Measuring Land Surface Air Temperature in Africa

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Conventional Manual Mercury Thermometer

- The instrument that is most widely used for measuring air temperature in Africa is the mercury thermometer housed in a Stevenson screen.
- The height of the Stevenson screen above the ground is typically 1.25 m or 1.5 m, depending on national practice . So the different instrument heights above the ground should be taken into account in making use of the temperature data.
- In the new table driven code forms (TDCF) for Synoptic message, the actual height of the instrument is included in the message.
- In Africa, at a standard synoptic station, air temperature readings are normally made at a three hourly interval during the day. The observation interval is typically one hour round the clock at international airports.

Stevenson Screen

Air Temperature Thermometers inside a Stevenson Screen

Potential Sources of Error in Temperature Observation Data

- The measurement of air temperature using the manual thermometer is prone to human error in reading the thermometer. The observed temperature reading is typically written down in a daily observation register.
- There are more sources of error when the data is transcribed from the daily register to the monthly climate return, and also in the manual key-entry of the data into the computer.
- Quality Control is therefore essential in the manual observation of air temperature

Continuous Temperature Recording using Thermograph or Thermo-hygrograph

- A thermograph or thermo-hygrograph (combining temperature & humidity recording) gives a continuous graphical record of air temperature on a strip chart over a period of one or two days depending on the clock configuration of the instrument.
- Although there is an advantage in getting a continuous recording of temperature showing diurnal variation, there is a significant error margin in comparison with temperature from the manual mercury thermometer.
- The strip chart from the thermograph or thermo-hygrograph, goes through a process of "chart reduction" to adjust the values read off from the chart, relative to values read from the mercury thermometer at synoptic observation hours.

Thermograph

Thermo-hygrograph

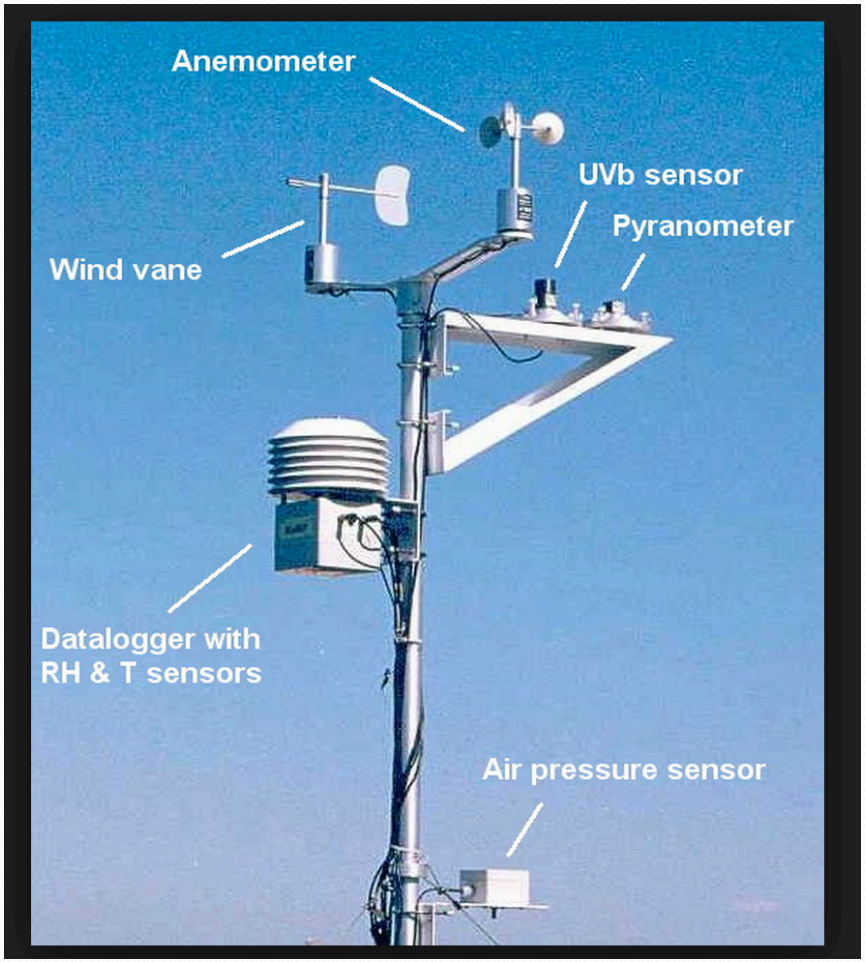
Station Network Density

- The distribution of synoptic stations measuring air temperature in Africa is generally very sparse in most countries
- Due to internal civil strive in some African countries, a considerable number of stations have been closed permanently or temporarily, reducing the network density further. Although some of the stations have been reopened, infilling of the temporal data gaps is a big challenge.

Automatic Weather Stations

- Of late, there has been a marked increase in the installation of automatic weather stations (AWS) in Africa to increase the density of observing stations.
- However, the maintenance of the AWS is a challenge, resulting in some of the AWS being unserviceable for some time.
- Unreliable telecommunications infrastructure also causes disruptions in the transmission of data from remote AWS to national data collection centres.

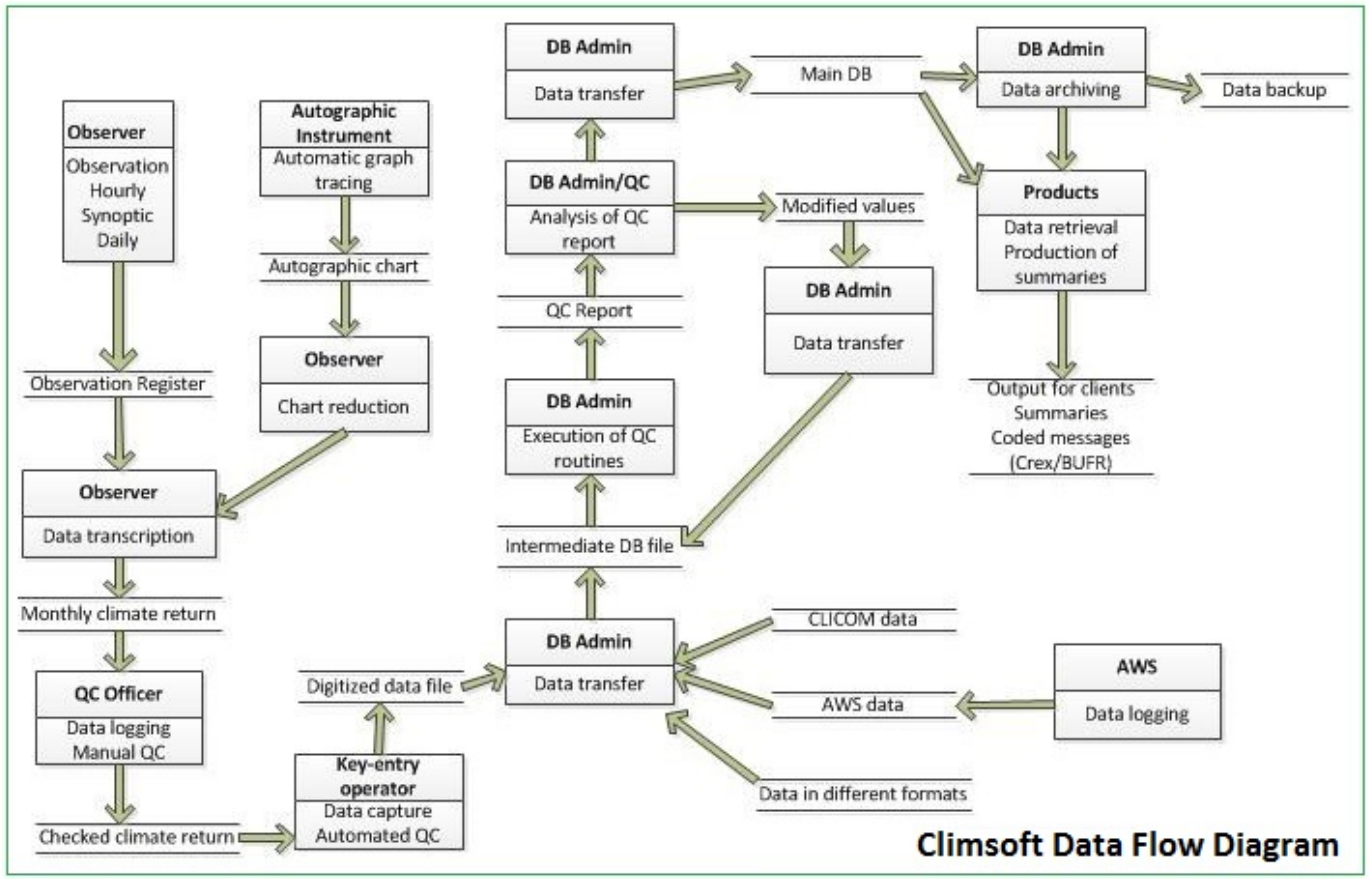
Example of multi-sensor AWS



Climate Data Management in Africa

- A large number of countries in Africa currently use a professional climate data management system (CDMS) to manage historical and fairly recent climatological data. One such CDMS is CLIMSOFT which was successfully evaluated by WMO.
- The CDMS was developed by a tea]\ of developers in the NMHSs of Zimbabwe, Kenya and Guinea, with support from WMO and UK Met Office.
- CLIMSOFT is currently operational in about 10 African countries and also at ACMAD which is responsible for the project management and distribution of the CDMS.

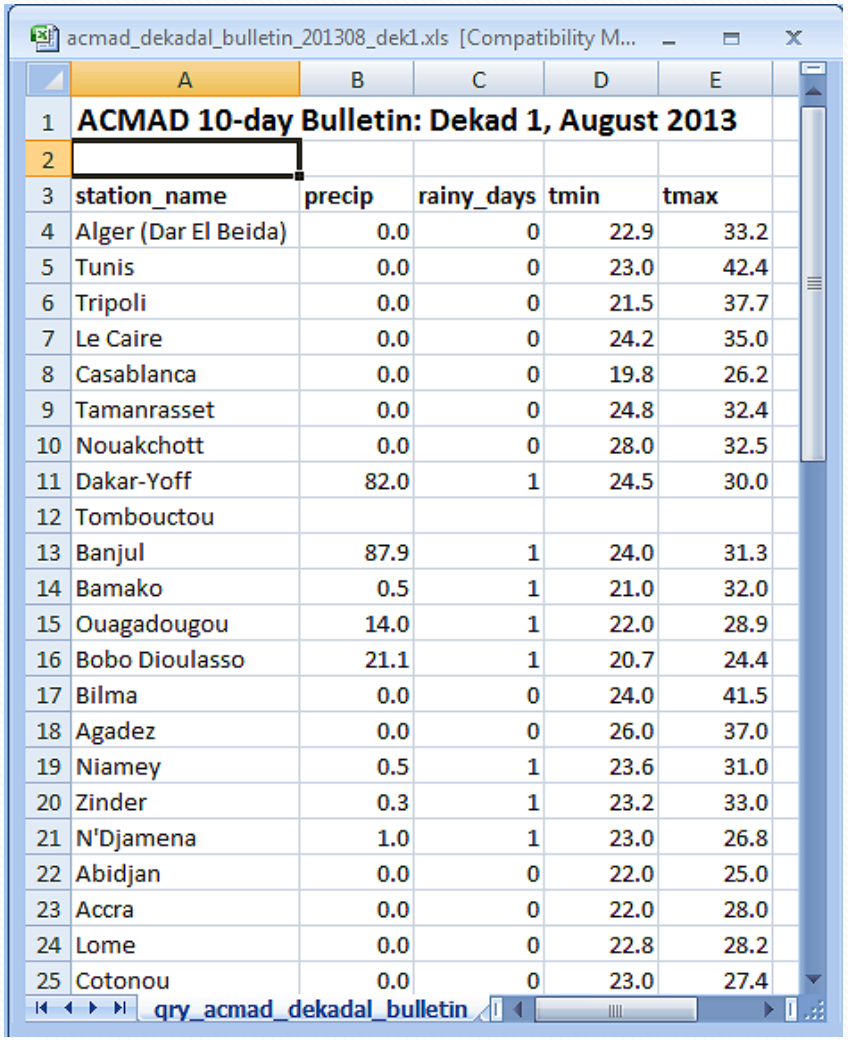
Typical Data Flow in a NMHS in Africa



Climate Data Products from CLIMSOFT

- Data products derived from CLIMSOFT are used in routine climate monitoring e.g. in the 10-day bulletin at ACMAD.
- Other products include output for Climate Change indices using RClimDex and also output for seasonal forecasting using Climate Predictability Tool (CPT)

Sample Data Summary for Decadal Bulletin at ACMAD



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	A	B	C	D	E
1	**ACMAD 10-day Bulletin: Dekad 1, August 2013**				
2					
3	**station_name**	**precip**	**rainy_days**	**tmin**	**tmax**
4	Alger (Dar El Beida)	0.0	0	22.9	33.2
5	Tunis	0.0	0	23.0	42.4
6	Tripoli	0.0	0	21.5	37.7
7	Le Caire	0.0	0	24.2	35.0
8	Casablanca	0.0	0	19.8	26.2
9	Tamanrasset	0.0	0	24.8	32.4
10	Nouakchott	0.0	0	28.0	32.5
11	Dakar-Yoff	82.0	1	24.5	30.0
12	Tombouctou				
13	Banjul	87.9	1	24.0	31.3
14	Bamako	0.5	1	21.0	32.0
15	Ouagadougou	14.0	1	22.0	28.9
16	Bobo Dioulasso	21.1	1	20.7	24.4
17	Bilma	0.0	0	24.0	41.5
18	Agadez	0.0	0	26.0	37.0
19	Niamey	0.5	1	23.6	31.0
20	Zinder	0.3	1	23.2	33.0
21	N'Djamena	1.0	1	23.0	26.8
22	Abidjan	0.0	0	22.0	25.0
23	Accra	0.0	0	22.0	28.0
24	Lome	0.0	0	22.8	28.2
25	Cotonou	0.0	0	23.0	27.4

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