

GCOS Land Surface Temperature ECV

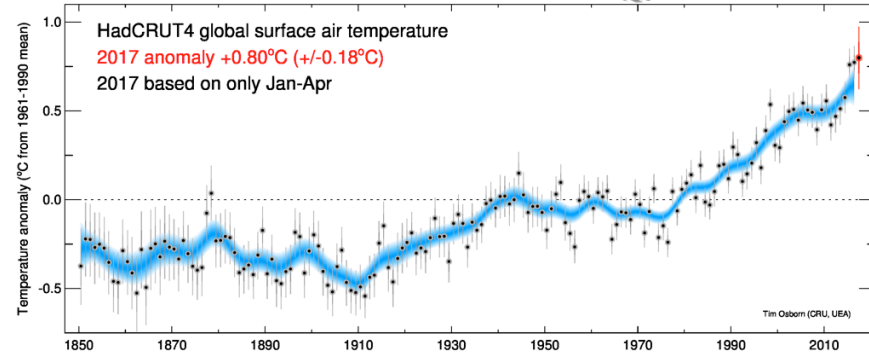


Land Surface Temperature & Climate

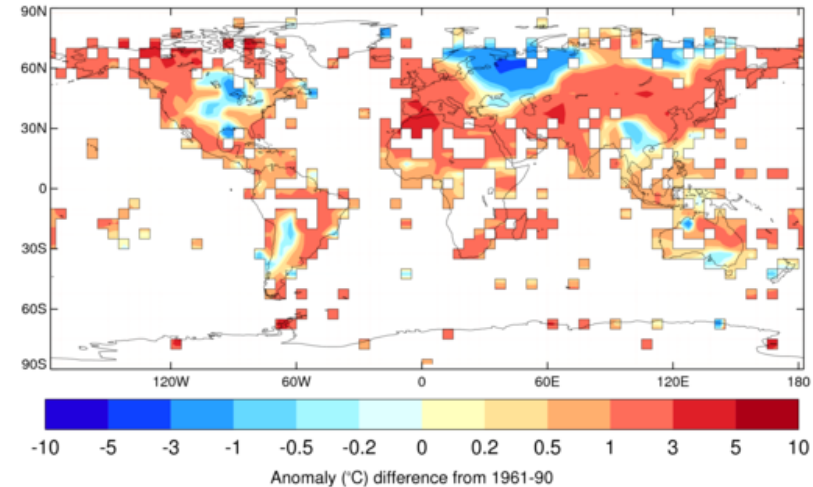


Climate Monitoring

- Spatially continuous proxy for surface temperature (but LST \sim T_{surf} relationship is complex)
- Key information for verification of bias adjustments of T_{surf} records, and the statistical interpolation methods used.
- High profile (and much criticised) climate indicator
- Fundamental measure in UNFCCC Paris Agreement
- Key variable in surface energy and moisture balance
- Evaluation of land surface energy exchange processes, and development of LSMs
- Driver of vegetation phenology, agriculture
- Necessary for the study of extreme heatwaves and urban heat islands, epidemiology
- Verification of model estimates of skin temperature, particularly where *in situ* measurements are sparse.
- Essential for monitoring polar regions, snow melt and permafrost.



Met Office Surface Temperature Anomalies (°C, w.r.t. 1961-90) 2017 May



GCOS Requirements

	Freq.	Resolution	Uncertainty	Stability/ decade
LST	3 hr	1 km	1 K	0.1 K

Also:

- Report emissivity
- Land surface radiometric temperature
- GCOS Implementation Plan Actions: T43, T44, T46

Land Surface Temperature: Key Users



Key Users of the LST ECV

European and international climate science organisations that:

- Develop land surface components of climate models
- Perform climate model intercomparison and verification studies (CMIP projects)
- Developers and providers of climate services (agriculture, heat stress, drought, etc)
- Developers of global land surface air temperature records (*e.g.* ISTI, CRUTEM, GISS)
- Drought, wildfire and desertification processes, and impacts of climate change on agriculture
- Investigation of elevation dependent climate warming
- Producers of land cover, snow, permafrost and soil moisture ECVs

LST: International Context



ILSTE - International Land Surface Temperature and Emissivity Working Group

CEOS-WGCV-LPV Land Surface Temp and Emissivity

CMIP6 projects: LS3MIP, ALMIP2, GABLS, GLACE-CMIP, ...

TOPC – link to GCOS

ISTI – International Surface Temperatures Initiative

EDW – Elevation Dependent Warming initiative

GEWEX – Global Energy and Water Cycle Experiment

EUMETSAT Land-SAF

H2020 Projects:

FIDUCEO – FCDR development

EUSTACE – Developing usage of LST for surface air temperature analyses

Copernicus Services - Climate Change and Global Land



TIR Radiometers:

- Polar Orbiters: AVHRR, (A)ATSR, ASTER, MODIS, VIIRS, SLSTR
- Geostationary: MVIRI, SEVIRI, GOES, MTSAT, Himawari-8/9
- Hi-Res TIR: Landsat

Passive Microwave Radiometers:

- SMMR, SSM/I, AMSR, SSMIS, TMI, ...

LST: Key Issues for CCI+ (1)



- Diurnal Cycle: Need to merge multi-mission geostationary and polar orbiter data to provide global long term record of LST including its diurnal variation.
- Merging approaches:
 - Develop consistent algorithms to be applied to LEO and GEO Level-1 data
 - Angular dependence of LST
 - Quality of the FCDR
- Long term ECV stability assessment (changing instrument characteristics, breakpoints, calibration drifts, orbit drifts, ...)
- Reduce uncertainties related to land surface emissivity
- Develop per-pixel product uncertainty estimates (and validate them)

LST: Key Issues for CCI+ (2)

- Cloud-clearing – major source of uncertainty in current products
- Tsfc \sim LST relationship
- Use of LST in models – needs model development.
- Clear-sky bias of IR measurements (passive microwave, in-situ)
- Relationship between PMW and TIR LST measurements, with aim to develop an integrated LST product.
- Ice and Snow surface temperature
- Validation – few high quality in-situ radiometers