3rd EarthTemp Network Workshop

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Karlsruhe Institute of Technology, Karlsruhe, Germany

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

This document contains transcripts of the handwritten report sheets from the "Making Connections" exercise that kicked off the workshop. Small groups discussed the different topics in succession. All participants had an opportunity to comment on each of six topics. Participants were asked to comment on knowledge gaps and suggest future research opportunities.

A: Which general challenges make it difficult to collect data in Africa?

- Lack of interest in products/output make it difficult to justify collecting data
- Agencies don't measure coastal temperatures
- Data quality is varied
- Farmers
- Large region sparse in situ network
    - Money is in issues
    - Inhibits development of new methods of measurement
    - Lack of validation
    - Lack of validation of existing satellite data
- Political instability can be problematic/disruptive
- Data sharing can be problematic
    - Need to incentivize this
    - Discontinuous records need metadata to rescue what there is

        - Need diplomacy for this
    - IT networks/infrastructure lacking/needs improvement
- Complex terrain can lead to unrepresentative stations
    - Arid areas
    - Mountains
    - Different land surface type over short distances
        - Changes in land type in time – seasonal cycle
    - High variability even in apparently homogenous regions
        - Temporal
- Urban areas make satellite data difficult to interpret
    - Securing equipment – vandalism/theft of equipment
- Changes in land use can be difficult to identify and take account of
- In tropics cloudiness makes IR retrievals hard
- Need to know who are the experts locally
    - Difficult for Europeans to link to local capacity
- Logistics for in situ measurement are challenging
    - theft of equipment
    - supplies
    - access – remote areas
    - wildlife
- funding needs to be sustained for long term study
    - to work on analysing what data there is
    - to enable projects to continue after they end
- needs to be more international collaboration between agencies
- insufficient involvement by local universities
- lack of big ST initiatives
- main problem is lack of local capacity
- bringing instrumental information together with indigenous knowledge

B: Knowledge gaps: which geographical areas of climate zones in Africa do we have to understand better? Why (relevance)?

- Tropical rain forest
    - Controls one of the main branches of Walker circulation
    - No data
- Flood plains
    - Main rainfall areas
- Seasonal wetlands

  - Change in surface type and land use
- Coastal waters
  - Currents
- Remote regions – desert (have good access to Namibia desert)
  - Politically unstable regions
- Lakes
  - Urbanisation around surrounding topography (e.g. Lake Victoria)
- Reservoirs – water resources/quality
- Urban areas
  - Health
  - Urban planning
  - Effect of urbanization
- Grasslands/Savannah
  - Changes – desertification, agriculture, changing boundaries
  - Aridity
  - Wildlife protection
  - Heterogeneous surface
- Croplands
  - Response of tree species to [variable] ST
  - Which areas are most sensitive to ST
- Coastal deserts
- Coastal
- Highland areas
  - Important for rainfall
- High mountains
- What is important for forecasting medium range/ rainy season onset
- Wetlands
  - Health – malaria, west Nile virus, vector borne, dust related etc.
- Desert boundary (south Sahara)
- Congo forest
  - Deforestation
- Semi-arid zones

C: Which user communities in Africa benefit from better surface temperature data? How?

- Drought and crop and pasture assessment
  - Farmers, community agriculture

- Short and medium forecasting (lack of in situ)
    - Farmers
- Urban planning
    - monitoring unplanned urban areas
    - Heat stress
- Data rescue
- Epidemiology
    - Malaria
    - Aid agencies
    - Heat stress
- Flood management
    - River basins
- Smart phone apps
    - Getting data to users and back from users
- Communities susceptible to fire
    - Surface dryness – satellite temperature data
    - Fire risks
- Increase awareness of ST data from satellite
    - Biodiversity
        - Wildlife management
- Vegetation monitoring
    - Yield forecasts
    - Region monitoring
- Fisheries
    - Marine transportation
    - Rescue at sea (marine safety)
- Climate change community
    - SST and LST
- Modelling
    - Validation is still a problem

D: Existing or potential opportunities: Which developments, techniques or initiatives can improve understanding of STs in Africa?

- Validation site
- Blended satellite/in situ temperatures
- New/ future satellites? Sentinel
- Assimilation of satellite/in situ for NWP

- ST links to soil moisture, precipitation, vegetation, ET
- Capacity building: skills, equipment
- Calibration facilities for in situ instruments
- Multi-sensors -> long term trend -> variation and relationship with climate change
- Incentivising data publication and sharing
- Blended satellite LST from various satellites
- Different spatial resolutions
- Collaboration N-S, S-S
- Understanding coupled dynamics – near coast
- Characterising land surface change routinely e.g. SAR and LST links
- Link local Tair observations to reanalysis circulation variables (U-wind, geopotential)
- Data rescue: ACMAD and others
- Non-IR in tropics where cloudy STs (plus investigate sampling in IR)

E: Temperatures in coastal areas. Specific challenges? Knowledge gaps?

- Cloudmasking problems:
    - Clashes in sea/land algorithms
    - Significant data loss – large temperature gradients
- Fog – data loss/ corruption – night. Applicable also over wider ocean
- Rapid temporal variations
- How to derive temperature in mixed ocean/land pixels – getting atmospheric correction right
- Local teleconnections/dynamics -> climate change
- Natural resources and environment – bridge the gap between observations and models
- Land cover varies – difficult to know emissivity, more difficult than inland
- Lake coasts – shallow water/lake vegetation
- Shipping – safety in regions where more data are needed
- Rapid changes in the boundary location – storms etc.
- Knowledge of the tides
- Water depth and ground height not well known
- Erosion prevention can change dynamics
- Urban coastal developments
- Minimal in situ observations for validation
- Poor observations of coastal currents
- Seamless transition of temperature retrieval

- Linking water temperature to ocean colour

F: Temperatures in lake areas in Africa: Specific challenges? Knowledge gaps?

- Effect of ST on lake ecosystem – **fishing**
- What is climatology?
- High resolution data – challenge
- Information about run-off, inflows, water table/lake interactions
- Atmospheric correction
- Important for lake Tanganyika, Lake Malawi – deep lakes wind driven overturning
- Different lake sub-types, regional climates
- In situ data resolution (temporal and spatial), record length and continuity – data availability, research networks
- Sediment cores – long term record
- Are lake temperatures in Africa different to other regions?
- Use lake ST for land ST validation?
- Large lakes effects on local weather and climate – coupled models
- Mixed pixels – shores
- Shallows – need to take underlying lake bottom surface into account
- Inaccessibility of lakes
- Impact of ST on marine safety, shipping, epidemiology
- High diurnal variability – link to sampling
- Lake depth knowledge lacking – makes difficult to model
- Non-permanent lakes
- Ground truth data acquisition
- Changing levels
    - water storage for cities
    - may dry out completely
- Measurement of temperature profile for heat storage estimation
- Growing urbanization around lake
- Algae blooms – foam on surface