3rd EarthTemp Network Workshop

23-25 June, 2014

Karlsruhe Institute of Technology, Karlsruhe, Germany

Delivering and exploiting surface temperature observations in key land regions, with a focus on Africa

The following topics were discussed at breakout sessions (some topics were discussed by two groups)

This document contains transcriptions of the handwritten reporting sheets from each breakout session. Towards the end of the meeting the participants were asked to mark the one bullet point in each report which they thought was the most important. The marks are given as red asterisks in the transcribed reports.

A Lake water ST and applications/ST challenges in coastal areas

- Challenges
  - Heterogeneity / small scale structures ***
    - Sea/land/atmosphere
    - Coastal urbanisation
  - Rapid changes temporally (relative to open ocean] **
    - Sampling issue
    - Boundaries move
      - Particularly Lake Chad, Caspian Sea, Lake Victoria, Lake Kariba
    - Mixed pixels (water/land) **
  - Lake Depth
  - Tidal waters – changing topography
  - Cloud masking especially in upwelling regions ***
  - Small spatial correlations
  - In situ/satellite comparisons are difficult for validation *
  - In situ data are often in homogeneous regions, not at boundaries
  - Strong temperature gradients across lakes *
  - How to use the available info in an accessible way?
  - Is the definition of 'surface' appropriate? *
  - Mixed layer depth important for biology
  - Surface temperatures can be used to drive models
    - Model validation?
  - Models need info on water capacity, mixed layer depth
  - Correlations between temperature and fish stocks
  - Making links between people to make progress
- Possible research opportunities
  - Crowd source data – what quality do we need? ****
  - Can we encourage more of these data?
  - We could be missing data in ports
  - Temperature integrates heat flux over a given time period. Temperature sensors are cheap.

- Wind speed data are also important
- Coastal areas – smaller shipping companies/individuals
- Temperature important for marine safety – it would be ideal for them to push for measurements *
- Data validation for satellite data in coastal/lake areas from in situ data *
- Oil companies - could they measure temperature on ships and at rigs?
- Data from the navy?
- Infrared sensors on passenger aircraft?
- Integrating observations and modelling model validation in coastal regions
- Research driven by user needs **
    - More consultation required
    - Lack of awareness of user needs?
    - Reanalysis by-products may be useful to users
- Corals – a good argument for funding
    - Studies in these areas may have temperature data
- Lake-climate interactions in the Rift Valley
- Lake Tanganyika – long climate memory, 1 km depth
- Paleo information in lakes on nearby LST's
- Data exchange for Africa/data management
    - Time series, in situ, ship measurement collected together in some regions e.g. Germany
    - SADCO – open access data
    - GEOSS data exchange
- Correlations between temperature and fish stocks
    - Provide a direct link to users
    - Relate to satellite products/ predictive potential
    - Could get policy makers involved
    - Operational products *
    - Social-economic benefit
    - Water quality
    - Water turbidity/colour for coasts and large lakes
    - Model impovement

- Demonstrate data use ⇔ Have the data *
- Information about data quality
  - Atmospheric corrections
  - Uncertainties can help users use the data correctly
- Can we learn from studies in the Mediterranean/HYMICS/Baltic Sea projects
- Diverse user communities
- Need co-operation between countries
  - Lakes/coastal areas across politial boundaries

B Spatially complete ST for Africa

- Accessibility to regions *
- Need in situ data *
  - Data retrieval/sharing *****
    - Long time scale
    - Help create local gridded product
      - Aligned with national institutional mandate
    - Non-met service monitors need to be approached
    - Securing data – copying records *****
      - To be done by locals – ownership
      - Secured at Regional Climate For a
      - Priority on raw records
    - New stations
      - Reference stations – for remote sensing, reanalysis,etc.
      - In addition to synoptic and validation stations
      - In areas lacking coverage and representative of challenges for remote sensing
      - Future research into needs for these stations e.g. static vs. mobile
    - Interpolation – spatial and temporal analysis
      - How to deal with retrievals in clouded areas ********

- How to merge IR and microwave ***
- Careful with communicating where product is interpolated ****
- Communicating with modellers
- Creating product with absolute temperatures
    - Work being done
    - Need information on uncertainties **

C Relating LSAT to LST and reanalyses for Africa I

- No global all-season relationship of LST/LSAT
    - Changes in surface coverage/type, wind regime, topography
    - Perhaps stronger anomalies, but still not generic
- Specific requirements – determined by the goal of study
    - Vegetation processes *
    - Indicator of thermal conditions across space e.g. in water processes *
    - For reanalysis
        - Long time series of consistent data
        - Help improve geographic detail/ heterogeneity across continent
    - Forecasting in Africa? Local area model?
- Data producers' and users' point of view can be quite different – users need to link to other data and application
- Difficulty of linking reanalysis and other experts – partly practical
- Scientific process to improve reanalysis **
    - Satellite-NWP/reanalysis compare and learn iteration
- LST/SAT not only different things but have different spatial scales *
- Specific for Africa – what reasons for reanalysis? Useful to fill gaps *****
    - Ecosystem assessment
    - Basis for downscaling to local applications ***
- Need reanalysis people to make connections

D Relating LSAT to LST and reanalyses for Africa II

- LST vs. LSAT at pixel scale
  - Ambiguity of point vs. pixel
  - Understand scale issues
  - Understanding different measurands
  - Understanding the LST-LSAT relationships under cloud – especially variable cloud ***
  - Systematic analysis of station data with both LST and LSAT and cloud data ********
  - ABM, BSRN, LANDSAF
  - Assess cloud impact on LST monthly and LST/LSAT (clear-sky bias)
  - Assessing impact of apparent observation on temperature record **
    - Geographical and metrological factors
  - Analysis of high density measurements and satellite data (BUCL)
- Reanalysis
  - To understand effects inputs must be applied to NWP before application to reanalysis **
  - Analyse LST and LSAT from reanalysis with satellite of in situ data ******
  - Using reanalysis for break point identification *
    - E.g. Hamburger(2012). Radiosond temp and wind
  - Can models capture relationships between areas with strong seasonality (moisture, vegetation)
  - What temperatures do we want to know over canopies
  - 5-10 years
- Gaps in understanding
  - Research activities – increase understanding
  - Relationship of LST vs. LSAT vs. reanalyses
  - Energy balance
  - LST – LSAT sub
  - Spatially complete *
  - Station discontinuities
  - LST vs LSAT and user requirements **
  - Clouds on LST and incomplete sampling **
  - 20 CR – breaks in surface obs

E Reference sites for ST I

- Validation ***
  - Land SFC temperature
  - Full description -> variables, sensors, instruments, end members, surrounding coverage, seasonality
  - Homogeneous
    - Identify a small number of end members
    - The same over ~ km, 2x2 pixel size
  - Flat
  - Covering different land types atmospheres
  - Permanent sites *****
- Parameters observed
  - SW and LW
  - Upwelling radiance for end members
  - SW and LW Downwelling radiance
  - Aerosol
  - Emissivity probe
  - In situ ndvi
  - ZmT zm 7
  - Wind
  - Soil probes
- Metadata
  - Landcover (distribution of end members)
  - Phenology
  - Emissivity
  - Mandatory for LST validation, quality
- Important issues
  - Accessibility *
  - Permanent **

- Satellite in situ comparison *
  - Satellite radiance and emissivity
  - Insitu radiance, emissivity, LST of each end member
- Satellite LST -> land cover
  - Endmembers representative station
  - Variability of pixels around station should be small *
- Existing sites
  - Africa
    - Gobabeb
    - Kalahari
    - Senegal
  - South Western Europe
    - Evora
    - Donana
  - North America
    - Surfrad
    - ARM
    - Lake Tahoe
- Near future *
  - South Africa
  - Skukuza (Savana)
  - Paardefontein (Grass)
- Circulate info on existing sites **

F Reference Sites for ST II

- Challenges
  - What do we mean by 'reference'?
  - From a pure measurement perspective
    - Only Lake Tahoe is reference site because it has redundant

measurements (4 buoys)

- Do we want to communicate this to funding agencies?
- Reference -> Baseline/HQ ->All

- How will 'status reduction' from reference to baseline be received by current 'reference' site operators
- Catelog existing stations and networks *
- Need measuring protocol
  - Comparability and uncertainty quantification (what, where, how, how often?)
  - Independent measurements of the same variable (for reference site)
  - Representability
  - Traceability
- Standardisation data: management and dissemination

- 5-10 year plan **
  - Define what a reference site is *
  - Stop mis-using the term 'reference'
  - Define quality levels: reference, baseline, standard,campaign *****
  - Convince WMO, GEOS, … to establish reference site(s) in Africa *
  - Joint repositories (GlobTemperature) ***
  - Standard LST geometry normalisation, e.g. via geometric or statistical modelling *
  - Quantify uncertainty of spatial mismatch for sites and/or
  - Quantify representativity of in situ site *****
- Wishlist
  - Standard meteorological stations at sites
  - Urban ('reference') sites *
  - Aircraft and UAV data – easier access and support of campaigns (esp. UAV)
  - Radiometers over inland waters
  - Also retrieve water temperature of lakes
  - Catalogue of stations/networks ***

G Meeting user ST needs for Africa I

- Define users *
- Science
  - Climate
- Operational
  - Business
  - Ecology
    - E.g. flamingos
  - Water quality
  - Food
  - fish
  - Livestock
  - Marine safety
  - Hydrology
  - Weather/met
- Public
- Which data?
  - SST <- direct interest
  - Lake
  - LST
- How to use info?
- What is required?
  - Info
  - Access
  - Explanation
  - Understanding
- Long-time series **
  - Homogeneous **
  - Gap-filled *
    - Spatial
    - Temporal
  - Short/diurnal cycle

- Climatology
- Parameters
- Indices **
- Easier use/download *
- Science

- Operational users
  - NRT
  - Continuity *
  - Reliable delivery **
  - Quality control **
  - Easy access to quality measures
- Documentation
  - How to use different STs
- Initialisation of models
- SST
  - Safety
    - High resolution
  - Fisheries, planning policy
    - Indices
    - Trends
    - Long-term
  - Fisherman
    - Here and now
- Temperature based models
  - Confidence in T? not yet but increasing
- Agriculture
  - Crop yield models
    - SST - Seasonal forecasting
  - Indices
    - NDVI
    - LST

- Water stress
- Rainfall intensity
- Two-way industry-science users
  - E.g. fire risk
  - Vinyards
- Gaps and research priorities
  - Communicate uses
    - Application examples
  - Build confidence ***
    - Prove consistency of data **
  - Develop models that use LST ***
  - Capacity building ***
  - Gap-filling
    - Develop techniques
  - Communicate
    - awareness of limitations
    - education
  - User friendly products *****
    - Format
    - Packaging
    - accessibility
- Opportunities
  - Satellites
    - Sentinel
    - MSG MTG
  - Exploit ST data bank
  - SASSCAL
  - HYVIC
  - AMMAZ

H Meeting user ST needs for Africa II

- Needs
  - Data availability – in situ and satellite – accessibility, file formats …
  - Spatially complete *
  - Seasonal forecast *
  - Quantifying extremes
  - Current monitoring – NRT? *
  - Uncertainty *****
  - Landcover change
  - Drought assessment
  - Long-term multi-decadal records *
- End Users
  - How to translate the data and disseminate ******
  - Smart phones – data to and from users
  - NGOs for disaster management
  - Health, malaria
- Objectives
  - Finding out who has what information on user needs – to focus development
  - Engaging with organisations which produce data eg IRI
  - Improved products *
  - Group to consider the spatial/temporal needs of users and evaluate whether we can supply the demand
  - Educate users in producing the products *
  - Policymakers (local and international) *
  - Interacting with the users *
- Progress
  - More station data being digitised
  - Data improving, good quality e.g. LST data
  - Gathering information together on user needs, lots of information already been obtained ***

- Who's got what information

- Recommend
  - High spatial resolution
  - Gap-filling
  - EarthTemp to engage with people to have information on user needs and have access to the users and the policy makers
  - EarthTemp wiki, people can link to documents