Evaluating aerosols impacts on Numerical Weather Prediction (NWP)

Saulo Freitas with contribution from
Angela Benedetti et al (ECMWF)

Main Goal

We aim to determine the current capabilities of NWP models to simulate aerosol impacts on weather prediction.

Outline

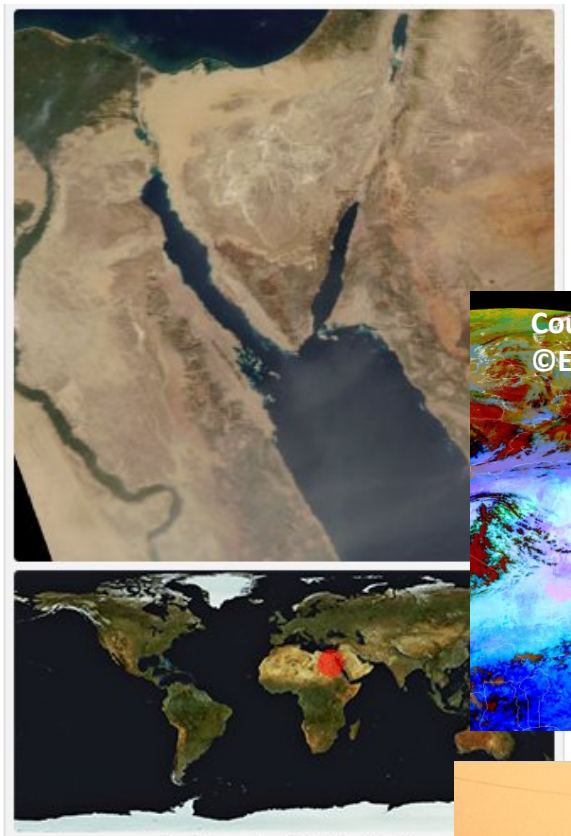
- Select strong or persistent events of aerosol pollution worldwide that could be fairly represented in the current NWP model allowing the evaluation of aerosol impacts on weather prediction.
- Perform model runs both including and not the feedback from the aerosol interaction with radiation and clouds.
- Evaluate model performance in terms of AOD simulation compared to observations (e.g. AERONET/MODIS data) or any other related aerosol observation available.
- Evaluate aerosol impacts on the model results regarding 2-metter temperature, wind, rainfall, surface energy budget, …

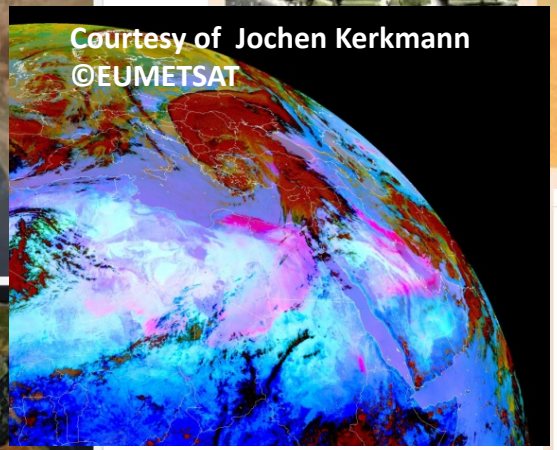
Proposed cases studies for Aerosol-NWP impacts evaluation

Angela Benedetti, Johannes Flemming, Jean-Noel Thepaut

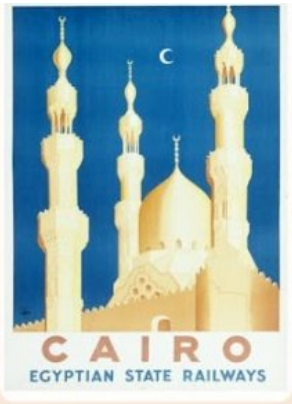
ECMWF

Dust Storm on April 18 2012





Dust over the Nile delta from satellite imagery.
Image courtesy of Chelys.



Wednesday, April 18, 2012

#Sandstorm in #Cairo

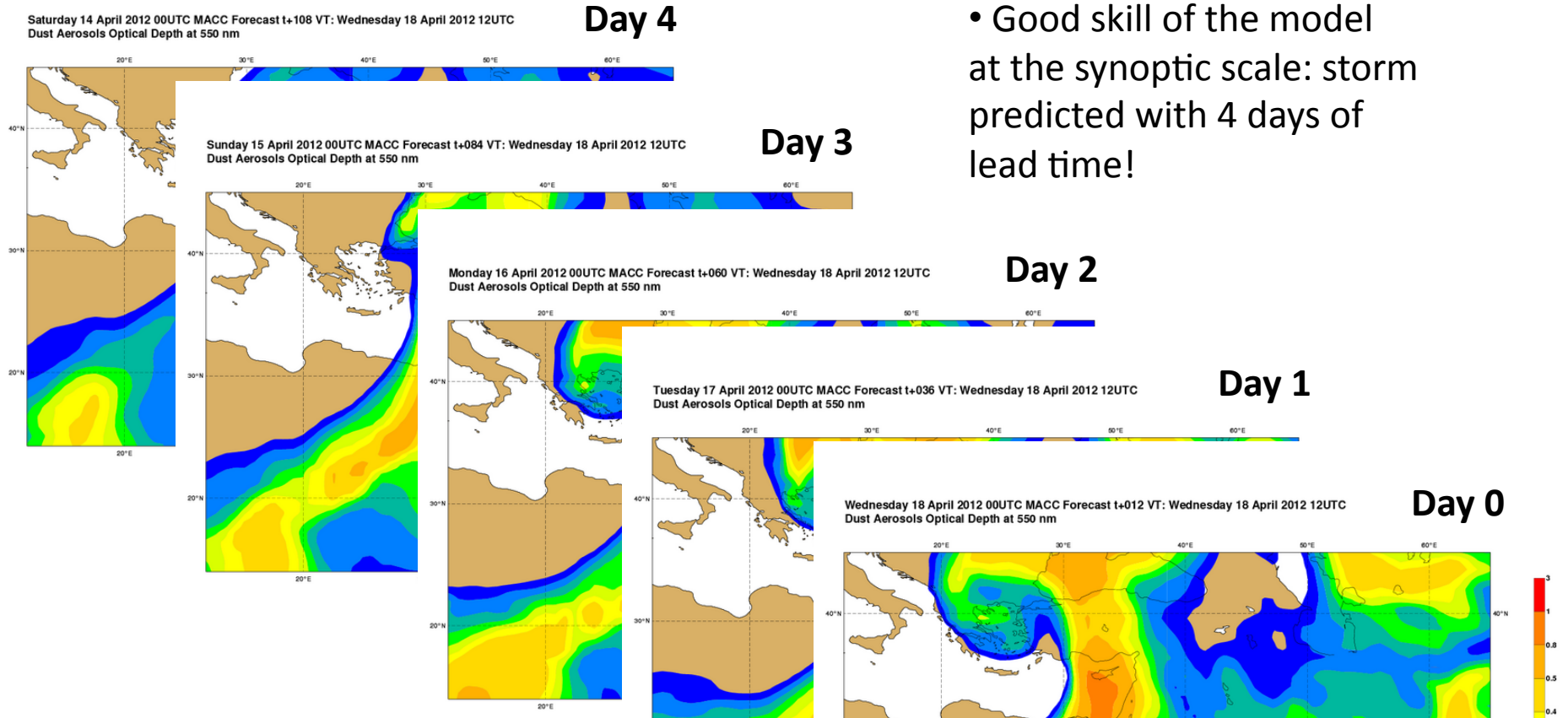
We are having the worst sandstorm in Cairo today. It is the Khamsin in its official time after Easter.The storm started at 8:30 AM this morning. Suddenly we got this yellow color in the air.
Here is Tahrir square from short awhile ago .

Khamisn in Tahrir square "Kolena Khaled Said"

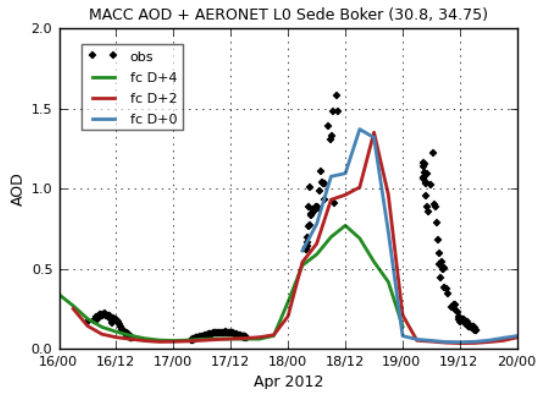
Palestinian men cross a main road as a sand storm envelops the town of Rafah along the border with Egypt in southern Gaza Strip, on April18, 2012. (SAID KHATIB/AFP/Getty Images)

MACC-II/ECMWF forecasts for April 18 2012

Graphycs by Miha Razinger



- Good skill of the model at the synoptic scale: storm predicted with 4 days of lead time!



AERONET verification at Sede Boker, Israel

macc
Monitoring atmospheric composition & climate – II

Air pollution event Beijing 12-14. January 2013 in MACC forecasts

Description

- News-worthy air pollution in Beijing , 12-16.1. 2013
- above worst AQ index (EPA) “Hazardous”, PM2.5 > 700µg/m^3
- Observations: in-situ 2.5 PM at Chaoyang District, BEIJING, (US embassy ?), retrieved from twitter log by Xiaobo
- Observations scaled in plots to fit model values
- Model grid point Beijing from MACC-II NRT run
  - PM2.5, PM10 at model level 50 (1km) and 60 (surface)

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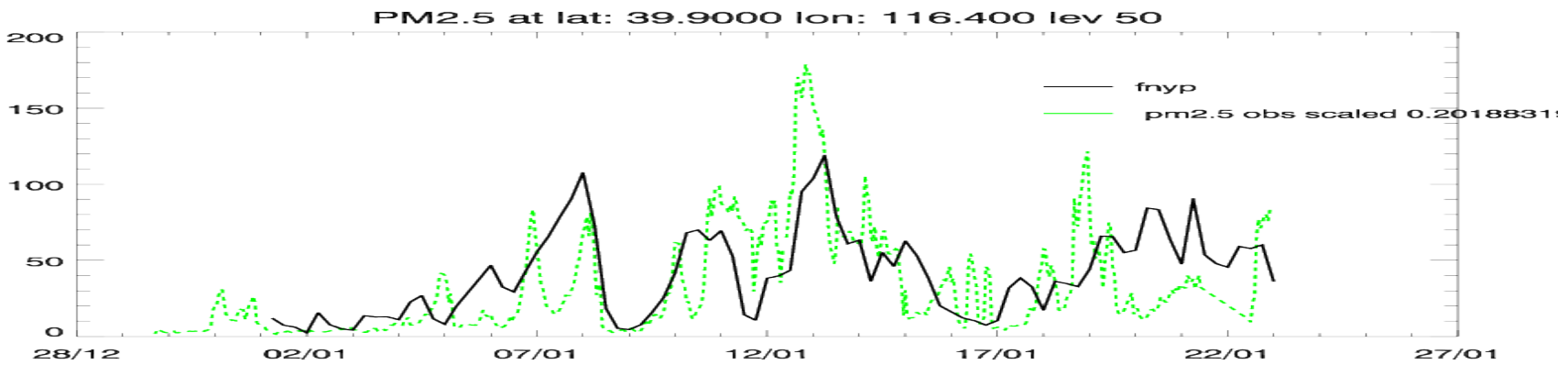
Monitoring atmospheric composition & climate – II

PM2.5 µg/m^3


PM2.5 at lat: 39.9000 lon: 116.400 lev 50
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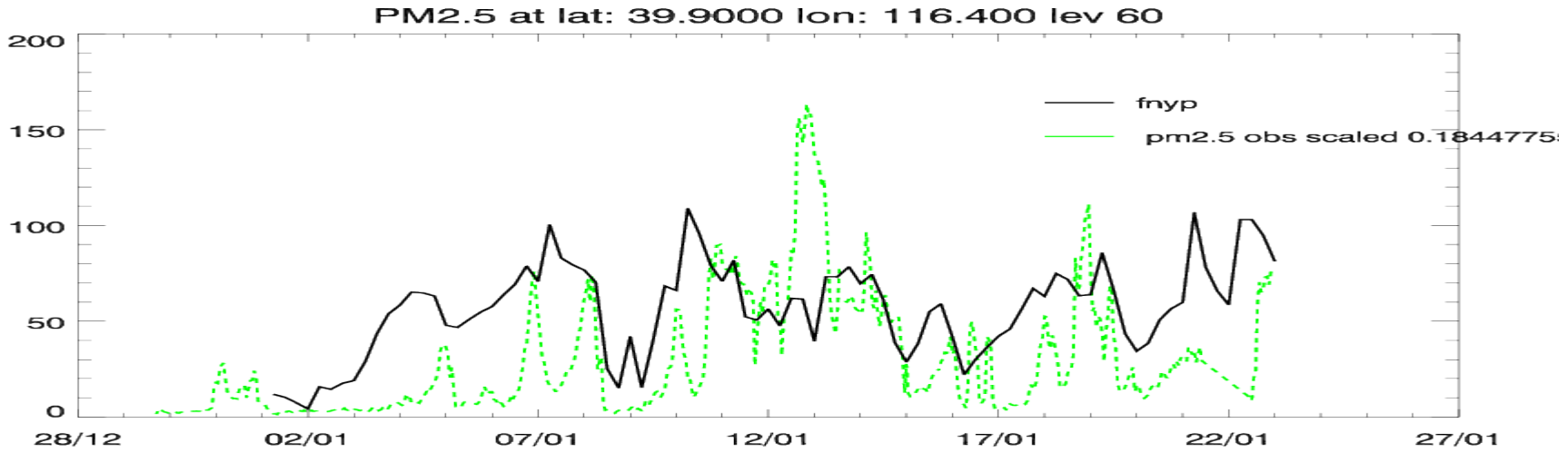
pm2.5 obs scaled 0.2018831


PM2.5 at lat: 39.9000 lon: 116.400 lev 60
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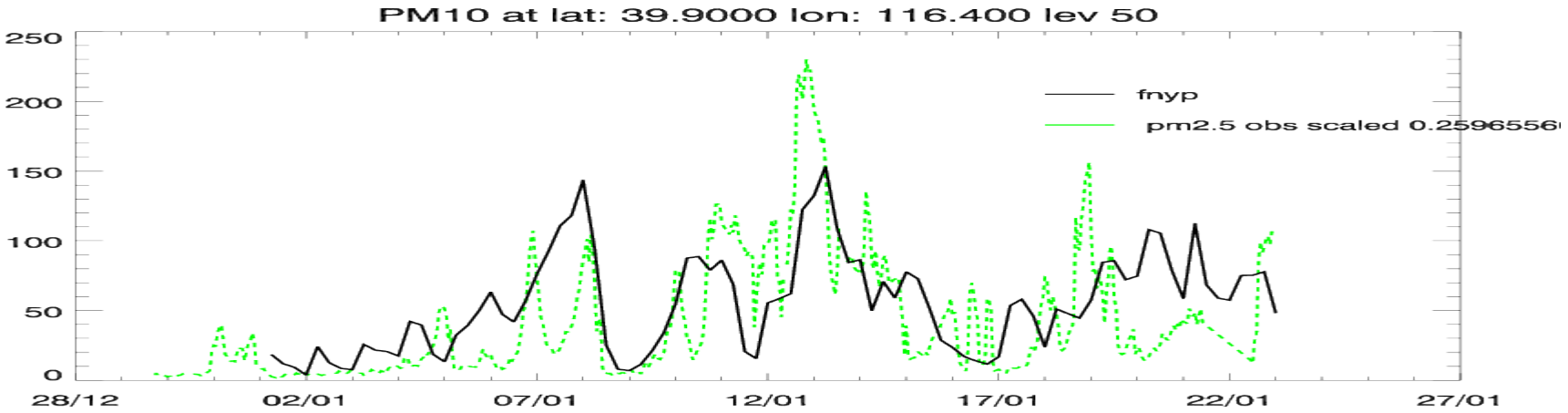
PM10 µg/m^3


PM10 at lat: 39.9000 lon: 116.400 lev 50
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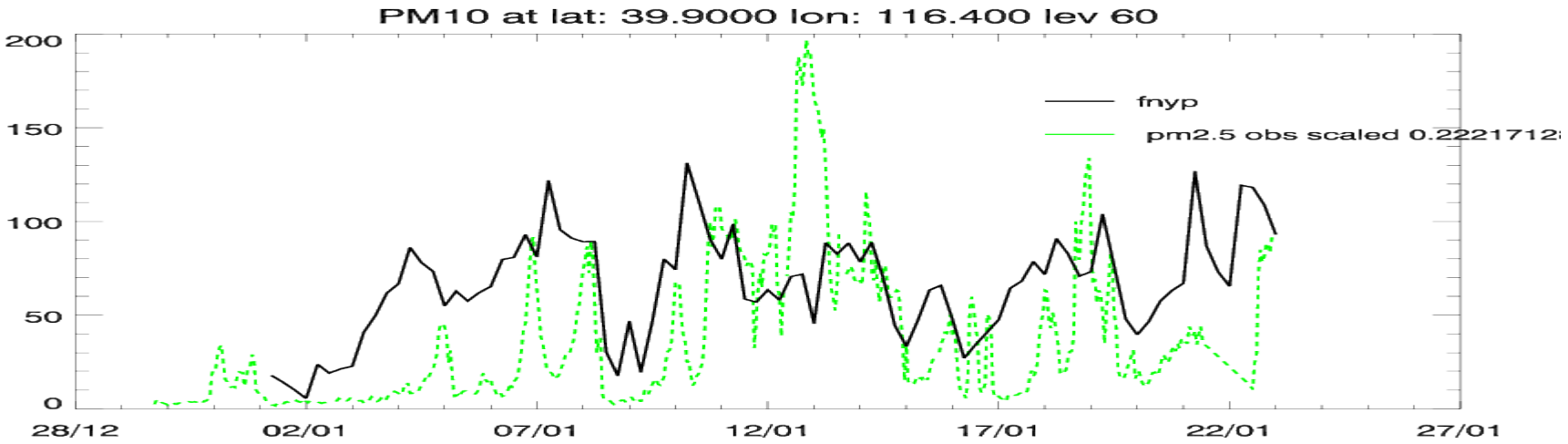
PM10 at lat: 39.9000 lon: 116.400 lev 60
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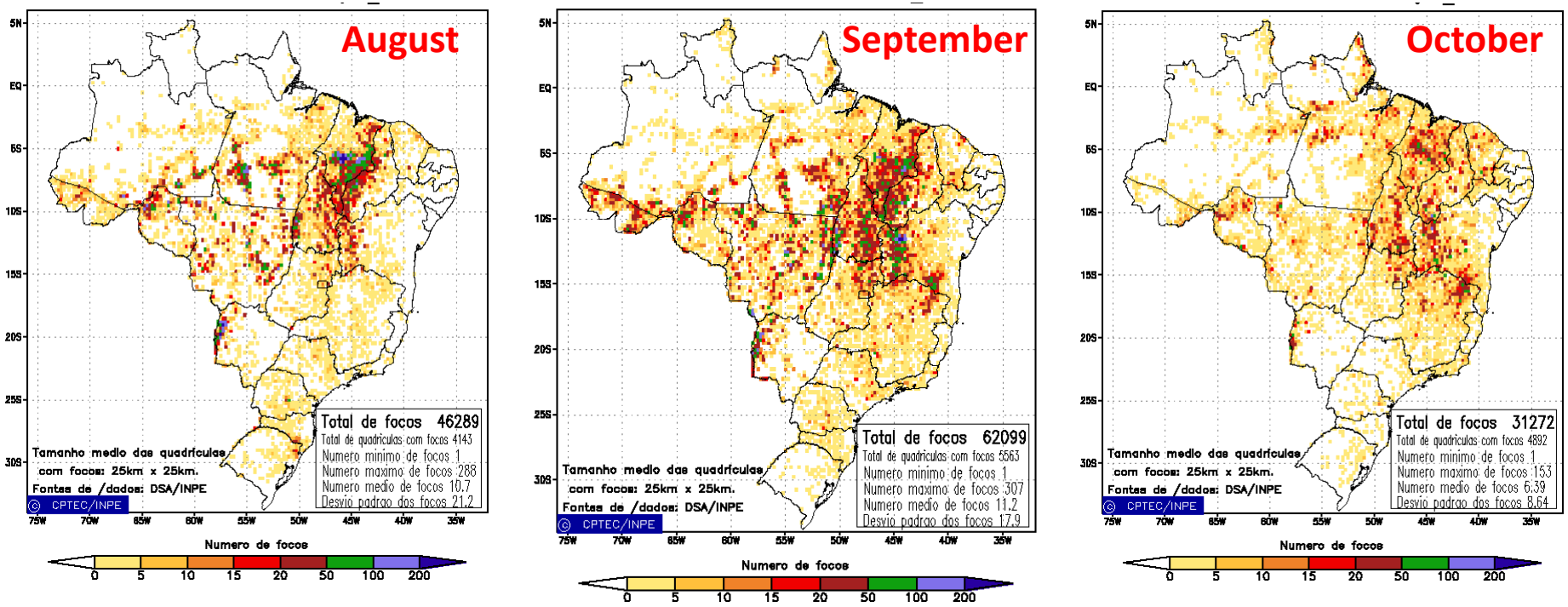
pm2.5 obs scaled 0.2221712

SAMBBA Case

- Biomass burning aerosol over South America
- September 2012

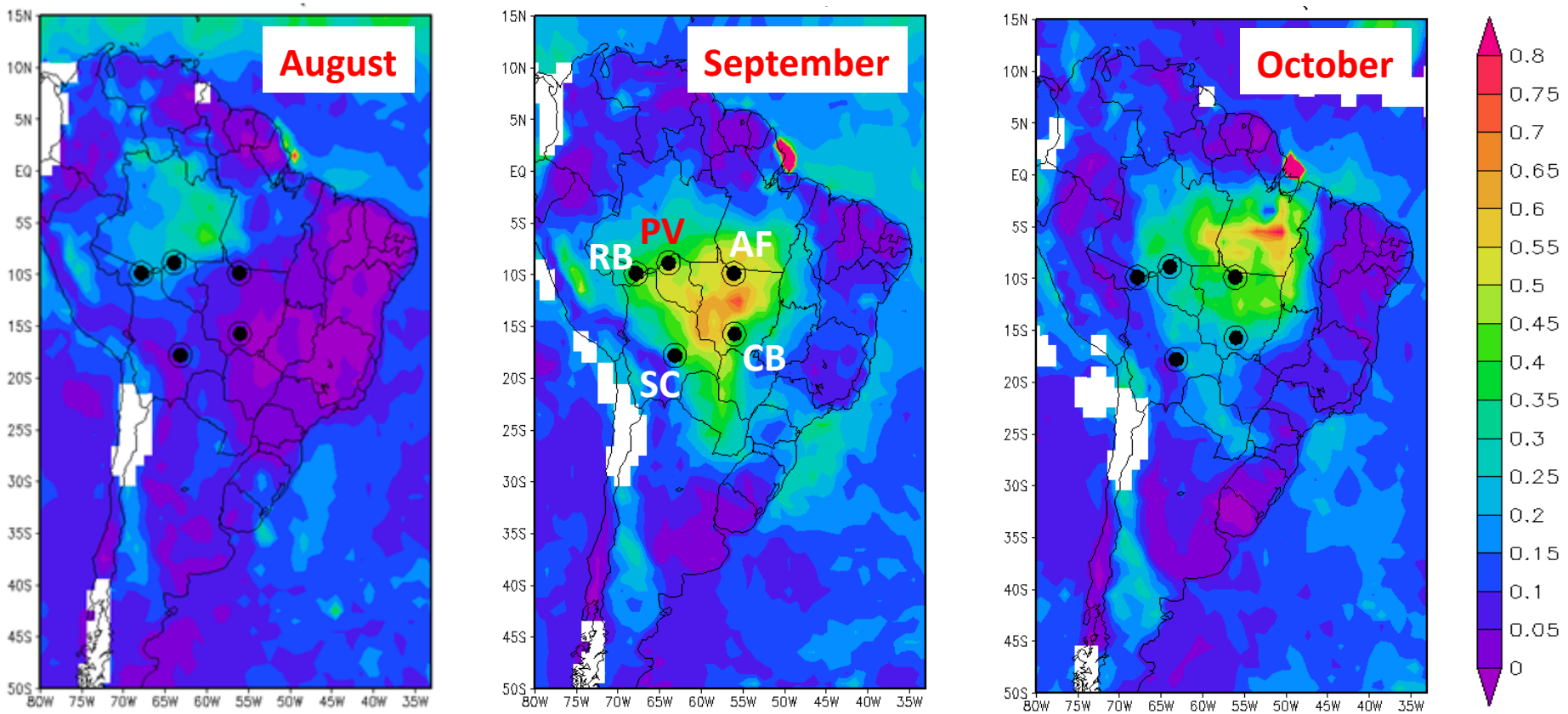
Accumulated fire spots: 2012 biomass burning



Peak September : 62 099 identified hot spots

http://www.inpe.br/queimadas/

2012 regional smoke plume: AOD@550 nm (MODIS)

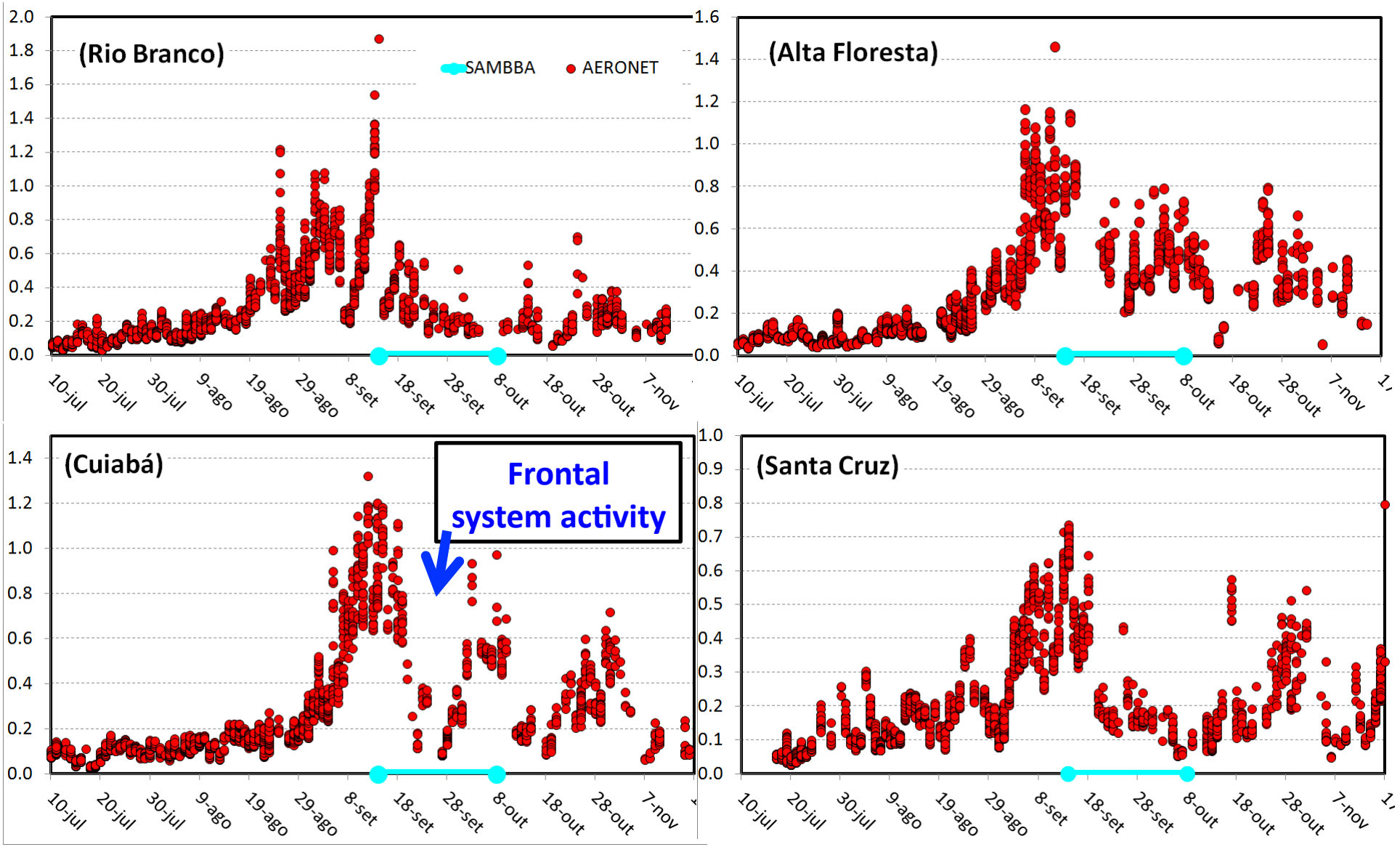


(monthly average)

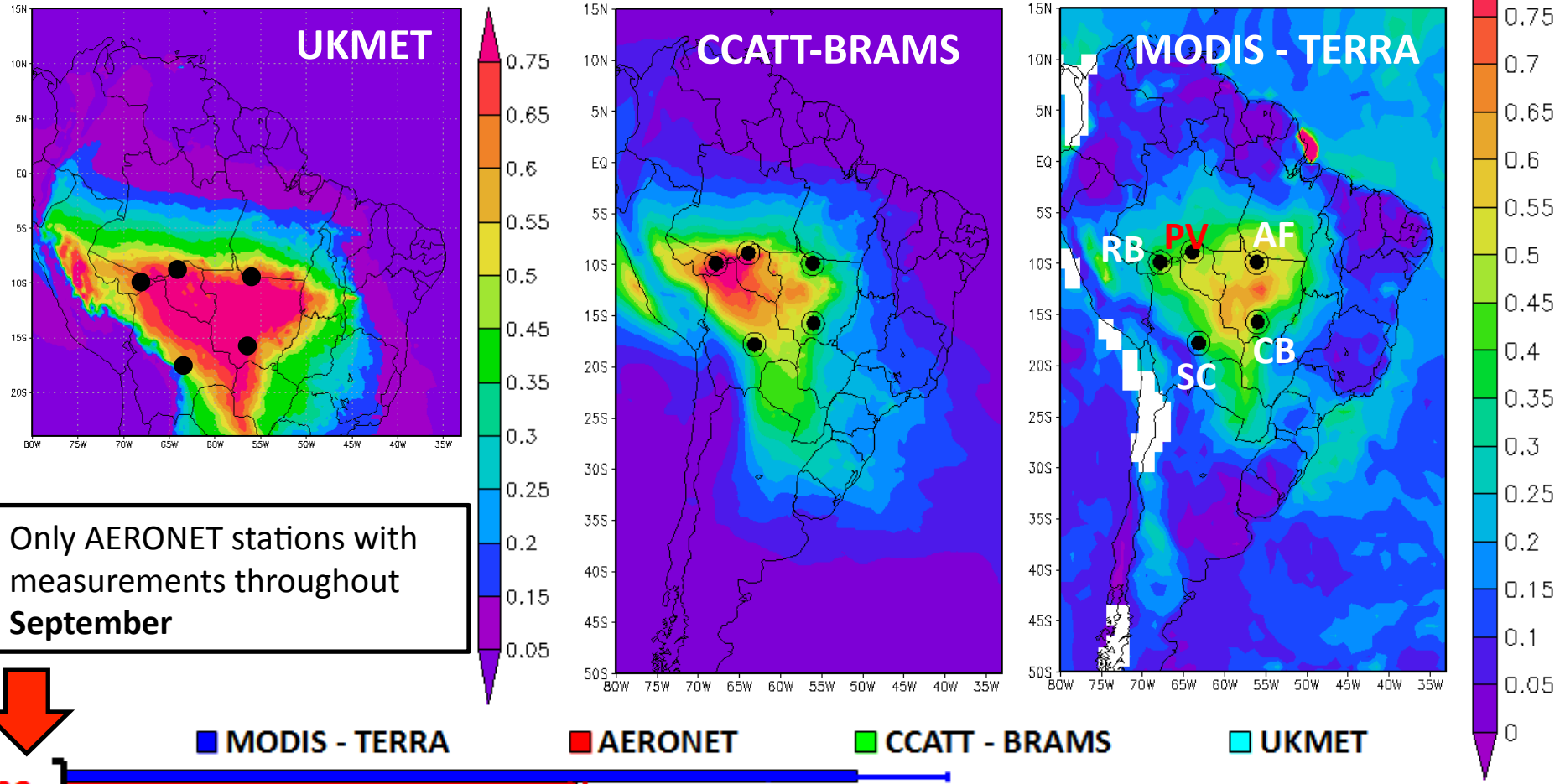
AERONET sites:
SC – Santa Cruz ; **CB** – Cuiabá ; **RB** – Rio Branco; **AF** – Alta Floresta; **PV** – Porto Velho

2012 regional smoke plume: Time variability (AERONET)

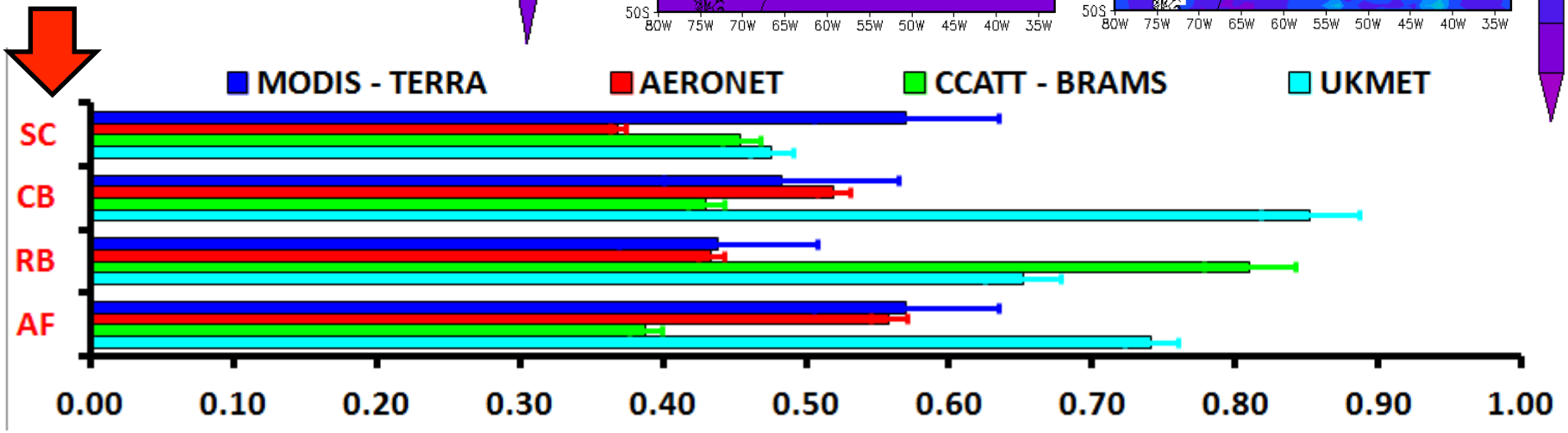
Build up from ~ 09 August / Peak (~8- 18: September)



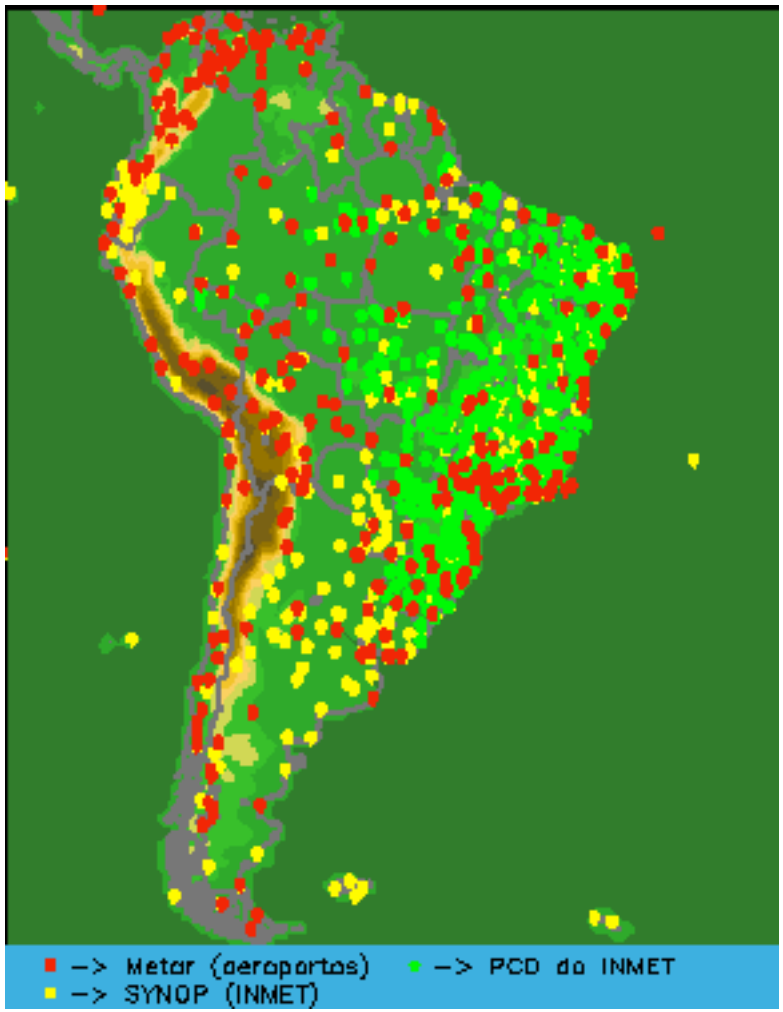
MEAN AOD@550 nm: September 2012



Only AERONET stations with measurements throughout **September**



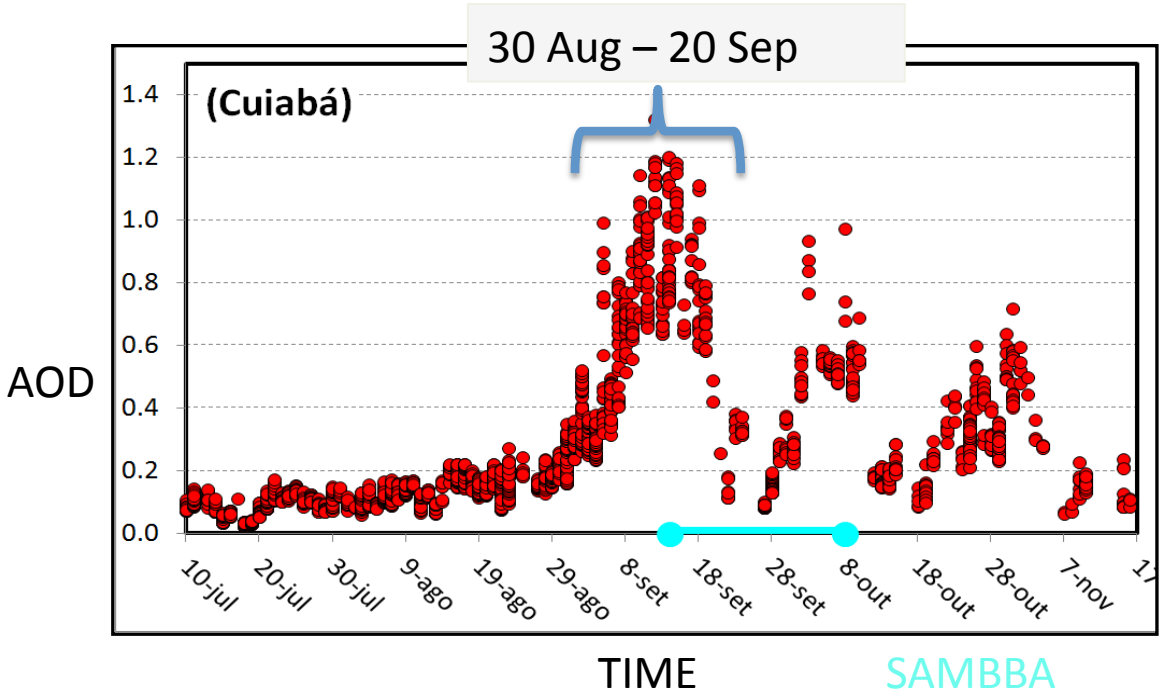
Weather observations available



- South America surface network:
  - 2-m temp and dew point temp, 10-m wind, surface pressure : hourly data on ~ 1000 locations
  - Rainfall: 6 and 24 hours accumulated on ~ 600 locations

Time period for the exercise

1. SAMBBA case is not a ‘strong’ event, but a persistent case of large area covered by smoke from biomass burning.
2. The plans are to run the NWP models for ~ 10 days with 72 hours forecast each day. Total of 30 forecast days.
3. The best time period should be an overlap between the most polluted and the occurrence of SAMBBA field campaign.
4. Probably, the best time period for this exercise is 05 – 15 September



Proposed Agenda

Date	
~30 August	Detailed information about the cases will be available.
~30 September	The Centres inform if will/not participate on the exercise. Also which cases will run.
~30 January	Model simulations and results should be available.
2014 WGNE Meeting	Session to discuss the inter-comparison and models performance.

Thanks for your attention!