ESA - MOST Dragon 2 Programme

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“龙计划”二期2011年学术研讨会

Key Eco-Hydrological Parameters Retrieval and Land Data Assimilation System Development in a Typical Inland River Basin of China’s Arid Region (ID. 5322)

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捷克 布拉格 2011年6月20-24日

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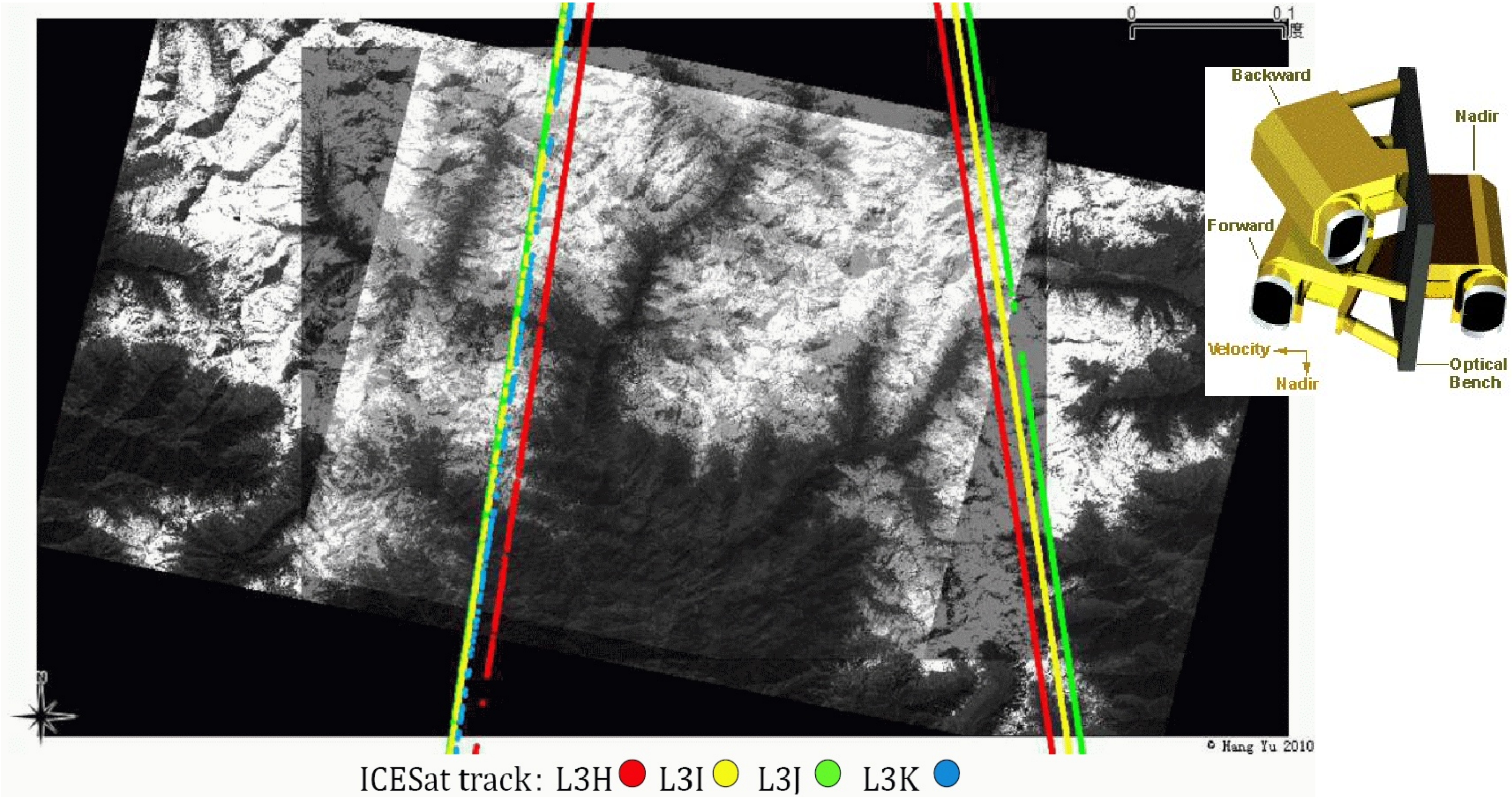
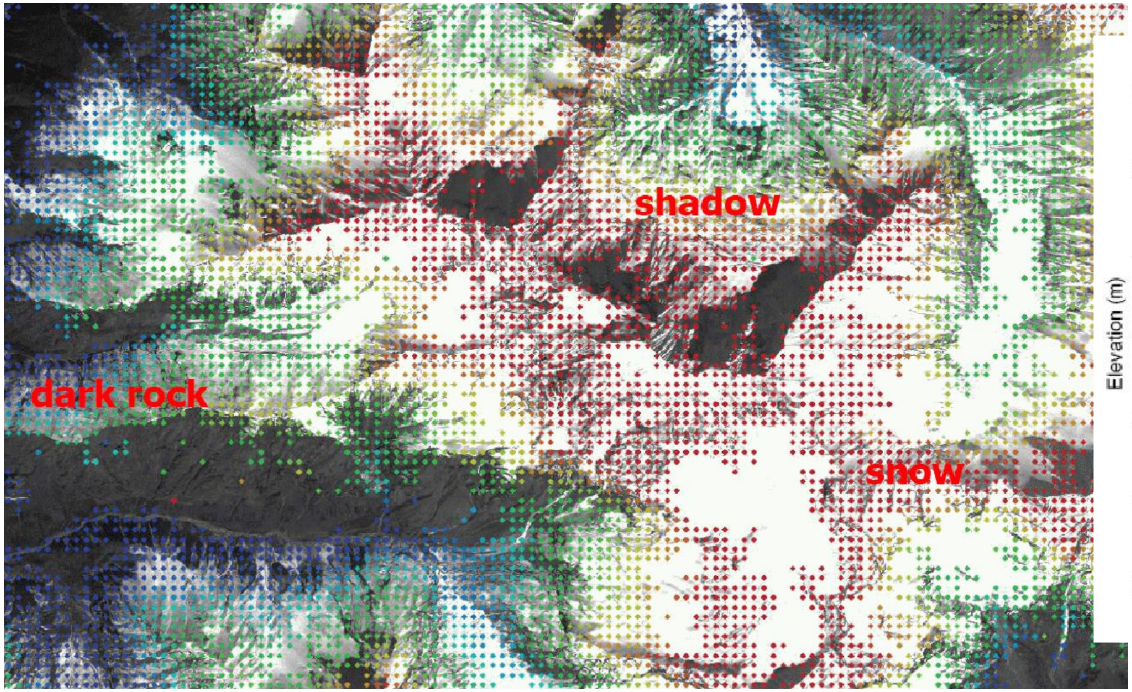
High resolution DTM to estimate glaciers mass balance

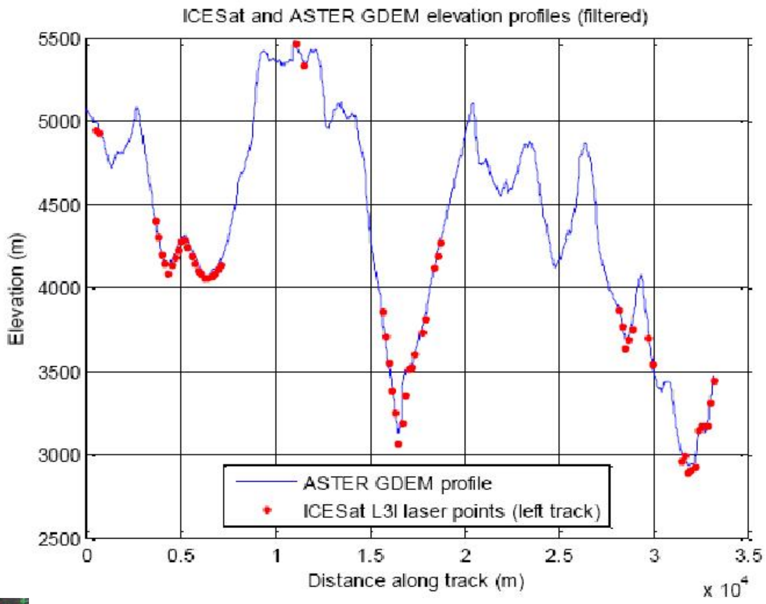
ALOS/PRISM DTM generation



Photogrammetry: overlapping ALOS/PRISM image pairs + ICESat Ground Control Points.

ALOS/PRISM DTM results, Mount Saipal



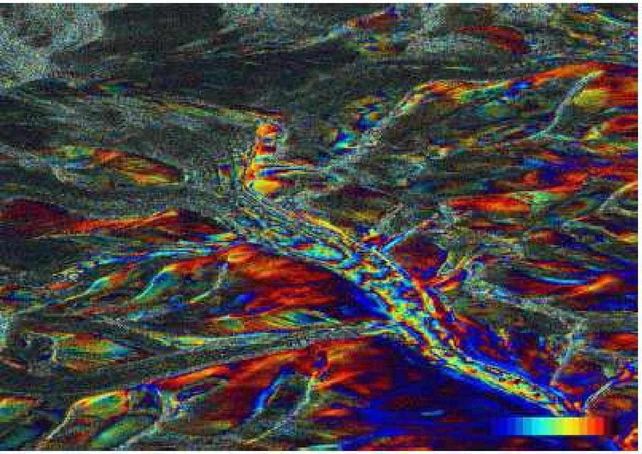


- Using 2 from 3 images: problems with very dark and very bright features
- ALOS/PRISM DTM vs ICESat elevations:
  - mean difference: 20 m
  - Standard deviation: tenths of meter
- Future work: use 3 from 3 images + better (in situ) Ground Control Points

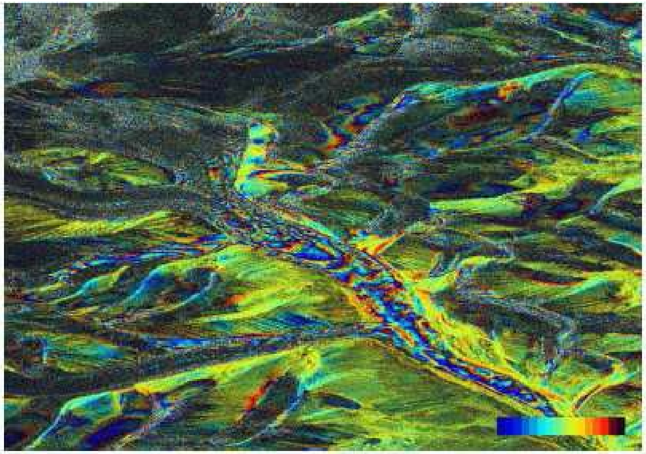
Topographic Changes: SAR

- SAR: records radar amplitude and phase ‘independent of weather‘
- Needed: two SAR images obtained at different time and location.
- Baseline: line between to satellite acquisition locations
- Two techniques to estimate a glacial flow velocity field from a SAR pair:
  - 1. Speckle tracking: Computer vision technique:estimate flow velocity field by matching features in amplitude image.
  - 2. InSAR: Based on phase differences. Results in velocities in the LOS (Line of Sight)

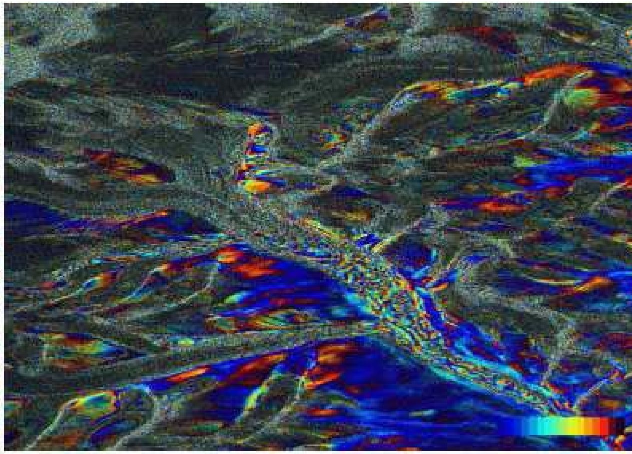
Interferograms Rongbuk glacier



Date: 20071213 – 20080128
Bperp: 265.4m
Btemp: 46 days
Height amb: -241.6m



Date: 20080128 -20080314
Bperp: 185.4m
Btemp: 46 days
Height amb: -345.8m

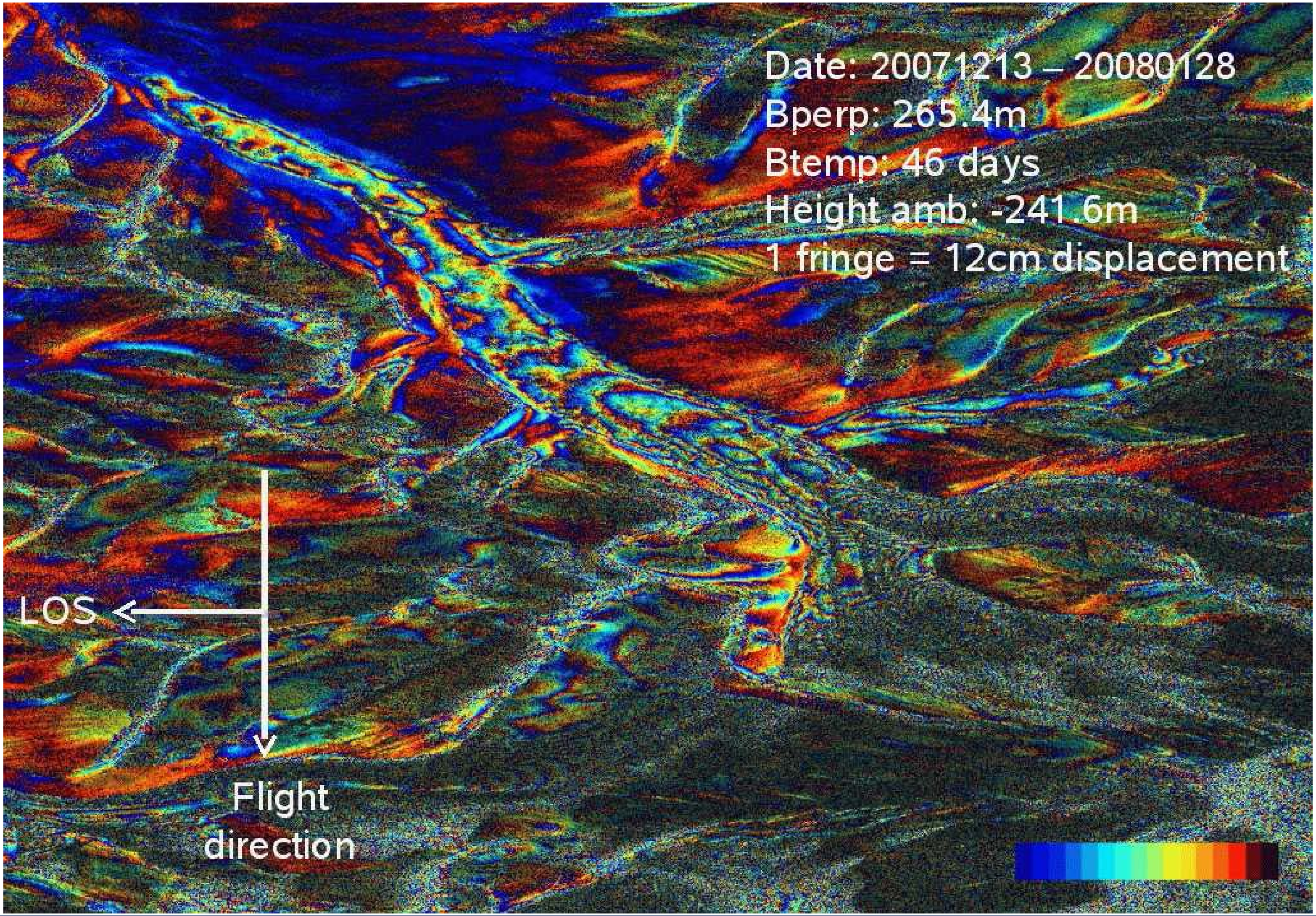


Date: 20071213 - 20080314
Bperp: 443.3m
Btemp: 92 days
Height amb: -144.6m

Steps:

1. **'Count' fringes to obtain displacements in meters**
2. **Convert to along glacier velocities**
3. **Convert to meter/year (now periods of 46 or 2 × 46 days)**

Rongbuk velocity field



ICESAT / GLAS measurements of lake levels and mass balance

ICESat Lake Monitoring

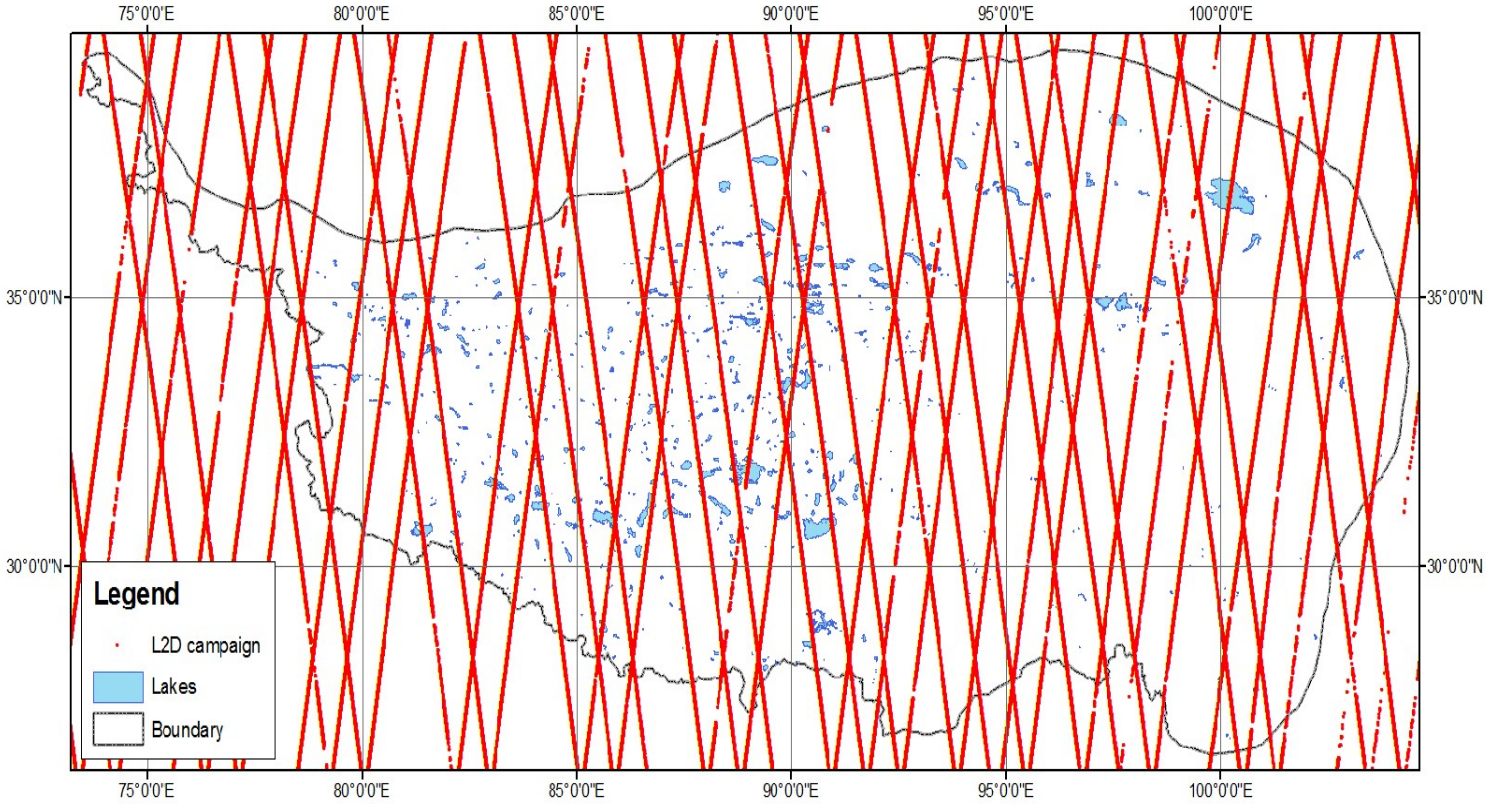
Still big challenge:

- direct monitoring of glacial elevation changes

Alternative:

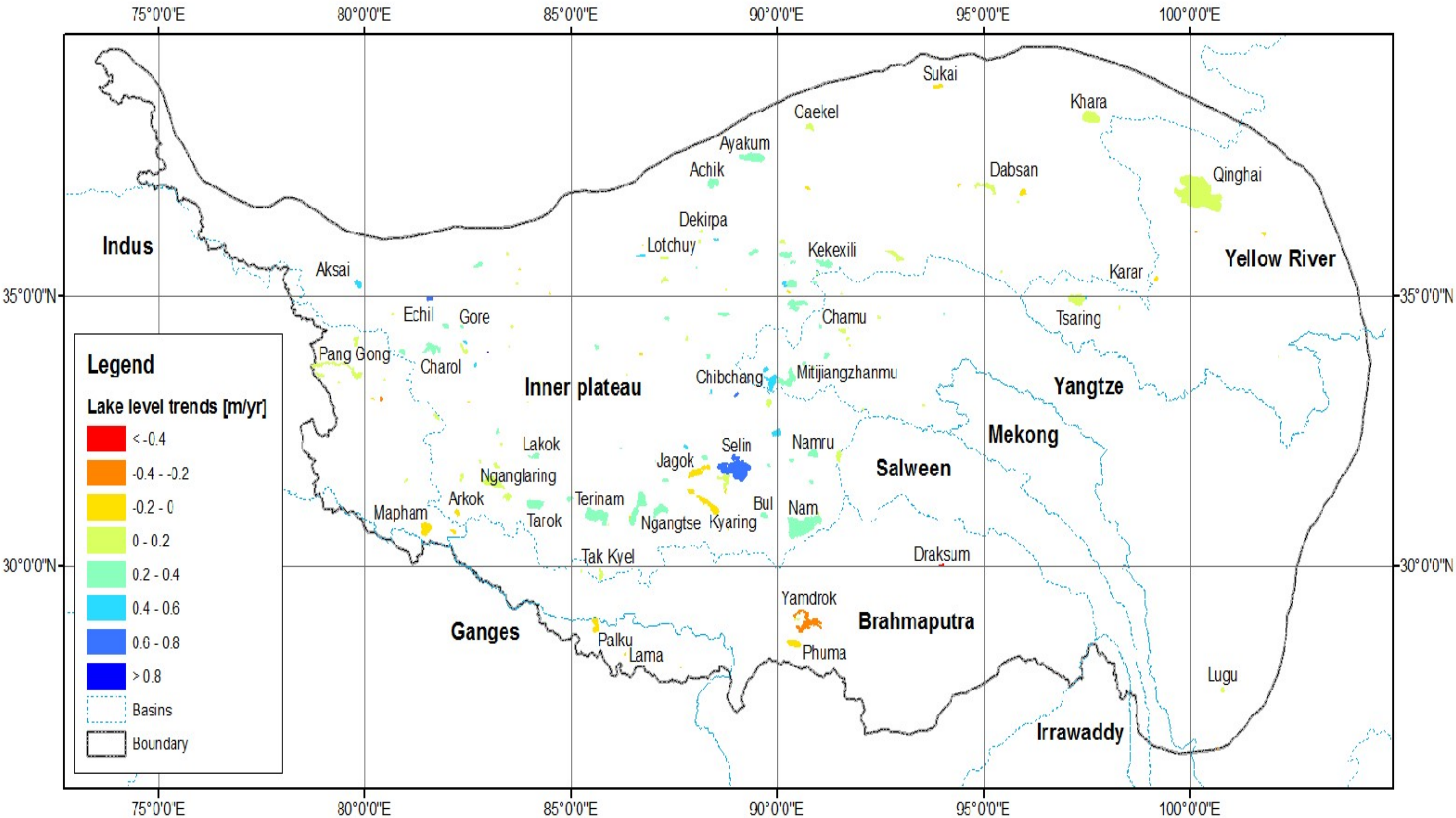
- indirect monitoring: evaluate run-off using ICESat elevations

ICESat tracks over Tibet

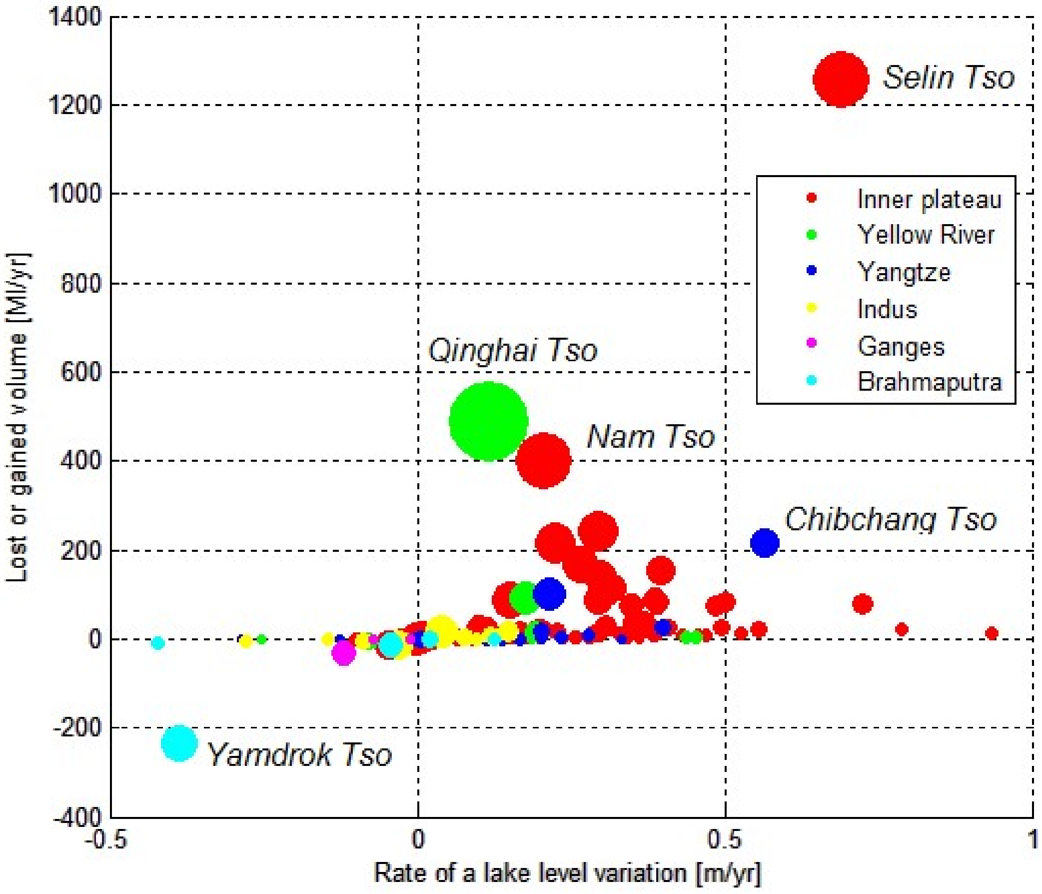


- Elevations from 18 campaigns between 2003 and 2009
- Tracks over lakes selected using MODIS lake mask

157 lake level trends, 2003-2009



Corresponding volume changes



(Area) x (change rate)

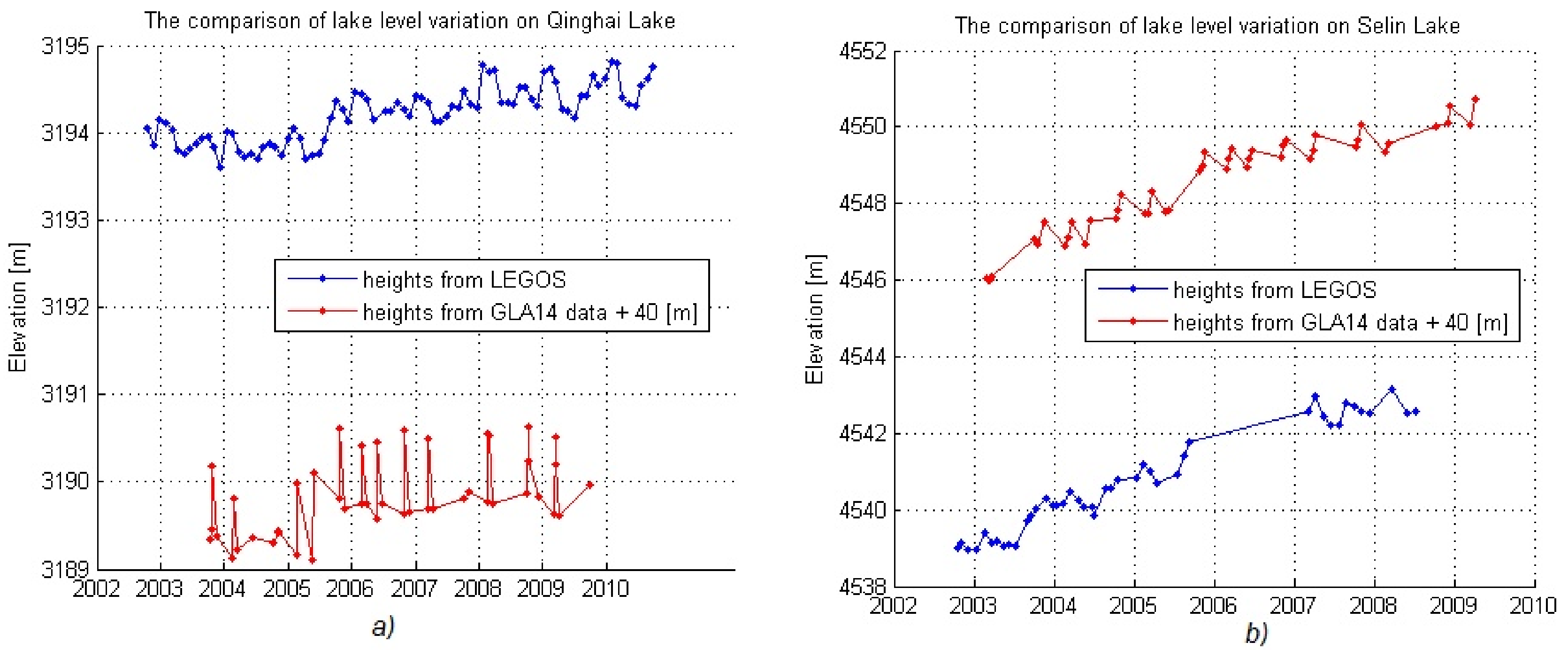
→

water volume change

Area averaged lake level increase over Tibet between 2003 and 2009:

0.20 [m/yr]

Validation: Selin and Qinhai Lake



Comparison with Radar Altimeter LEGOS

http://www.legos.obs-mip.fr/en/soa/hydrologie/hydroweb/Page_2.html

Same trend variations, (vertical bias due to geoid issues)

To do

Linking lakes to glaciers

- Lakes (checked) from MODIS mask
- Glaciers from (updated) CAREERI glacier mask
- Connecting rivers from a combi of
  - ASTER GDEM channel detection, and,
  - Landsat spectral river detection

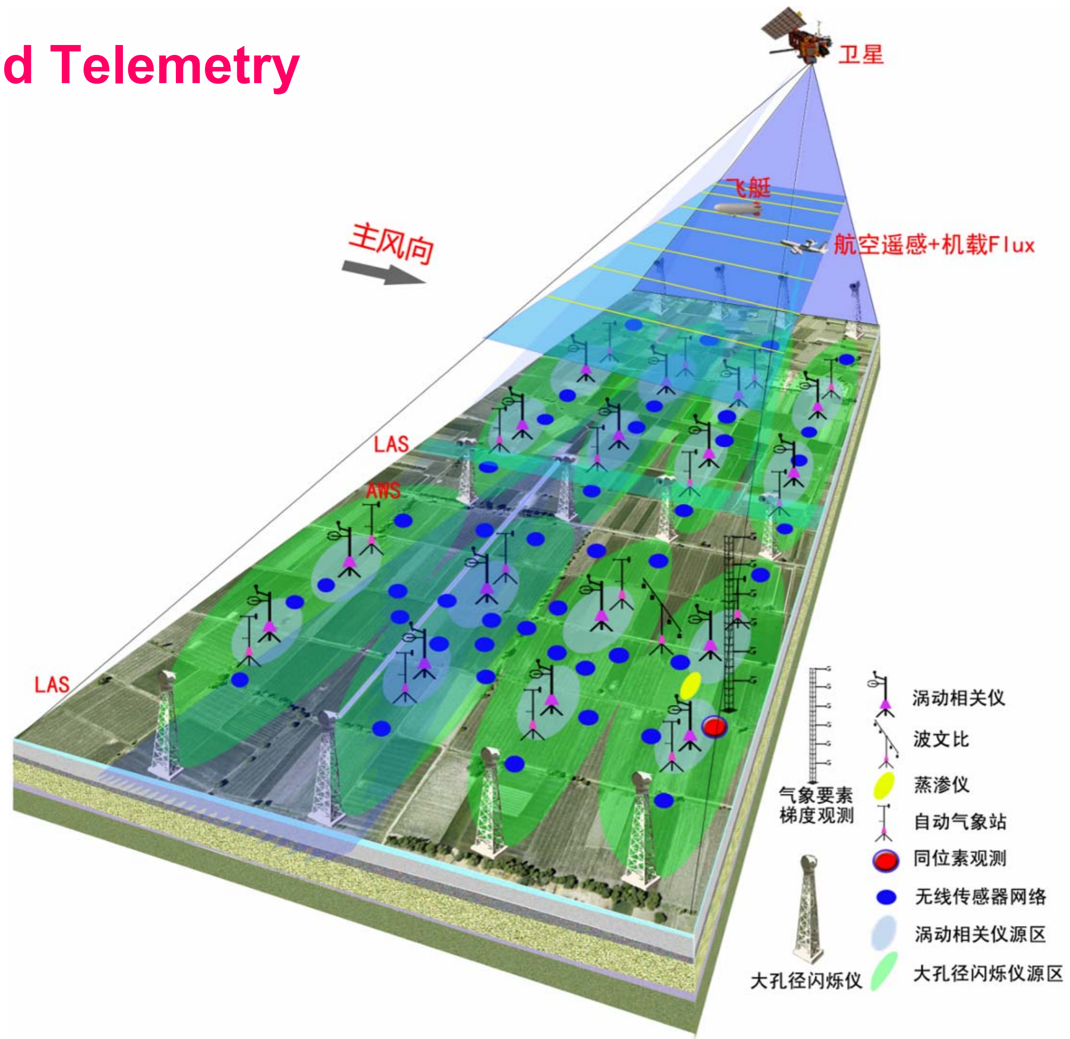
Glacial flow velocity fields

Improved photogrammetric DEMS

3D heterogeneity of land surface and convective boundary layer

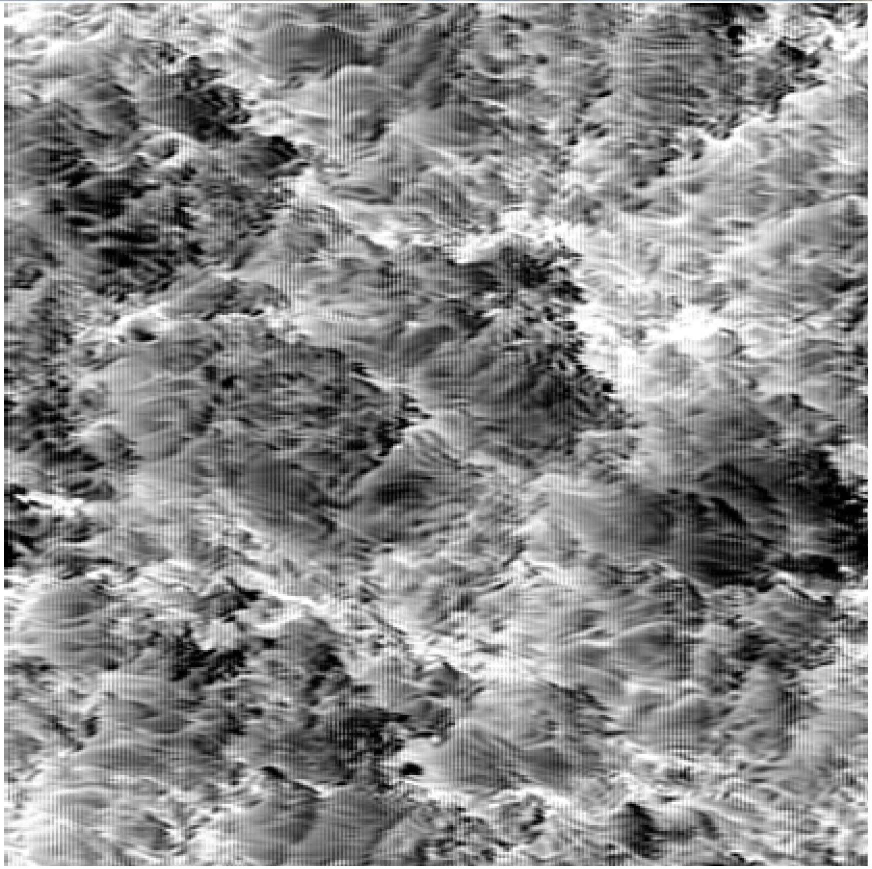
3-D heterogeneity of water flux

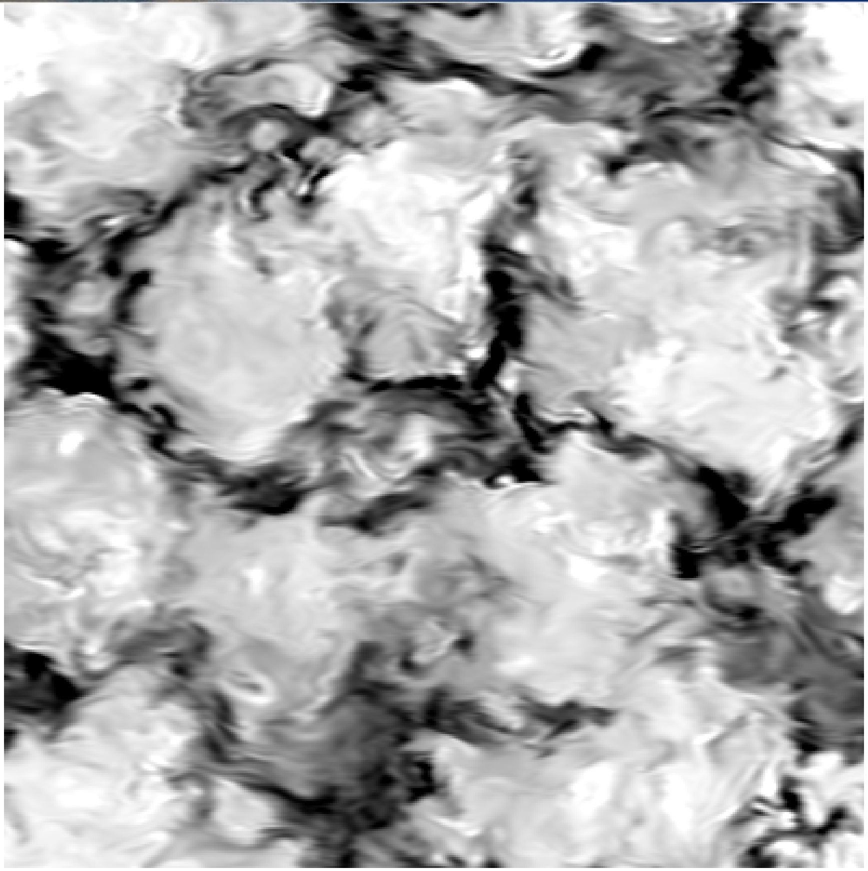
The Heihe Watershed Allied Telemetry Experimental Research



Heihe Watershed Allied Telemetry Experimental Research
Hi-WATER

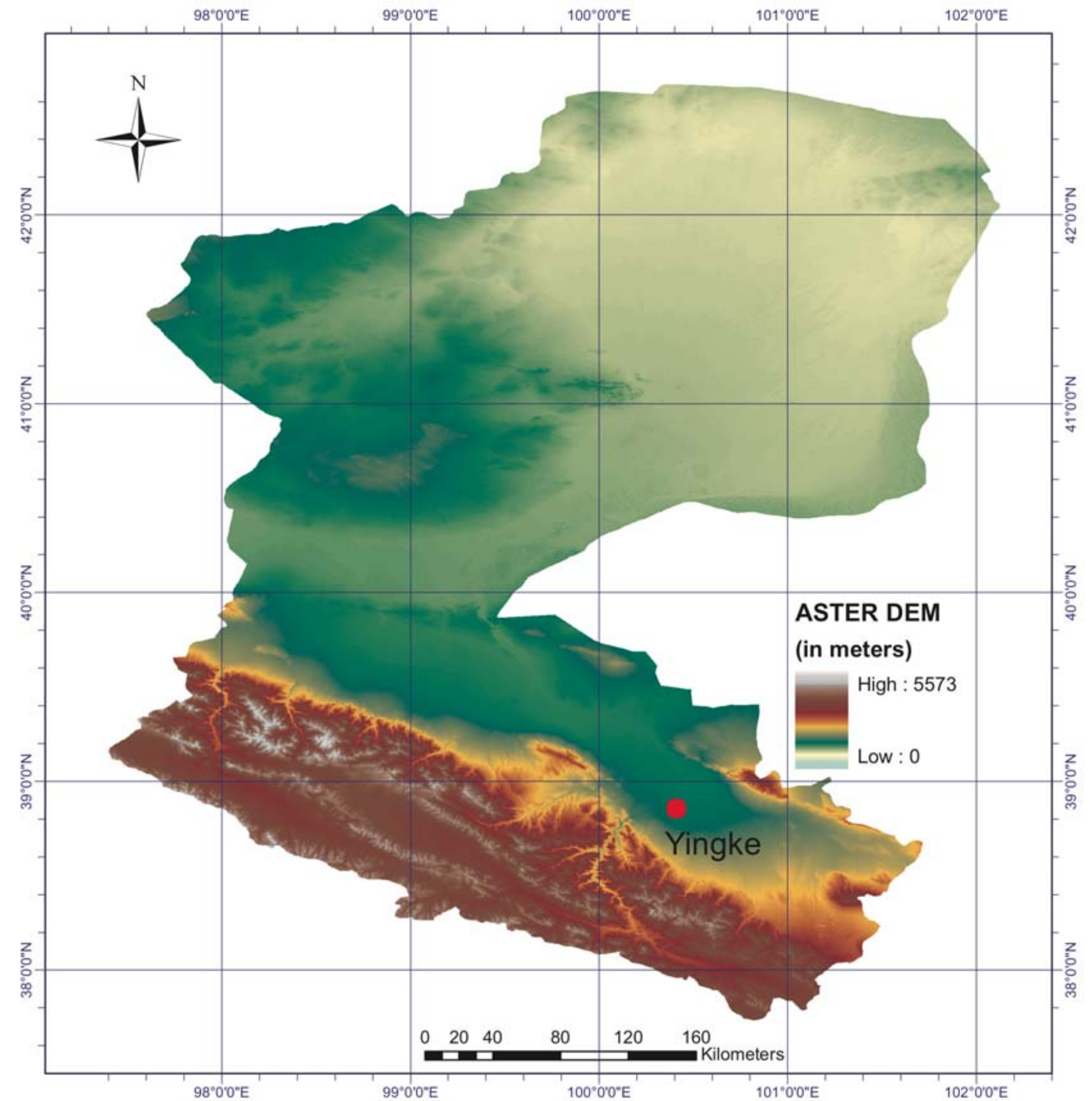
3D Planetary Boundary Layer



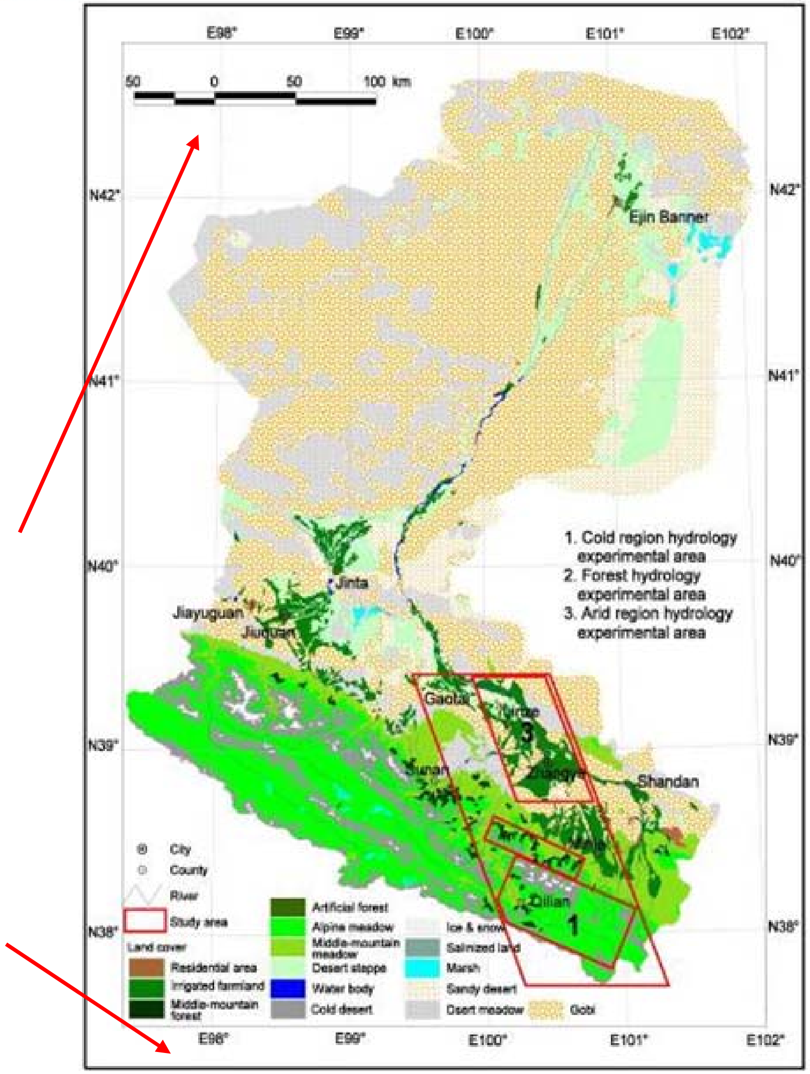


Large Eddy Simulation of water vapour concentration in the Convective Boundary Layer over a domain of 10 km x 10 km at a horizontal spatial resolution of 25 m: left) surface; right) 3200 m (courtesy of Siebersma, KNMI).

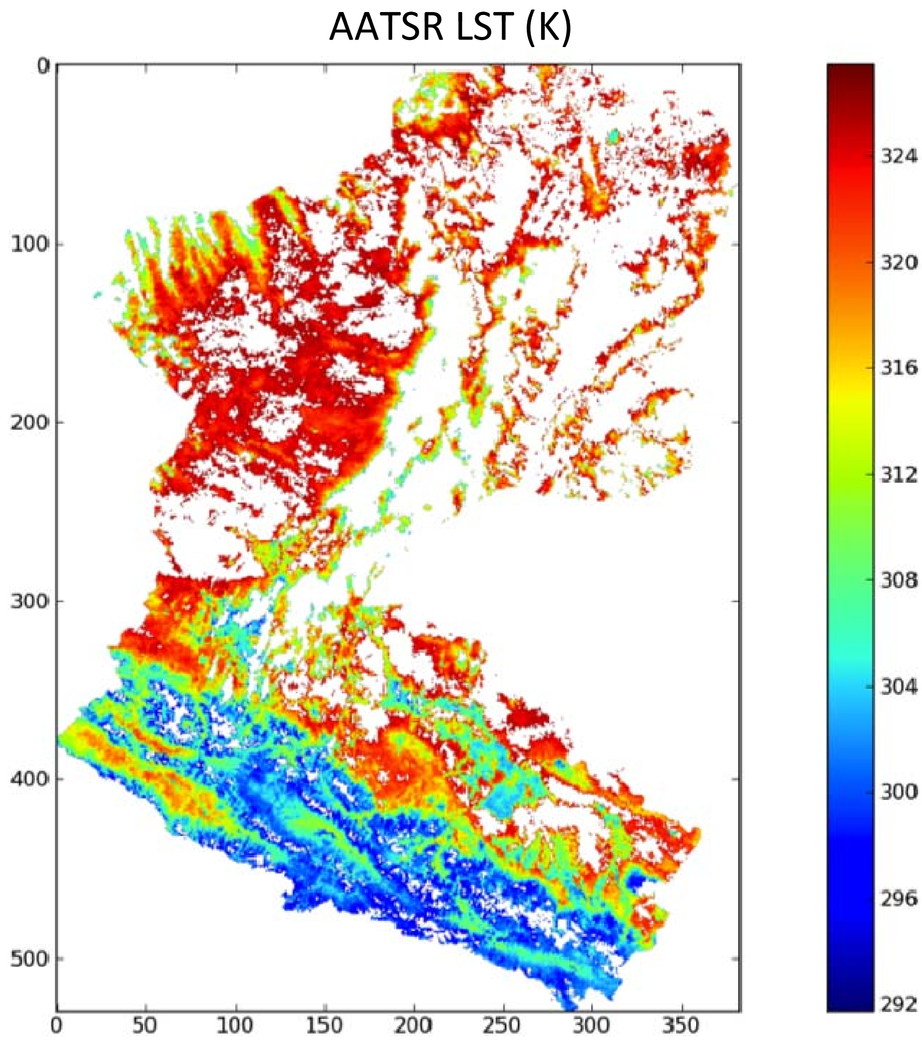
HeiHe Basin


98°0'0"E
99°0'0"E
100°0'0"E
101°0'0"E
102°0'0"E
42°0'0"N
41°0'0"N
40°0'0"N
39°0'0"N
38°0'0"N
N
ASTER DEM
(in meters)
High : 5573
Low : 0
Yingke
0 20 40 80 120 160
Kilometers

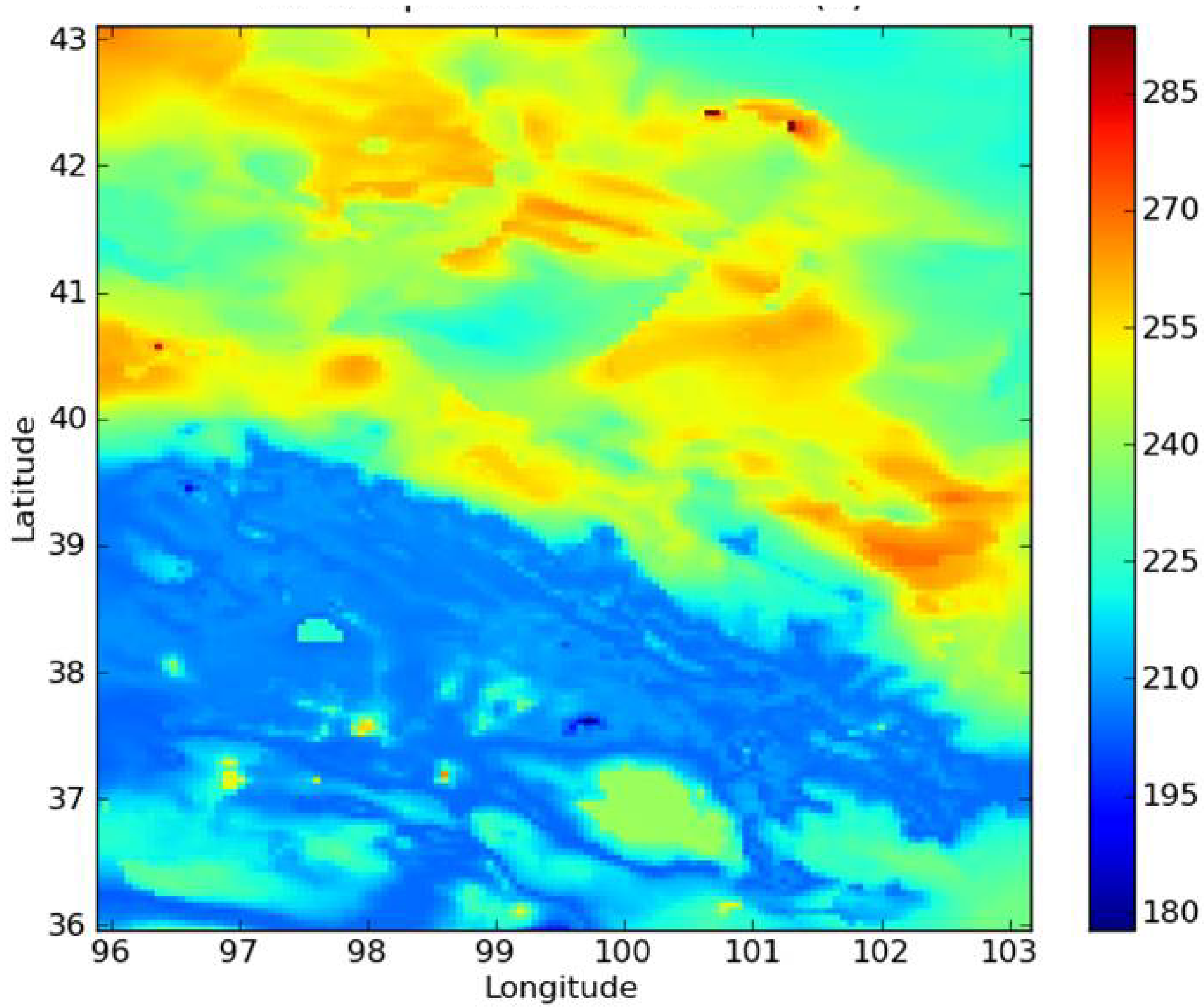
Land cover, surface wetness and temperature



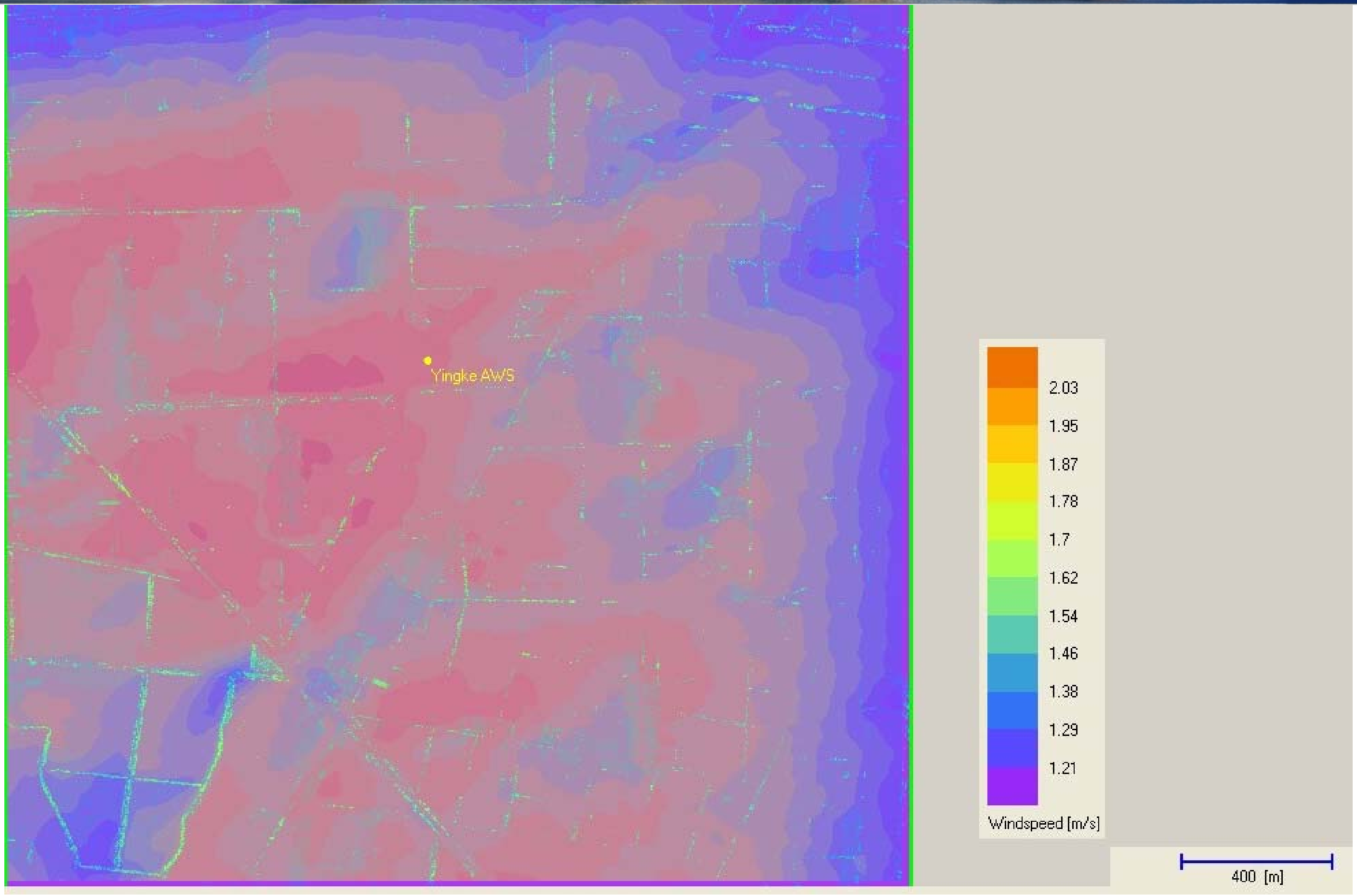
Land Surface Temperature: AATSR



Air temperature at height of Planetary Boundary Layer

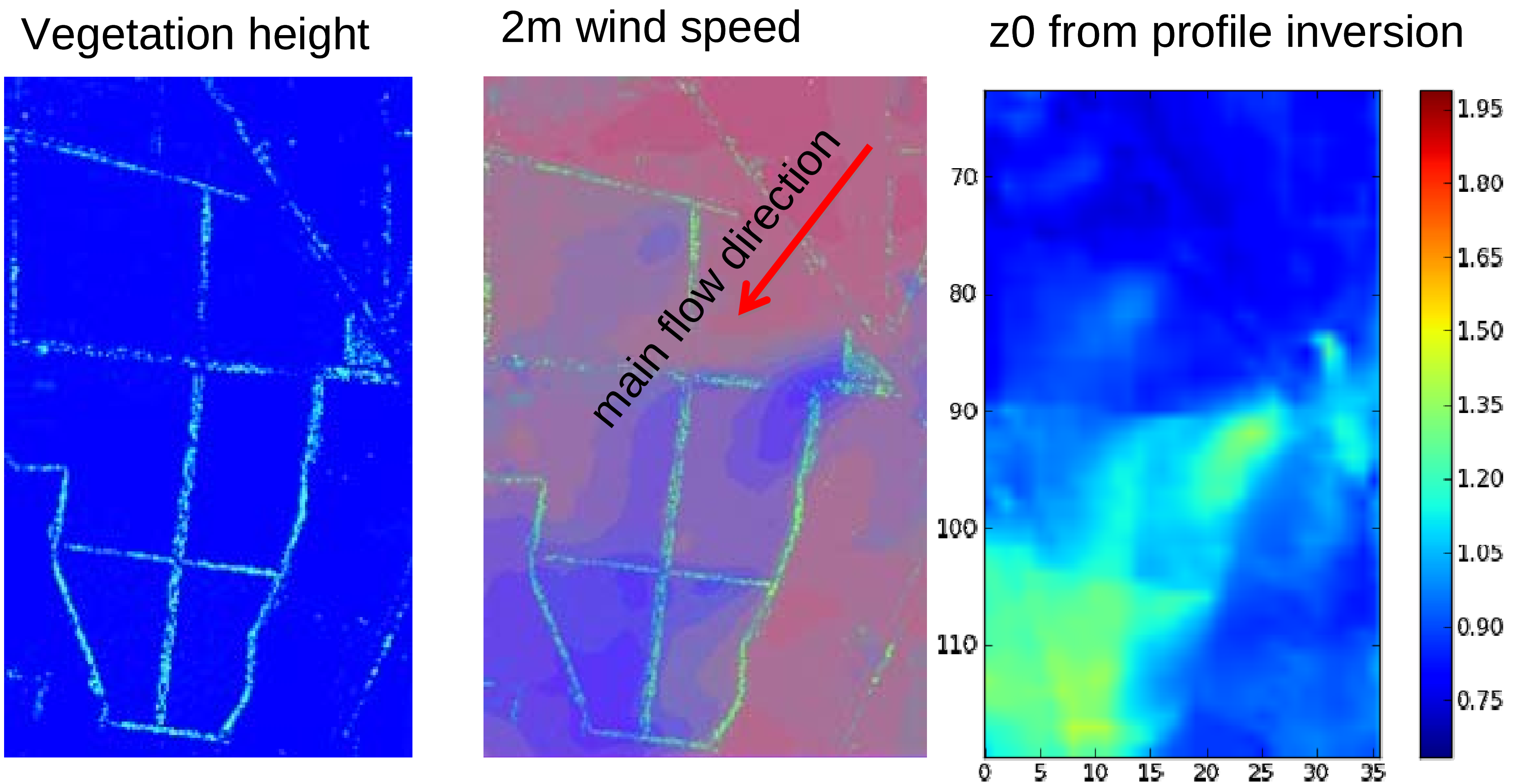


CFD modeling of wind field



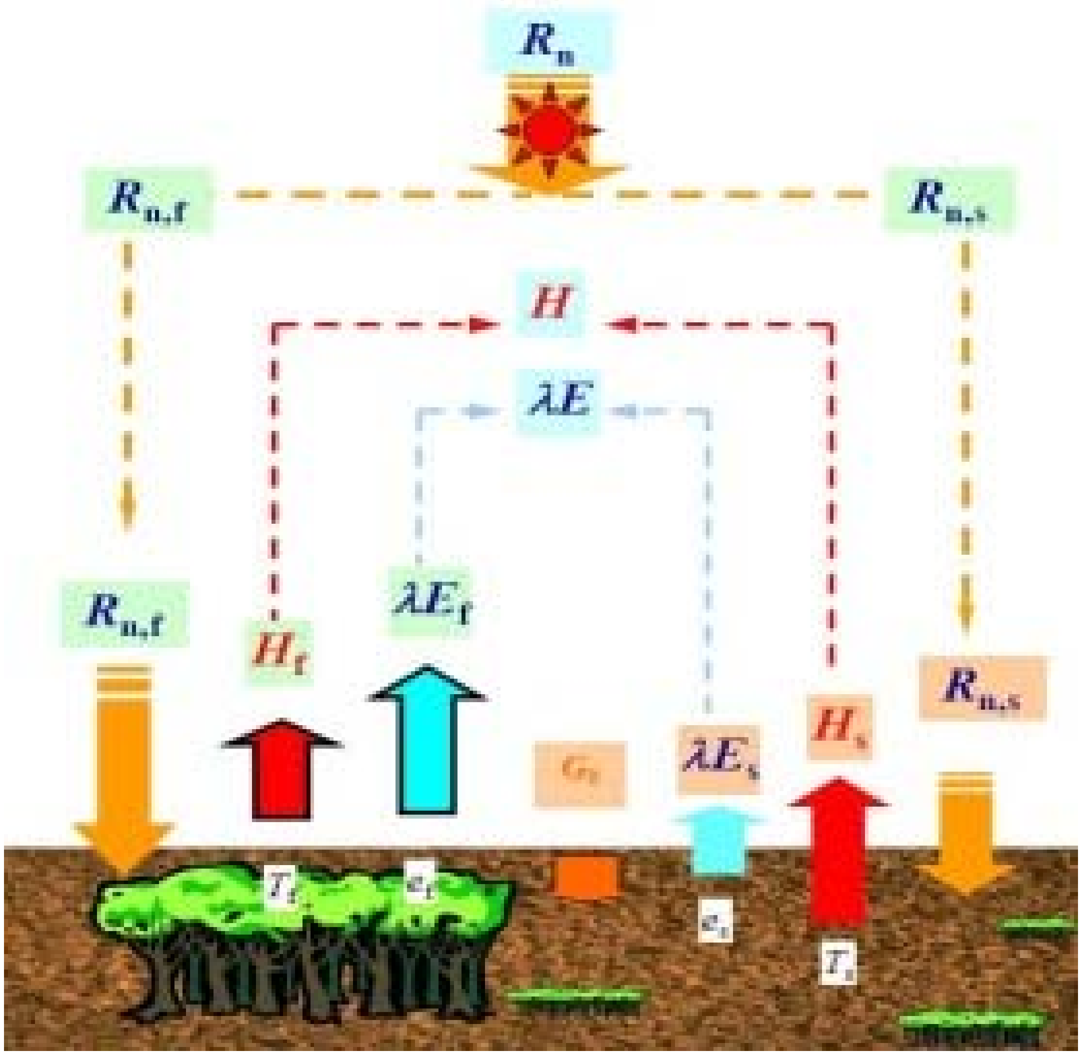
Wind flow (at 2m) over vegetation height map from LIDAR measurements

Mapping aerodynamic roughness



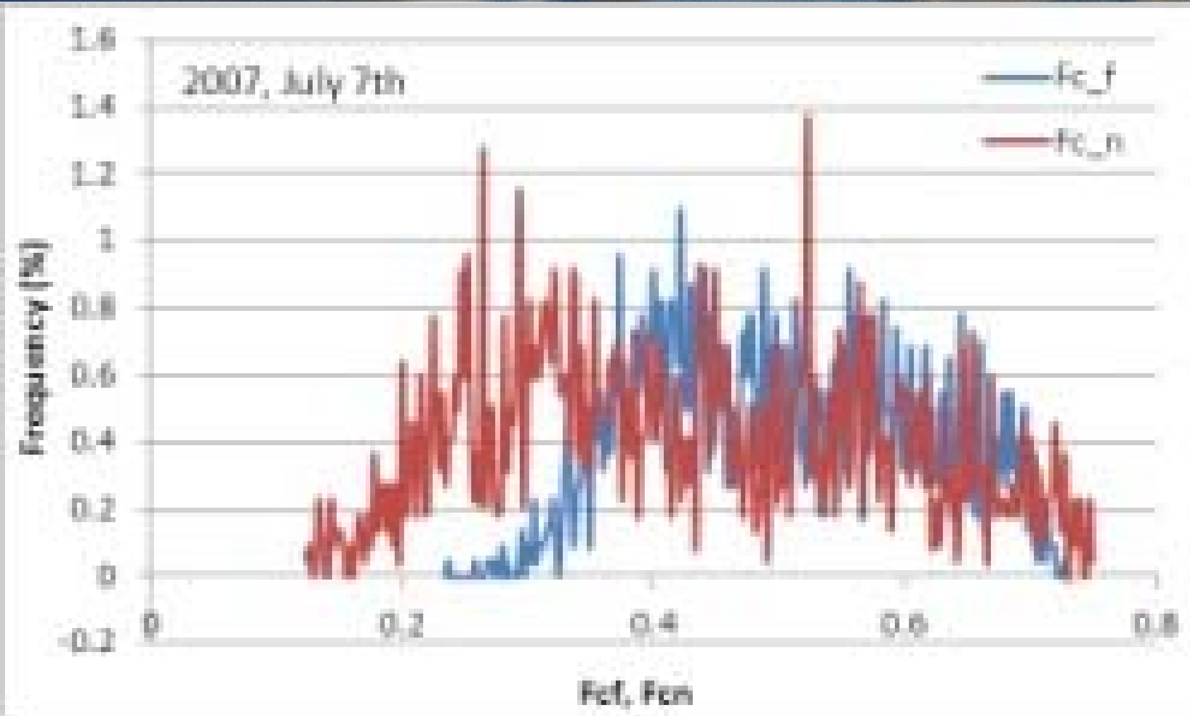
Colin and Faivre, 2010; Dragon 2 Mid Term Report project 5322

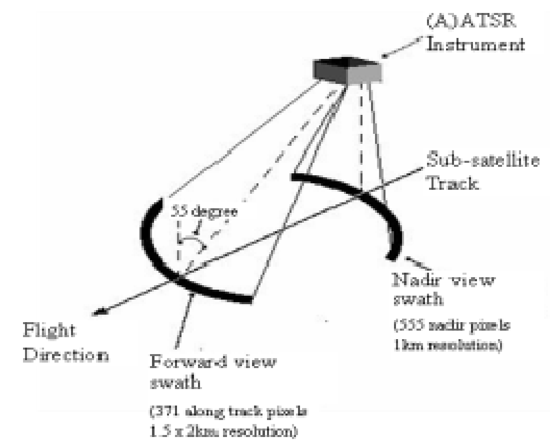
Dual source model



Vegetation and soil component temperatures are used directly in the dual-source model parameterization scheme to calculate component and total heat fluxes (*Jia, 2004*).

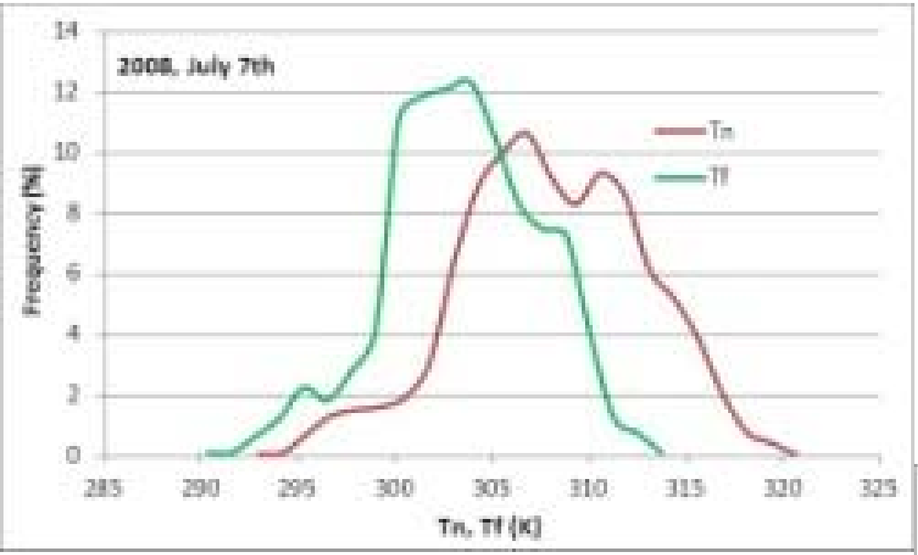
AATSR: Bi-angular LST measurements



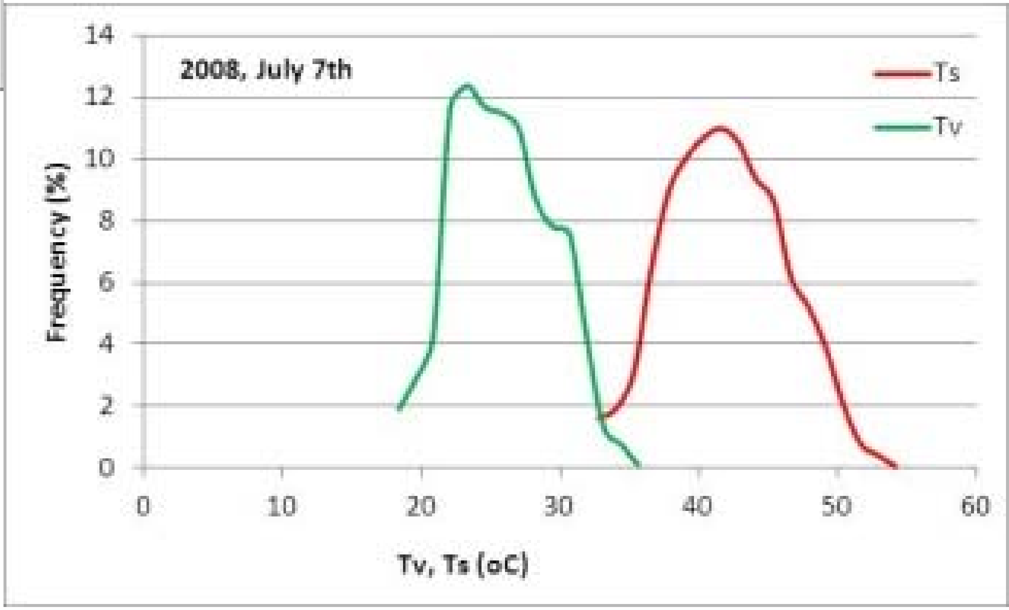


Fraction vegetation cover is observed by the satellite when looking at the land surface at the large off-nadir angle

AATSR: Soil and foliage component temperatures

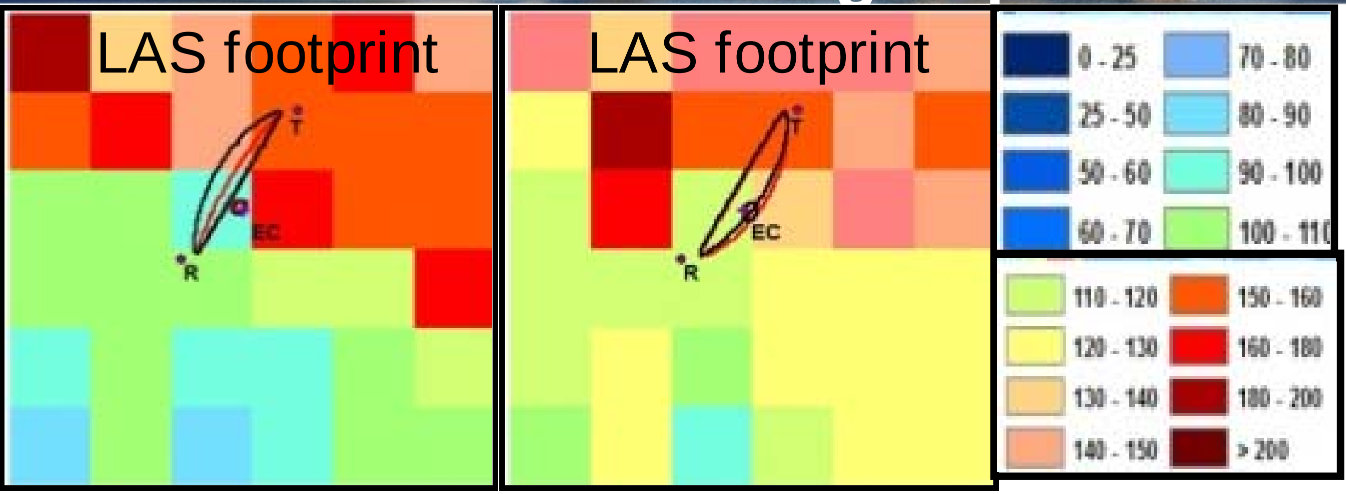


Higher surface temperature is observed at nadir view than at off-nadir view indicating anisotropy of the thermal emittance of the land surface.



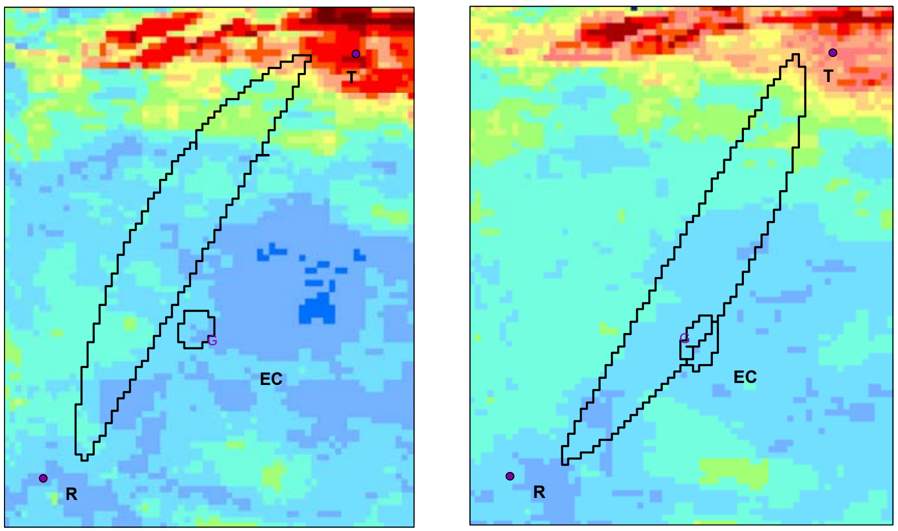
Clear separation between soil and vegetation component temperatures.

AATSR heat fluxes: Validation with Large Aperture Scintillometer



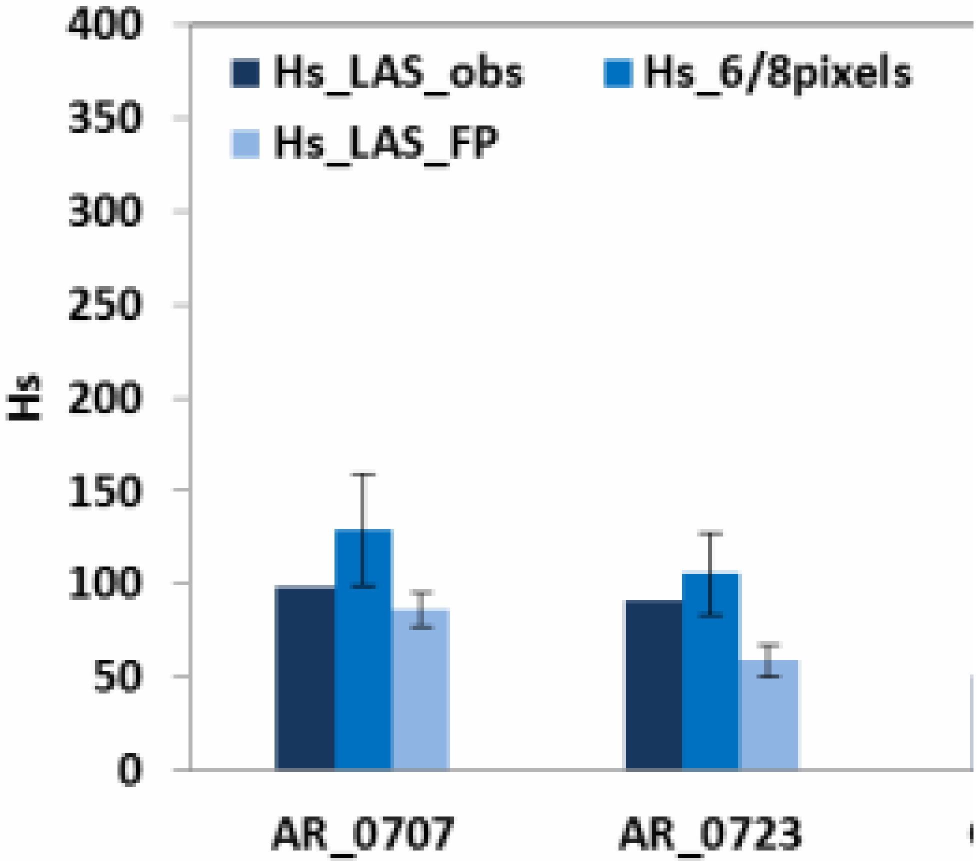
AATSR: 1 km x 1 km

TM: 30 m x 30 m



Large Aperture Scintillometry is the only experimental technique for the validation of heat fluxes at the AATSR spatial resolution

AATSR: Validation



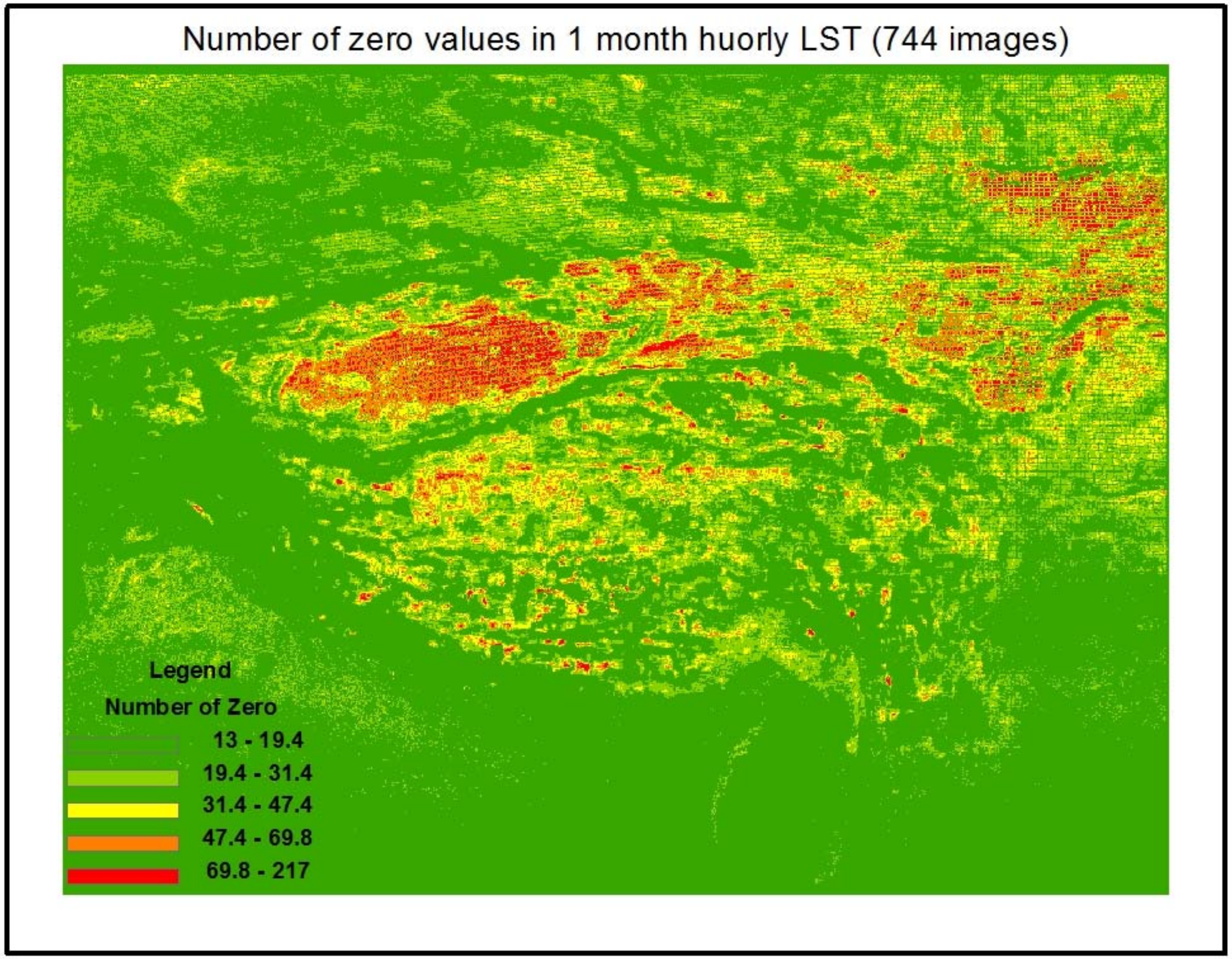
Footprint analysis of the ground-based LAS measurements is needed for validation of heat flux estimates at satellite pixel scale (1km).

See Poster Jia et al

Time series analysis and gap filling LST records: FY 2

Hamid Reza Ghafarian TU Delft

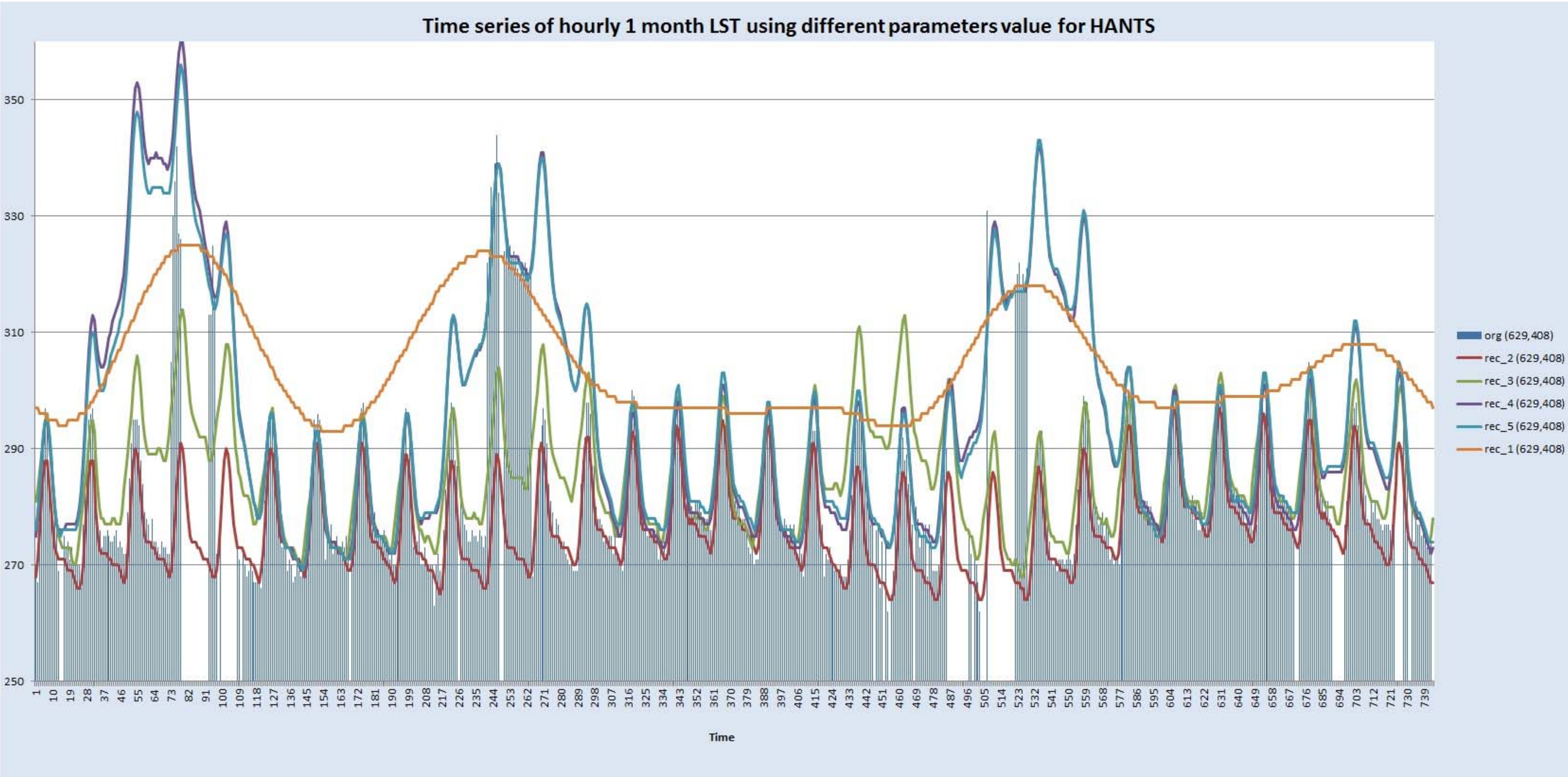
Frequency of gaps



HANTS: setting parameters

	rec_1	rec_2	rec_3	rec_4	rec_5
Number of images	744	744	744	744	744
Width	801	801	801	801	801
Height	601	601	601	601	601
Valid data range	260-330	260-330	260-310	260-320	260-330
Length of period	744	744	744	744	744
Number Of Frequencies (NOF)	8	13	13	13	13
Periods	744-372-248-186-148-124-106-93	744-372-248-186-148-124-106-93-48-24-12-8-6	372-248-186-148-124-106-93-48-24-12-8-6-3	744-372-248-186-148-124-106-93-48-24-12-8-6	744-372-248-186-148-124-106-93-48-24-12-8-6
Direction of outliers	low	low	low	low	low
Fit Error Tolerance (FET)	3	3	2	3	3
Degree of OverDeterminedness (DOD)	20	50	25	50	50
Delta	0.1	0.1	0.1	0.2	0.5
Scaling factor	1	1	1	1	1

Results


Time series of hourly 1 month LST using different parameters value for HANTS
350
330
310
290
270
250
1 10 19 28 37 46 55 64 73 82 91 100 109 118 127 136 145 154 163 172 181 190 199 208 217 226 235 244 253 262 271 280 289 298 307 316 325 334 343 352 361 370 379 388 397 406 415 424 433 442 451 460 469 478 487 496 505 514 523 532 541 550 559 568 577 586 595 604 613 622 631 640 649 658 667 676 685 694 703 712 721 730 739
Time
org (629,408)
rec_2 (629,408)
rec_3 (629,408)
rec_4 (629,408)
rec_5 (629,408)
rec_1 (629,408)

Comments

Satellite data provide the 3D information required by hydrological and atmospheric models

Hydrological processes in remote data-poor areas can be observed building upon the complementarity of observing systems

Evaporation: focus on merging observations from multiple sources (sensors) and high resolution land – atmosphere models