HyspIRI Preparatory Science at the University of Alaska Fairbanks

For details contact: Anupma Prakash, Geophysical Institute, UAF (prakash@gi.alaska.edu)

Evapotranspiration Estimation:

Science Question: How is the changing climate affecting the landcover, temperature, and evapotranspiration (ET) in Arctic Alaska?

Objectives: (1) Use MODIS, Landsat, ASTER, and potentially airborne TIR data to simulate HyspIRI data and derive landcover classification, surface brightness temperature, and ET magnitude and variability over time.

(2) Collect field data for turbulent fluxes and turbulence scales to validate satellite derived summer ET estimates.

Study Area: Imnaviat basin, near Toolik Field Station, Northern Alaska (Fig.1)

Work Progress and Plans: Two level sonic anemometers installed (Fig2.) and working (Fig.3). Scintillometers to be installed in late August. Image processing and implementation of ET algorithm in progress.

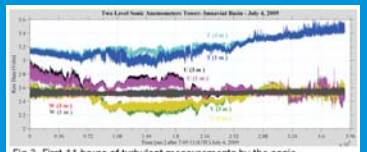
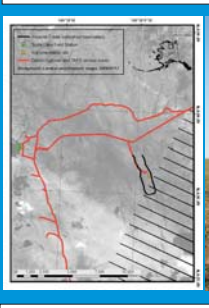


Fig.3. First 11 hours of turbulent measurements by the sonic anemometers. High resolution (10 Hz-sampling rate) sonic anemometers measure temperature and 3 components of the wind speed (U, V and W).

After signal processing these measurements in the low frequency (synoptic component) and high frequency (turbulent component) (e.g. $T = < T > + t'$) we will deduce the following turbulent quantities to characterize the Imnaviat site:

1. Turbulent fluxes of momentum: $u'.v', v'.w', u'.w'$
2. Heat turbulent fluxes: $u'.t', v'.t', w'.t'$
3. Turbulent Kinetic Energy u'^2, v'^2, w'^2



Project Collaborators: Anupma Prakash; Martha Anderson (USDA); Chris Wyatt; Javier Fochesatto; Doug Kane; UAF Students - Erin Trochim and John Mumm.

Funding and Support: Alaska's NASA EPSCoR Program; NASA ESSF; Toolik Field Station.

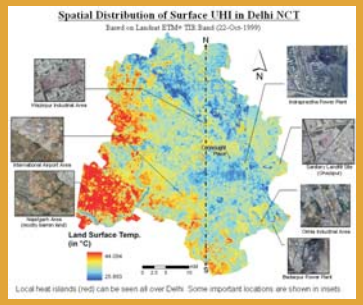
Urban Heat Island Mapping:

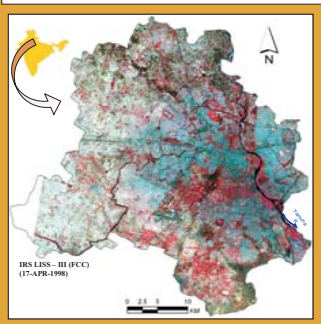
Science Question: How does change in landcover and landuse (especially urbanization) relate to Urban Heat Island (UHI) effect?

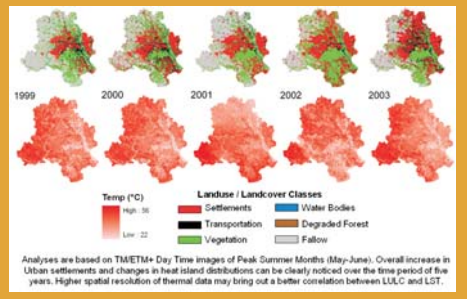
Objectives: (1) Carry out a spatio-temporal analysis of UHI in Delhi National Capital Territory (NCT), India using remote sensing.

(2) Derive relationship between change in Land Surface Temperature and Landuse/Landcover

Team and Support: Ashis Saha (DU, India); E. Csaplovics (TU-Dresden, Germany); Anupma Prakash (UAF); DAAD; NASA Geobrain.







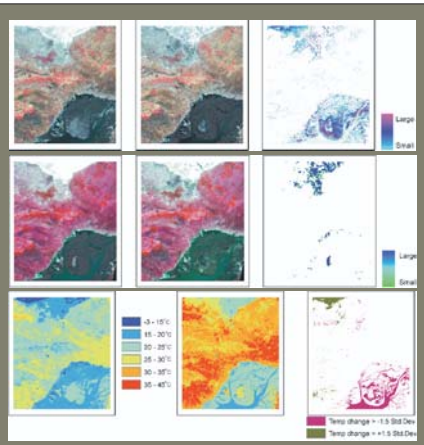
Analyses are based on TM/ETM+ Day Time images of Peak Summer Months (May-June). Overall increase in Urban settlements and changes in heat island distributions can be clearly noticed over the time period of five years. Higher spatial resolution of thermal data may bring out a better correlation between LULC and LST.

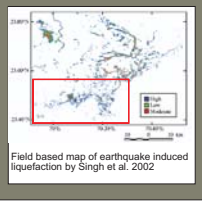
Earthquake Induced Changes:

Science Question: How do changes in surface spectral signatures in VSWIR and TIR regions relate to earthquake induced liquefaction and other changes?

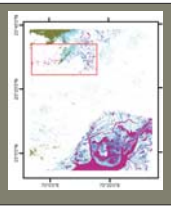
Objective: Use multisensor (MISR and Landsat) pre- and post-earthquake images to characterize associated land surface changes.

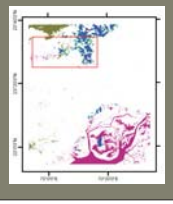
Preliminary results: The three figures on the right show pre-, post earthquake images and change maps from Landsat ETM VNIR; MISR VNIR; and Landsat TIR bands, respectively. Post-eartquake the area was generally warmer. Only extreme temperature changes are shown. Detected changes corraborate well with ground observations made by Singh et al. in 2002.





Field based map of earthquake induced liquefaction by Singh et al. 2002





Team and Support:

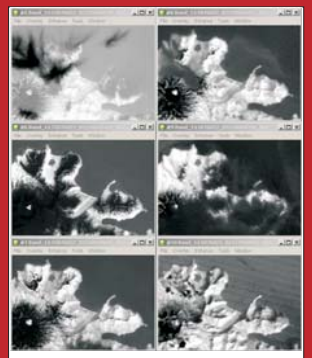
Thomas Oommen (Tufts); Laurie Baise (Tufts); Rudiger Gens (ASF); Anupma Prakash (UAF); Ravi P. Gupta (IIT-R, India). NSF and IIT-Roorkee,India.

Geothermal Exploration:

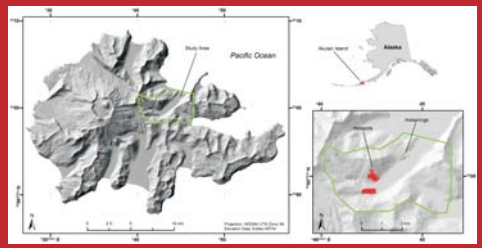
Science Question: How do surface temperature anomalies relate to deeper thermal sources?

Objective: Use subtle surface temperature anomalies associated with geothermal fields to narrow down location of potential sources for further geothermal exploration.

Approach: Surface temperatures over a geothermal field are often only subtly higher than the background. We use a multi-temporal stack of TIR images over the target area. A persistent anomaly signature becomes more pronounced compared to variable background thermal signatures. Repeated anomalies (see red pixels in fig. below) are declared as areas amenable to further exploration.



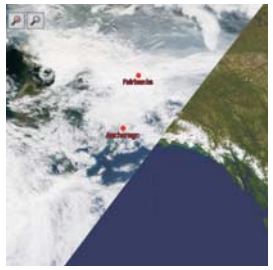
Six cloud free Landsat TIR images of the study area. Edifice of the Akutan volcano is clearly visible in the middle left portion of the images. Individual images do not bring out the surface temperature anomalies associate with the geothermal field, though an stacked and summated image product shows distinct anomalies



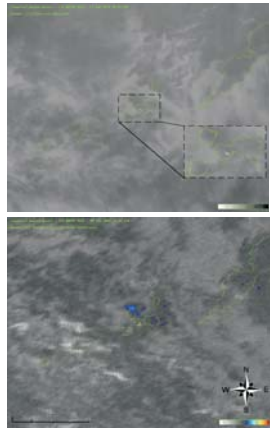
Work progress and plans: First fieldwork planned for Aug - Sept to validate image processing results.

Team and Support: Anupma Prakash; Amanda Kolker; Christian Kienholz; City of Akutan

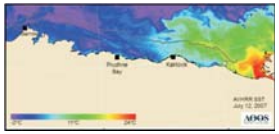
Operational Facilities that Benefit from Direct Broadcast:



The left side of the image above is a scene from Terra MODIS, August 6, 2009 at 2:37pm. Every summer millions of acres in Alaska are ravaged by fire and engulfed in smoke. Timely data from visible, SWIR and MIR channels is very useful for fire monitoring. Image credits: University of Alaska - GINA www.gina.alaska.edu



AVHRR thermal anomaly (top) on Feb 11, 2008 at Cleveland volcano, Alaska. AVHRR split window showing weak ash cloud to the northwest of the volcano on February 9, 2008. Image courtesy: AVO/UAF-GI. Image creator Webley, Peter. URL: www.avo.alaska.edu



Coastal processes in Arctic Alaska are complex with considerable influence of winds, wave action, general circulation, glacial melt, riverine inflow, permafrost and sea-ice. Monitoring of coastal regions is important for transportation and sustainable living of coastal communities. Image Courtesy AOOS; Okkonen et al., 2009.