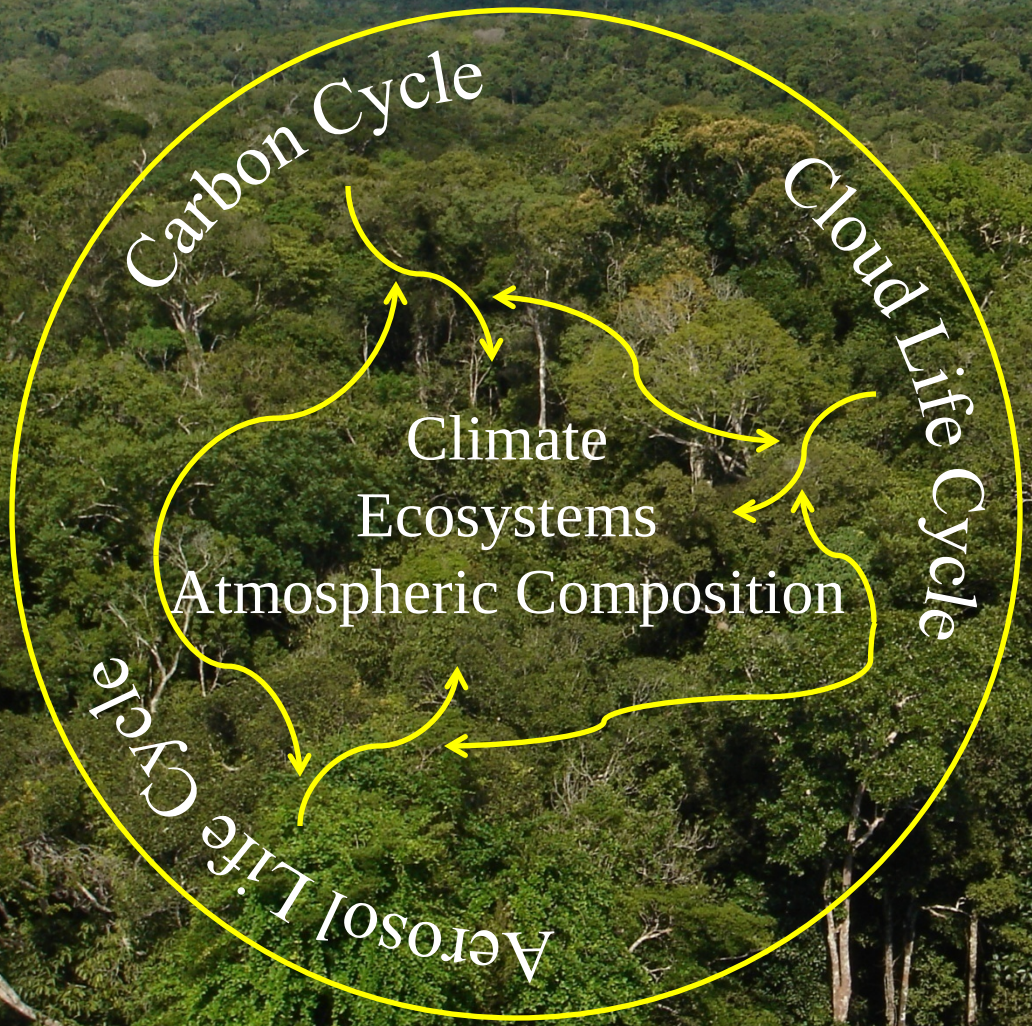
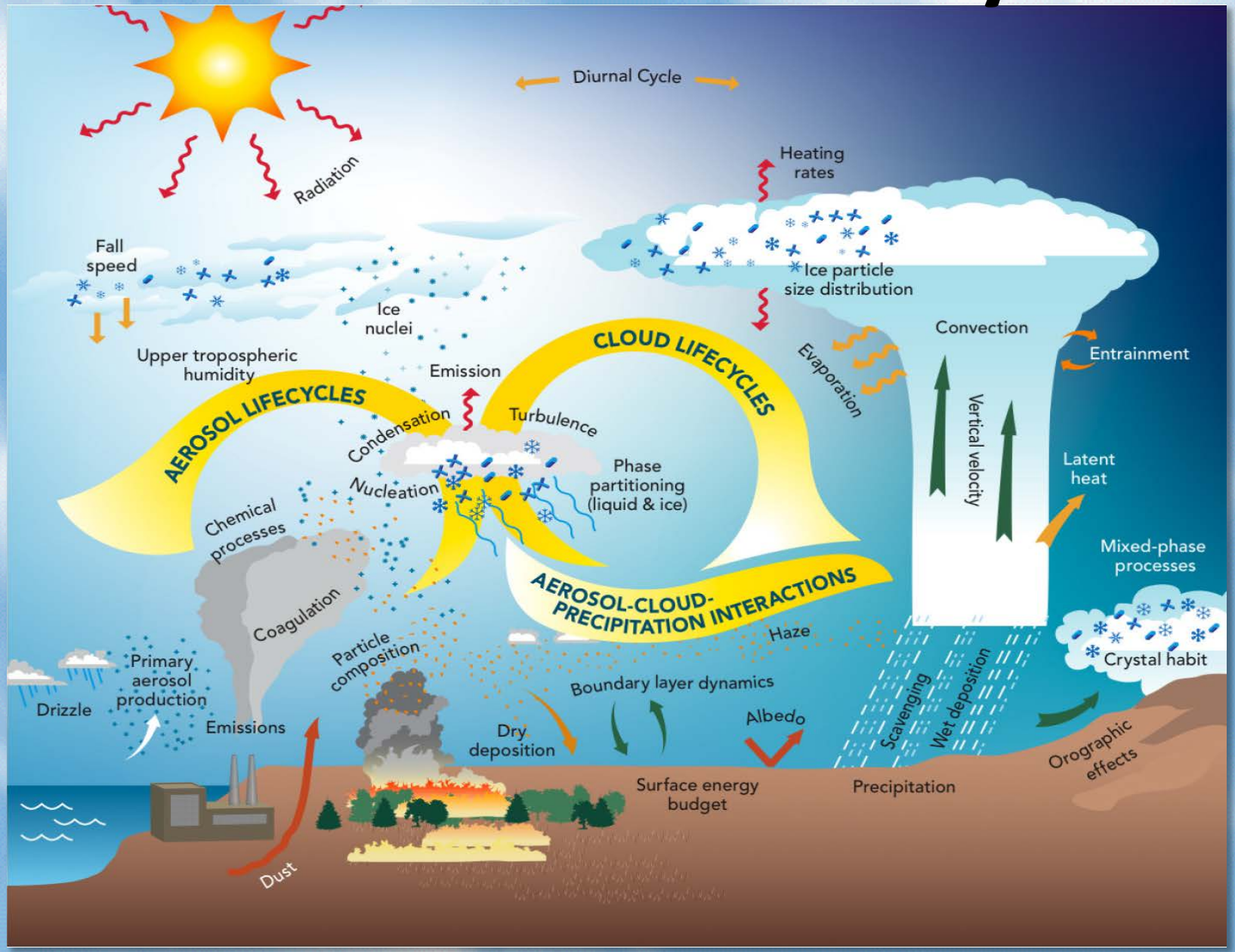
The Brazilian component of GoAmazon

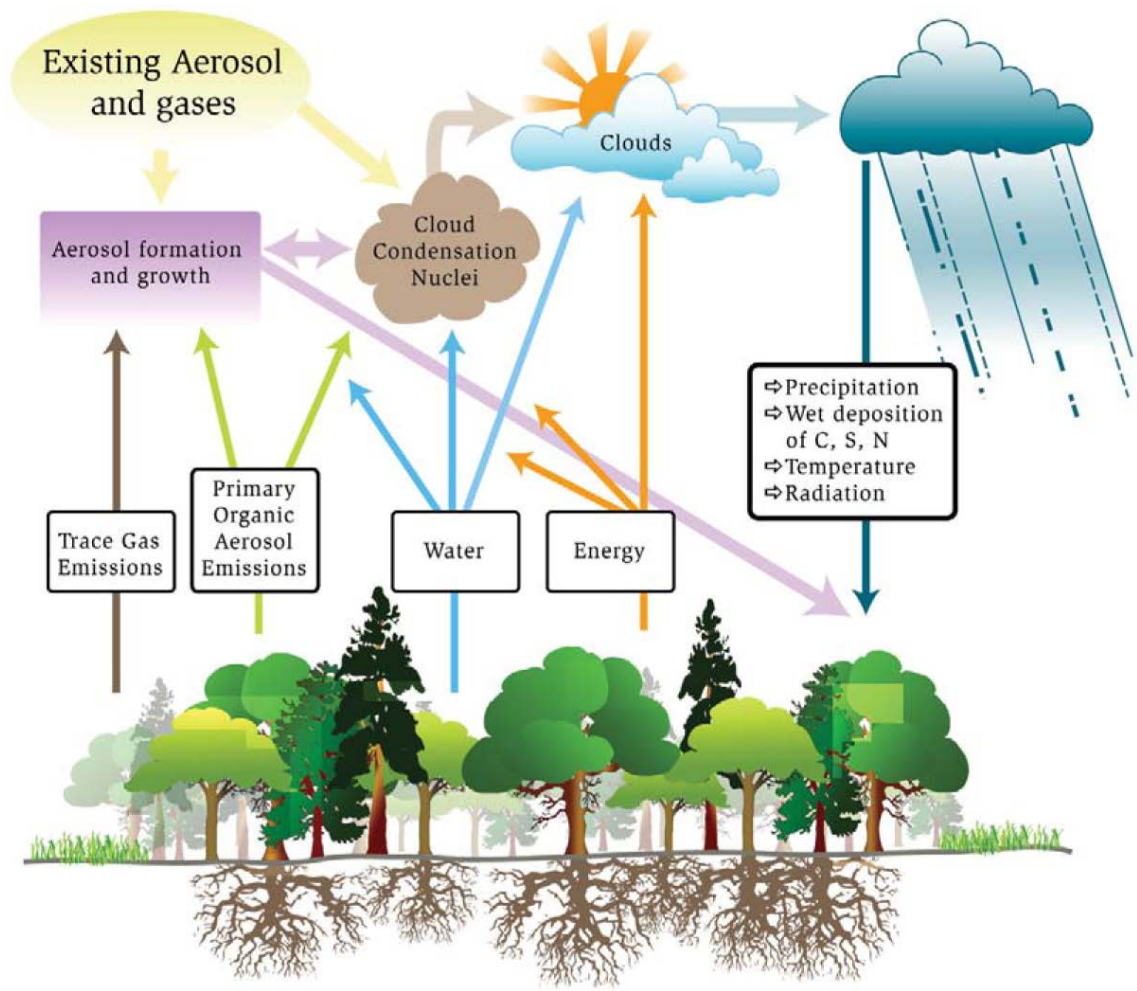


Paulo Artaxo, Maria Assunção Silva Dias, Luiz Augusto Machado, Gilberto Fisch, Rodrigo Souza and the Brazilian GoAmazon Science team

Aerosol and cloud lifecycles

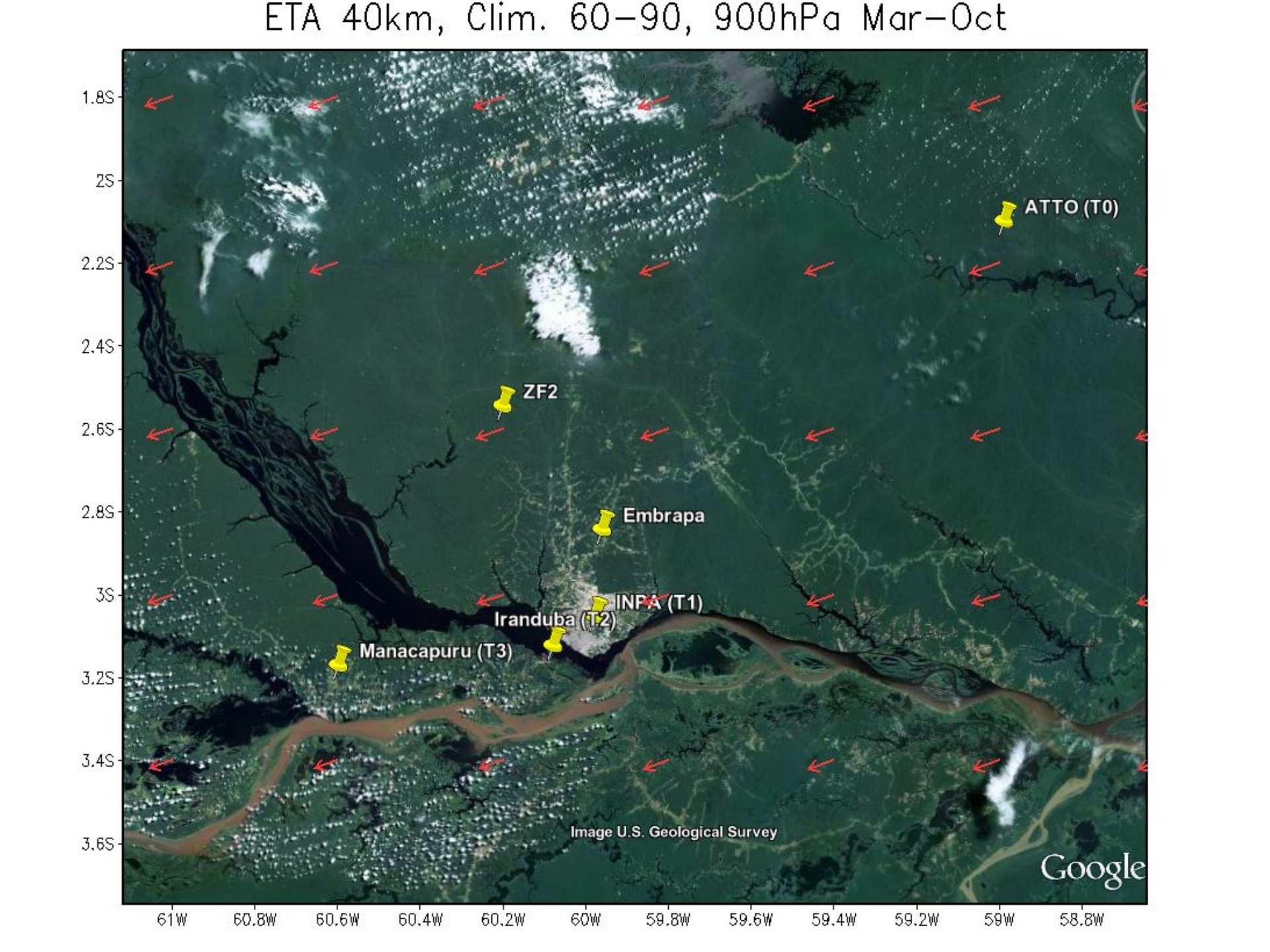


Amazon Basin has strong coupling between terrestrial ecosystem and the hydrologic cycle: The linkages among carbon cycle, aerosol life cycle, and cloud life cycle need to be understood and quantified.



Source: Barth et al., "Coupling between Land Ecosystems and the Atmospheric Hydrologic Cycle through Biogenic Aerosol Particles," *BAMS*, *86*, 1738-1742, 2005.

Susceptibility and expected reaction to stresses of global climate change as well as pollution introduced by future regional economic development are not known or quantified at present time.


ETA 40km, Clim. 60-90, 900hPa Mar-Oct
1.8S
2S
2.2S
2.4S
2.6S
2.8S
3S
3.2S
3.4S
3.6S
61W
60.8W
60.6W
60.4W
60.2W
60W
59.8W
59.6W
59.4W
59.2W
59W
58.8W
ATTO (T0)
ZF2
Embrapa
INPA (T1)
Iranduba (T2)
Manacapuru (T3)
Image U.S. Geological Survey
Google


SITE_
Iranduba site
IRANDUBA CITY

Interactions of the Manaus plume across 60 km forest

Objectives based on these critical questions and issues are as follows:

Aerosol Life Cycle

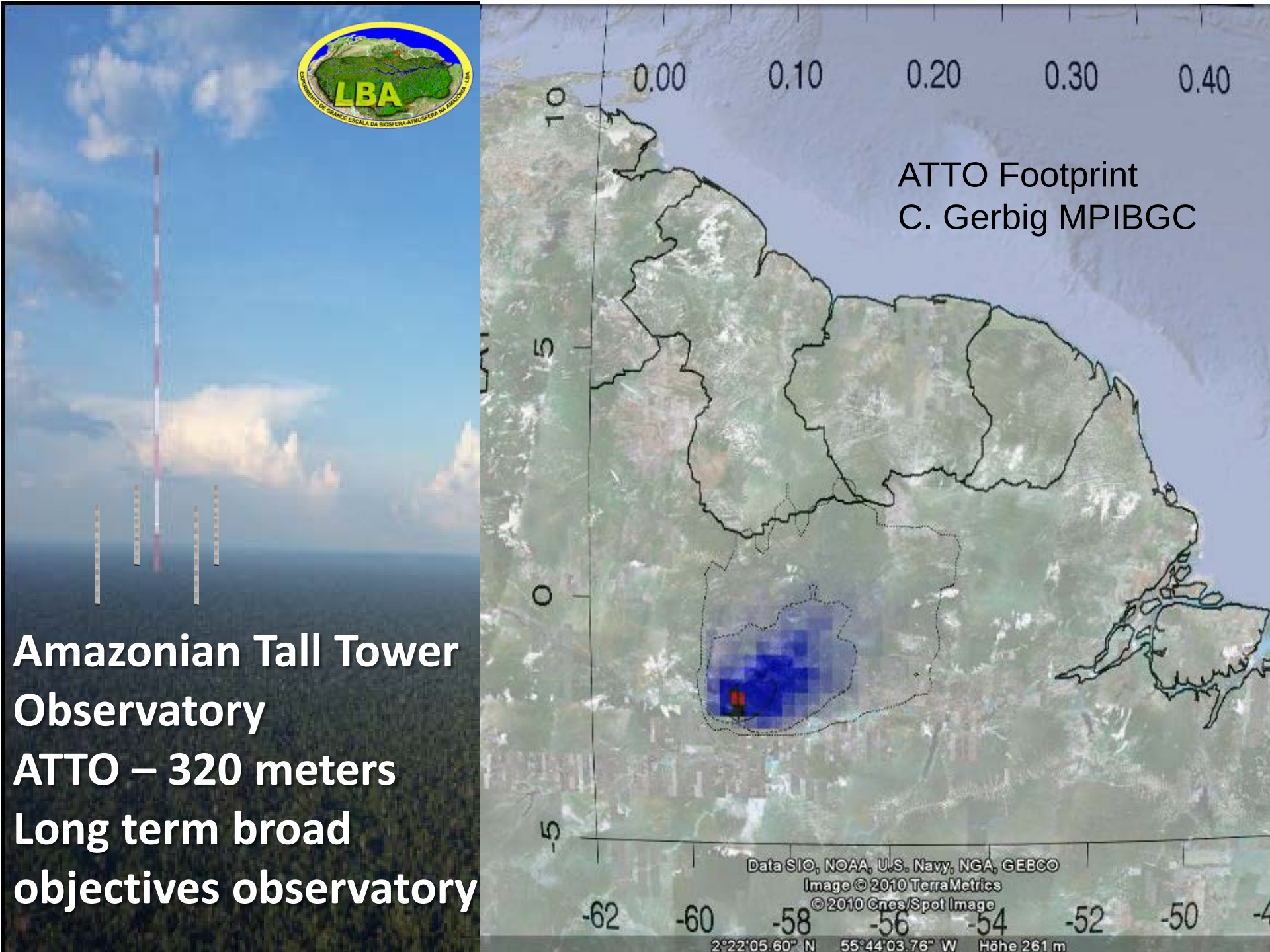
1. Study process and interactions of the Manaus pollution plume with biogenic emissions of VOCs, especially the impact on the production of secondary organic aerosol (SOA) and the formation of new particles;
2. To measure the aging of biomass burning plumes and the subsequent formation of additional SOA;
3. The influence of anthropogenic emissions i.e., (a) the Manaus pollution plume and (b) biomass burning aerosols on aerosol microphysical, optical, CCN, as obtained by comparing the aerosol properties between pristine and anthropogenically influenced air masses; and
4. Determine the optical properties of aerosols from the interaction of the Manaus plume and the natural vegetation atmosphere and obtain the aerosol radiative forcing.

Cloud Life Cycle

5. Study the role of landscape heterogeneity (e. g., the urban area of Manaus or km-long scale of rivers) on the dynamics of convection and clouds;
6. The evolution of convective intensity from severe storms in the dry season to moderate storms in the wet season, and to consider how changes caused by local deforestation lead to similar transitions;
7. The transition from shallow to deep cumulus convection during the daily cycle of the Amazon Basin, with comparison and understanding to other ARM sites; and
8. Development of a knowledge base and test cases that will improve tropical cloud parameterizations in regional and global climate models (GCMs).

Cloud-Aerosol-Precipitation Interactions

9. Aerosol effects on scattered cumulus clouds, especially the aerosol radiative effect, with a special focus on the impact of biomass burning aerosols;
10. Aerosol effects on deep convective clouds, precipitation, and lightning under different aerosol and synoptic regimes, including the roles of aerosols in changing regional climate and atmospheric circulation; and
11. Improvement of parameterizations of aerosol-cloud interactions in the regional and global climate models


LBA
Amazonian Tall Tower Observatory
ATTO – 320 meters
Long term broad objectives observatory
ATTO Footprint
C. Gerbig MPIBGC
0.00
0.10
0.20
0.30
0.40
10
5
0
-5
-62
-60
-58
-56
-54
-52
-50
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image © 2010 TerraMetrics
© 2010 Cnes/Spot Image
2°22'05.60" N 55°44'03.76" W Höhe 261 m

ATTO site: Picture of the 85 meters tall tower at the left that is being used for aerosol and trace measurements and the proposed 320 tall tower under construction.

Fonte: Flávio Luizão.

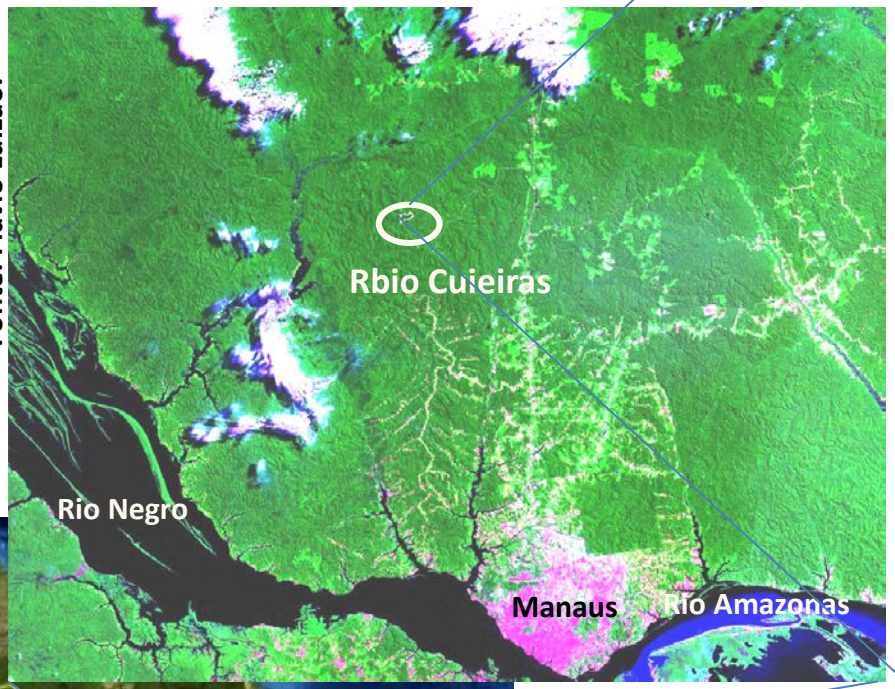


Foto: Carina Prado

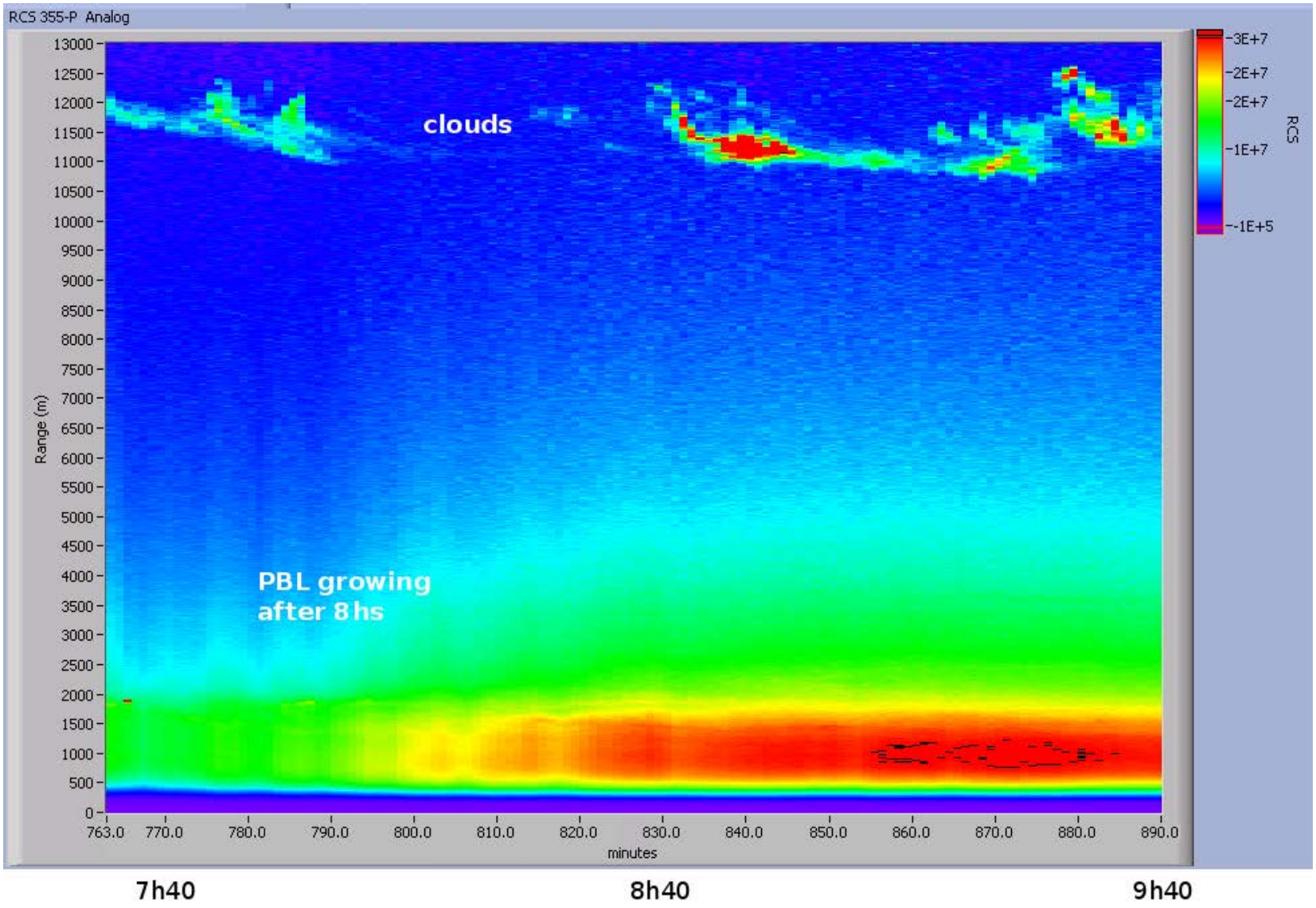
List of instruments at our upwind clouds site (EMB-Embrapa). Second column indicates instrument status. Third column shows if the downwind ARM site will have exactly the same instrument (=) or similar (DIF) instrumentation.

Instrument	EMB	ARM	Quantity Provided
UV Raman Lidar (Raymetrics)	1	DIF	Vertical profile of aerosol extinction and backscatter; night only: water vapor, lidar ratio
THIES Disdrometer	1	DIF	Raindrops size distribution (optical) at ground.
Multi Filter Radiometer (MFR)	1	=	Spectral shortwave radiation (direct and diffuse), optical depth of water vapor, ozone and clouds
Aeronet Sunphotometer	1	=	AOD, size distribution, phase function, water vapor, Angstrom coefficient, 7 wavelengths
Thermal infrared imager	1	DIF	Brightness temperature on cloud sides and cloud base
Thies Met station	1	DIF	P, T, RH, wind and radiation
Ceilometer (Jenoptix CHM15k)	2	DIF	Cloud base, Cloud amount, Penetration depth, Vertical visibility, Height of mixing layer
Micro Rain Radar (Metek MRR-2)	2	DIF	Vertical profile of reflectivity, raindrop size distribution and rain rate.
MP3000 Radiometer (Radiometrics)	3	=	Vertical profile of T, RH and liquid water of non-precipitating clouds
JOSS Disdrometer	3	=	Raindrops size distribution (acoustic) at ground.
PARSIVEL Disdrometer	3	DIF	Raindrops size distribution (optical) at ground.
Davis Met station	4	=	P, T, RH, wind and precipitation
GPS/GNSS + Vaisala Met station	4	=	Integrated Precipitable Water (IPW), P, T, RH

List of instruments to be acquired and operated within this FAPESP component, to be operated at Embrapa. Justification is included in the discussion above.

Instrument	ARM	Quantity Provided
Sky imager (YesInc TSI-880)	=	Cloud cover, Sun shine duration
Campbell CNR4-L Net Radiometer	=	up/down pyranometers and pyrgeometers for net short and thermal radiation
IRGA SON Integrated Gas Analyzer and Sonic Anemometer	DIF	latent and sensible heat fluxes

Raman Lidar: aerosols and water vapor up to 13 Km in Manaus

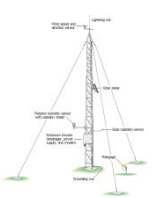


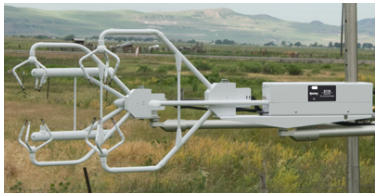
Henrique Barbosa, 2013

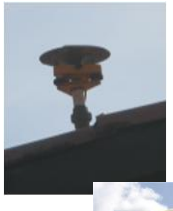
Instrumentation in GoAmazon 2014.

SELEX METEOR 50DX
X-Band DUAL POLAION RADAR

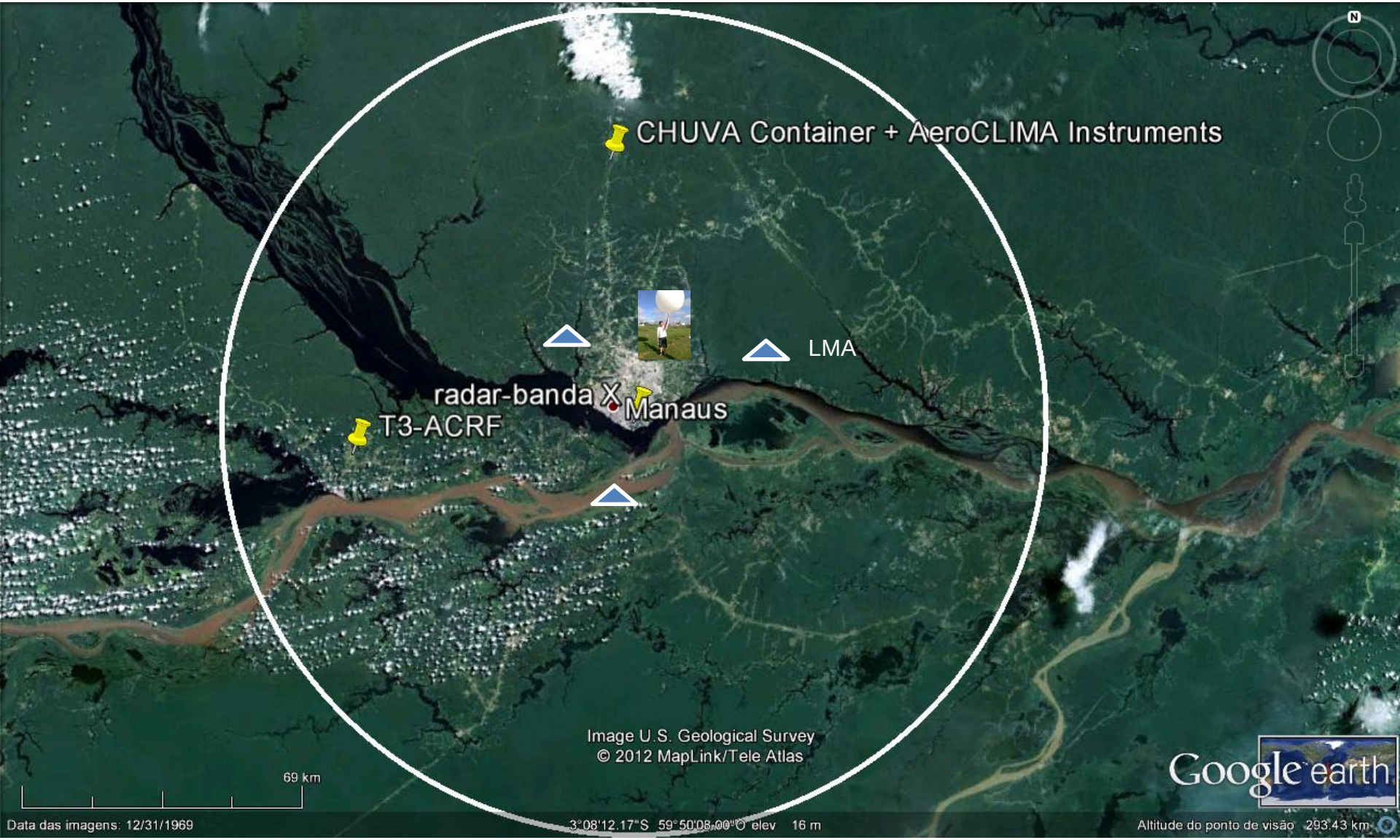
Multi Instrument Container and Networks





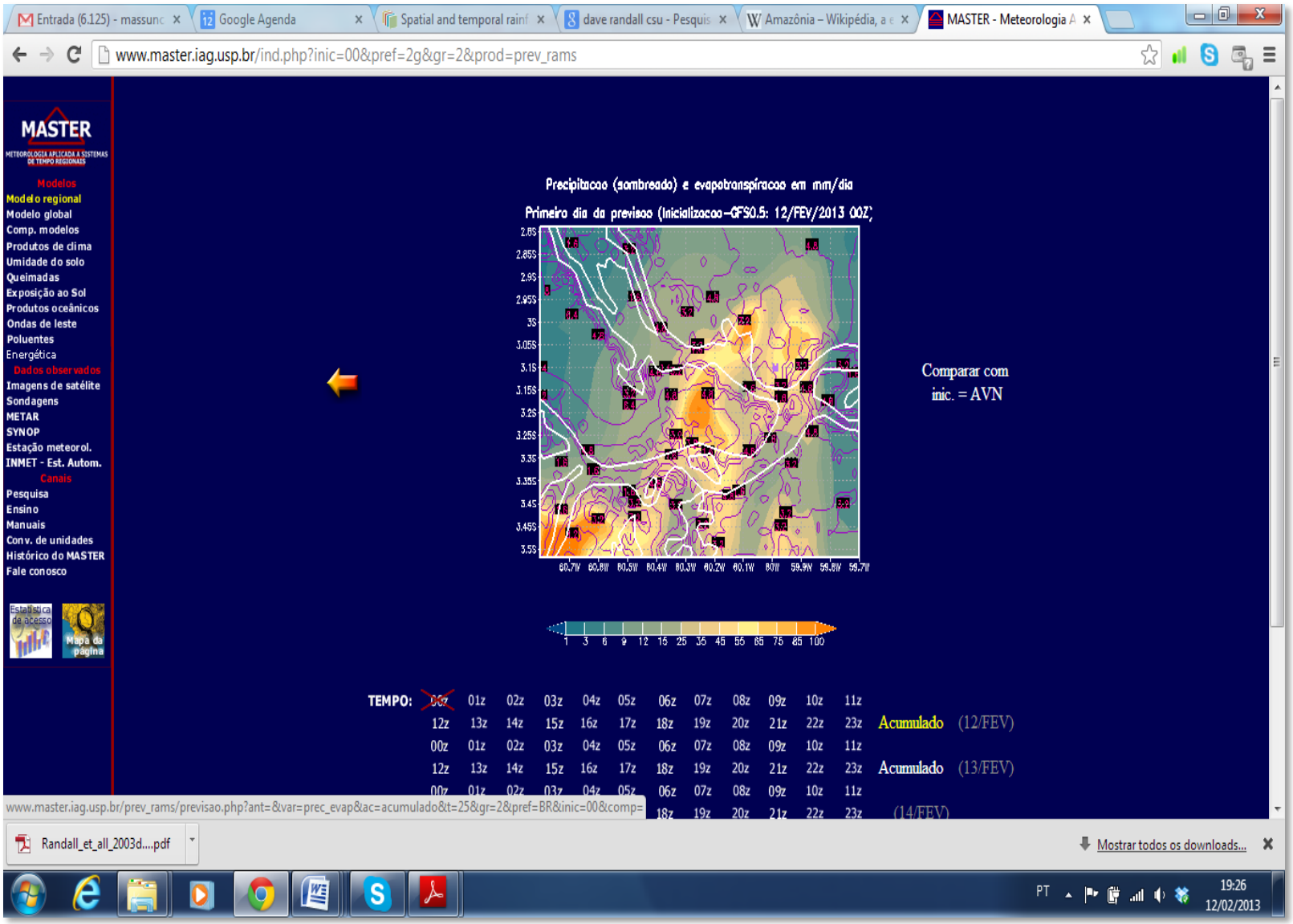


Proposal Locations



High resolution operational 2 km resolution regional forecast with BRAMS for the GOAMAZON.

http://www.master.iag.usp.br/ind.php?inic=00&pref=2g&gr=2&prod=prev_rams



Aircraft camapiagns

IARA - GoAmazon 2014

Activities related to Aerosol, Cloud, Precipitation, and Radiation Interactions and Dynamics of Convective Cloud Systems (ACRIDICON)

and CHUVA Project

Luiz.Machado@cptec.inpe.br

Changes in Net Primary Productivity with Radiation Field
The future of Amazon forests with increased human activities?

Many studies outside the tropics have found an increase in whole-canopy and shade leaf photosynthesis under conditions that enhance the diffuse fraction of irradiance from clouds or aerosols (Gu et al. 2003, Still et al. 2009).

However, recent work in Amazon forests in Santarem, Manaus and Rondonia, found that photosynthesis in old-growth tropical forests exhibited complex relationships with the quality of solar radiation (Doughty and Goulden 2008; Doughty et al. 2010). ; Oliveira et al., 2007, Cirino et al., 2013

The daily cycle of BVOC emissions between tropical and temperature forests are also very different

Thanks for the attention!!