

# Remote Sensing of Aerosols and Water Vapor in the Amazon within the AEROCLIMA project



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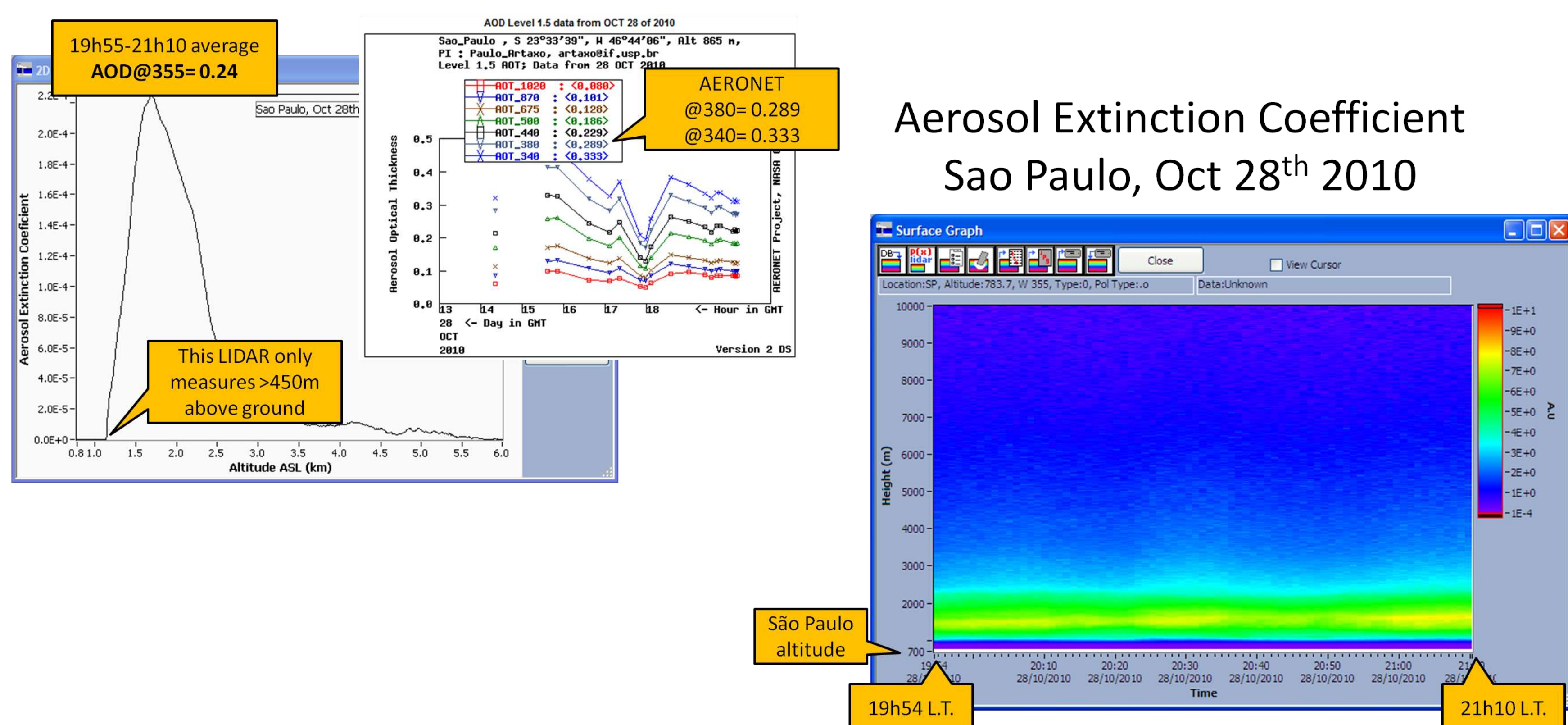
## AEROCLIMA

In order to reduce the uncertainties on direct and indirect aerosol radiative forcing, AEROCLIMA is combining field studies with intensive in-situ measurements, remote sensing and regional and global modeling. Key aerosol properties such as size distribution, mass, elemental and ionic composition, light scattering and absorption, CCN activity, and others are being or will be measured in 3 aerosol sampling sites: north of Manaus (pristine natural and biogenic emissions), Alta Floresta (biomass burning aerosols) and Campo Grande at the Pantanal region.

An important part of this study will be the use of a Raman-Lidar to perform almost continuous measurements of the vertical distribution of aerosol optical properties.

## AEROSOL PROPERTIES

From the elastic channel and the lidar ratio measured with the raman channel during the night, it is possible to derive the back scatter and extinction aerosol coefficients. The example below shows a comparison between lidar and AERONET measurements in São Paulo.



## THE RAMAN LIDAR

The system is fully automated and remotely senses the troposphere, from 400m up to 12km, by sending 95 mJ pulses of a Nd-Yag laser at 355 nm up in the air.

The elastic backscattered signal, as well as the inelastic signals due to the raman crosssection of N<sub>2</sub> (387 nm) and H<sub>2</sub>O (408 nm) are collected by a 20 cm cassegrain telescope and read individually by different sets of photo-multiplier-tubes and interferometric filters.

Vertical resolution is **7.5m**

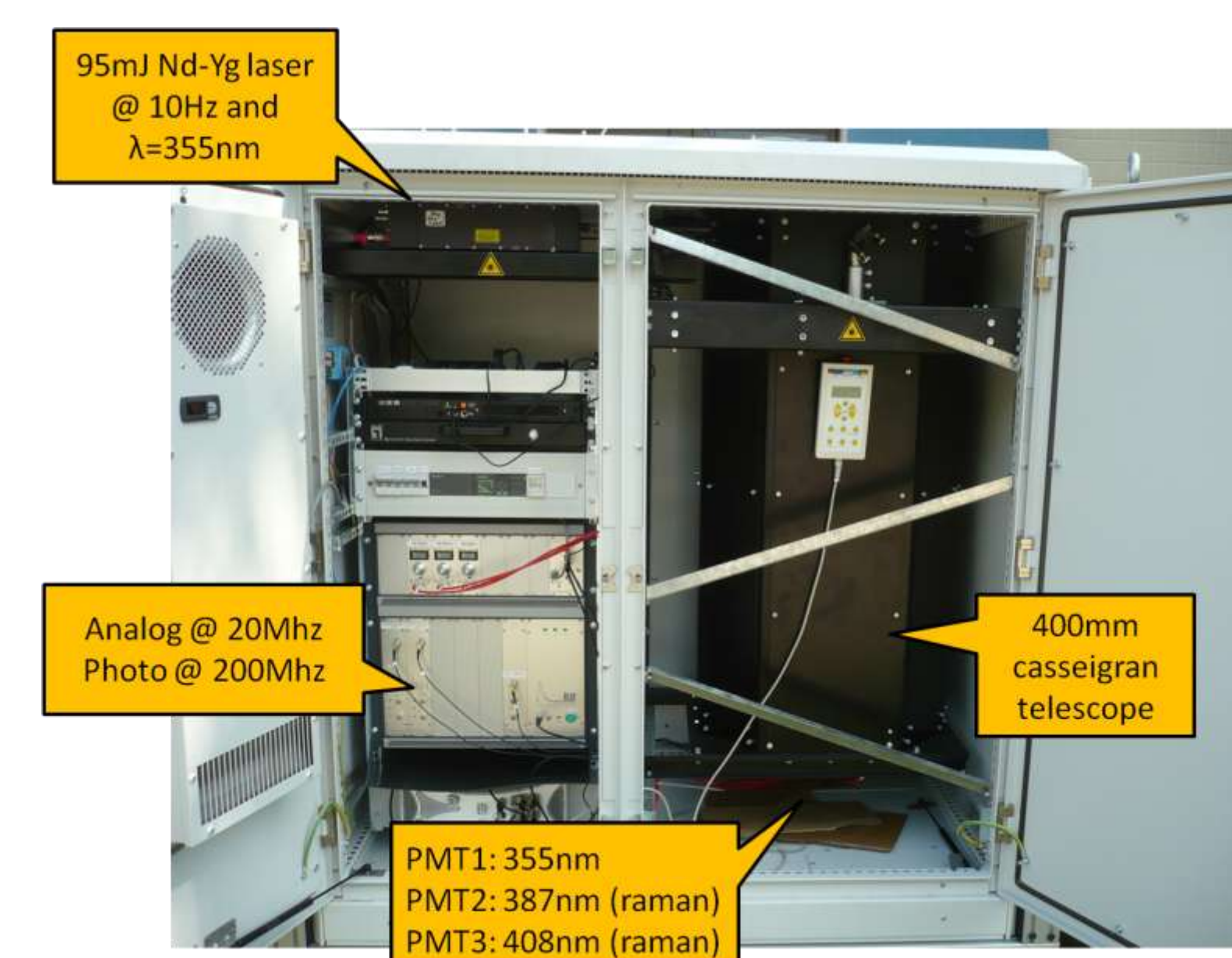
Range is **400m to 15km**

Derived quantities:

**Back scatter coefficient**

**extinction coefficient**

**Water vapor**



**95mJ Nd-Yag laser @ 10Hz and λ=355nm**

**3 PMT's reads 355 nm (elastic), 387 nm and 408 nm (inelastic)**

**Photon-counting @ 250 Mhz**

**Analog/Digital conversion @ 20 Mhz**



## EMBRAPA SITE

The instrument is installed up-wind from Manaus, inside the campus of Embrapa Amazônia Ocidental, on Km-30 of AM-010 highway.

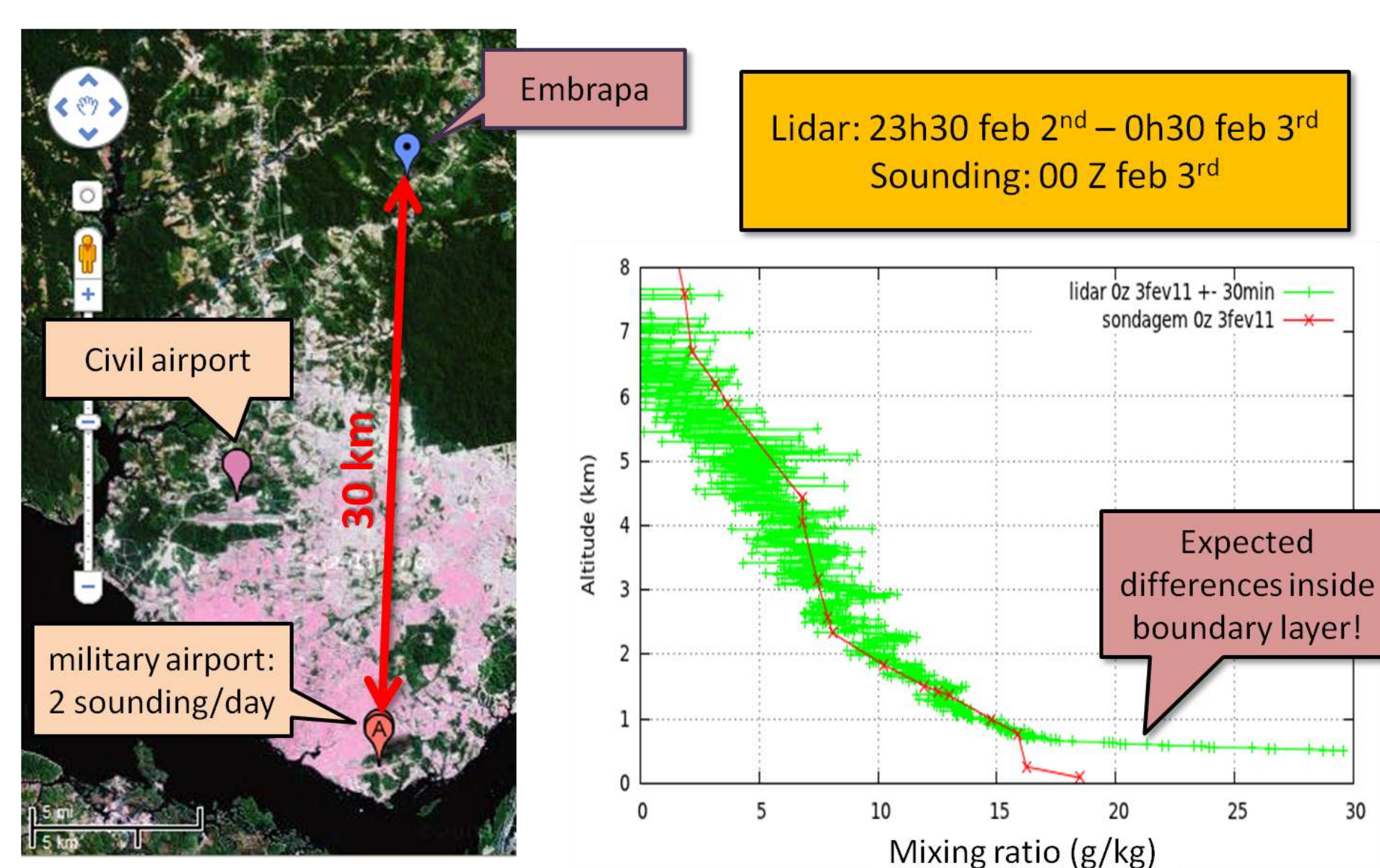
Embrapa Site – km30 AM-010



## WATER VAPOR

The ratio of the H<sub>2</sub>O to N<sub>2</sub> signals is proportional to the amount of water vapor in the atmosphere and its simultaneous measurement should allow for the study of aerosols hygroscopicity.

Example: Water Vapor Profiles



$$w_{H_2O} = C'' \Gamma_A \Gamma_M \frac{S_{H_2O} - BG_{H_2O}}{S_{N_2} - BG_{N_2}}$$

