

MODIS LST Campaigns in 1995

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- TIR Instrumentation for Field Measurements
- LST Test Sites
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TIR INSTRUMENTATION

- Portable FTIR Emission Spectrometer M2405-C from MIDAC
 - spectral range 3-15 μm , spectral resolution 0.5-32 cm^{-1} ;
 - ZnSe beam splitter and window, max scan length 1cm;
 - front aperture 1.5" diameter, FOV 45 mr (2.6°);
 - * closed-cycle cryogenic cooling InSb/MCT sandwich detector allows viewing at any angle;
 - * powerful mirror drive allows operation at any angle without loss of the radiometric accuracy;
 - * a liquid cooling system (coolant pump, radiator, copper sleeve around the laser tube) for STABILIZATION;
 - portable, weight about 30lb;
 - data collection speed: 8 scans / sec at 4 cm^{-1} ;
 - * $\text{NE}\Delta\text{T}$: 0.15K in 8-12 μm ; 1-2K in 3.5-5 μm , corresponding single scan SNR 20-500 at 25°C.

- A Semispherical Pointing System for BRDF Measurements
 - * 2" diameter aluminum tubes rolled to the specified radius of 1.5 meters and welded into hoop assemblies;
 - * the spectrometer carriage rolls along a double hoop and positions the spectrometer pointing (accuracy $\approx 1^\circ$) to the center of the semisphere at variable zenith angles;
 - the double hoop rolls along the horizontal hoop to set the relative azimuth between spectrometer and TIR source;
 - TIR source is provided by a 5" by 5" ceramic plate (Infrasource) at a distance of 24" from the surface being measured, the plate temperature measured by Platinum Film RTD distributes from 560 to 580 °C with temporal variations of 5 °C in half hours and $< 1^\circ\text{C}$ in a few seconds; Solar Beam can be used as MWIR source;
 - * A shutter plate pivots to block and to pass the source illumination in less than 1 sec;
 - * A reference plate assembly consists of a pivoting arm and a 10" square diffuse gold plate.

TEST SITES FOR LST VALIDATION

- Favorable Surface Conditions
 - large (at least 3 by 3 km) homogeneous flat area;
 - land covers with high and stable surface emissivity such as lake surface, grassland; $\epsilon \geq 0.97$ and $\delta\epsilon < 0.005$ (in case also for calibration)
 - measurements error $\delta T_s \leq 1^\circ\text{C}$;
 - temporal-spatial T_s data from wideband radiometers.
- Favorable Atmospheric Conditions
 - high surface visibility and cloud-free;
 - low surface wind speed;
 - atmospheric temperature and water vapor profiles are desirable;
- Test Sites in MODIS LST Campaigns '95
 - Railroad Valley, NV.
 - Koehn Dry Lake, Isabella Lake, and Carrizo Plain grassland, all in Central CA.

PRELIMINARY RESULTS

- Railroad Valley Campaign joined by the JPL ASTER Team
 - MAS and TIMS flights, and field measurements were completed on August 3th, 1995.
 - partial cloudy, but clear-sky over field measurement site during 1-2pm PDT. Column water vapor 1.92 cm.
 - 59.1 °C from MODIS generalized split-window LST method using MAS data.
 - 59.2 °C from calibrated MIDAC spectrometer field data.
 - 58.5 °C from broadband radiometer (Everest).
 - spatial variation in LST over the test site ≤ 1 °C.
 - Conclusion: all match within 1 °C.
- Central CA Campaign on October 25th, 1995
 - Field measurements made over Koehn Dry Lake & Isabella Lake.
 - MAS flight cancelled due to its last minute technical problem just before its schedule for maintenance.

TABLE N,. Summary of LST values over the test site (38' 31.46

size of area	mean (°C)	stdv (°C)	remarks
12 cm diameter	58.5		by radiometer
5 cm diameter	59.2		by spectrometer at θ_v 20°
1 MAS pixel	59.1		at θ_v 18.75°
3 by 3 MAS pixels	59.4	0.67	
5 by 5 MAS pixels	59.3	0.66	
7 by 7 MAS pixels	59.4	0.67	
9 by 9 MAS pixels	59.5	0.76	
11 by 11 MAS pixels	59.6	0.84	
21 by 21 MAS pixels	59.5	1.18	

ACTIVITIES PLANNED FOR LST VALIDATION IN 1996

- Four Field Campaigns
 - Feb.-March 1996, snow cover in Mammoth, CA.
 - March-April 1996, lakes, agriculture fields & grassland in Central CA.
 - July-August 1996, New Mexico.
 - June-September 1996, Central CA.
- Daytime and evening MAS flights have been requested for each campaign in order to validate day/night method for retrieving surface emissivity & LST.