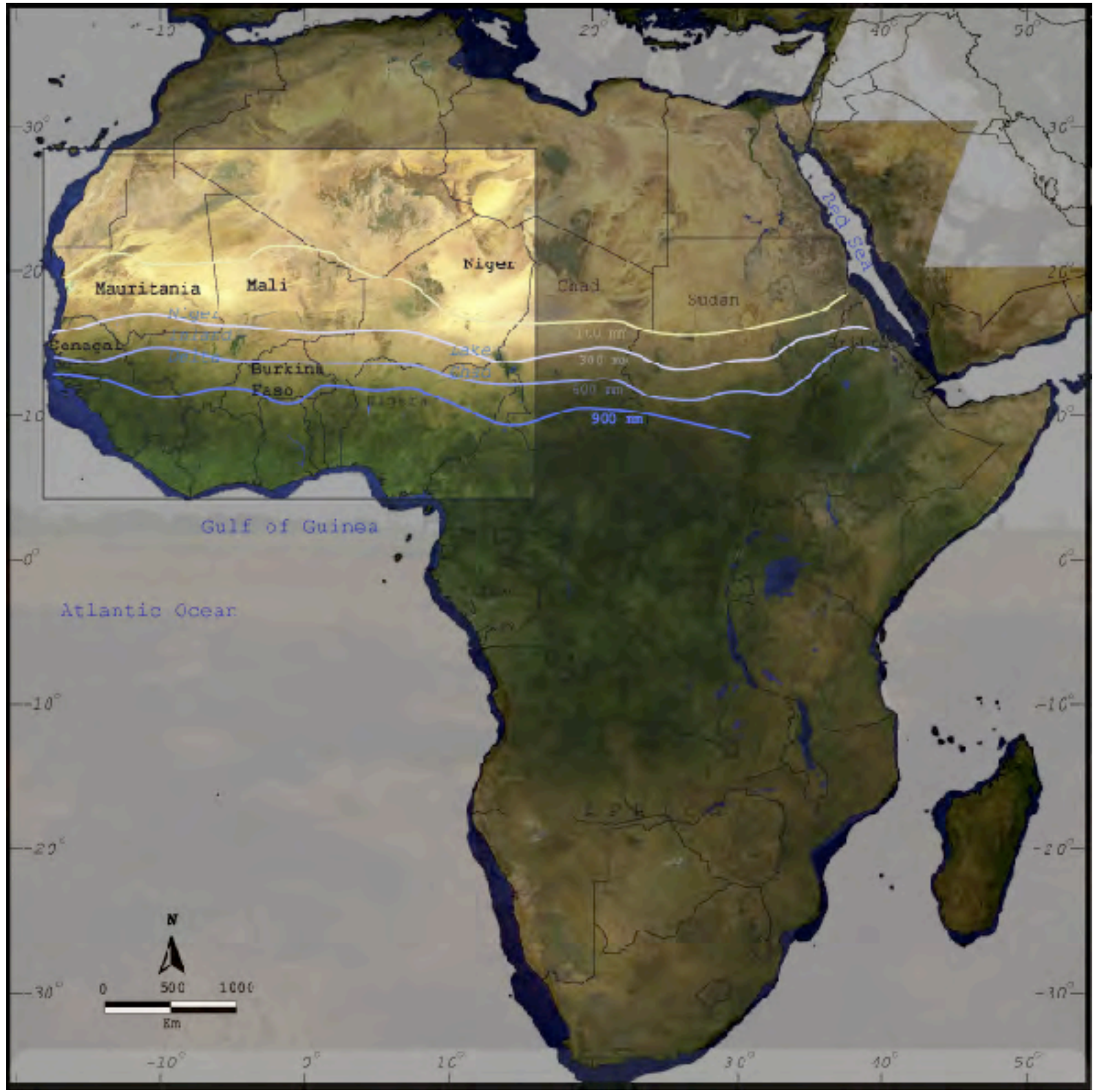
West Africa Sahel
Changing landscapes

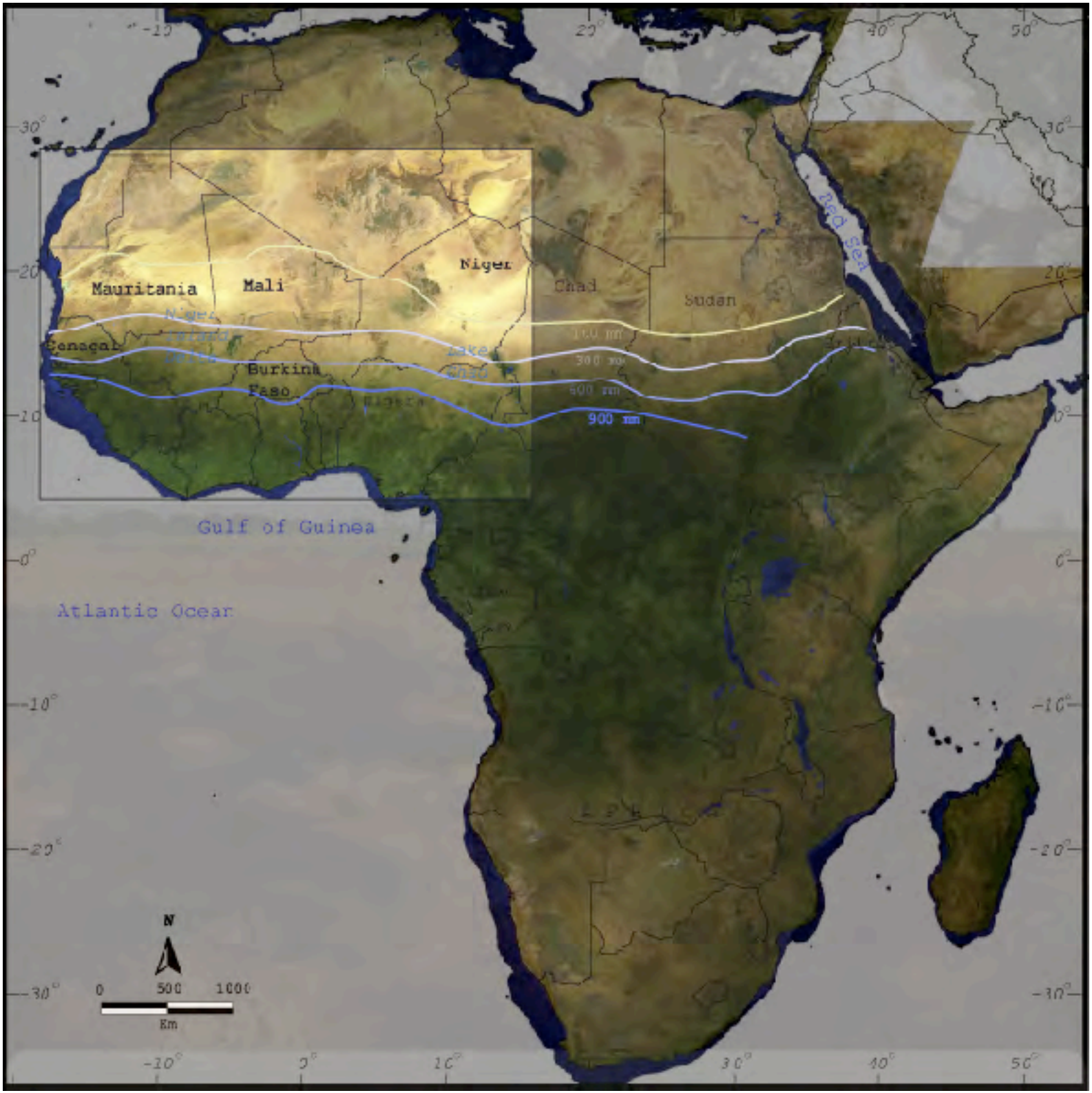
The West Africa
Drylands Project by
UNEP and ICRAF

ICRAF Science forum 2009
Thomas Gumbricht, GRP 4


I am really bad at speaking before an audience (it's genetic in my family), but it might work
ICRAF Science forum 2009
Thomas Gumbricht, GRP 4


Mauritania
Mali
Niger
Chad
Sudan
Red Sea
Senegal
Burkina Faso
Lake Chad
100 mm
300 mm
400 mm
900 mm
Gulf of Guinea
Atlantic Ocean
N
0
500
1000
Km

Sahel is the transition region between woodlands in the south and the Sahara Desert in the North. It is bounded by rainfall limits of approximately 100 to 800 mm per year



Rainfall over West Africa in February 2004, the orange arrows indicate the hot and dry Harmattan trade wind dominating the climate of West Africa in the dry season.

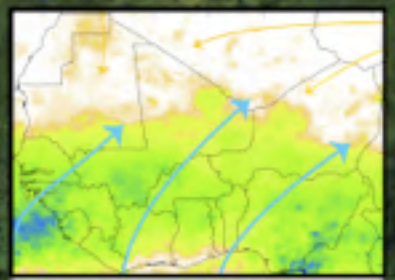
The winter (February image) is dry with the hot Harmattan wind blowing from the Sahara

MODIS reflectance image
(we have one of these for each week going back to 2000)

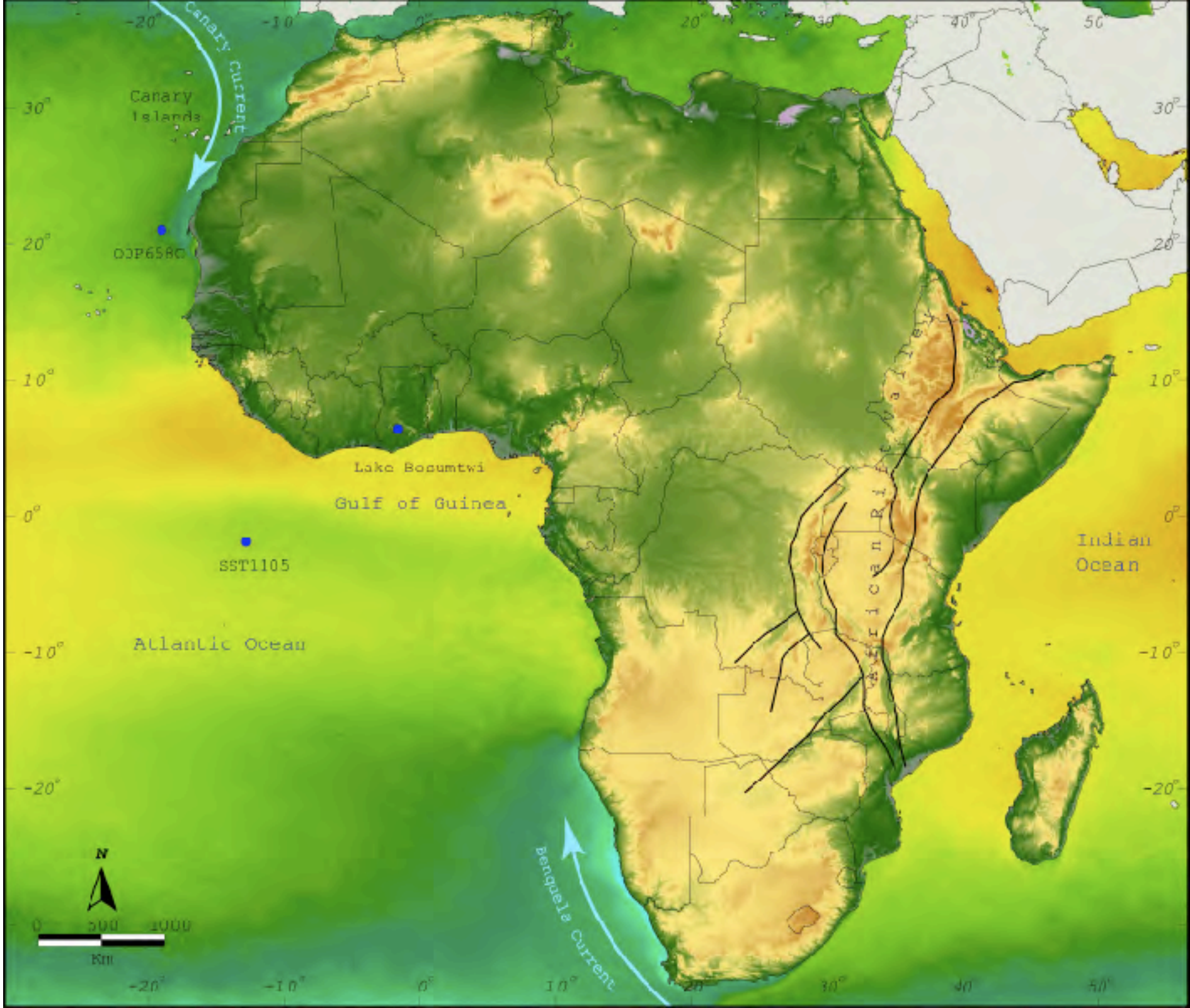
Rainfall over West Africa in February 2004, the orange arrows indicate the hot and dry Harmattan trade wind dominating the climate of West Africa in the dry season.

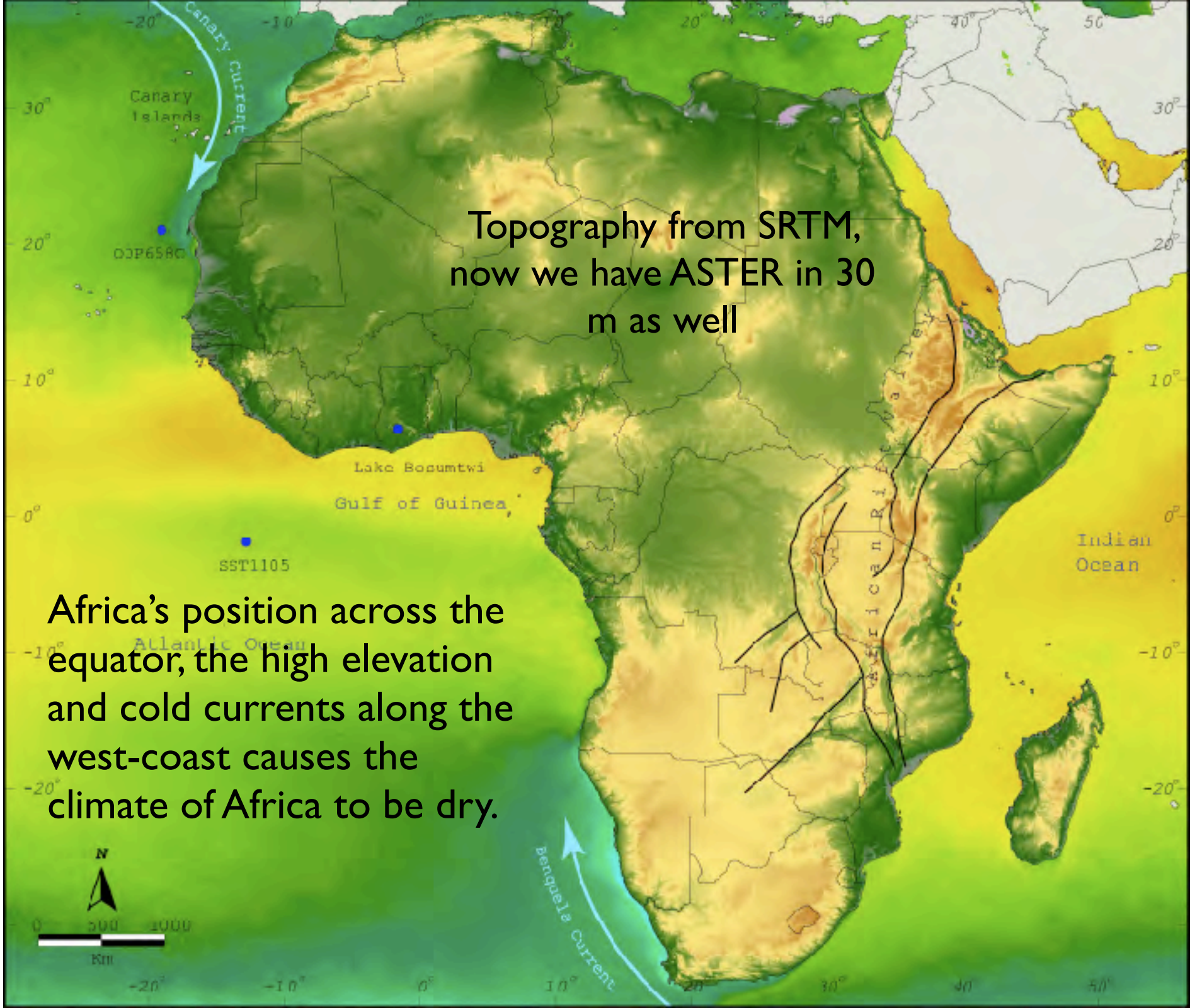
Rainfall over West Africa in August 2004, the blue arrows indicate the wet monsoon bringing rainfall to the Sahel in the wet season.

The summer (August image) is wet with the doldrums or tropical rain (or ITCZ) belt bringing rain laden winds from the Atlantic



Rainfall over West Africa in August 2004, the blue arrows indicate the wet monsoon bringing rainfall to the Sahel in the wet season.

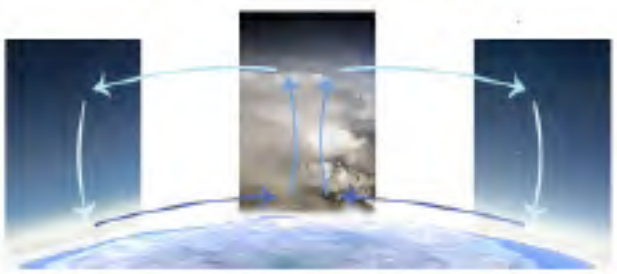

Canary Current
Canary Islands
ODP658C
Lake Bosumtwi
Gulf of Guinea
SST1105
Atlantic Ocean
Indian Ocean
African Rift Valley
Benguela Current
N
0
500
1000
Km



Topography from SRTM, now we have ASTER in 30 m as well

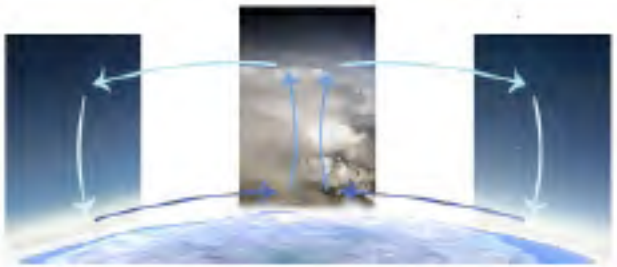
Africa's position across the equator, the high elevation and cold currents along the west-coast causes the climate of Africa to be dry.

Recent climate variations in Africa are forces externally by the changes in sea surface temperature



Hadley cells with the doldrums (ITCZ) at the equator

Recent climate variations in Africa are forces externally by the changes in sea surface temperature



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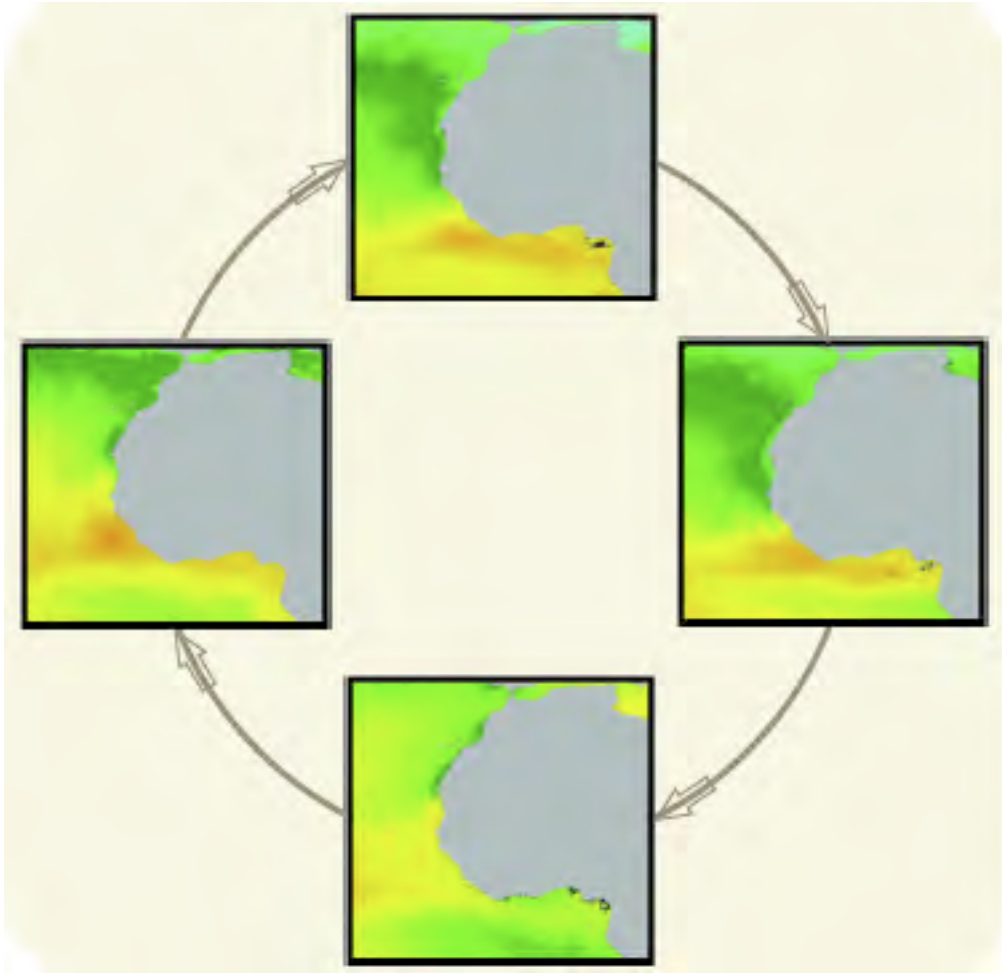
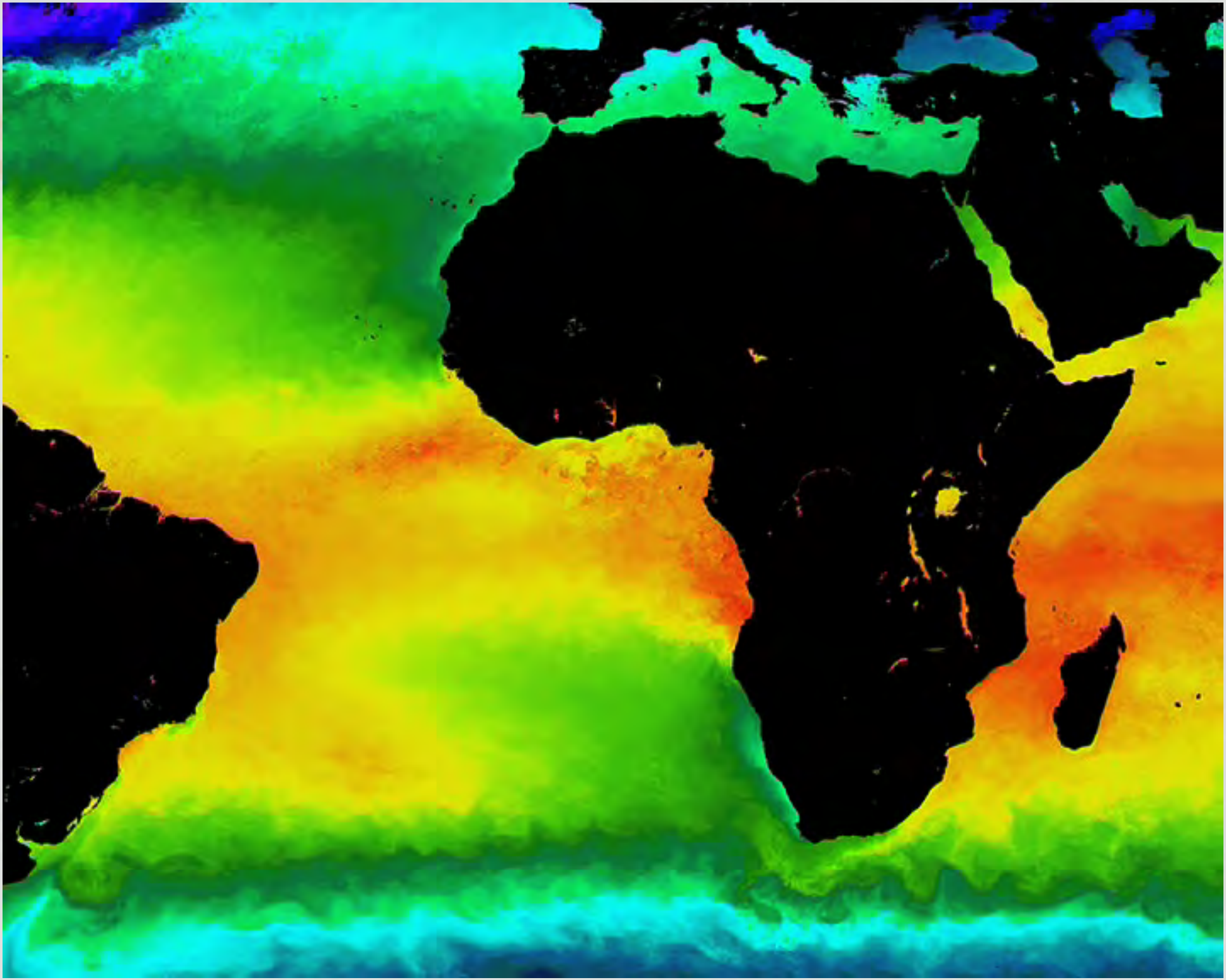
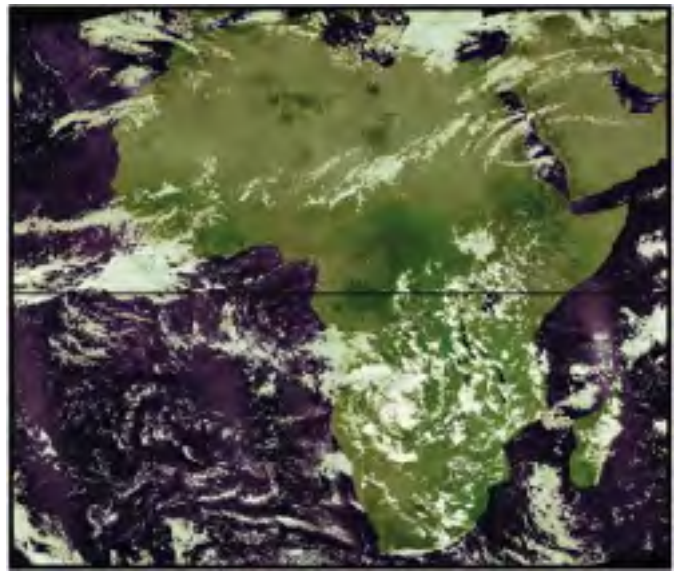


The annual sea surface temperature cycle in the Atlantic Ocean outside West Africa

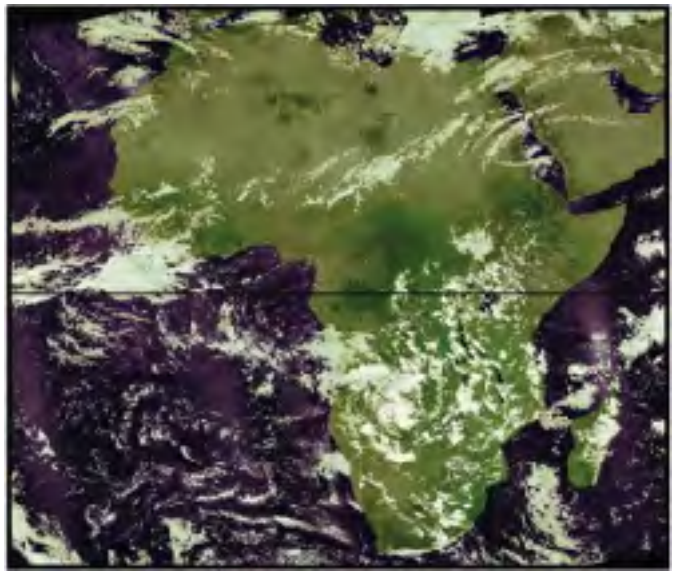


The seasonal changes in rainfall are driven by the oscillation of the ITCZ

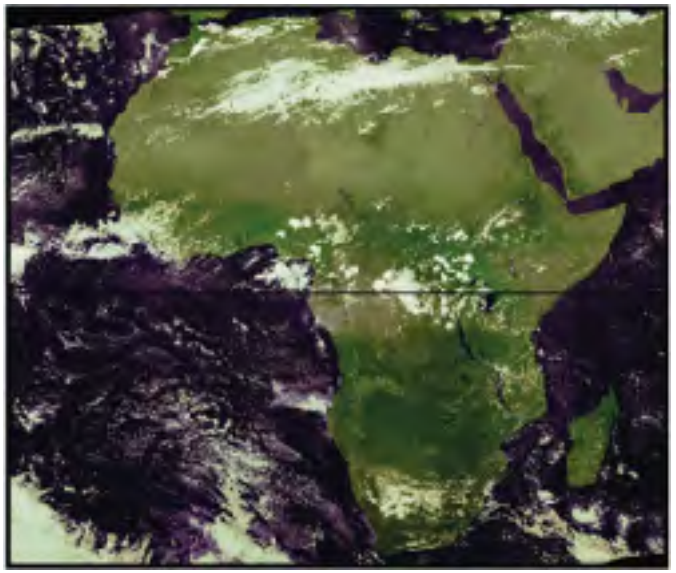


February

The seasonal changes in rainfall are driven by the oscillation of the ITCZ



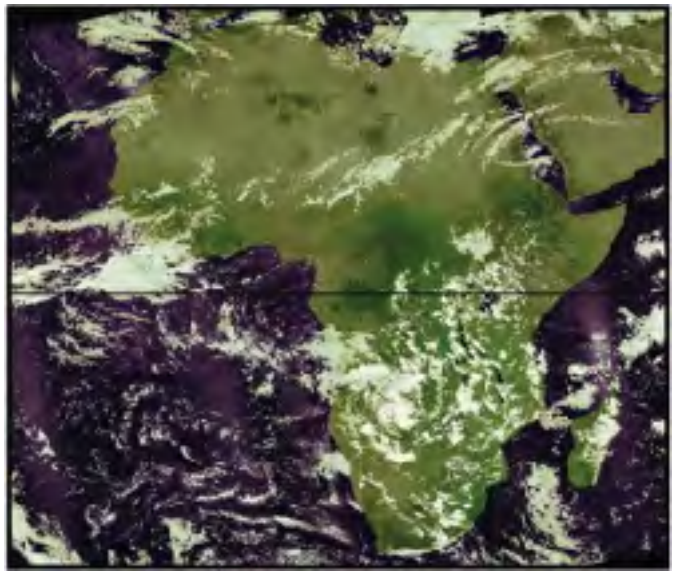
February

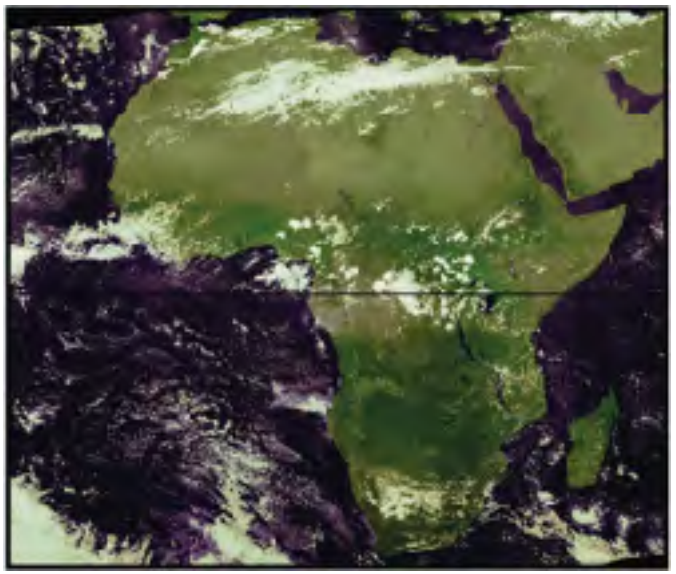


May

The seasonal changes in rainfall are driven by the oscillation of the ITCZ

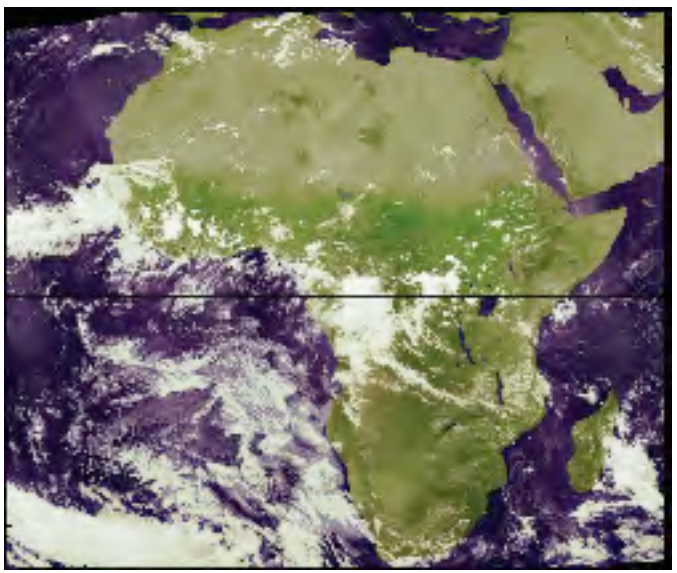
February





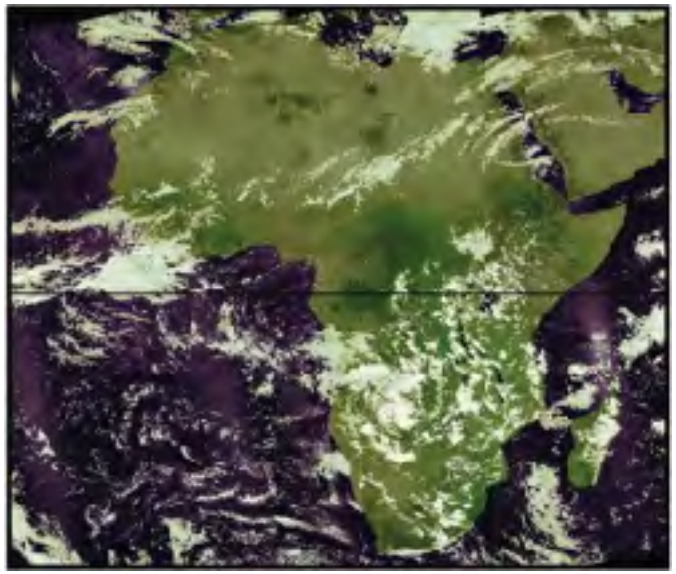
May

August

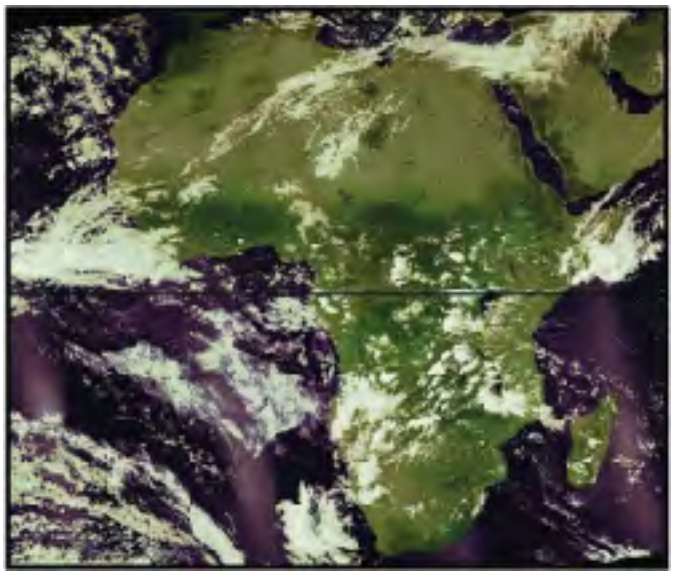


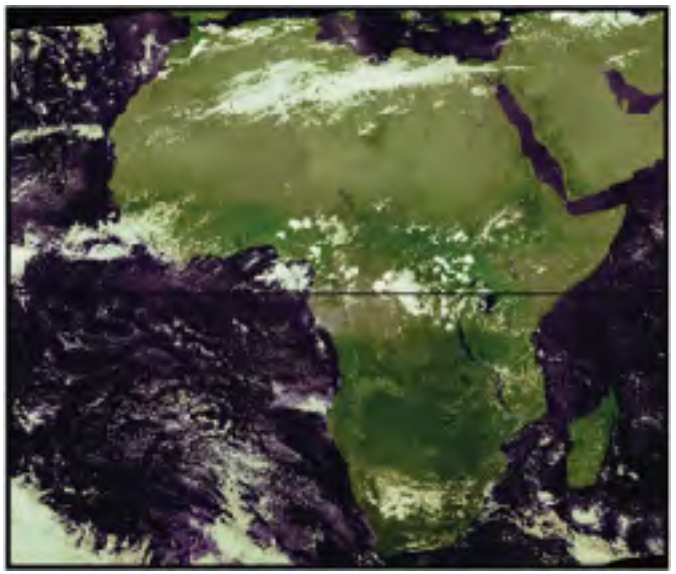
The seasonal changes in rainfall are driven by the oscillation of the ITCZ

February



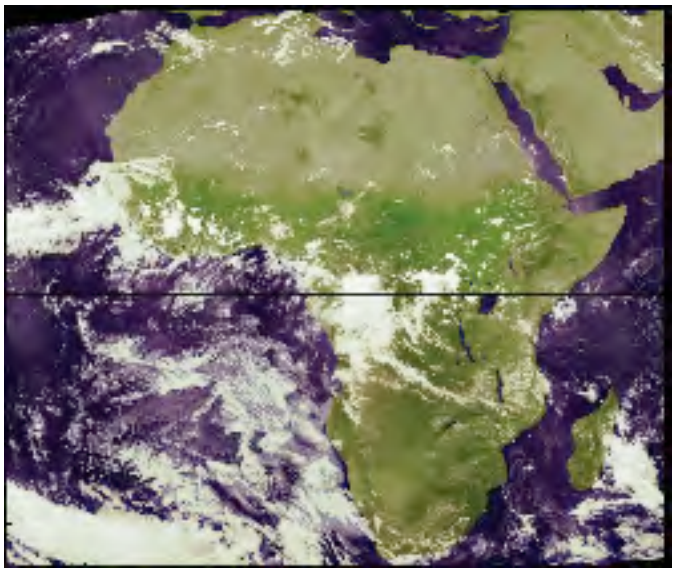
November





May

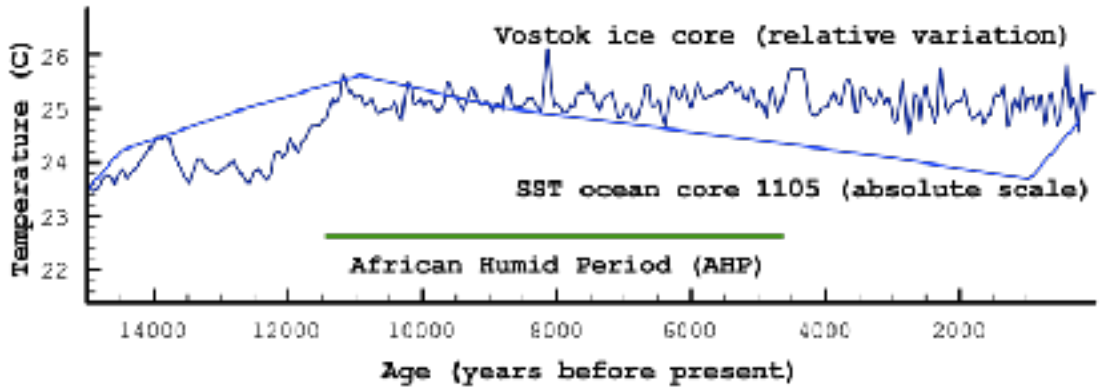
August



NOAA-AVHRR satellite image in 4 km resolution (1 per day since 1980)

The Sahel has a long history of flip-flop climate

The ice age was followed by the African Humid Period that came to an end about 5000 years ago



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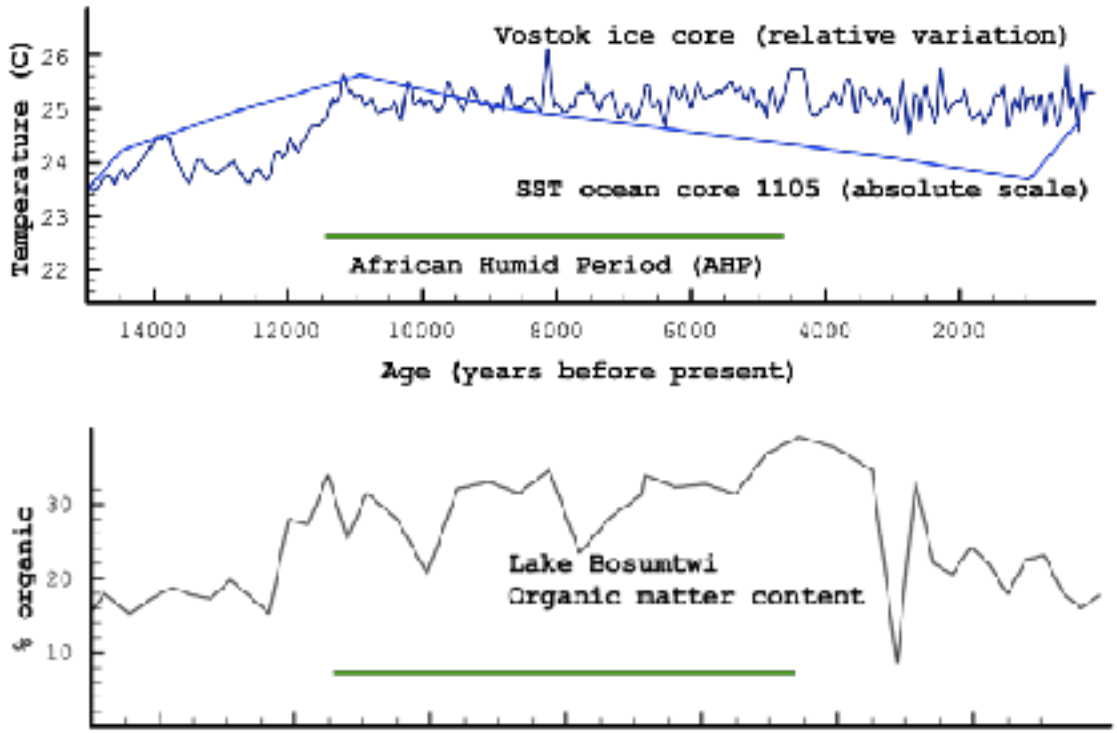

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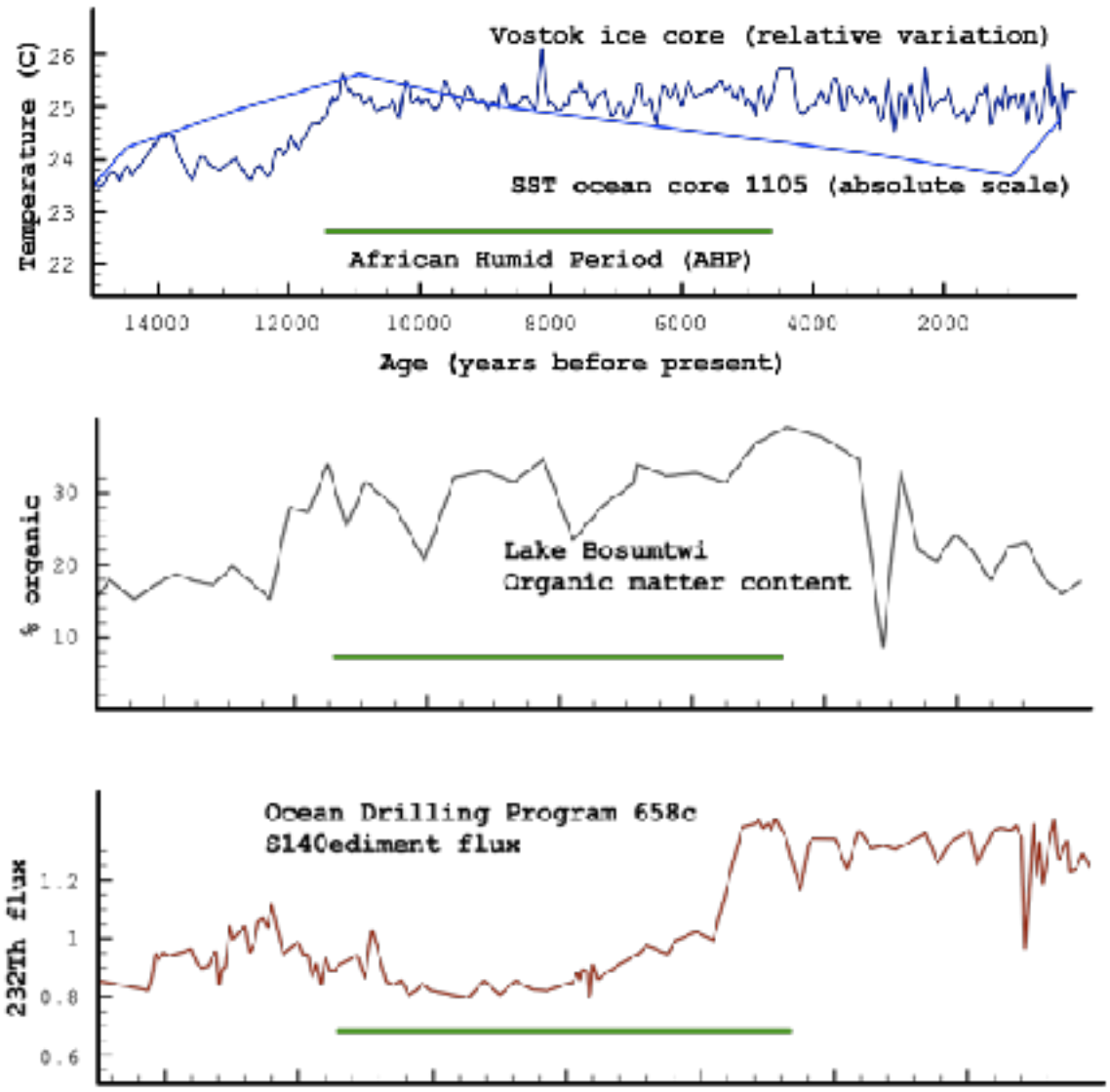

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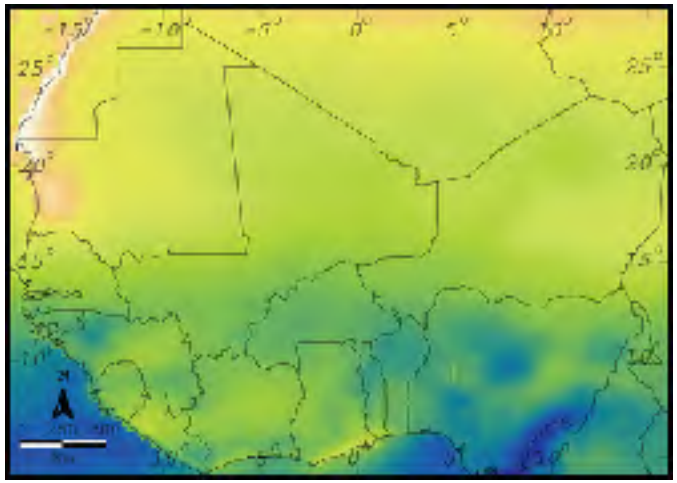
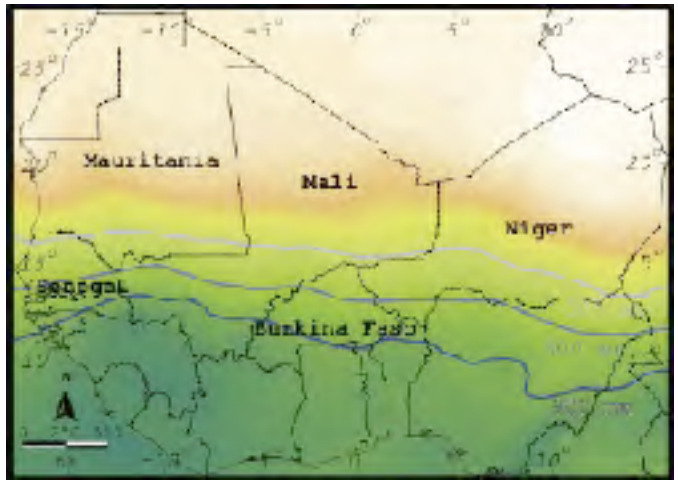
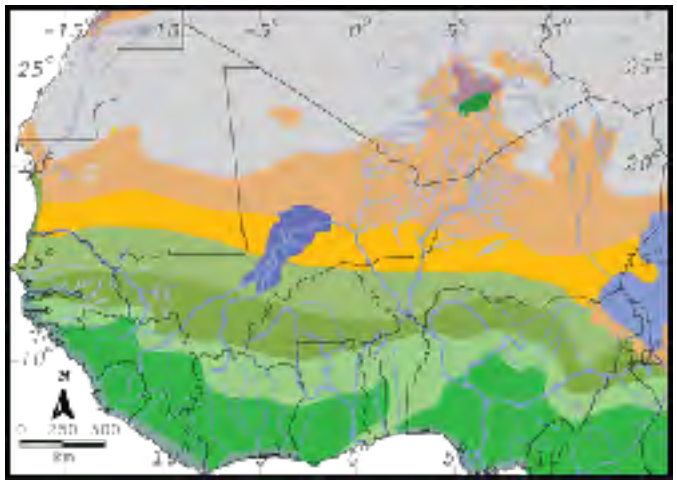
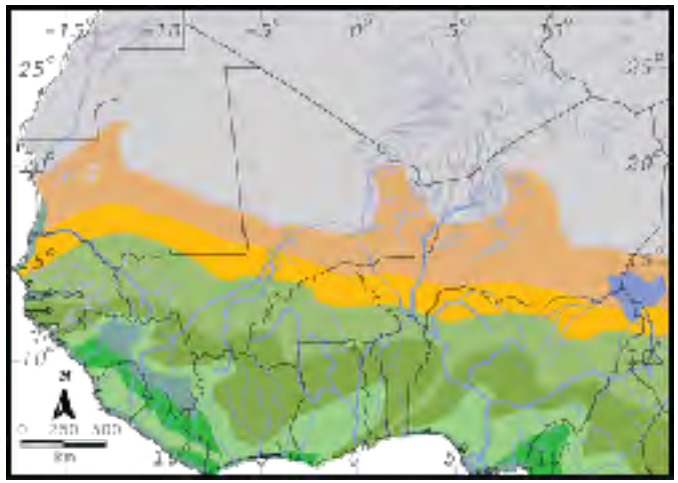


Rainfall





Vegetation classes

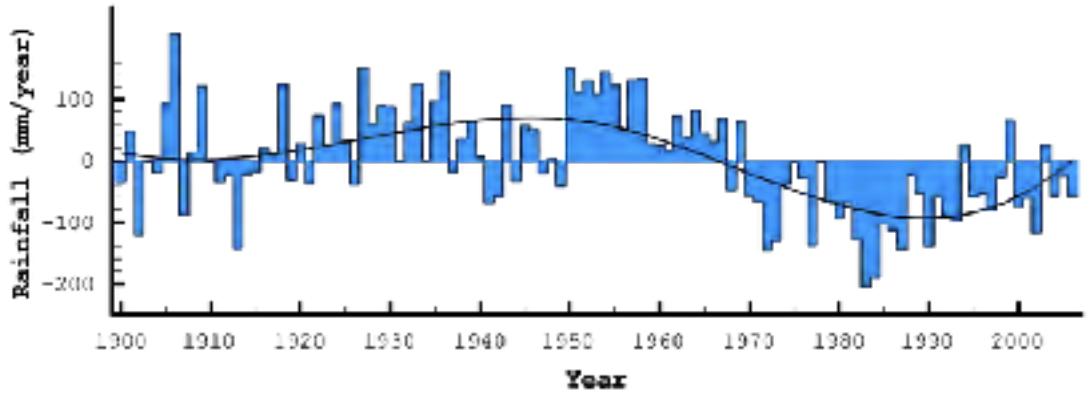


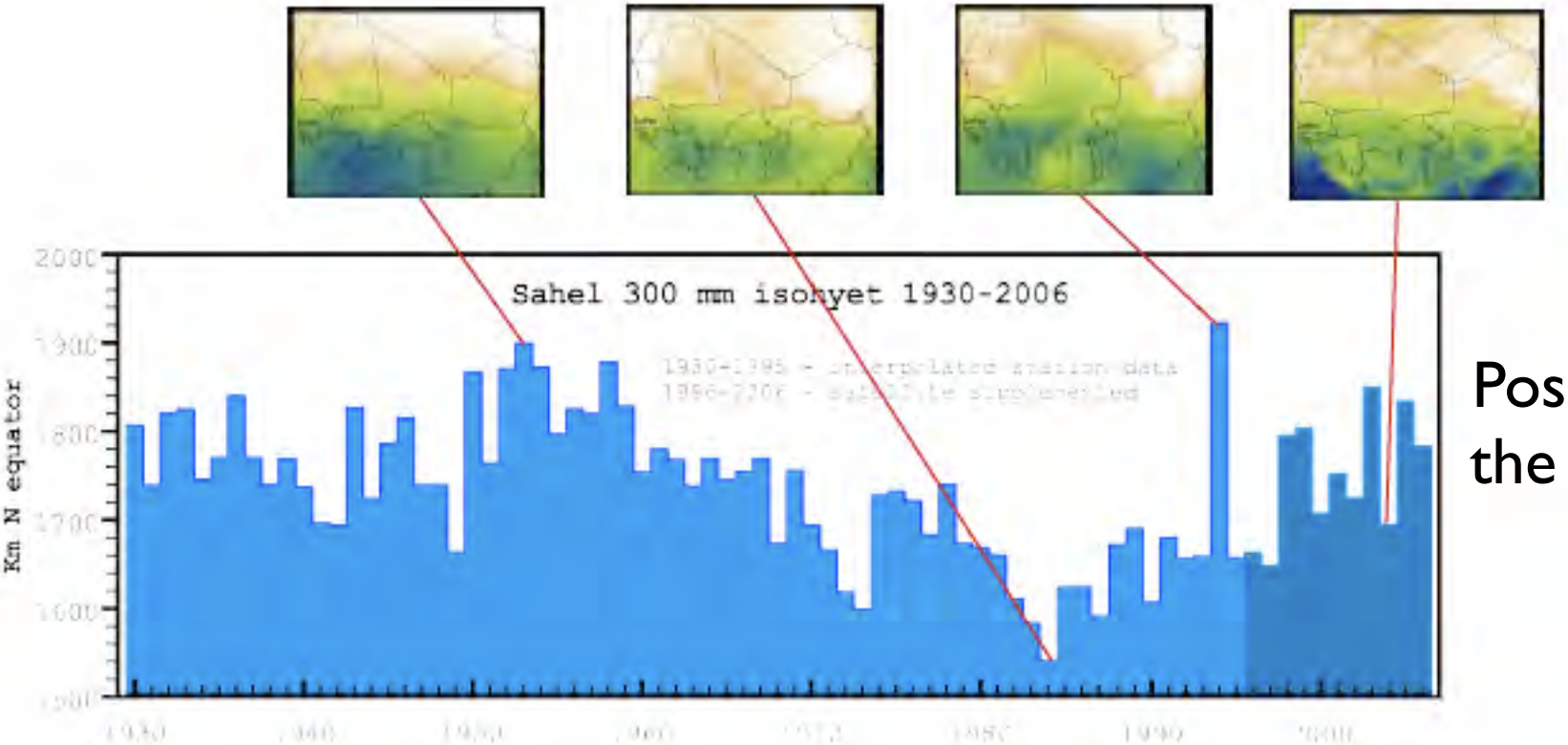
African Humid Period

Present situation

Climate variations in the Sahel over the last century

Rainfall record data and spline trend

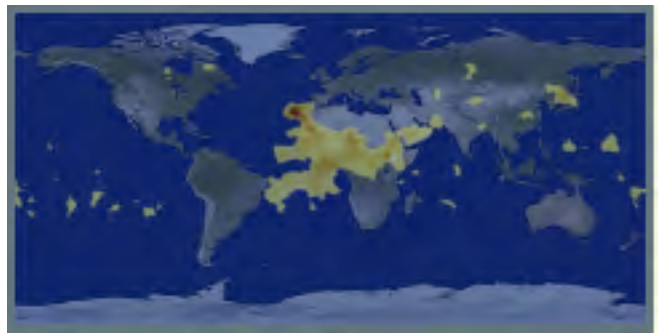


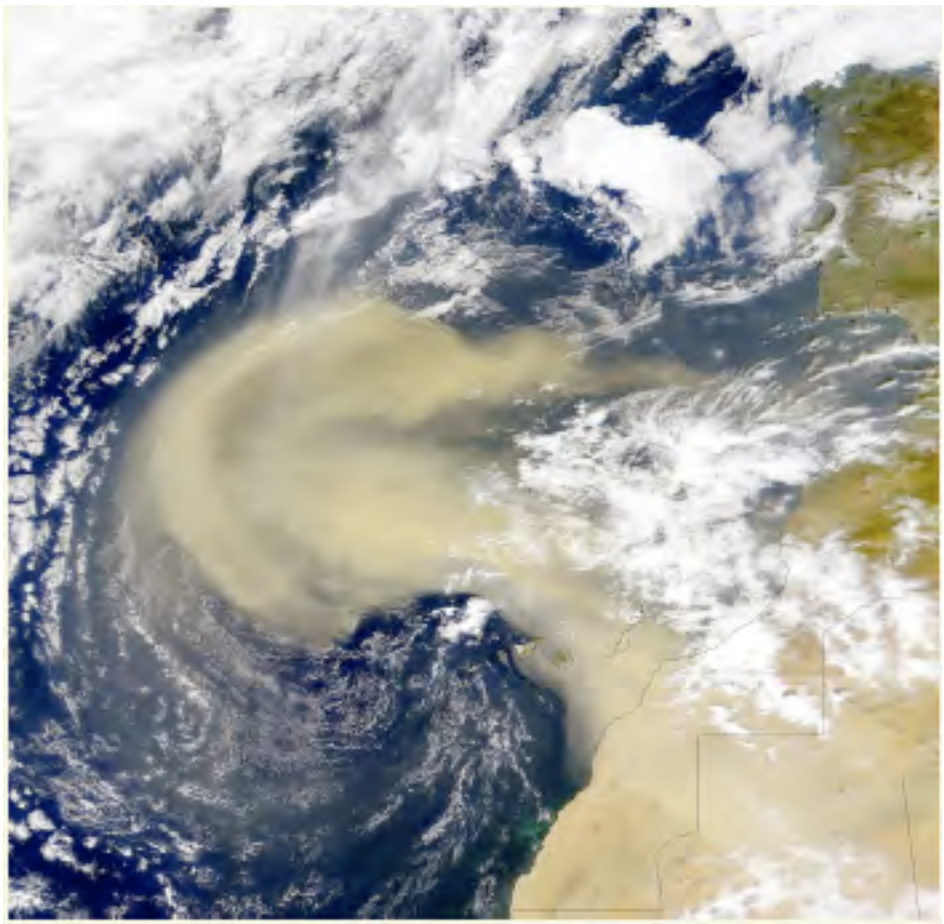


Positional change in the 300 mm isohyet

Internal feedback in climate variations?

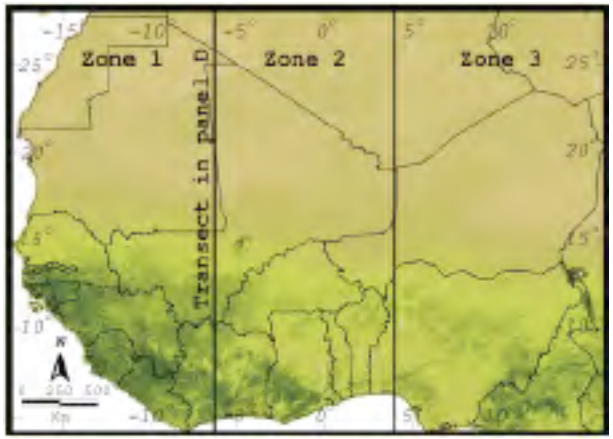
Toms data showing aerosol depth in February 2000





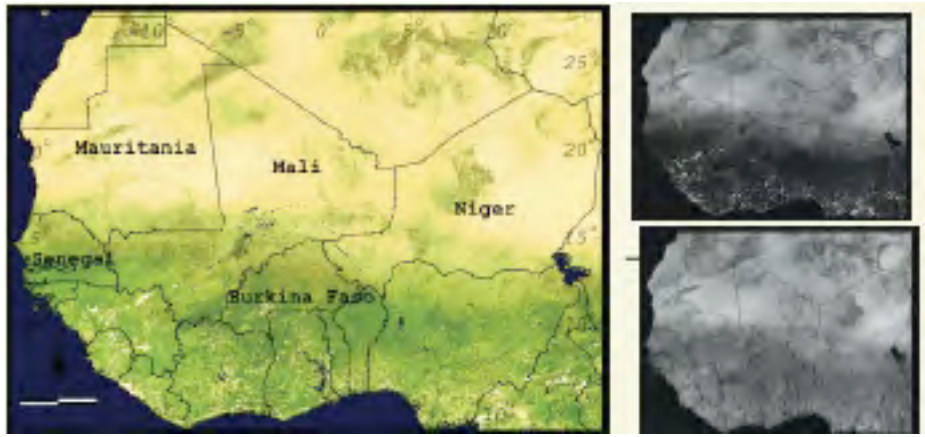
SeaWifs image showing dust storm from the Sahara reaching out over the Atlantic Ocean

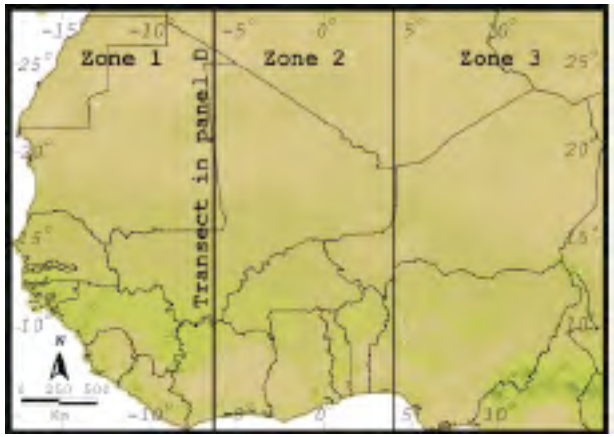
Using satellite vegetation data to trace land degradation



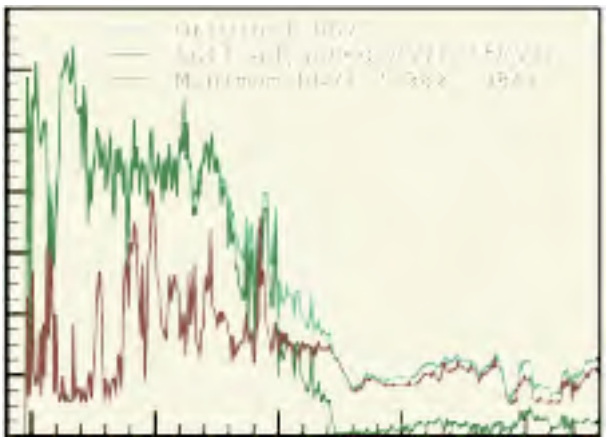
Raw NDVI

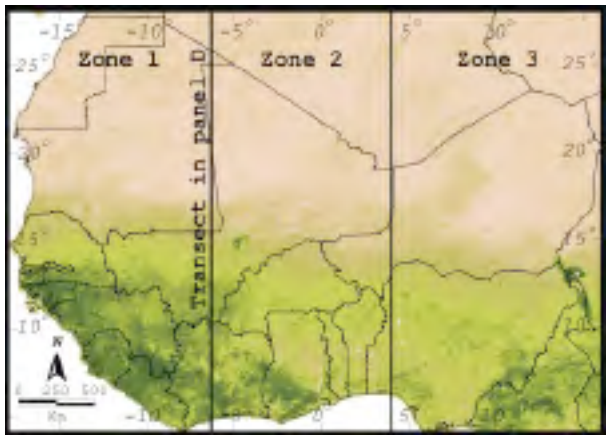
NOAA-AVHRR





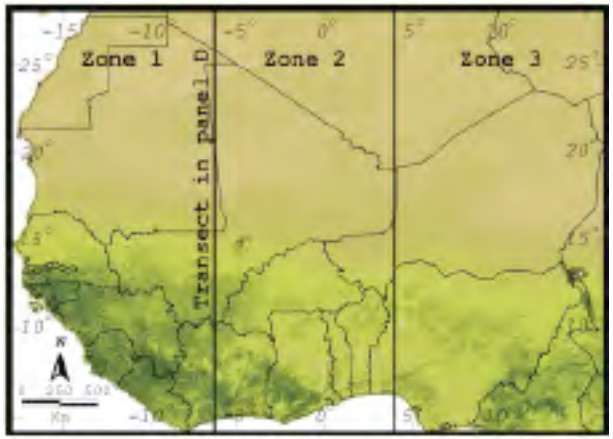
Minimum NDVI





Adjusted NDVI

Using satellite vegetation data to trace land degradation



Raw NDVI

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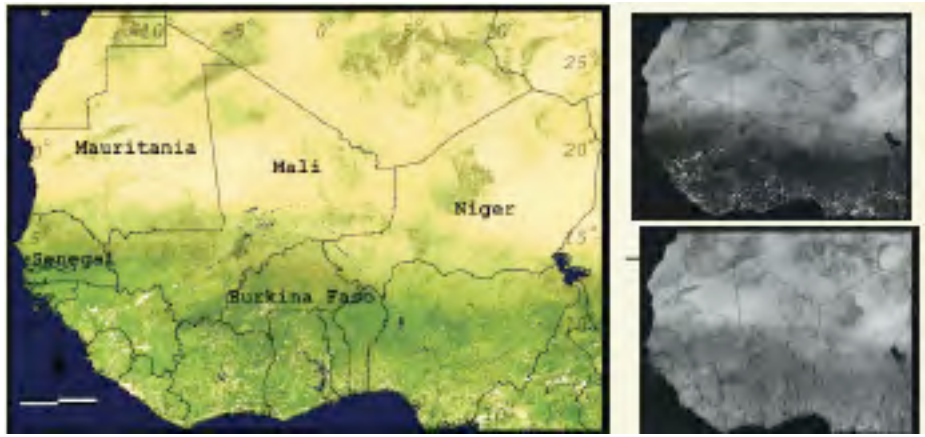
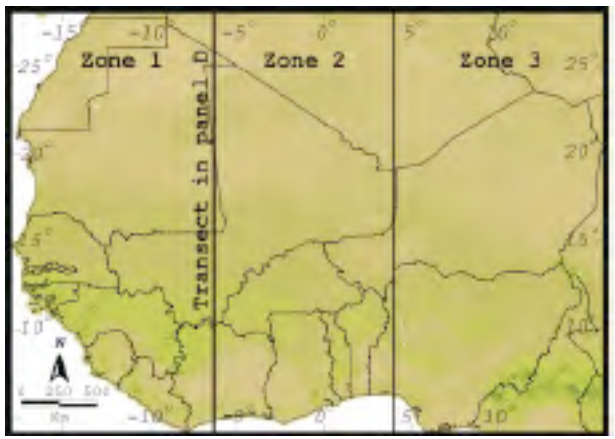
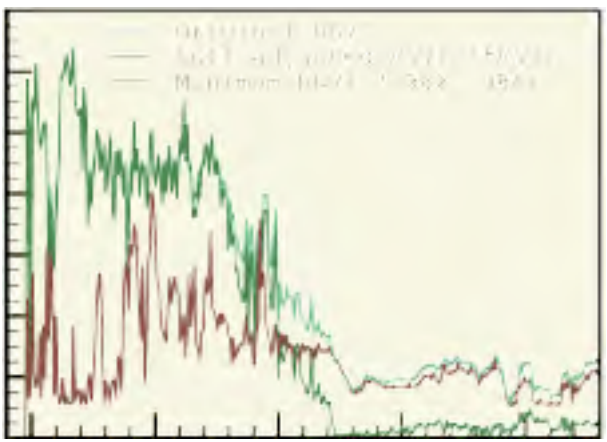
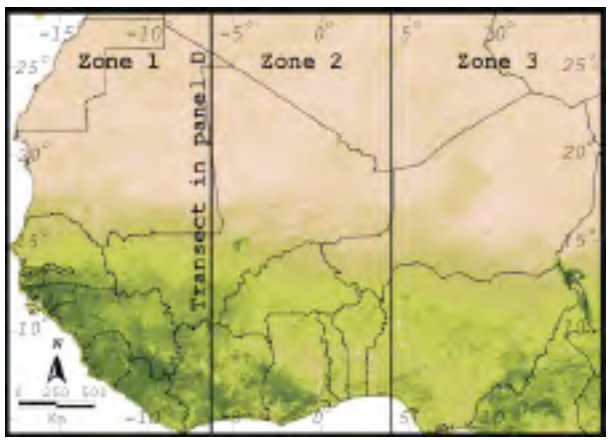




Minimum NDVI

These NDVI images are 10-day composites (available from 1981)

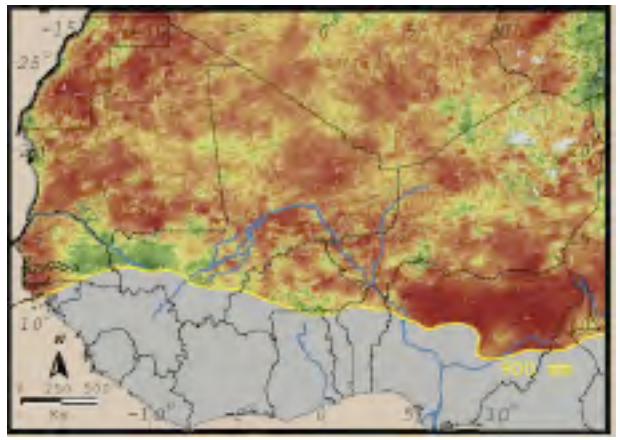




Adjusted NDVI

Using satellite vegetation data to trace land degradation

Trend in vegetation growth 1982-2006

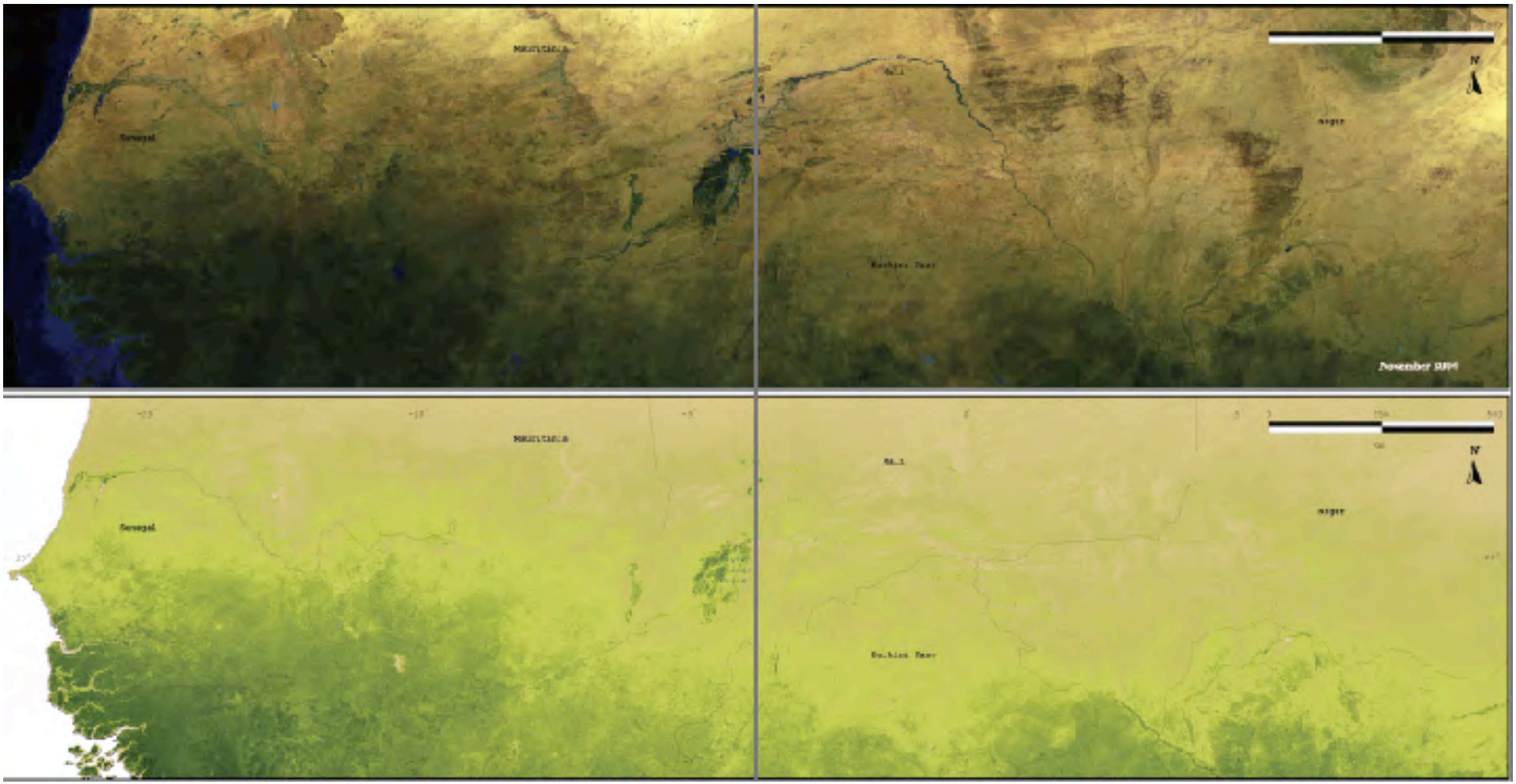


Trend in rain normalised vegetation growth 1982-2006

AVHRR NDVI

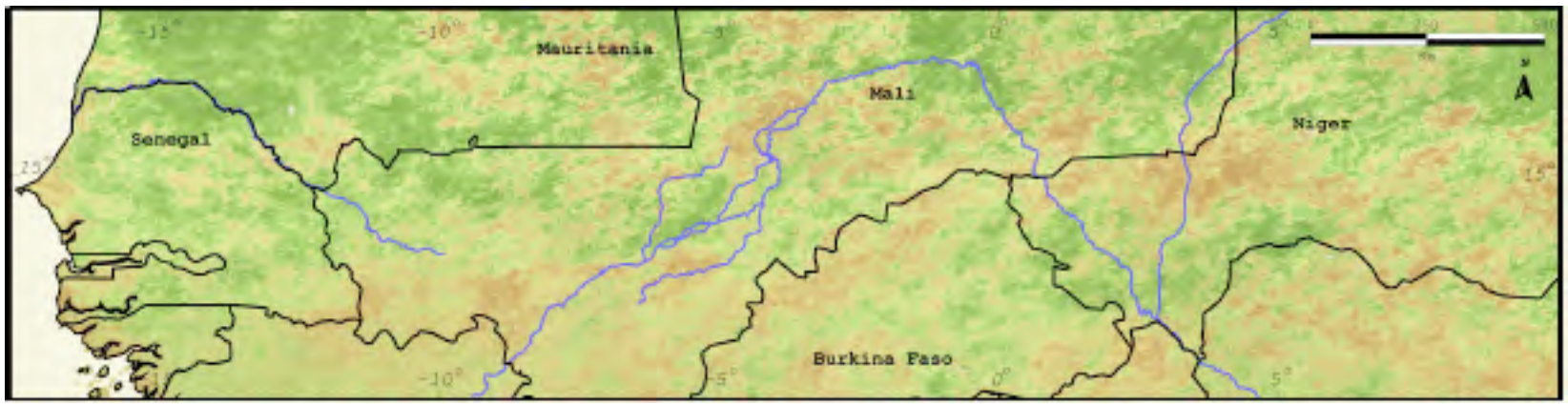
Using satellite vegetation data to trace land degradation

MODIS EVI



Using satellite vegetation data to trace land degradation

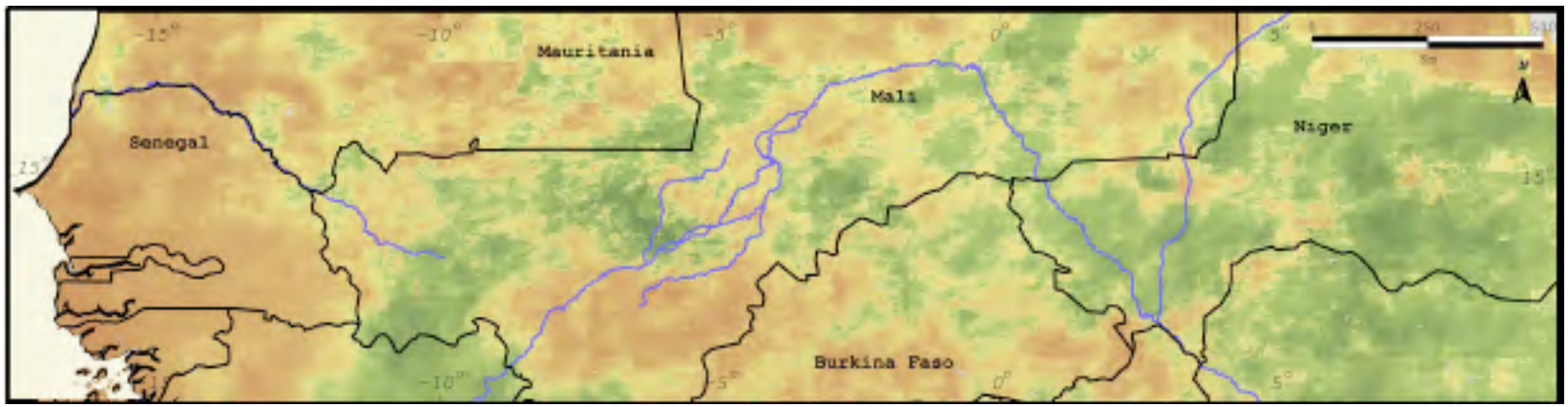
Average EVI 2001-2006



Trend in average EVI 2001-2006

Using satellite vegetation data to trace land degradation

Average rain normalised EVI 2001-2006



Trend in average rain normalised EVI 2001-2006

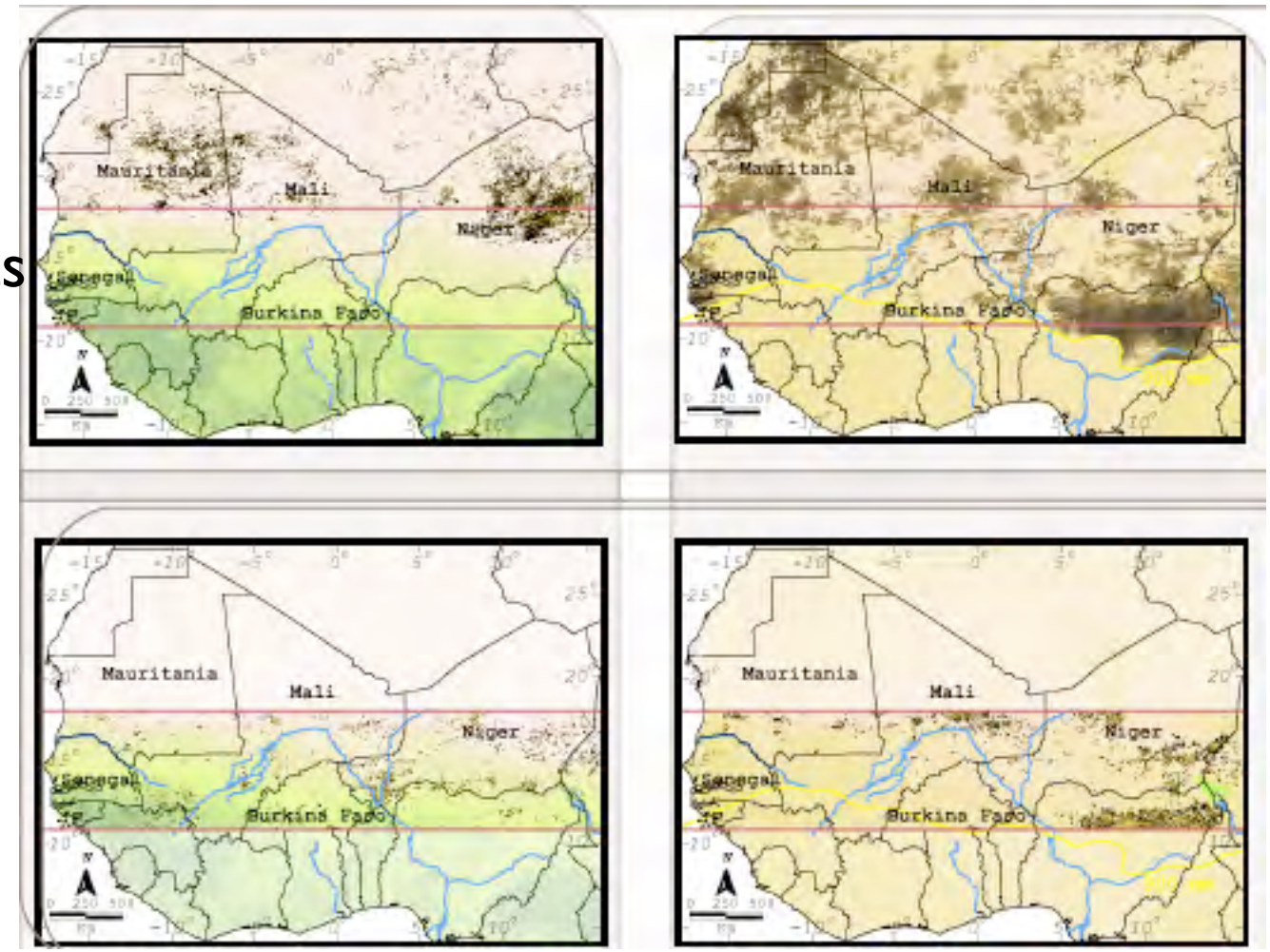
Identifying potential land degradation hotspots

Absolute greening/ browning

Rain normalised

Multi Criteria Evaluation using normalised trends as factors

Trends in spatial ranking



Identifying potential land degradation hotspots

MCE of trends in rain normalised EVI

Illustration of the MODIS reflectance data - here showing the annual seasons around Lake Tanganyika

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illustrating the correction and use of Landsat timeseries data (Mt Kilimanjaro)

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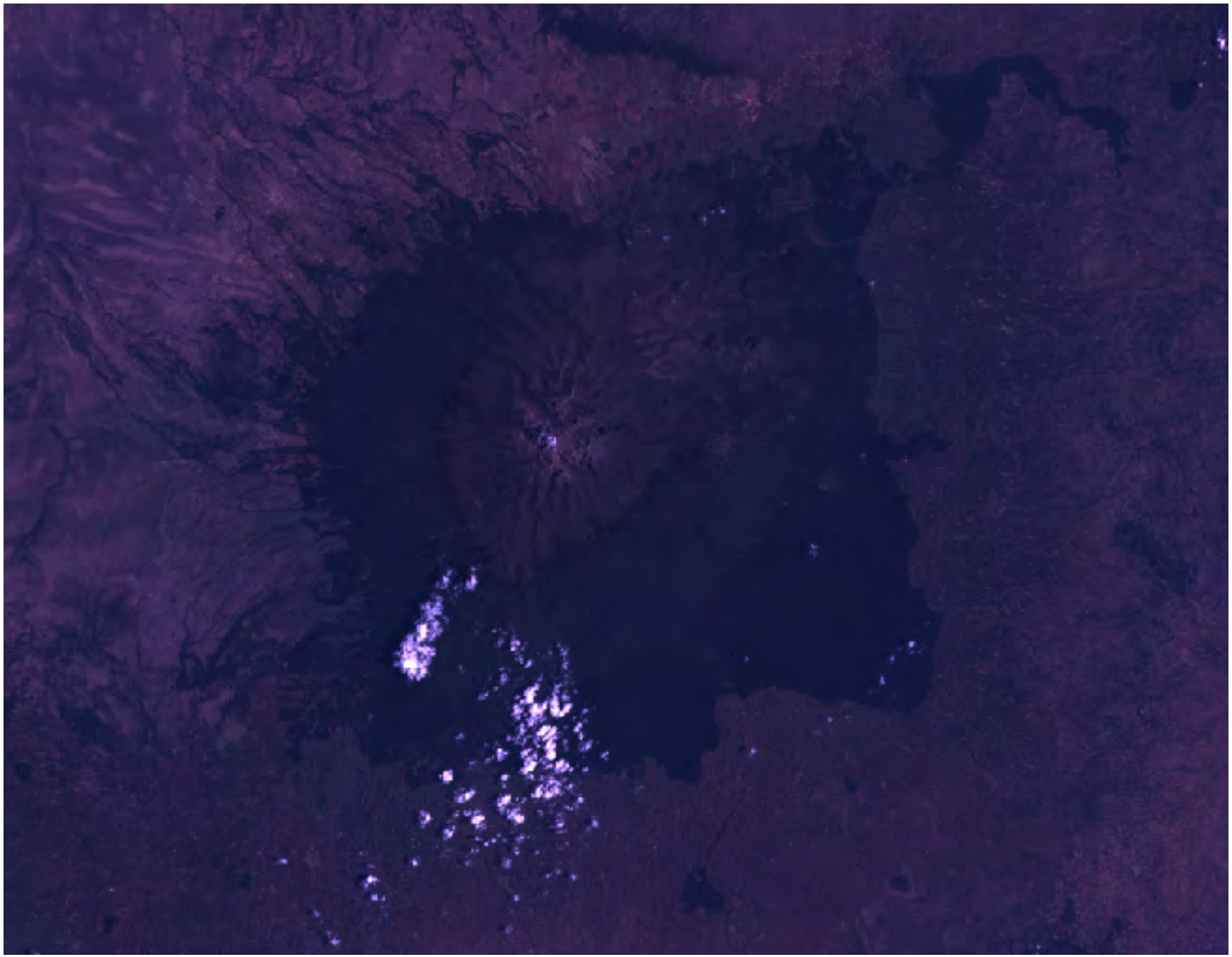

illustrating the correction and use of Landsat timeseries data (Mt Kilimanjaro)

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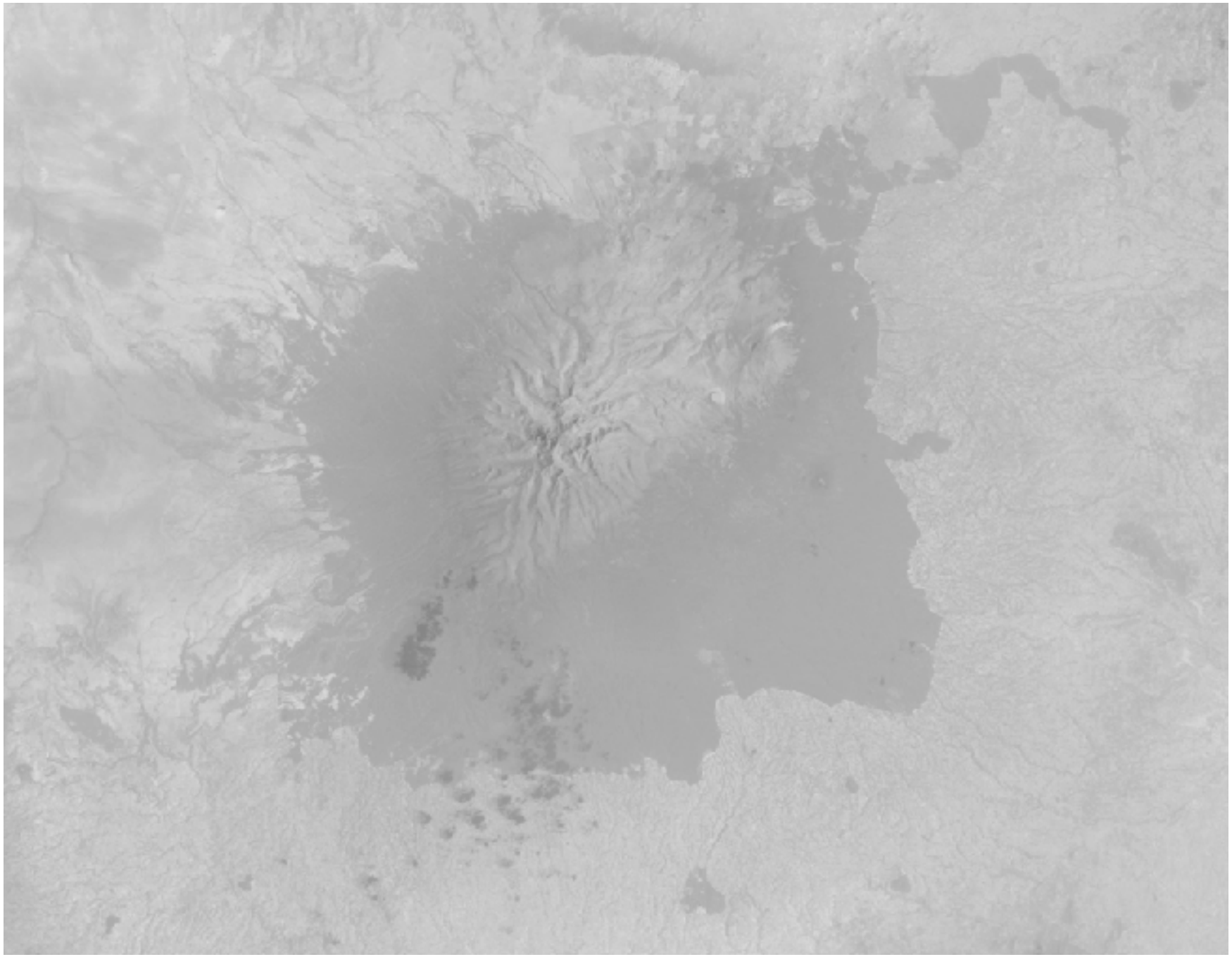


illustrating the correction and use of Landsat timeseries data (Mt Kilimanjaro)

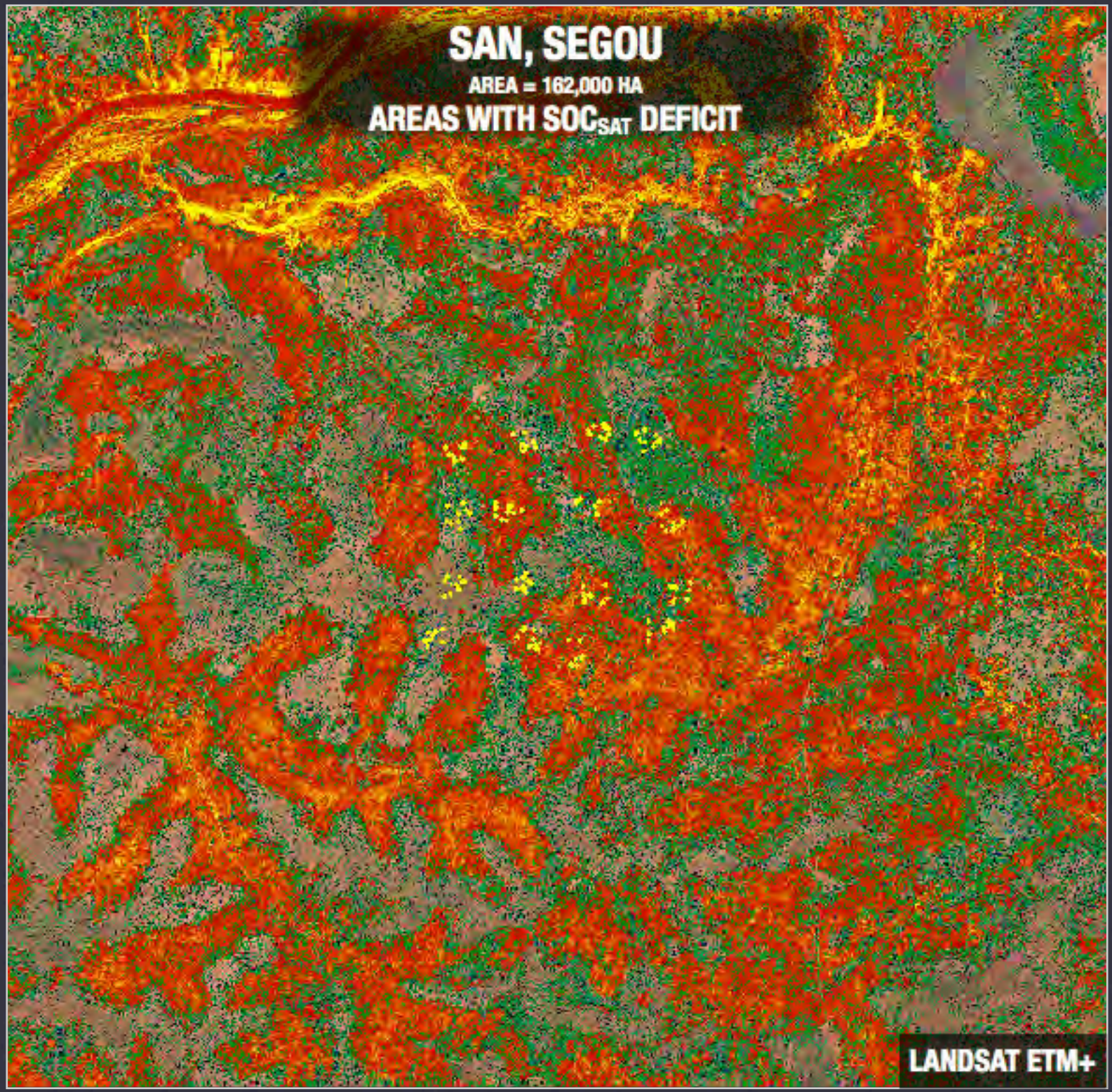
We have landsat images covering the whole of Africa going back to 1972 (usually 4 scenes per site)

Keep in mind that the AVHRR, MODIS, LANDSAT, SRTM, ASTER (and most other) data that you have seen are globally available. For free.

REGIONAL C_{ref}

BY
T. VAGEN

REGIONAL C_{ref}



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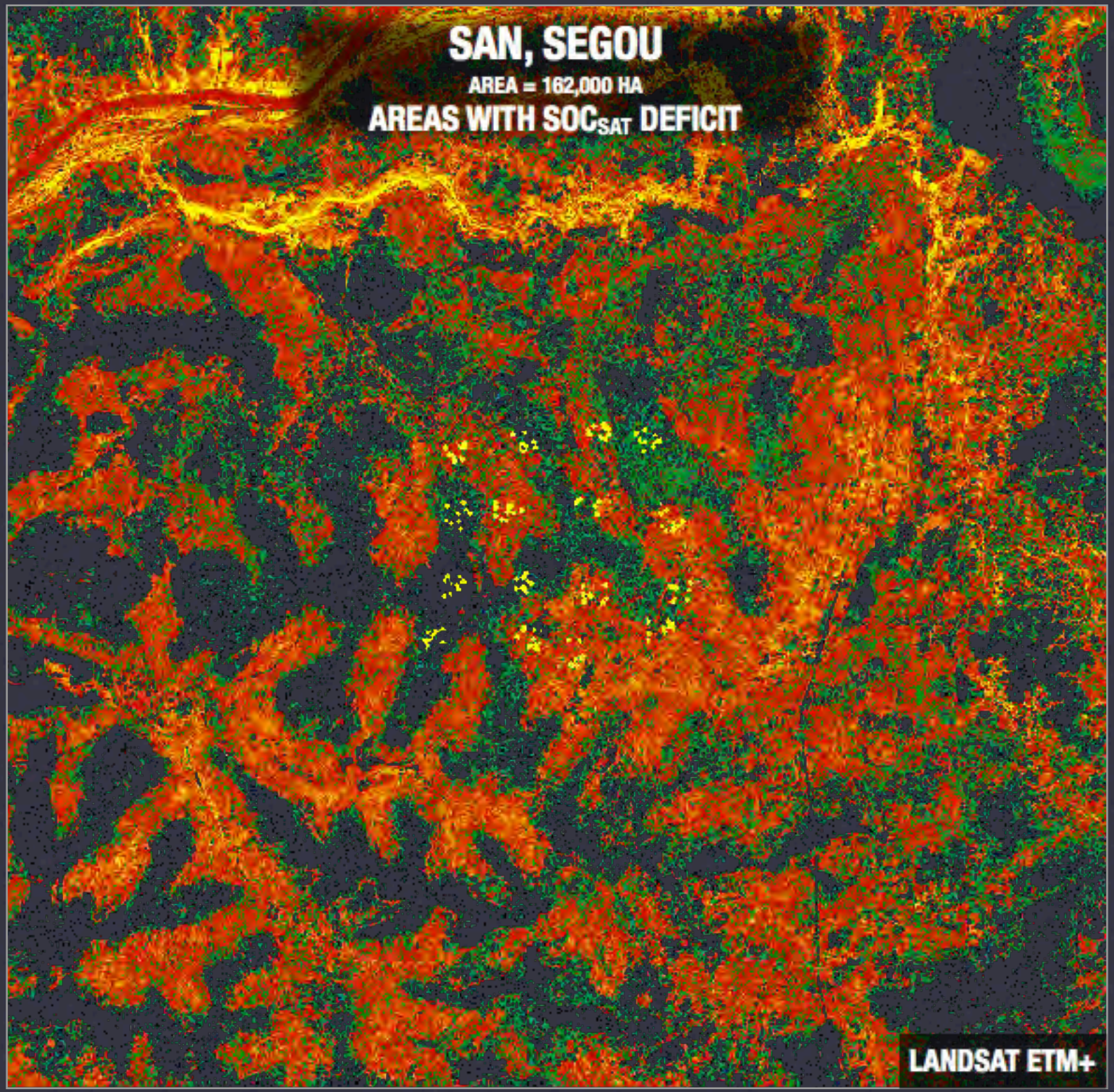

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