

James Acker:

Charles, in a couple of minutes you'll be made the presenter and then you can upload your presentation.

CHARLES ICHOKU:

Sure. I'm ready.

Loading

This presentation is about how GIOVANNI has been one of the tools helping us in our interdisciplinary research in the Northern sub-Saharan African (NSSA) region.

First I would like to acknowledge my collaborators from various organizations as listed, plus many others.

On the image:

Red dots represent fire detection from Aqua-MODIS (at ~1:30 PM Equator crossing time on 17 January 2007).

Dust is massively being generated from the Bodélé depression.

Combination of dust and smoke is so thick that it obscures the coastline.

Two of the most widespread environmental phenomena that happen frequently in this region are biomass burning and drought.

We seek to determine whether there is a link between the two, and how significant the link is.

The 1980s showed a significant decrease in rainfall across the region compared to the pre-industrial era.

Lake Chad saw a dramatic reduction in water content since the 1970s and has never recovered.

Dust is being emitted from the bare surfaces around Lake Chad, but burning has continued in the remaining vegetated areas as the red dots (fires) show.

Some regions that were green in the 1970s (including protected areas) have been cleared through burning, as the brownish burn scars near the top center of the image indicate.

To understand the phenomena better, we developed a hypothesis to explain what we think may be going on and how they may be linked.

The burning season in this region is typically between October and March, with a sharp peak in fire activity in December or January.

This image shows the abundance of fires detected in just one month and their corresponding fire radiative power (FRP), which is a measure of the relative intensities, at the satellite nominal resolution of 1x1 km.

We formulated some science questions to address for this investigation.

We made a detailed plan on how to conduct the study using a large variety of data and models, and shared the work according to our areas of expertise, but proceeding with proper coordination.

How do you start such a complex study.

We started by segmenting the region into smaller blocks.

Then we extracted most of our data from GIOVANNI (with the exception of the FRP data).

The plots I will show are based on monthly means over the individual blocks.

Please note that the block IDs are derived from top-down (North, Middle, South) and left-right (West, Central, East) block coordinates.

Also note the line-colors and symbol-shapes of the plots that will follow and relate them to the blocks.

Normalized Difference Vegetation Index (NDVI) curves show the relative magnitudes and seasonal cycles of their vegetation greenness.

The ratio of total FRP to land area of the blocks show the relative magnitudes and seasonal cycles of fire activity.

It seems that peak fire activity was increasing until about 2006 and started decreasing thereafter.

Precipitation seemed to remain more or less unchanged in the central column blocks.

Precipitation showed a fairly significant decrease in the Eastern blocks coinciding with the period of decrease in fire activity.

Precipitation showed a fairly significant increase in the Western blocks during that same period.

Surface evaporation minima shows an increase during that same period, particularly in the Western and Central blocks.

We did many more analyses using GIOVANNI data than time would allow me to show here.

This is the summary of our findings from our preliminary analysis based on GIOVANNI data.

These findings are guiding more detailed research activities we are still conducting in that region.

Here we are looking in detail on how fires can change albedo in different landcover types.

In this example we show two pixels of the same landcover type tracked for two years, one was burned and the other was not.

The one that burned showed a sudden albedo decrease that recovered a few months later.

We are using satellite aerosol (MODIS) and FRP (MODIS and SEVIRI) measurements to estimate smoke particulate emissions.

This example is for December 2009.

We are ingesting the smoke emissions in the WRF-Chem model to simulate both horizontal and vertical transport, which we compare with satellite observations, such as CALIPSO Lidar curtain scans of the atmospheric column profile.

We are studying micro-landcover changes around Lake Chad, and have found that indeed Bare land surfaces have increased over time, and water bodies decreased through the 1980s, but has increased very slightly since the 2000s.

Field survey of the groundwater around Lake Chad shows that it has been virtually stable, and has even increased toward the west, in agreement with the rainfall increase we observed in our Western boxes using GIOVANNI data.

We are proceeding in many other aspects of the research, but the few examples just shown is to give you a flavor.

I will stop here.
Our plans moving forward are listed.

To end, I would like to say that Greg was a great guy and did an outstanding job, not only with GIOVANNI, but also in many other areas, and we miss him.

I would be happy to take questions now.

James Acker:
Thank you, Charles.

CHARLES ICHOKU:
Sure, my pleasure.

James Acker:
As a bellwether of climate in sub-Saharan Africa, do you think Lake Chad is destined to eventually disappear?

CHARLES ICHOKU:
It is not easy to make a prediction at this time, as we see rainfall increasing in the west, and the groundwater being stable or also increasing in the west.

James Acker:
I think I had read that increasing irrigation efficiency would help.

CHARLES ICHOKU: Probably, but currently there is severe water shortage and the current irrigation needs are not met.

James Acker:

Thank you. Any other questions?

CHARLES ICHOKU:

Thanks to everyone for participating, and to you Jim for pulling all this together.

James Acker:

It's been very informative so far, and I think that we will see much interest in the presentations online (many people told me that they could not attend but wanted to see the presentations). There are several meetings going on this week, particularly oceanographic meetings in Europe. One is about the ARGO float program.

We can take a 5-minute coffee break then hear from Richard Kleidman on ARSET.