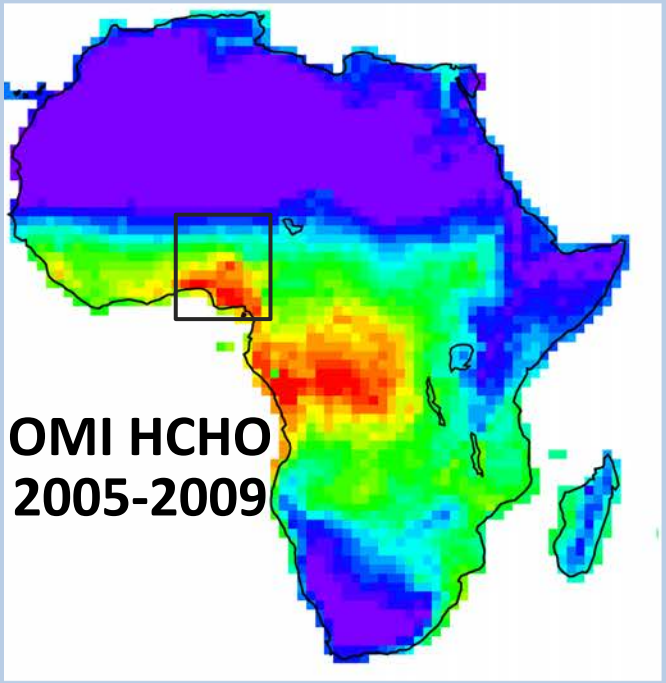
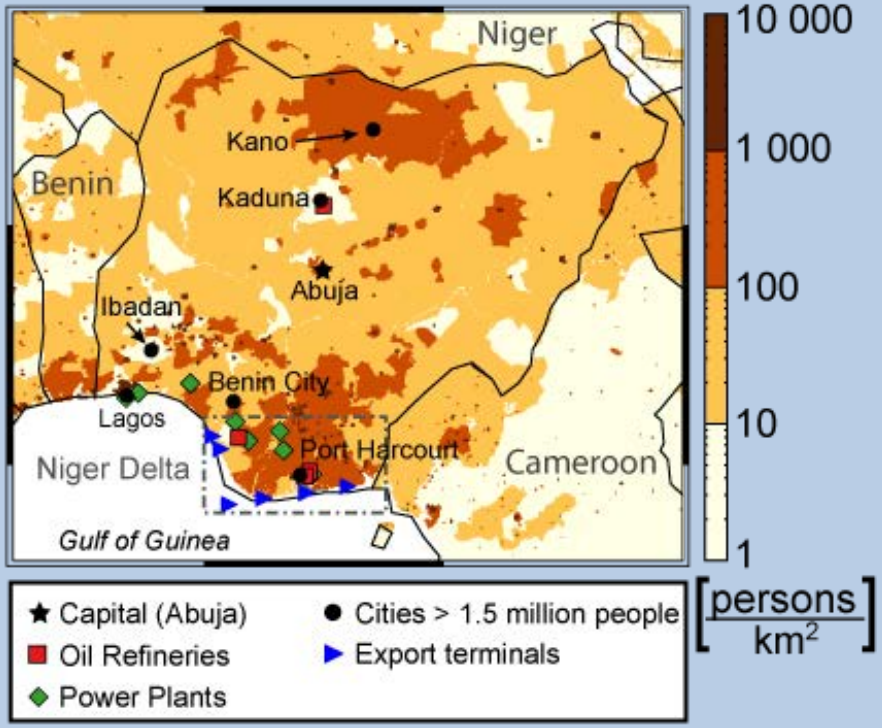
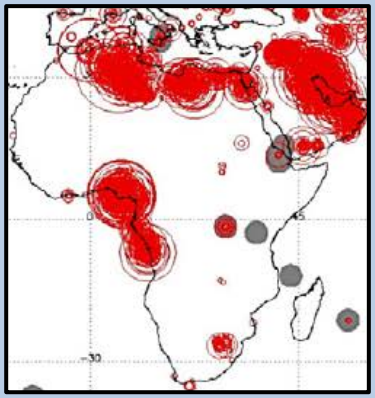
Air Quality Over Nigeria

Eloïse Marais, *D. J. Jacob, K. Wecht, C. Lerot, T. P. Kurosu, K. Chance*







Population: 170 mill (2.6% y^{-1})

GDP: USD 273 bill (7% y^{-1})

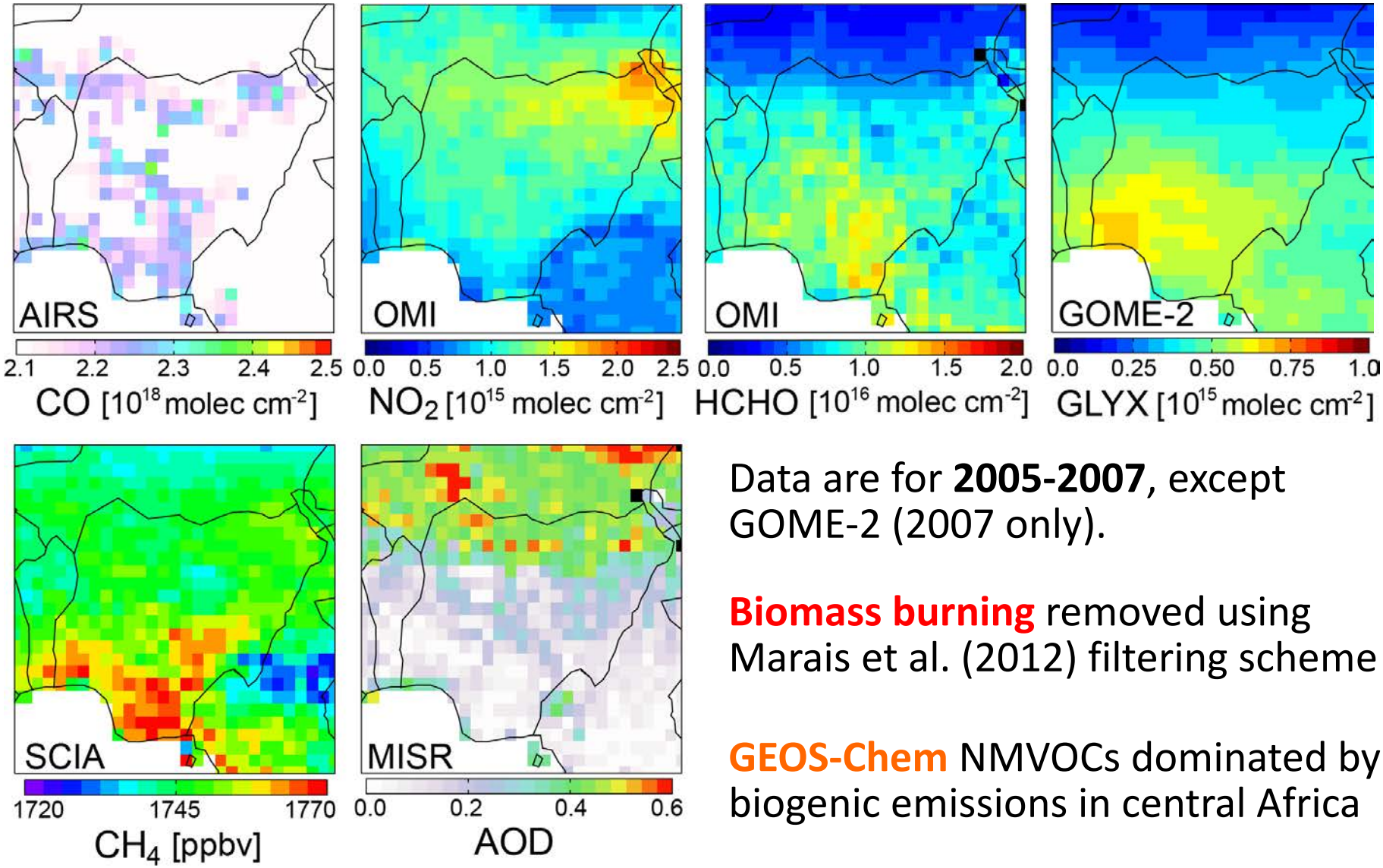
Earth Lights (left)

Gas flare hotspots (right)

IGC6
May 2013

Atmospheric Composition over Nigeria

Space-based observations of CO, NO_2, HCHO, GLYX, CH_4 and AOD

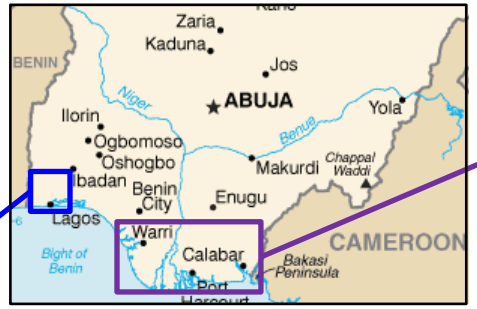


Data are for **2005-2007**, except GOME-2 (2007 only).

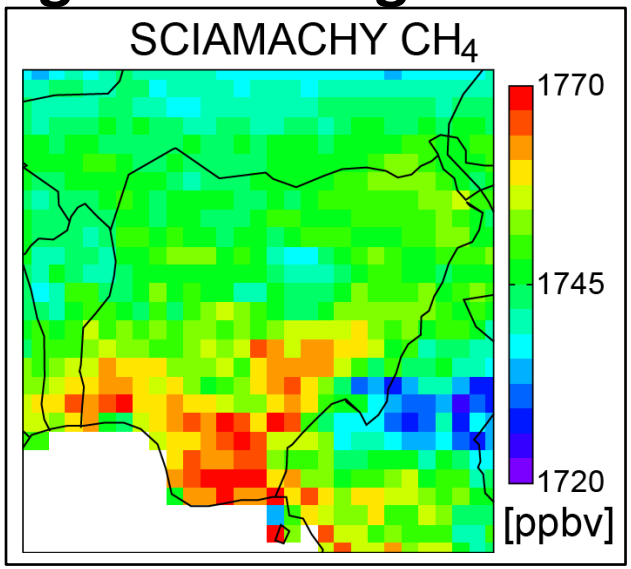
Biomass burning removed using Marais et al. (2012) filtering scheme

GEOS-Chem NMVOCs dominated by biogenic emissions in central Africa

Anthropogenic NMVOC Emissions Scaling

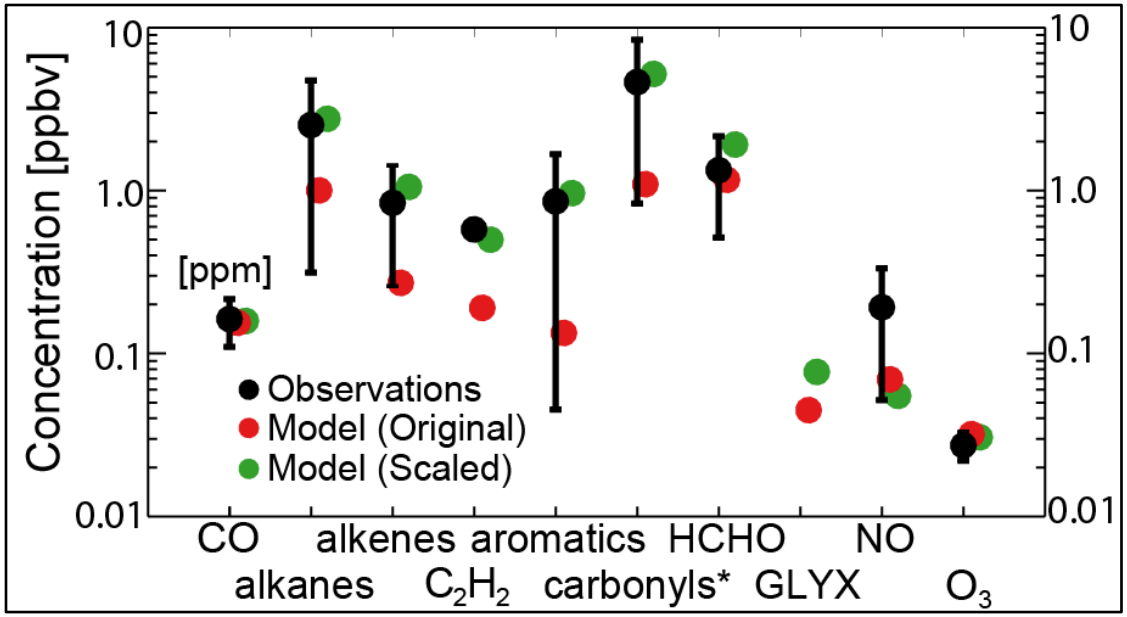


Niger Delta fugitive alkane



→ Test alkane emissions using **SCIA CH_4** & natural gas **composition ratios**

AMMA **Lagos** NMVOC observations



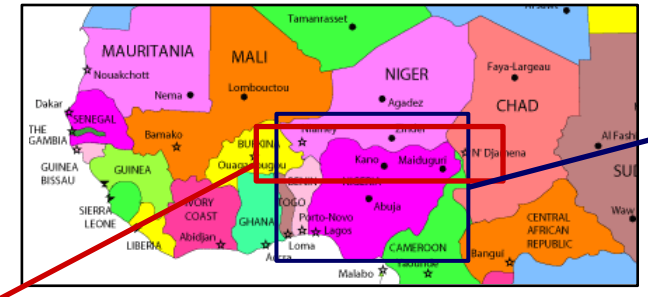
*excludes HCHO and GLYX

→ Scaling in Lagos alone **increases emissions** in Nigeria by a **20%**

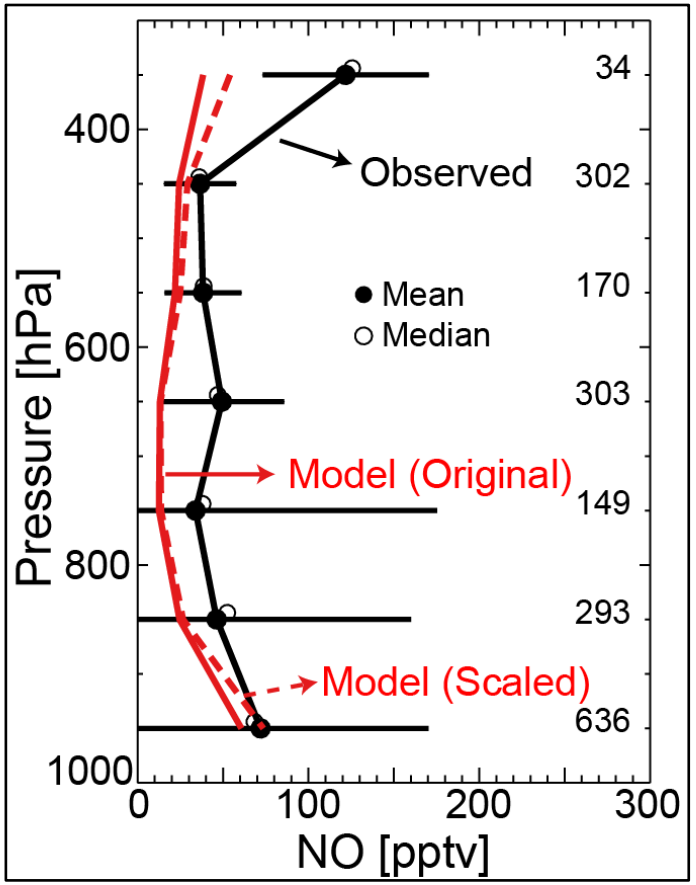
Delta natural gas mass ratio:

$CH_4 : C_2H_6 : C_3H_8 : C_4H_{10}$ =
100 : 4.5 : 4.9 : 18
(Sonibare et al., 2004)

Natural NO_x Emissions Scaling

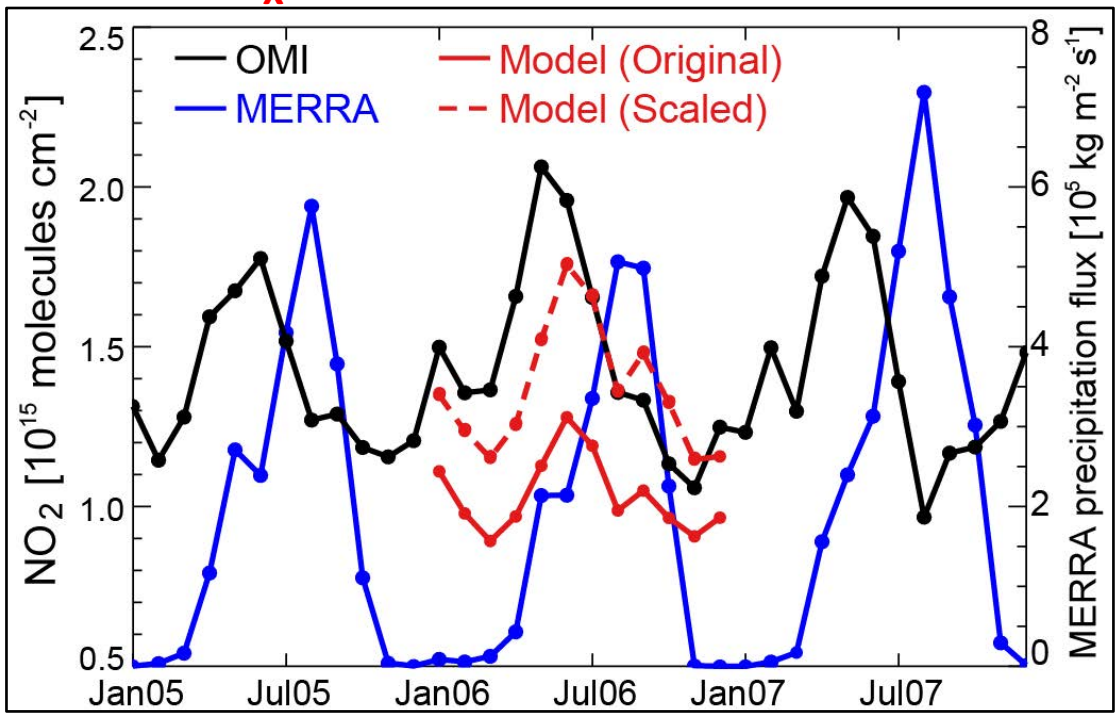


Lightning NO_x in W. Africa



Scale emissions above 400 hPa

Soil NO_x in northern Nigeria (13-17°N)

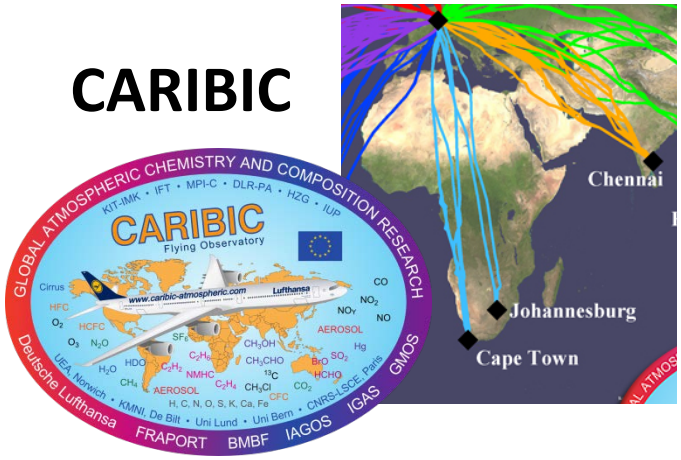


→ **Natural** emissions represent **68%** of all NO_x emissions in Nigeria

Future Work

- Parameterize **GEOS-Chem lightning NO_x** with cruise altitude NO observations on commercial aircraft.

CARIBIC



MOZAIC/IAGOS

- Assess impact of **Nigerian emissions** on local and regional air quality
- Project impact of **future** Nigerian **NO_x emissions** on local and regional air quality.

Satellite Look-Up Table

Satellite and species retrieval information with relevant **references**, links to **data**, and current GEOS-Chem **users to contact** with questions.

GEOS–Chem Wiki

http://wiki.seas.harvard.edu/geos-chem/index.php/**Satellite_Specifications_Table**

General Satellite and Instrument Information

Instrument	Satellite	Launch Date	Orbit	Equator Crossing Time	Footprint	Swath Width	Global Coverage
Global Ozone Monitoring Experiment (**GOME**)	ERS-2	April 1995	sun-synchronous	10h30 LT (descending node)	320x40 km2	960 km	< 3 days
Multi-angle Imaging SpectroRadiometer (**MISR**)	NASA EOS/Terra	December 1999	sun-synchronous	10h30 LT (descending node)	14.6x17.6 km2 (for aerosol properties)	400 km	9 days

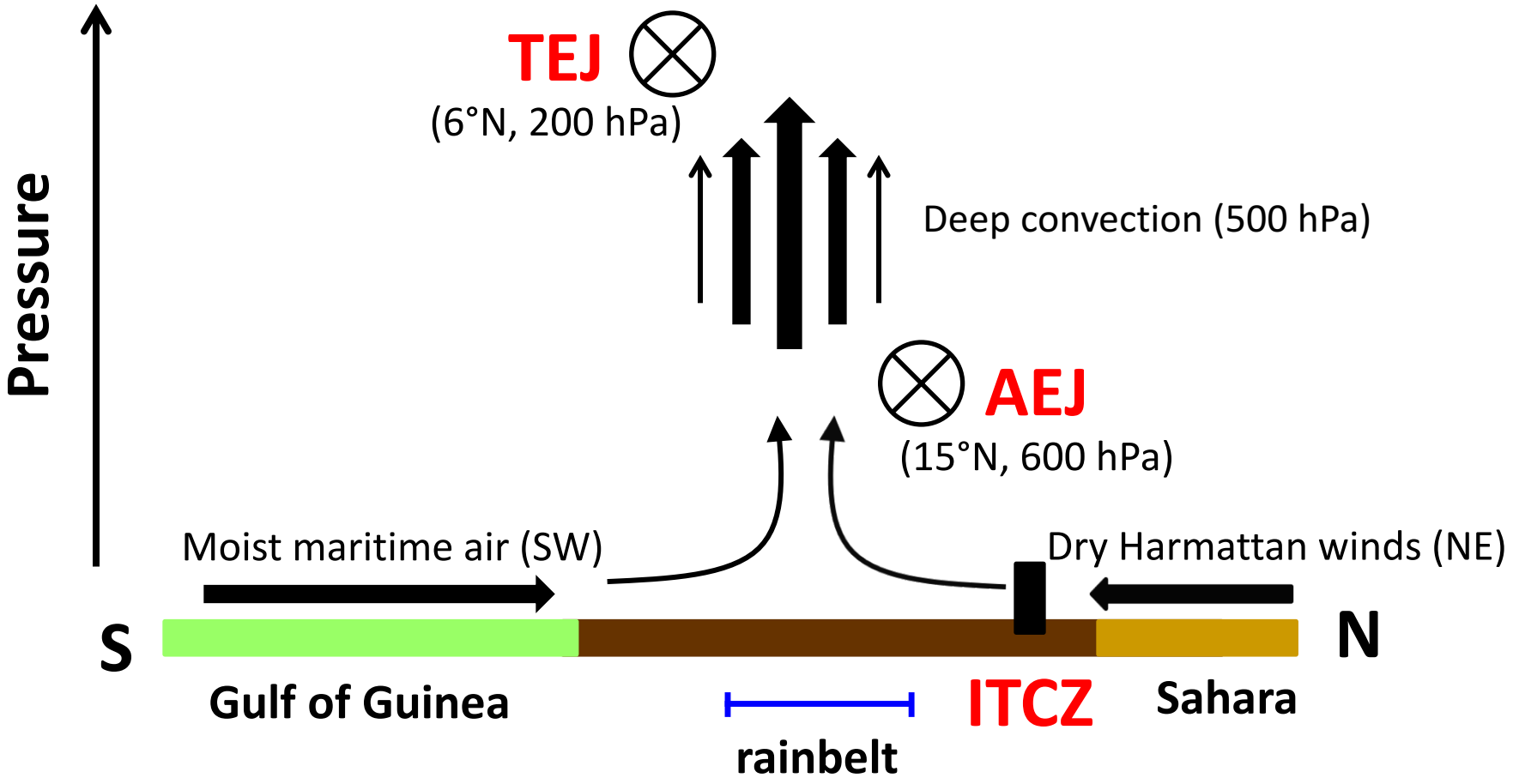
Satellite-Observed Species Information

Species (Instrument)	Version	Retrieval Spectrum	Spectral Resolution	DoFS	Uncertainty	Download link	References	Current Data Users
AOD (MISR)	V22 (Level 3)	9 viewing angles each with 4 spectral bands (446, 558, 672, 866 nm)	---	---	---	http://1.usa.gov/ZWP7RM OR http://1.usa.gov/11Wos5U	Martonchik et al., 2002	Eloïse Marais

Supplementary Slides

Synoptic-scale Meteorology

The West African Monsoon over Nigeria in August



Nicholson, 2009