

# GlobTemperature



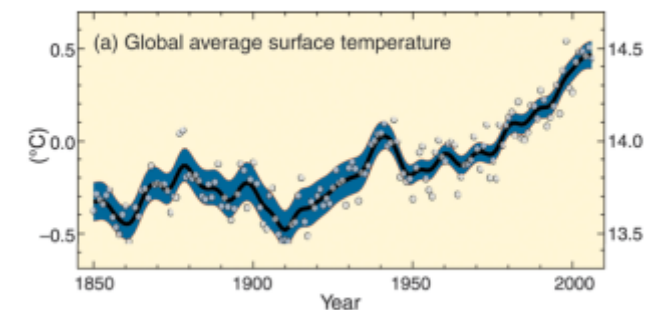
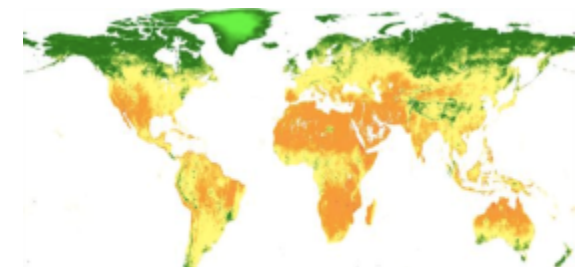
## Satellite Land Surface Temperature User Consultation

John McIntyre Conference Centre  
University of Edinburgh  
27-28 June 2012

To define **user requirements** for a potential future project under ESA's Data User Element (DUE), with the aim of strengthening user uptake of global satellite land surface temperature.

<http://tinyurl.com/globtemperature>

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**The mission of the Data User Element (DUE)** is “...to encourage the establishment of a long-term relationship between user communities and Earth Observation...”

→ User driven projects to transfer research to applications

## **DUE projects are run in close collaboration with users:**

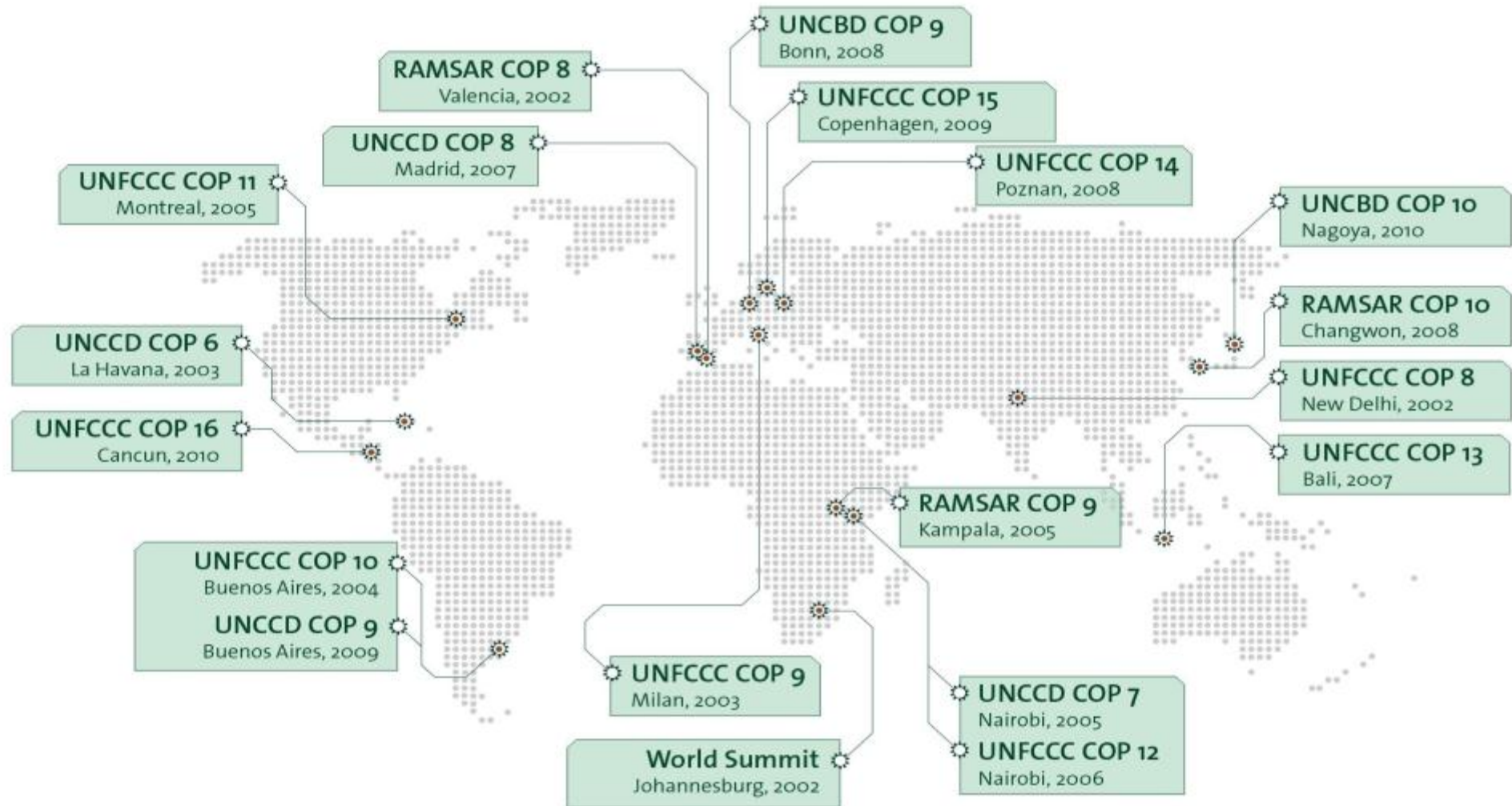
- User Requirements are defined prior to issue of the Invitation to Tender
- Collection of letters of commitment from Champion Users
- Users involved as advisors during the project (annual user consultation workshops)
- Users assess the project results

## **Scope of DUE projects is “Development and Demonstration”**

- Prototyping techniques built on established research results
- Processing chain development
- Production of large global data sets meeting users’ needs
- Validation
- Demonstration exploitation by users



# GlobTemperature





## A New Project planned for 2013 under ESA's 4<sup>th</sup> Earth Observation Envelope Programme

### Objectives:

Improve the uptake of global scale satellite land surface temperature information by the broad research and operational user communities:

- Meteorology and Climate
- Water and energy cycles, evapotranspiration
- Land surface change detection
- Agriculture, health, fire risk, etc

Potential Project Activities (not limited to):

- user driven LST product development and large scale data processing
- validation, intercomparison and quality assessment
- *in-situ* - model - satellite data merging
- construction of an LST information portal
- development towards an LST essential climate variable
- prepare/begin exploitation of Sentinel-3 SLSTR from 2014+

Emphasis on exploitation of European satellite data.



## Meeting Objectives:

The aim of this first GlobTemperature User Consultation meeting is to:

1. Survey users' requirements for global scale satellite LST
2. Explore the feasibility of meeting these requirements with available satellite data and techniques
3. Define a list of priority requirements to be addressed by a GlobTemperature project.
4. Provide a forum for the exchange of information on the latest developments in satellite retrieval capabilities, modelling, and users' applications of LST information.



## Agenda

### Wednesday 27 June (Prestonfield)

Session 1: Satellite remote sensing of Land Surface Temperature

Session 2: User Needs – Climate

Ice breaker: Aperitivo and canapes in St Trinneans

### Thursday 28 June (St Trinneans)

Session 3: User Needs – Meteorology and Land Surface Process

Session 4: User Needs – Land Surface Monitoring

Lunch

Session 5: Discussion and Conclusions

Finish at 15:00-ish



## Towards a GlobTemperature Project (subject to C-MIN Nov 2012)

### 1. Project Definition (Q3-Q4/2012)

- Edinburgh meeting: Review of capabilities and user needs
- Users - Specify User Requirements in more detail & sign a Letter of Commitment
- ESA - Develop feasible workplan: Statement of Work (SoW)

### 2. ESA issues competitive Invitation to Tender (Q1/2013)

- SoW, incl URD + Bidding and Contractual terms and conditions - (<http://emits.esa.int>)
- Open, competitive invitation to tender (ITT)
- Project budget: ~ 1.5 Meuro
- Open to universities, institutes, companies in ESA member states who subscribe to the EOEP-4

### 3. Project (Q2-Q3/2013)

- 2-3 year duration, close by end 2016
- All data products and technical documentation freely and openly available

For NEWS and UPDATES see <http://tinyurl.com/globtemperature>





## Summary of User Applications - 1

Many different applications need LST:

Climate:

- Global trends, w.v. feedback, regional studies, urban heat islands, lake temp, Ice temp
- There is a need to extract the full benefit of satellite information for the characterisation of long-term surface temperature changes – for verification of bias adjustments and statistical interpolation techniques, understanding macro/micro gradients, work towards fully integrated analysis.
- Long time series TIR and microwave for Regional CM model evaluation
- IST reanalysis – need more stable LST than AVHRR over last 30 yrs.

NWP:

- Model verification, improve surface analyses, reanalysis, study of heatwaves, improve assimilation of microwave radiances, ...



## Summary of User Applications - 2

Surface model development (katabatic flows, fog, snow melt, soil moisture; ET for biomass, yield and water use; JULES)

- Improve model verification compared to in-situ only
- Surface model calibration
- Development of LST assimilation into surface energy balance model for evapotranspiration (but 1K error in LST => 10% error in E.T.)

## Land Surface Monitoring

- Drought monitoring – LST anomalies can be an early indicator of vegetation stress
- Carbon balance of wetlands, impact of drainage
- Assessment of frost damage to winter crops (insurance)
- Urban changes, urban heat island
- Arctic monitoring (land, lakes, sea-ice, permafrost)
- Long term trends of land over change
- Sea ice break-up, info for oil and gas industry, ...
- Monitoring volcanoes and lava flows

# User Needs - 1



- Need global LST, full diurnal cycle, long time series
- High resolution LST (at least 1km, down to 50m, 0.5 to 1K accuracy, downscaling, incl SWIR for high temperature events)
- Gridded, metadata included, need to know what was used in the retrieval (emissivity, land cover, obs and solar angles, atm conditions, w.v., quality flags).
- Need Uncertainties (breakdown into random, systematic, ...)
- Need exchange of information between satellite and user communities
- Need help to find LST products! (listed on Google, directory of what's available, short desc. of products). Need one gateway for all LST products. Link to other datasets such as land cover, albedo, veg cover, fapar, soil moisture, snow cover, ...
- Easy availability, easy to use web interface (quicklooks), different temporal and spatial resolutions, known issues documented, validation info...
- Std/common formats (netCDF, HDF, TIFF etc), std projections, software tools provided
- Intercomparison of LST data sets to help work out which one users should use

- NRT! (L2 and gridded)
- Consistency across sensors
- Diurnal cycle (3-hourly)
- LST over lakes, land, snow and ice.
- BUFR or NetCDF, and easy to access
- Multisensor data archive covering 20-30 yrs
- Detailed breakdown of uncertainties per retrieval, including space/time correlation structures
- Gather accurate radiometer data in one place for validation.
- Daily composite required quickly, over Europe
- Continuity of service!
- 1km, 25km, weekly (sliding window), monthly, freezing degree days, thawing degree days, ...
- estimate of the bias, differences between satellite products
- aggregate polar orbiter obs each day over arctic
- ref sites for intercomp and validation (LST and LWST)



## Discussion 2: Potential Technical Developments and Activities

- Common formats L2 + L3
- Merged L4 LST information from geostationary & polar orbiters, (IR + microwave) combining good diurnal sampling with 1km resolution.
- Better characterisation of angular effects needed as prerequisite to merging
- Better cloud screening and scene classification
- International intercomparison of LST algorithms and data sets
- To assist validation: Multi-sensor matchup dataset "MDB" (satellite , in-situ, radiometer, SYNOP)
- Build LST "GDAC" – all the data accessible from one place, in the same format, free and open to all, including comparable error characterisation and auxiliary information, uniform documentation, LST and emissivity data, multiple product types: L2, L3, L4+, Earth System Grid for climate users
- Use of Landsat, ASTER, BIRD IR from DLR, LDCM, MISTIGRI for validation.
- Prep. for Sentinel-3 SLSTR
- Prepare for LST ECV
- Link to international activities: EarthTemp science network, ISTI, GEO, CEOS Land Constellation, etc.
- Learn from GHRSSST experience
- Multi-product ensemble to allow users to compare products