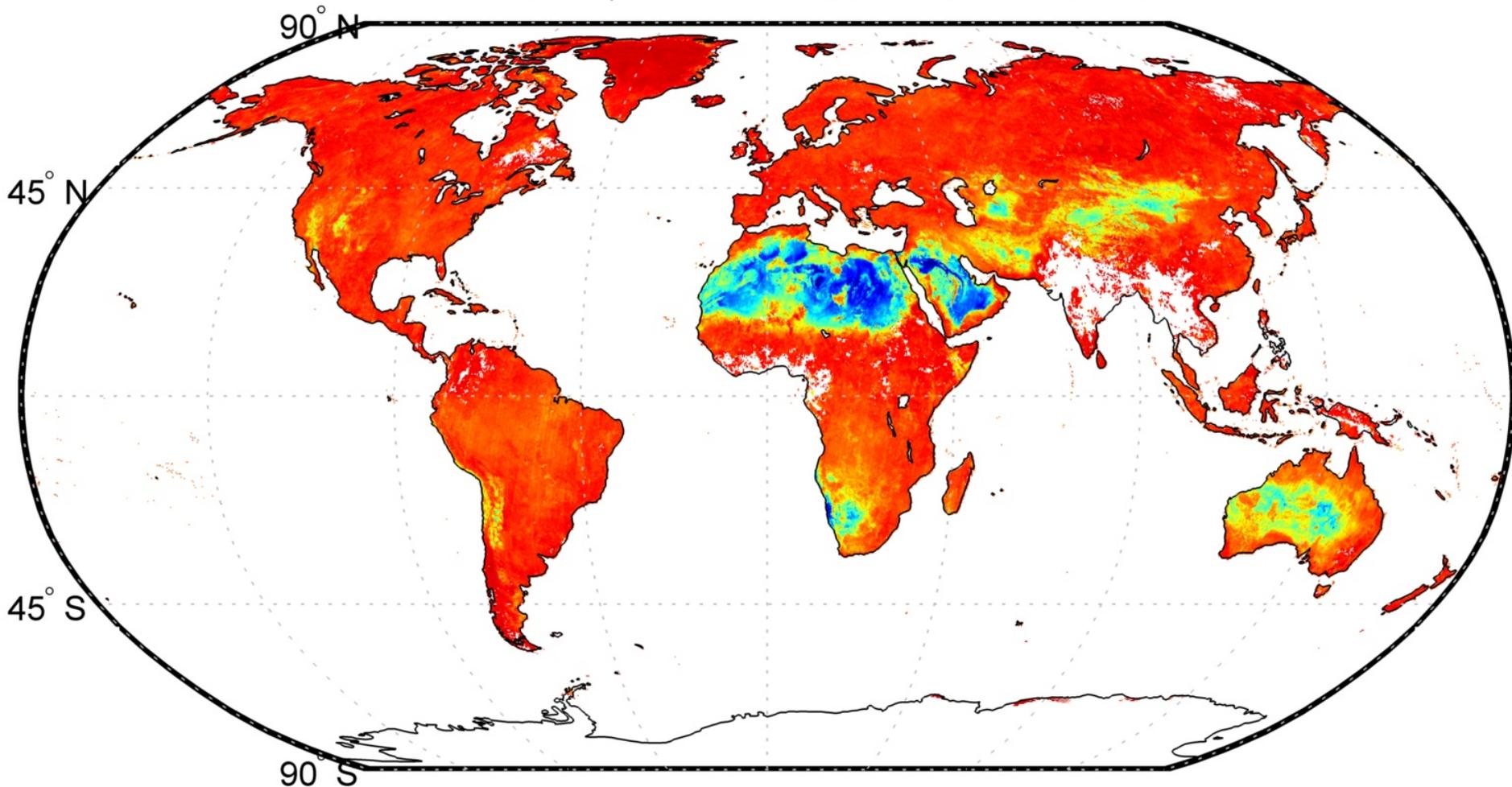
MODIS LST Products	Product Level	Dimensions	Spatial Resolution	Temporal Resolution	Algorithm	Output Products
MOD11_L2	L2	2030 lines 1354 pixels/line	1km at nadir	Swath 2x daily	Split-Window	- LST
MOD11B1	L3	200 rows 200 columns	~5 km (C4) ~6 km (C5)	Sinusoidal 2x daily	Day/Night	- LST - Emissivity (bands 20-23, 29, 31,32)
MOD11C3	L3	360°x180° Global	0.05° x 0.05°	Monthly	Day/Night + Split-Window	- LST - Emissivity (bands 20-23, 29, 31-32)
**MOD21_L2	L2	2030 lines 1354 pixels/line	1km at nadir	Swath 2x daily 8-day Monthly	TES (ASTER)	- LST - Emissivity (bands 29, 31, 32)

- MOD21 to be released with MODIS Collection 6 reprocessing Oct/Nov 2014.
- MOD21 C6 regarded as supplemental/experimental but after validation, testing and algorithm updates, MOD21 C6.1 will be primary MODIS LST product or merged with MOD11

MOD21 Land Surface Temperature [K], 8-day mean, August 2004

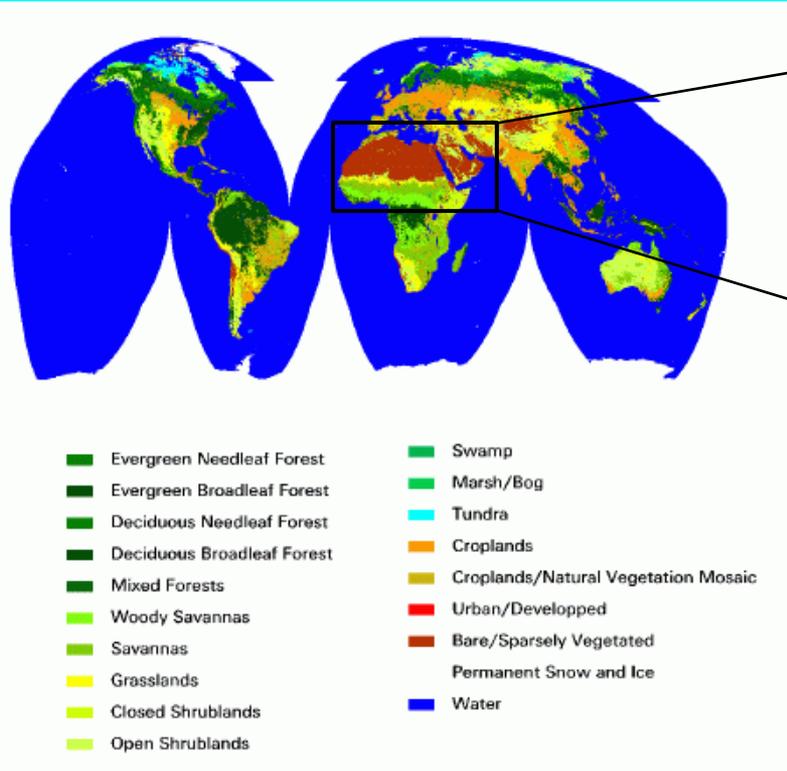


MOD21 Band 29 (8.55 μm) Emissivity, 8-day mean, August 2004

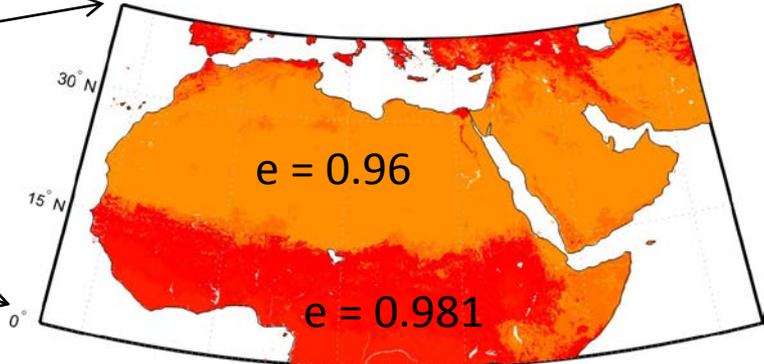


Generated using prototype MOD21 algorithm at MODAPS

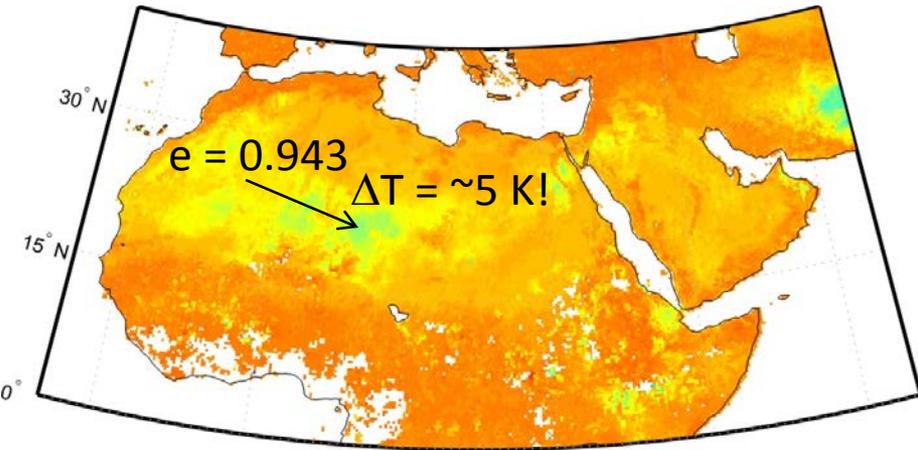
MOD11 (Split-Window) versus MOD21 (TES retrieval)



Split-window:
MOD11 band 31 (11 μ m)

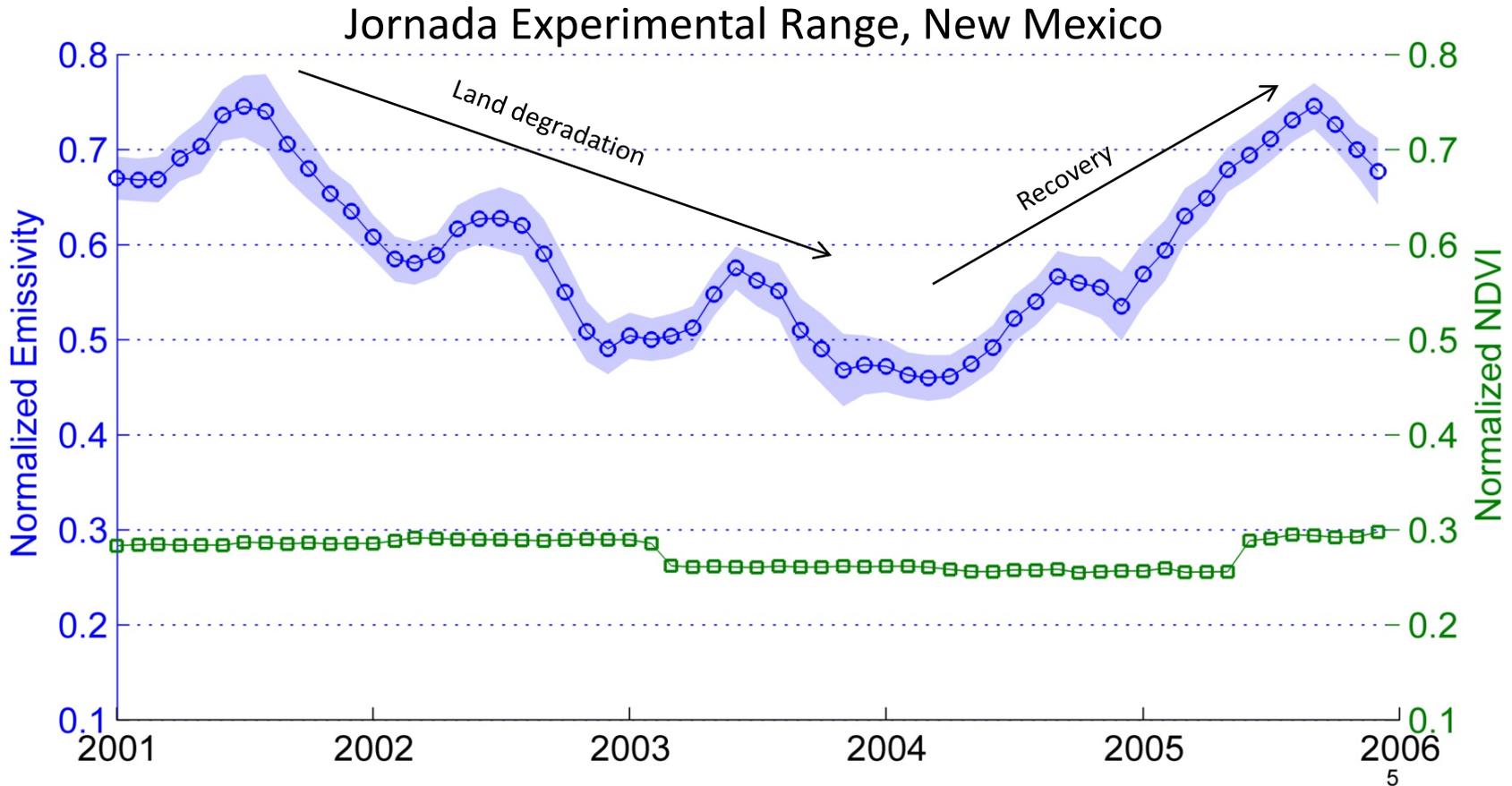


TES Retrieval:
MOD21 band 31 (11 μ m)



Over Sahara, MOD11 classified as bare and assigned single emissivity but a wide range in emissivity as seen with MOD21 (TES)

Physical-based MOD21 Emissivity used for Land Cover Change Monitoring



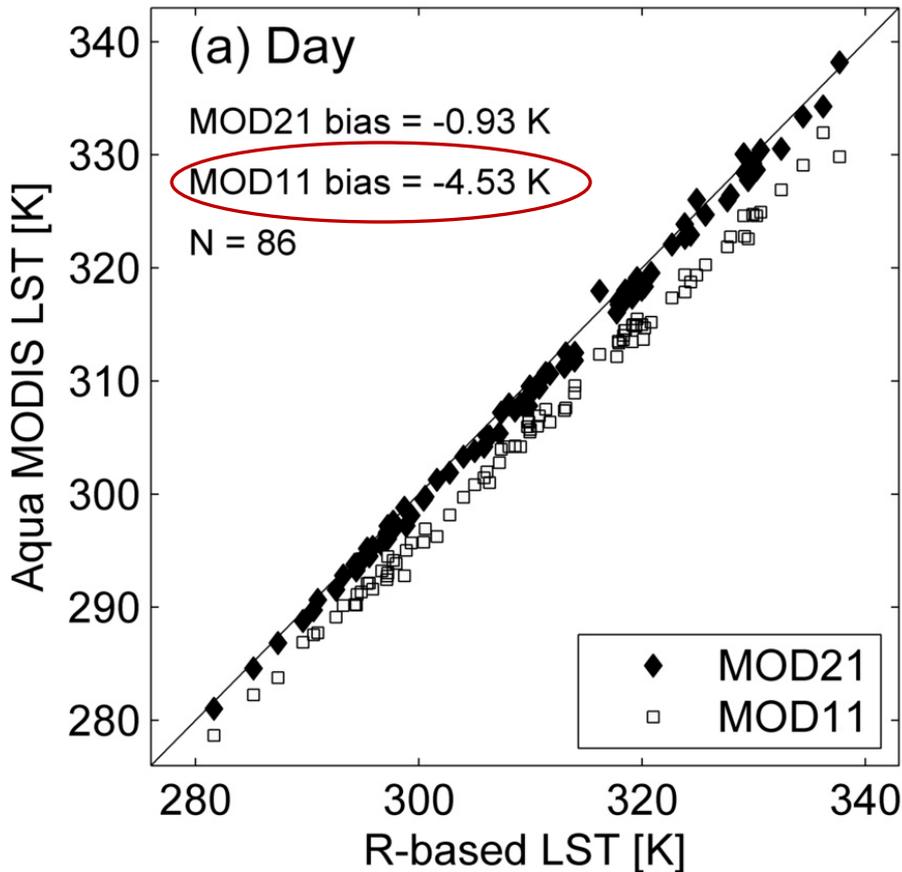
- MOD21 band 29 emissivity sensitive to background soil and dry/green vegetation
- NDVI unable to make distinction between background soil and dry vegetation
- MOD21 emissivity able to better capture seasonal trends and interannual trends than NDVI



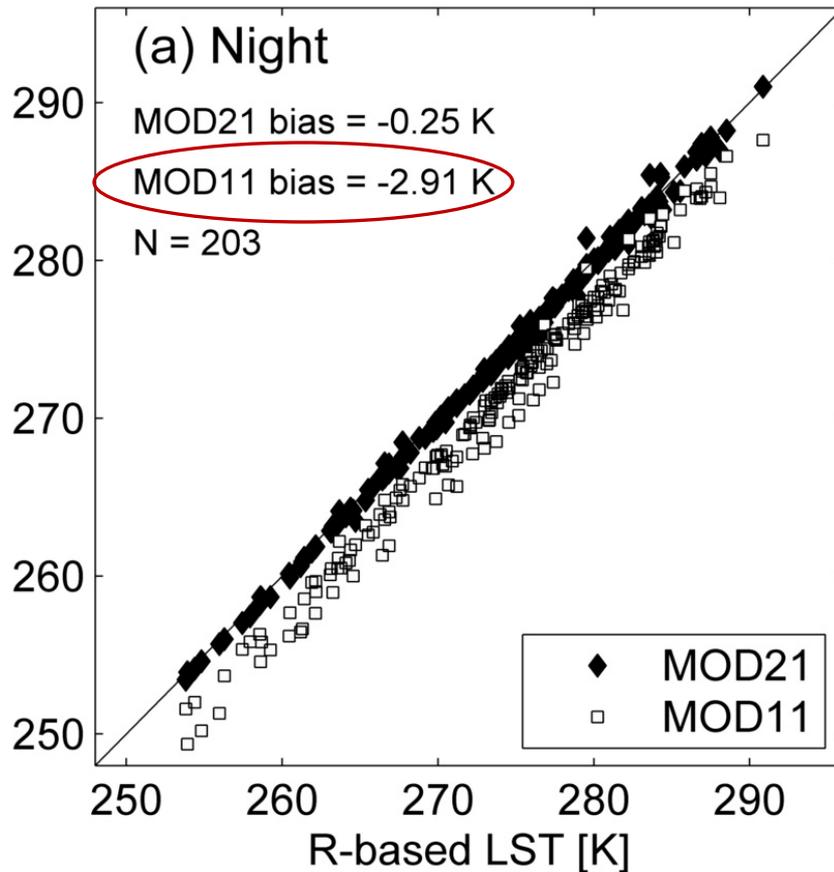
MODIS LST Validation: Great Sands, Colorado

MOD11 LST underestimated due to overestimation of bare surface type emissivity

Great Sands, CO



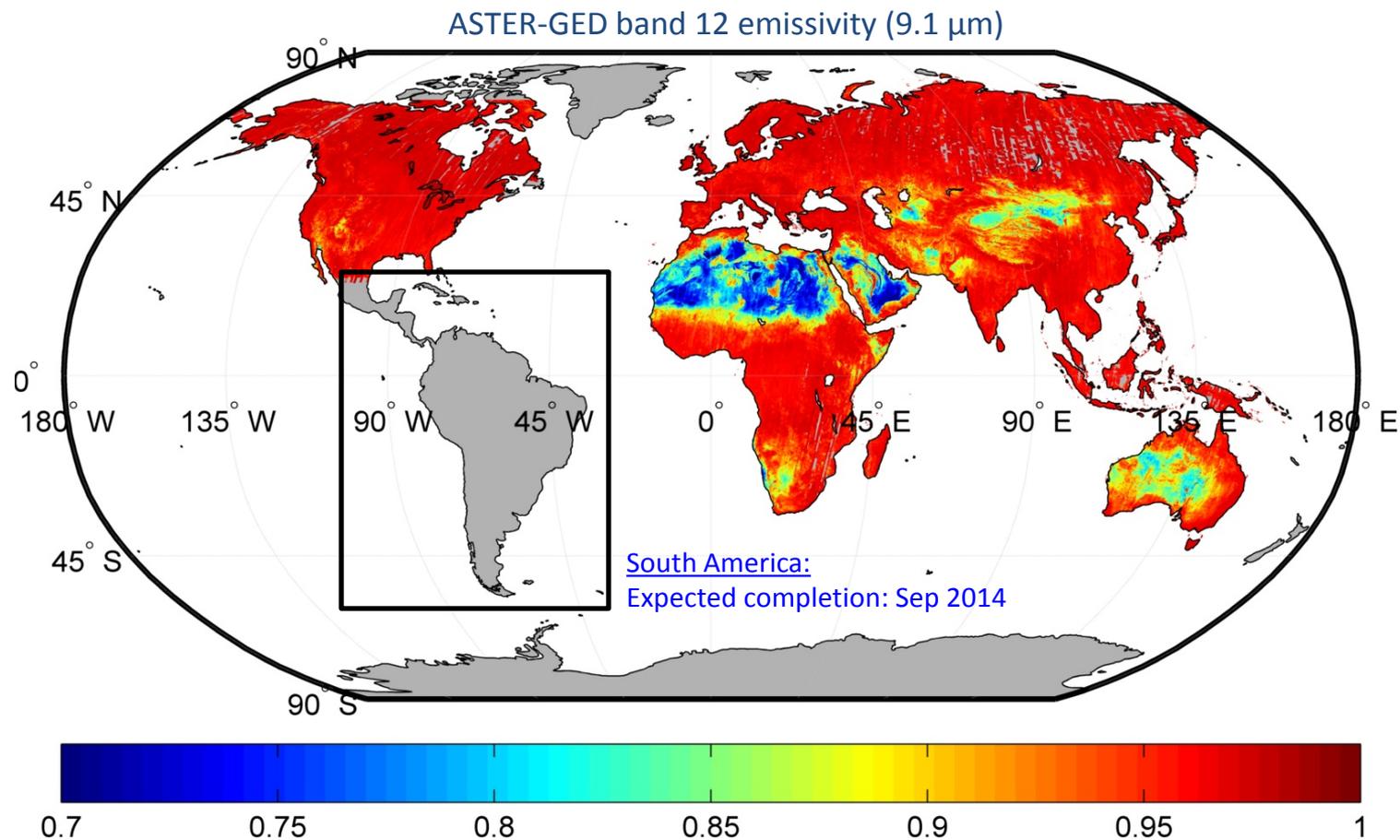
Great Sands, CO



** Radiance-based LST validation using lab-measured sand samples collected at dune site

ASTER Global Emissivity Database (GED)

Spectral	Spatial	Temporal	Products	Emissivity Accuracy
5 Bands (8-12 μm)	~100 m	Mean (2000-2008)	Emissivity, NDVI, GDEM, Water mask, LST	<1%

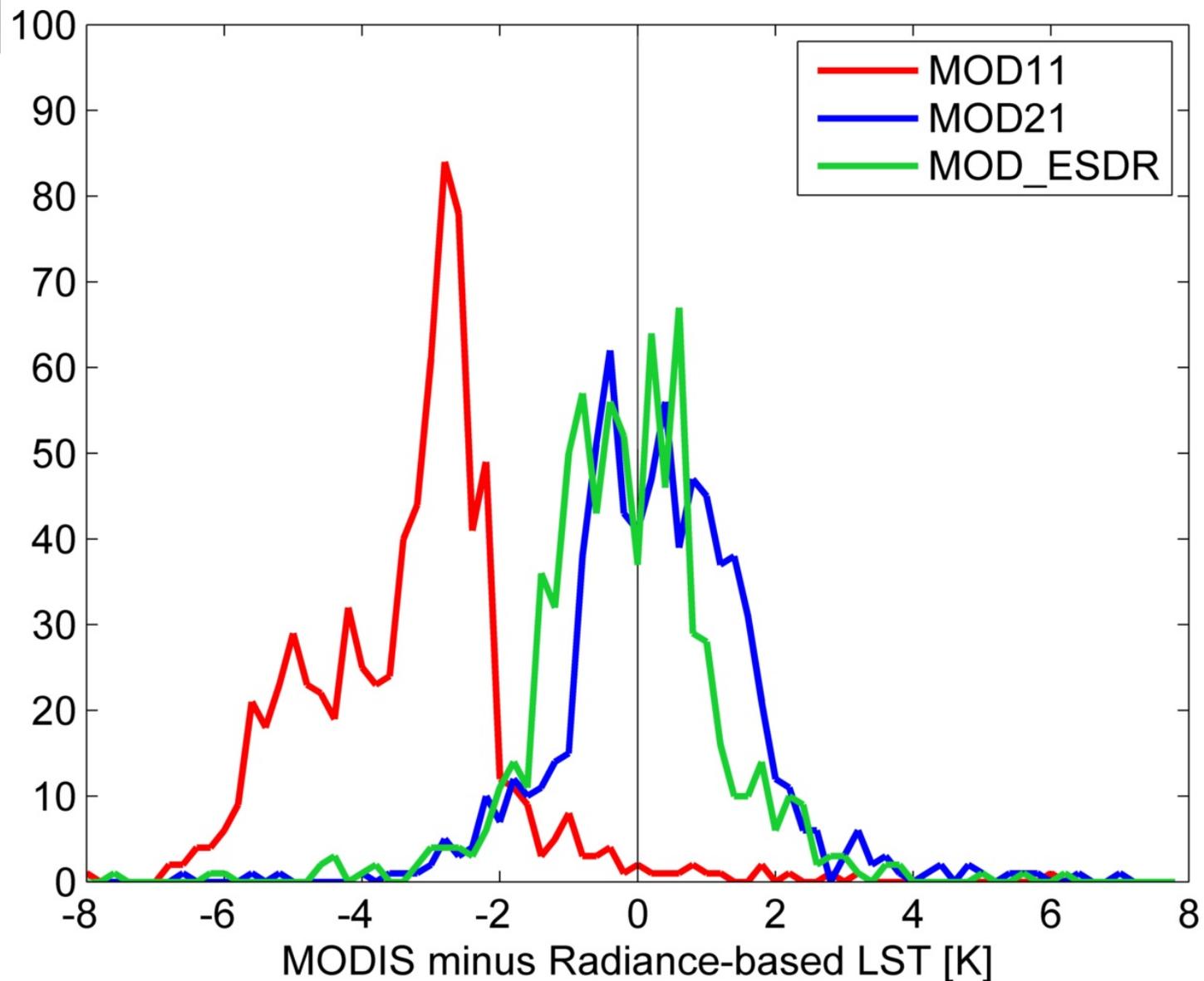


NASA MEaSUREs LST&E

- **GOAL:** *“Develop long-term, consistent, and calibrated Earth System Data Records (ESDR’s) valid across multiple missions and satellite sensors”*
- **NASA JPL will develop 3 LST&E ESDR’s**
 - **Unified MODIS LST&E Product**
 - Merging MOD11 and MOD21 using uncertainty analysis
 - **Consistent GOES LST Product**
 - Single channel inversion using unified MODIS emissivity
 - **Unified Emissivity Product**
 - Merging MODIS Baseline Fit database and ASTER GED

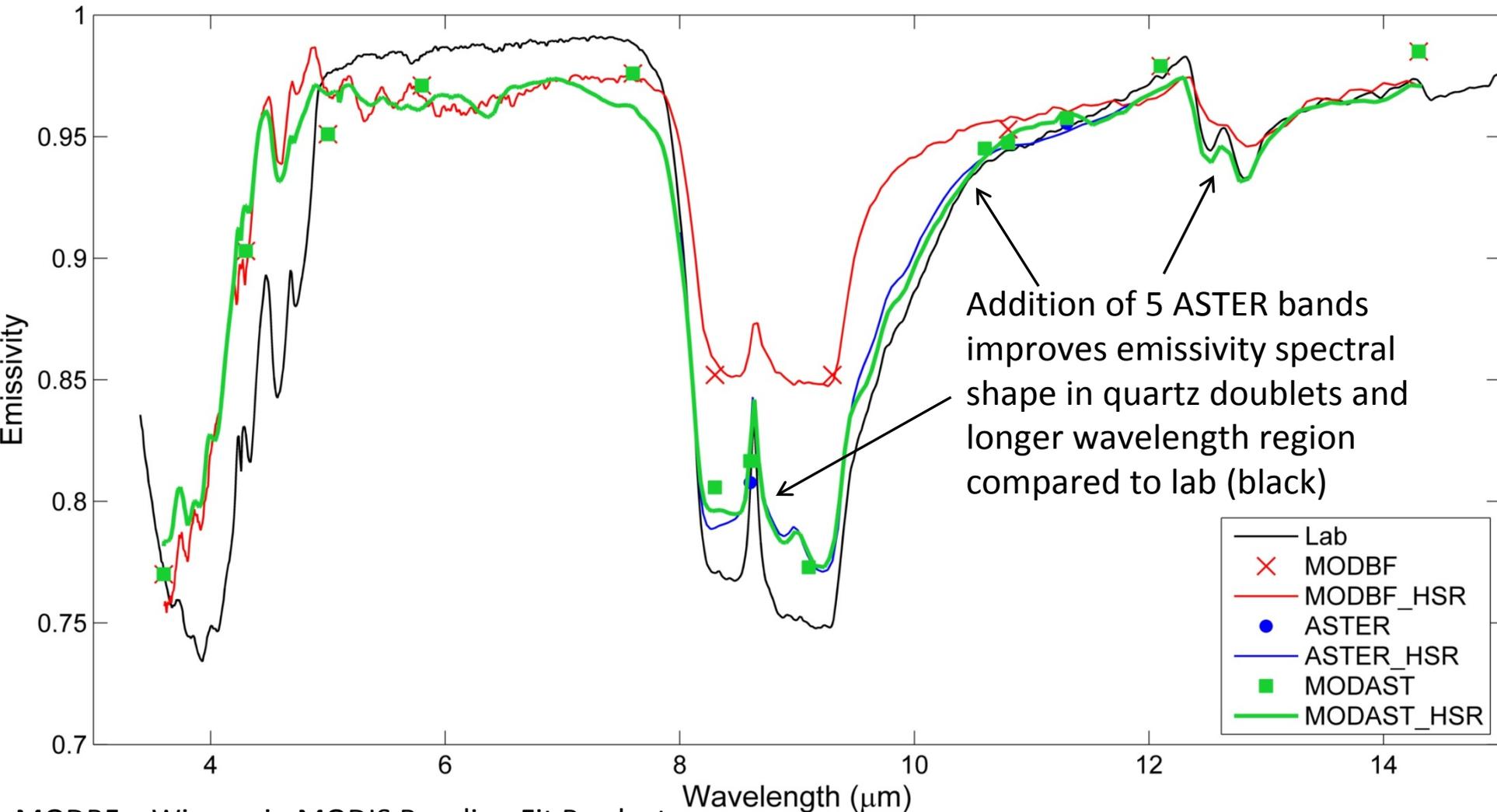


Unified MODIS LST ESDR Example: Kelso Dunes



Unified MODIS LST ESDR has higher accuracy

Unified Emissivity Example: Namib Dunes, Namibia



Addition of 5 ASTER bands improves emissivity spectral shape in quartz doublets and longer wavelength region compared to lab (black)

- Lab
- × MODBF
- MODBF_HSR
- ASTER
- ASTER_HSR
- MODAST
- MODAST_HSR

MODBF = Wisconsin MODIS Baseline Fit Product
ASTER = ASTER Global Emissivity Database (GED)
MODAST = Unified MODIS/ASTER Emissivity
*_HSR = High Spectral Resolution fit using principal component regression