FIRST TROPOSPHERIC OZONE MEASUREMENTS AT THE OBSERVATORY OF HUANCAYO, PERU

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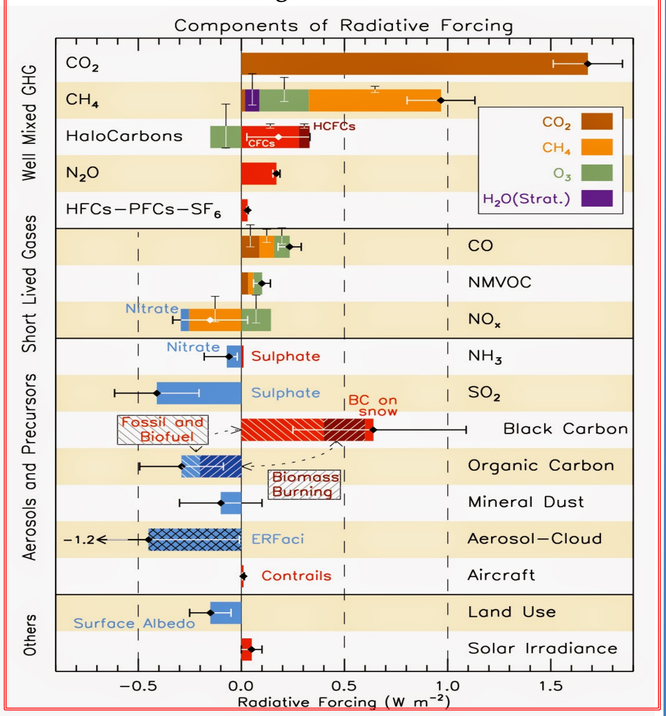
ABSTRACT

Biomass burning in the Amazon Basin produces large amounts of emissions that under the predominant easterly wind conditions can get transported to the Andean region. Satellite observations suggest that increasing tropospheric ozone over the Andes could be caused by secondary ozone production in biomass burning influenced pollution transport.

There are very few surface ozone observations in this region for investigating pollution sources and transport. In order to improve the understanding of the seasonal ozone dispersion over the Andes surface ozone monitoring was established at the Observatory of Huancayo, Peru(lat. 12.05 S, lon. 75.32 W and 3,313 masl) with support from the USAID program. These are the first reactive gas measurements at this meteorological station. The available record, starting in April 2014, shows a significant diurnal variation with ozone maxima during noon to early afternoon. Highest values were recorded from August to October; occasionally exceeding 60 ppbv, the Air Quality Standard for tropospheric ozone in Peru.This ozone dynamic is surprising given the rural setting of the site. Data are used to investigate the potential influence of mountain flow regimes, long-range biomass burning transport, and local pollution from urban areas in the Mantaro Valley.

IMPORTANCE

What is the importance of the transport of air pollutants (tropospheric ozone and aerosols) from biomass burning to the Andean and Amazonia region in Peru?
Is it an air quality or climatic issue? Is it a local or regional issue?



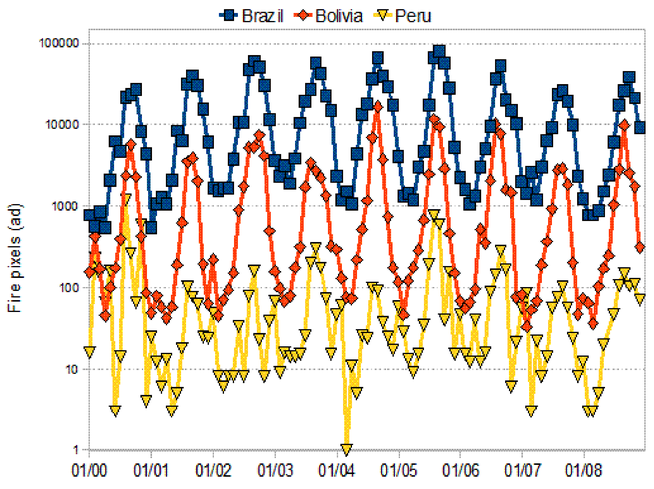


Fig. 1. Fire pixels from NOAA satellites for 2000 to 2008 (from DSA/INPE) over Peru, Brazil and Bolivia.
Important amount of pollution is produced by biomass burning mainly in Brazil. Note the logarithmic scale of Y axis.

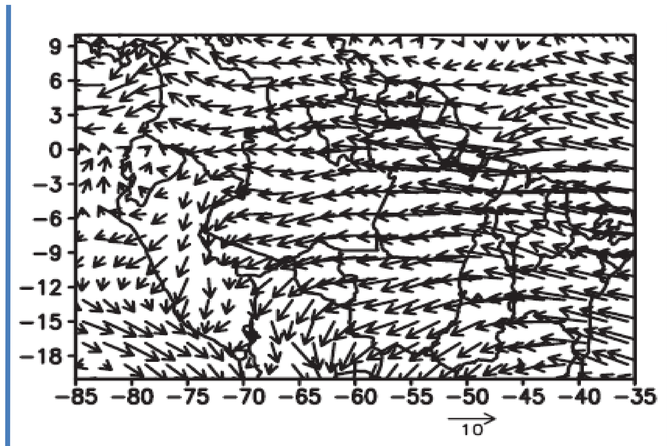


Fig. 2. Field winds at 700 HPa of global analysis (NCEP-NCAR)
It shows the special prevalence of winds coming from east to west region of the Amazonia creating special conditions for the transport of different pollutants.

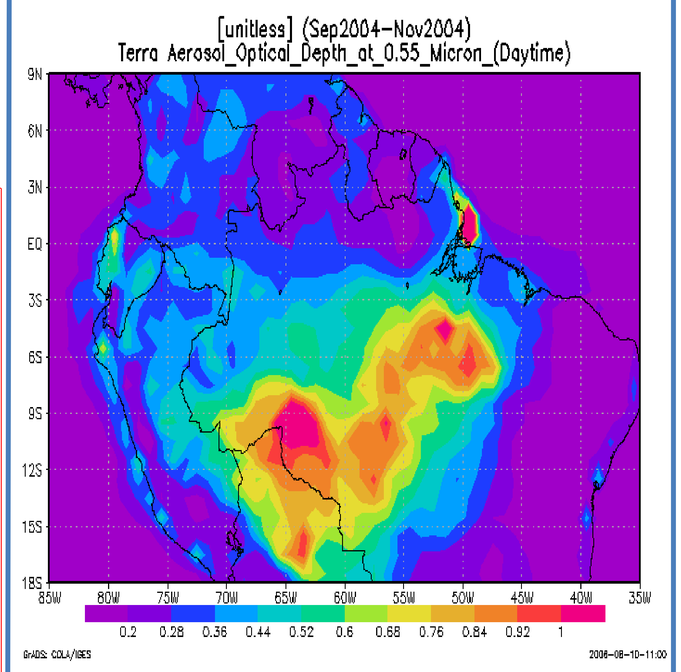


Fig. 3. Spatial variation of aerosol optical depth by MODIS sensor where is possible to note that aerosol over Peru is influenced by pollution coming from Brazil.

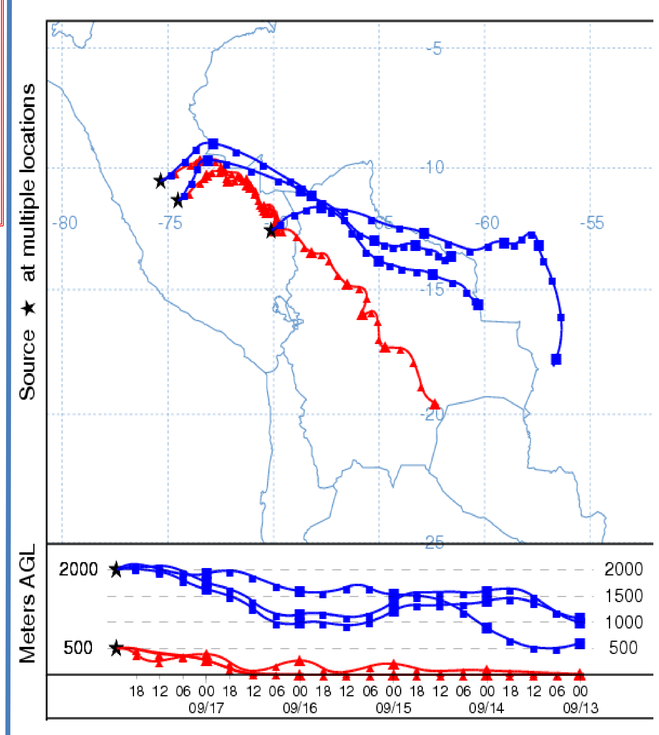


Fig. 4. Air masses trajectories with HYSPLIT model for 5 days before Sep. 17th 2008 for the 3 locations used in the study the transport of pollutants from Brazil and Bolivia to Peru. Lower box shows altitude variations of air masses.

IMPROVING AIR POLLUTION DETECTION

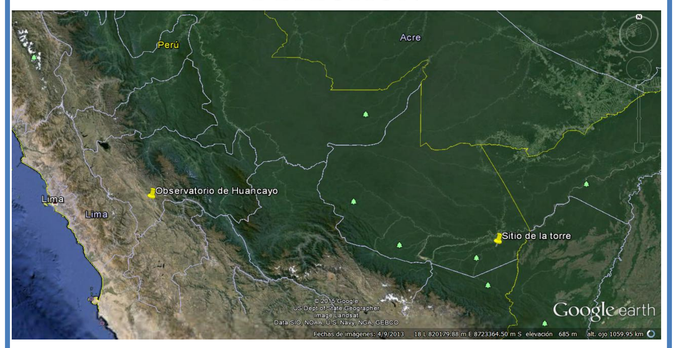


Fig. 5. Measurement sites over the Andean and Amazonia of Peru where there is an increase of monitoring and research capabilities.

Fig. 6. Wind rose for the hourly variability at the Observatory of Huancayo for the period 2002 – 2010. The Huancayo city, with about 300,000 inhabitants is located to the east of the site.

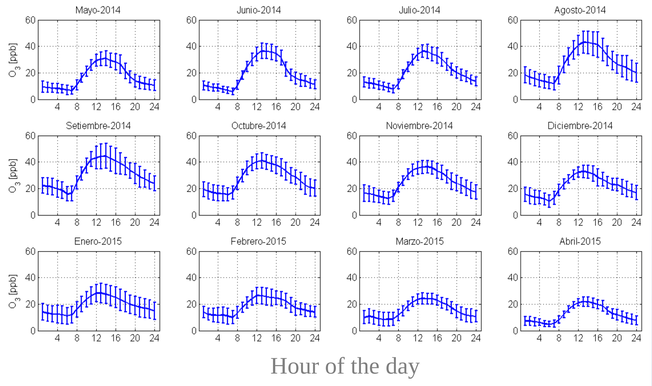


Fig. 7. Hourly variation of the 12 first months (May 2014 to Abril 2015) of tropospheric ozone measurements at the Observatory of Huancayo. It is possible to note the highest values during the dry season (from August to October) where most fire are registered too. Some hours exceeds the daily Peruvian Air Quality Standard for ozone (about 60 ppb) probably also with influence from Huancayo city.

Fig. 8. Additionally to the use of models and satellite data, with support of our US Partner, we are implementing an aerosol and tropospheric ozone monitoring system to be installed at a tower facility of 45 m of altitude, in the forest close to the borders of Bolivia and Brazil where most fires are produced.

INCREASING HUMAN RESOURCES FOR ATMOSPHERIC RESEARCH

Fig. 9. Support to graduate and undergraduate students for doing their thesis. With additional support from researchers from Brazil and USA. It included implementation of the facilities of the Laboratory of Atmospheric Microphysics and Radiation (LAMAR) at the Observatory of Huancayo.

SUMMARY OF ACTIONS

- It was reviewed the important influence of the long range transport of air pollutants related to biomass burning over Amazon and Andean region.
-It was completed the setup of the ozone monitoring station at the Observatory of Huancayo.
- It was possible to complete the first year of continuous tropospheric ozone measurements.
- There is an important increase of atmospheric research capabilities at the Observatory of Huancayo.
- A initial evaluation of winds and ozone temporal variations was presented.

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