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Introduction:

Climate affects human health in a number of ways directly or indirectly, as with infectious diseases such as malaria, meningitis.

During the past decade, climate associated risk has been recognized as a potential constraint to achieving development targets, including the MDGs. While recent focus on climate change has made these concerns more pressing, there has been a tendency to overlook the opportunities to use climate and environmental information to improve sustainable management of climate sensitive sectors - including health.

In 1999, the International Research Institute for Climate and Society (IRI) led a collaborative training course in Bamako, Mali on Climate Prediction and Diseases/Health in Africa. Convened by the Faculté de Médecine, de Pharmacie et d' Odonto-Stomatologie and by the Direction Nationale de la Météorologie du Mali, it was one of the first interdisciplinary workshops of its kind to address the challenges and opportunities around climate and health in Africa. The course was also co-sponsored by the African Center of Meteorological Applications for Development, the World Meteorological Organization, the Institut de Recherche pour le Développement and the US National Institutes of Health.

Since the initial Bamako workshop, awareness around the risks of climate has risen considerably and many significant lessons have been learned through many initiatives and many partnerships. The Ethiopian Climate and Health Working Group, along with a steering committee comprised of the African Climate Policy Center, WHO, UNDP, the UK Met Office, Exeter University and the IRI, proposes the organization of a second Pan-African Climate and Health workshop to be held in Addis, April 4-6, 2011.

Priority climate-sensitive health issues that affect pastoral, agrarian and urban populations will be addressed, for example:

- Dry conditions: respiratory diseases - aggravated by drought and dust, e.g. bacterial meningitis.
- Wet conditions: vector-borne diseases including zoonoses- e.g. malaria
- Heat stress: of considerable concern for rapidly urbanizing populations.
- Droughts/floods: impacts on under-nutrition, water, sanitation and diarrheal diseases, e.g. cholera.

"Ethiopia Monthly Climate Bulletin on Malaria that is prepared by National Meteorological Agency since 2006 " is One of Climate Information for the Health Sector in the country. This Bulletin has been designed to convey essential information regarding the monitoring and identifying of Malaria outbreak areas based on the analysis of temperature, relative humidity and precipitation data. The major objective of this bulletin is in line with the National Meteorological Agency's strategy of diversifying climate application products to the basic developmental sectors (such as the Health, the water, the agricultural sector etc…). This bulletin can be a very important source of information to Health professionals engaged in the monitoring of Public health. This bulletin distributed to users through postal service and websites.

Methodology for Ethiopia:

- Data

- Mean monthly Temperature of the actual observation data that collected from all the possible areas of the country.
- Monthly total rainfall of the actual observation data that collected from all the possible areas of the country.
- Average Relative humidity of the actual observation data that collected from all the possible areas of the country.

- Tool: surfer version 8

- Grover-Kopek et al. 2006

  The suitable climatic conditions for transmission of malaria in Africa are; when the monthly precipitation accumulation is at least 80 mm, the monthly mean temperature is between 18°C and 32°C and the monthly mean relative humidity is at least 60%.

Methodology for Africa:

- Data

- Mean monthly Temperature downloading from NOAA/NCEP- NCAR
- Monthly total estimated precipitation downloading from NOAA/NCEP
- Average Relative humidity downloading from NOAA/NCEP- NCAR

Procedure downloading each parameter from NOAA:

1 Mean monthly Temperature

http://iridl.ldeo.columbia.edu/SOURCES/.NOAA/.NCEP-NCAR/.CDAS-1/.DAILY/.Diagnostic/

- IRI
- Source. NOAA.NCEP-NCAR.CDAS-1.DAILY.Diagnostic
- Click on data selection
- Setting Ranges
- Type ,for long(20W to 55E), Lat(40S to 40N), Time(start month,year) (end month,year)
- Click on restrict Ranges
- Stop selecting if all selection is ok
- Click on filters
- Click on average over T
- Click on tables
- Click on Columnar tables with options
- Click on Text → numbers for column 1 to column 3
- Click on Get Table
- Result which is in tabular form and save as txt
- Import txt files in excel sheet and suit for surfer format

2 Monthly Estimated precipitation

http://iridl.ldeo.columbia.edu/SOURCES/.NOAA/.NCEP/.CPC/.FEWS/.Africa/.DAILY/.RFEv2/.est_prcp/

- Click on data NOAA/.NCEP/.CPC/.FEWS/.Africa/.DAILY
- Click on Expert Mode
- Sources.NOAA.NCEP.CPC.FEWS.Africa.DAILY
- RFEv2. est_prcp
- Click and Type X (20W (55E) RANGE and enter the next line

- Type Y (00N) (40N) RANGE and enter the next line
- Type T (beginning date,month,year) (End date,month,year) RANGE enter the next line
- Type T SUM
- Click on ok
- Click on Tables
- Click on Columnar tables with options
- Click on Text-→numbers for column 1 to column 3
- Click on Get Table
- Result which is in tabular form and save as txt
- **REPEAT THE PROCESSES FOR ALL COORDINATES AFTER** RFEv2. est_prcp
- Import txt files in excel sheet and suit for surfer format

3 Average Relative humidity

http://iridl.ldeo.columbia.edu/SOURCES/ NOAA NCEP-NCAR CDAS-1 DAILY Intrinsic

- IRI
- Sources. NOAA NCEP-NCAR CDAS-1 DAILY Intrinsic
- Click on data selection
- Setting Ranges
- Type ,for long(20W to 55E), Lat(40S to 40N), Time(start month,year) (end month,year)
- Click on restrict Ranges
- Stop selecting if all selection is ok
- Click on filters
- Click on average over T
- Click on tables
- Click on Columnar tables with options
- Click on Text → numbers for column 1 to column 3
- Click on Get Table
- Result which is in tabular form and save as txt
- Import txt files in excel sheet and suit for surfer format

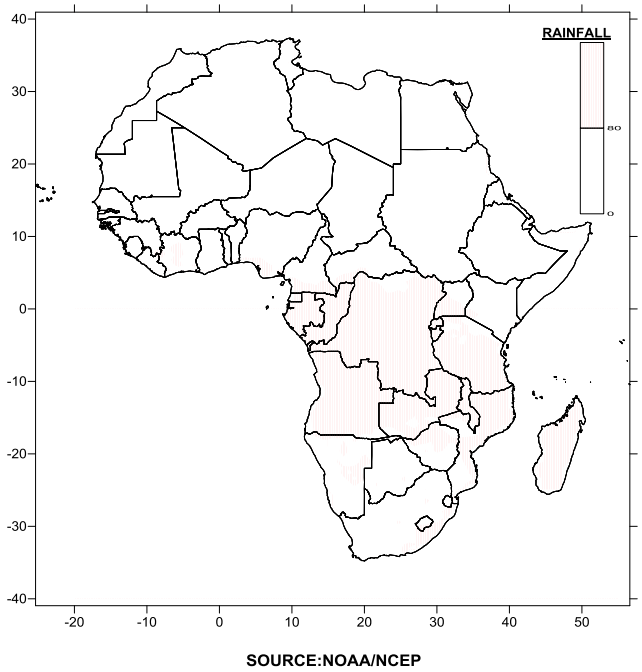
➢ Tool: surfer version 10

➢ Grover-Kopek et al. 2006

The suitable climatic conditions for transmission of malaria in Africa are; when the monthly precipitation accumulation is at least 80 mm, the monthly mean temperature is between 18°C and 32°C and the monthly mean relative humidity is at least 60%.

Products of Sample maps for each parameter within the threshold and the combined maps during the month of March 2012 and April 2012 were demonstrated as follow:

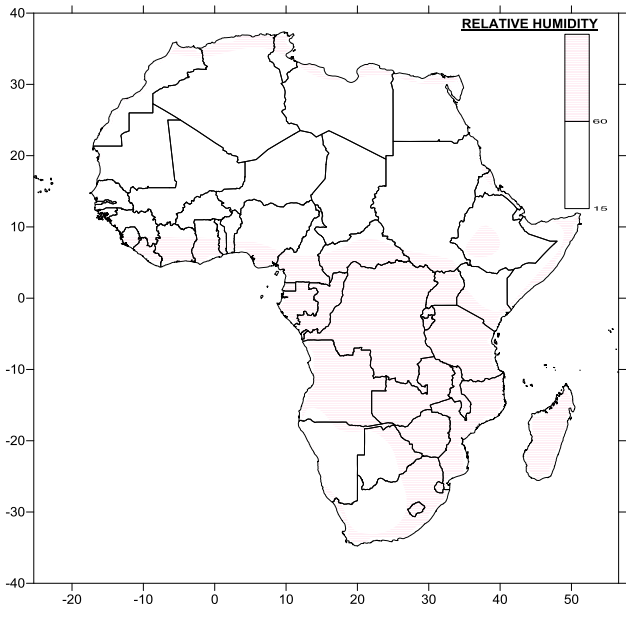
Rainfall estimate during March 2012



SOURCE:NOAA/NCEP

The rainfall estimate map illustrates the total estimated precipitations from NOAA/NCEP. Hatched areas had monthly rainfall amounts of 80mm and above.

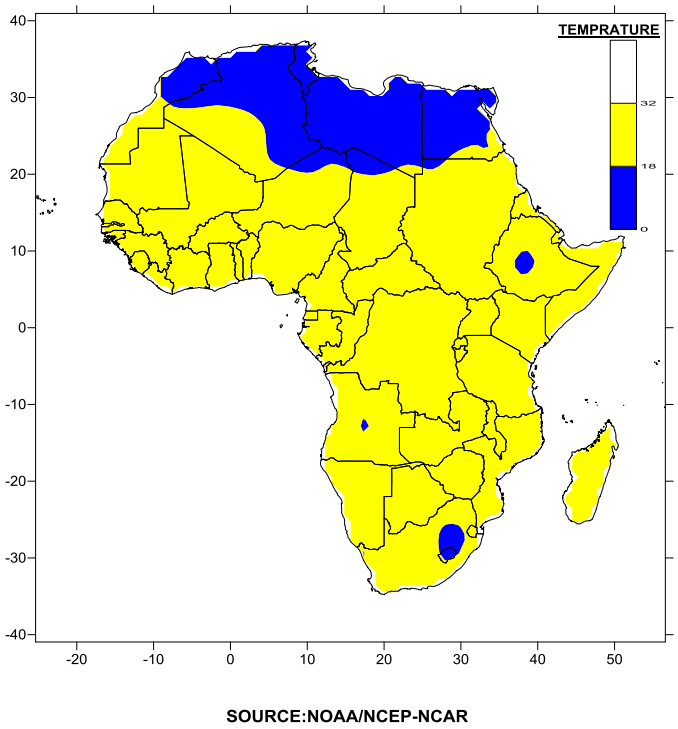
Relative humidity during March 2012



SOURCE:NOAA/NCEP-NCAR

The relative humidity map illustrates the total average relative humidity from NOAA/NCEP-NCAR. Hatched areas had monthly relative humidity amounts of 60% and above i.e. within the threshold of relative humidity.

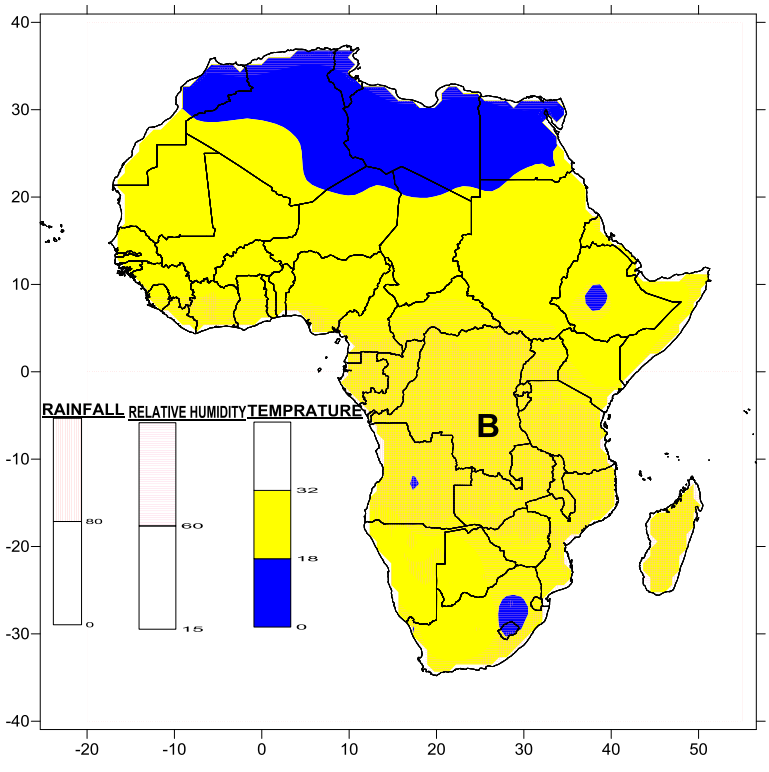
Temperature during March 2012



SOURCE:NOAA/NCEP-NCAR

The Temperatures map shows the Mean monthly temperature from NOAA/NCEP-NCAR. areas shaded in yellow color had monthly Mean temperature of 18 to 32 ^{o}c i.e. within the threshold of Mean monthly temperature .while areas shaded in deep blue color had monthly Mean temperature less than 18 ^{o}c. i.e. not in the threshold of temperature.

Monthly climatic suitability for malaria transmission for March 2012.

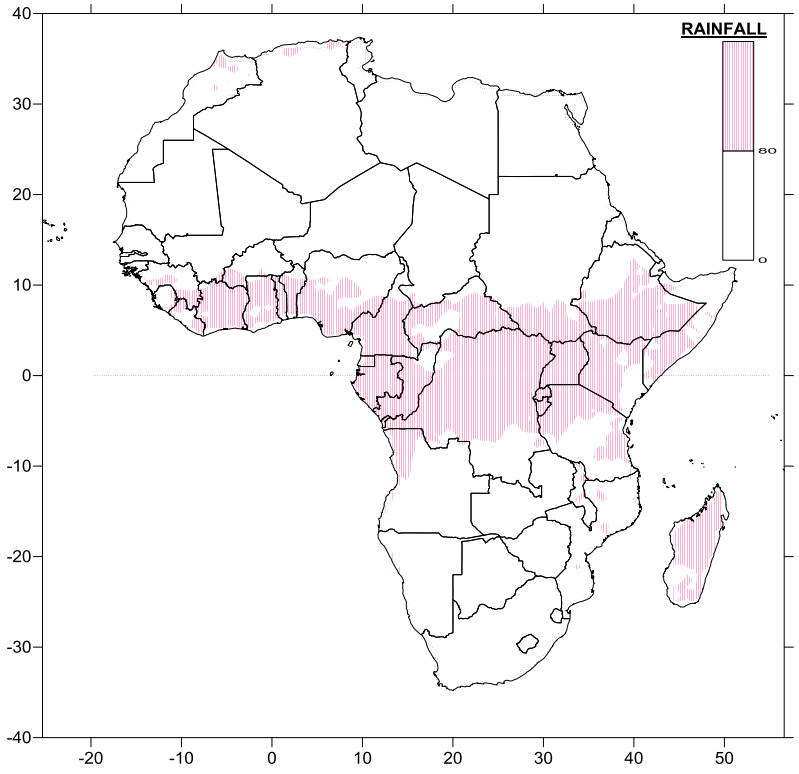


The thresholds of precipitation, temperature and relative humidity are used to assess climatic suitability of malaria transmission.

Figure B. the Combined temperature, rainfall and relative humidity analysis during March 2012. Areas under square patterns with yellowish background are assumed to satisfy Favorable climatic conditions for spread of malaria.

During March 2012 temperature between 18 and 32 degree Celsius, monthly total rainfall amount greater or equal to than 80 mm and the monthly average relative humidity exceeding or equal 60% over Madagascar, Congo, Zambia, some parts of Botswana, Mozambique, south eastern Africa, Democratic republic of Congo, Tanzania, Malawi, Northern Zimbabwe, southern Lesotho, Swaziland, south Cameron, south Nigeria, south central republic of Congo, Equatorial guinea, western Kenya, Uganda, Ruanda, Burundi, western Cote D'ivorie, Angola and Gabon of the continent. Hence climatologically, conditions were assumed to be suitable for the survival and distribution of malaria only with in the vicinity under square patterns of the above marked areas. **(The map is based on climate data and not based on the actual malaria data .so it may not shows all the actual malaria transmission status on the local scale.)**

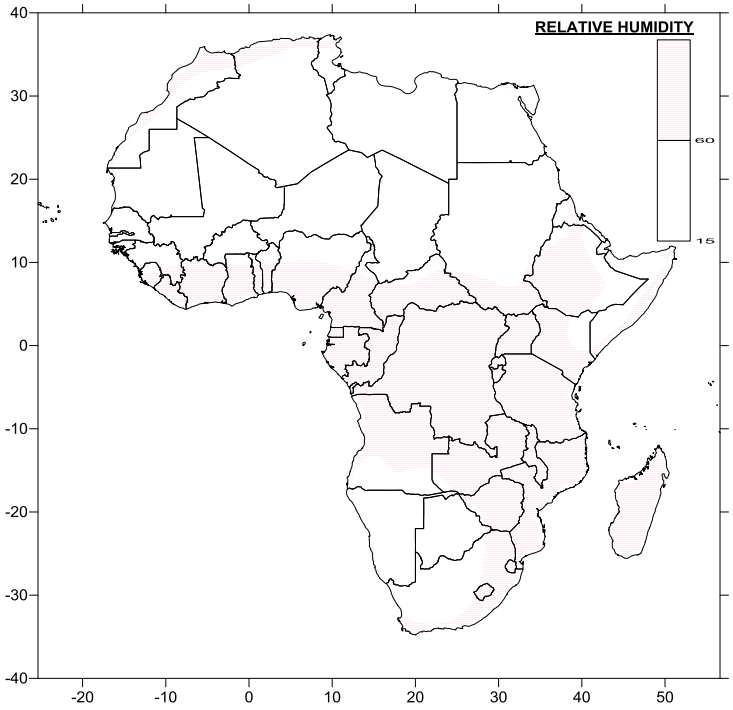
Rainfall estimate during April 2012



(FIG.D)SOURCE:NOAA/NCEP

The rainfall estimate map illustrates the total estimated precipitations from NOAA/NCEP. Hatched areas had monthly rainfall amounts of 80mm and above. The estimated precipitation increased northward and south western of the country while it decreased to the south ward of the continents as compared to the previous month. This situation creates positive impact for spread of malaria as precipitations increased whereas negative impact for spread of malaria as it decreased.

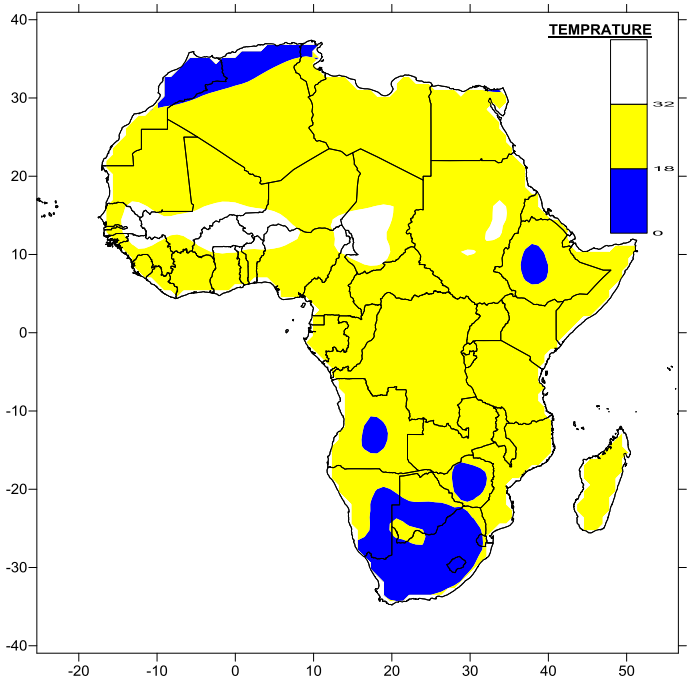
Relative humidity during April 2012



(FIG.E)SOURCE:NOAA/NCEP-NCAR

The relative humidity map illustrates the total average relative humidity from NOAA/NCEP-NCAR. Hatched areas had monthly relative humidity amounts of 60% and above. Monthly relative humidity of 60% and above increasing along south western of the country and eastern country of the continent from the previous month that creates favorable condition for spread of the mosquitos in those areas.

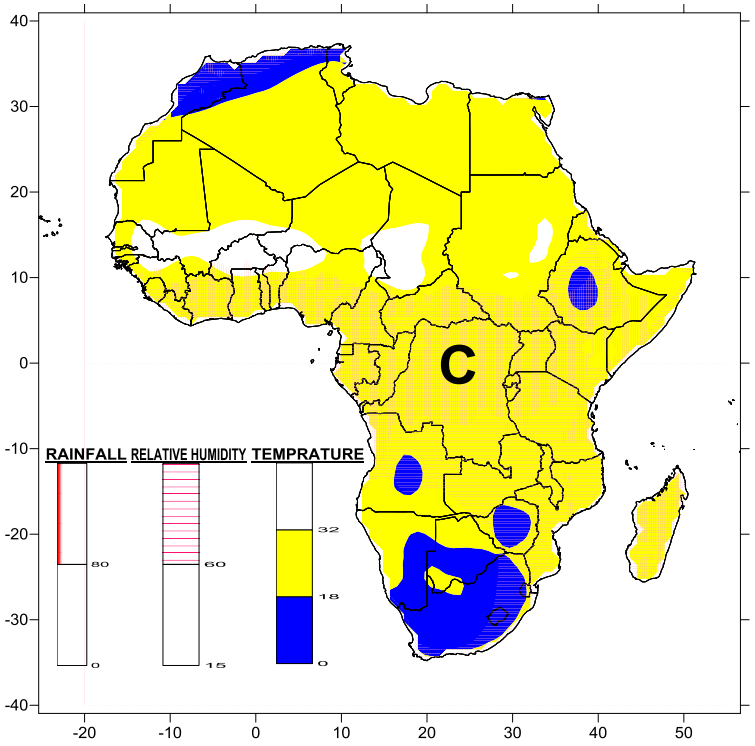
Temperature during April 2012



(FIG.F)SOURCE:NOAA/NCEP-NCAR

The Temperatures map shows the Mean monthly temperature from NOAA/NCEP-NCAR. areas shaded in yellow color had monthly Mean temperature of 18 to 32 ^{o}c .while areas shaded in deep blue color had monthly Mean temperature less than 18 ^{o}c. Temperature below the thresholds is increased in some of southern Africa countries this situation has negative impact for malaria spreading.

Monthly climatic suitability for malaria transmission for April 2012.



The thresholds of precipitation, temperature and relative humidity are used to assess climatic suitability of malaria transmission.

Figure B. the Combined temperature, rainfall and relative humidity analysis during April 2012. Areas under square patterns with yellowish background are assumed to satisfy Favorable climatic conditions for spread of malaria.

- During April 2012 temperature between 18 and 32 degree Celsius, monthly total rainfall amount greater or equal to 80 mm and the monthly average relative humidity exceeding or equal 60% over Madagascar, Congo, north east Mozambique, Democratic republic of Congo, Tanzania, Cameron, south Nigeria, central republic of Congo, Equatorial guinea, Kenya, Ethiopia, east Somali, south Sudan, Liberia, sierra Leon, Benin, Togo, Uganda, Ruanda, Burundi, Cote D'ivorie, northern Angola and Gabon of the continent. Hence climatologically, conditions were assumed to be suitable for the survival and distribution of malaria only with in the vicinity under square patterns of the above marked areas. Based on the above specifications, there was no area which satisfies the above three conditions during April 2012(FIG.C.) **The map is based on climate data and not based on the actual malaria data .so it may not shows all the actual malaria transmission status on the local scale.**

- The same principle is directly applied on the above indicated parameters (Rainfall, Temperature and Humidity) in Ethiopia to identify malaria prone areas but the difference from the above interactive map of Africa and Ethiopia is the methodology of data used. Ethiopia used the actual observation data that collected from all the possible areas of the country.to made above interactive map of Africa data is from the NOAA satellite estimated data of (Rainfall, Temperature and Humidity).

Objective

The major objective of this bulletin is of diversifying climate application products to the basic developmental sectors. This bulletin can be a very important source of information to Health professionals who served in the monitoring of Public Health.

Conclusion

This bulletin aims to inform users about the climate-health relationship with focus on the monthly nature of that relationship, where appropriate. Climate related diseases mostly seasonal in nature once it happens it has probability of staying in the season.
Since the monitoring of temperature, relative humidity and rainfall over a given area can be used to assess the likelihood of outbreak of Malaria with minimum of a lag of two months, this information can be an important for early warning tool.

Reference

Reference: - **Grover-Kopec et al. 2006** - Web-based climate information resources for malaria control in Africa, Malar J. 2006; 5: 38. Published online 2006 December11. doi: 10.1186/1475-2875-5-

Annex:

Rainfall

Call data and plot on surfer

- Grid
- Data
- File name...open
- Data interpolation X (-2O,55), Y(0,40)…..OK
- Grid
- Spline smooth
- Open Grid…..OPEN
- Spline smooth output grid file SAVE
- Spline smooth OK
- Grid
- Blank
- Open Grid Data file
- File name (Africa_blank.bln) OPEN
- Save Grid
- **REPEAT THE PROCESSES FOR ALL COORDINATES as in excel**
- Map
- Contour Map
- New Contour Map
- Open grid….OPEN
- contour map properties
- tick smooth contours
- tick fill contours
- tick color scale
- Levels
- Give different color for the levels
- Apply …ok
- **REPEAT FOR ALL GRID FILES**

- **MAP**
- **Base map**
- **Afr_nat.bna….ok**
- **Edit select all**
- **Map**
- **Overlay maps and save the map**

- Make interpretations on the plot map

Temperature

Call data and plot on surfer

- Grid
- Data
- File name...open
- Data interpolation X (-2O,55), Y(-40,40)…..OK
- Grid
- Spline smooth
- Open Grid…..OPEN
- Spline smooth output grid file SAVE
- Spline smooth OK
- Grid
- Blank
- Open Grid Data file
- File name (Africa_blank.bln) OPEN
- Save Grid
- Map
- Contour Map
- New Contour Map
- Open grid….OPEN
- contour map properties
- tick smooth contours
- tick fill contours
- tick color scale
- Levels
- Give different color for the levels
- Apply …ok

- **MAP**
- **Base map**
- **Afr_nat.bna….ok**
- **Edit select all**
- **Map**

- **Overlay maps and save the map**

- Make interpretations on the plot map

Relative humidity

Call data and plot on surfer

- Grid
- Data
- File name...open
- Data interpolation X (-2O,55), Y(-40,40)…..OK
- Grid
- Spline smooth
- Open Grid…..OPEN
- Spline smooth output grid file SAVE
- Spline smooth OK
- Grid
- Blank
- Open Grid Data file
- File name (Africa_blank.bln) OPEN
- Save Grid
- Map
- Contour Map
- New Contour Map
- Open grid….OPEN
- contour map properties
- tick smooth contours
- tick fill contours
- tick color scale
- Levels
- Give different color for the levels

- Apply …ok
- **MAP**
- **Base map**
- **Afr_nat.bna….ok**
- **Edit select all**
- **Map**
- **Overlay maps and save the map**

- Make interpretations on the plot map