1.25 THE STRUCTURE OF THE ATMOSPHERIC BOUNDARY LAYER COUPLED WITH THE HETEROGENEITY OF THE SURFACE DURING THE SAMBBA EXPERIMENT HELD IN AMAZONIA - 2012

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1. INTRODUCTION

The *South AMerican Biomass Burning Analysis* (SAMBBA) project [2] is an international partnership between British (UK Met Office and 7 Universities) and Brazilian (INPE and University of Sao Paulo) institutions, which together have the goals to investigate the properties of biomass burning pollution over South America and its interaction with the Amazonian biosphere, weather and climate.

The field campaign of SAMBBA was held during September/October 2012 in Amazonia and a set of equipment were deployed, specially an aircraft from UK Met Office [the UK *Facility for Airborne Atmospheric Measurement* (FAAM) BAe-146 research aircraft]. Sept/Oct months represent the end of the dry season in the Amazon.

The objective of this work is to analyze the time evolution of the properties of the atmospheric boundary layer during a specific flight (Sept 26, 2012), in which the aircraft flown over different types of vegetation (landscape heterogeneity), which can trigger distinct mesoscale processes. Also, recent studies provide evidences of the influence of surface heterogeneity on local and regional atmospheric circulations ([1], [3], and [5]).

2. DATA SET

During the flights, dropsondes (RD94 from Vaisala Oy, Finland) were released in order to get the basic meteorological parameters (temperature, humidity and winds – windspeed and direction).

At the ground, rawinsoundings (RS92-SVP from Vaisala Oy, Finland) were launched at the synoptic times (00:00 and 12:00 UTC – local timezone is GMT – 4 h), thus the latter corresponds to an early morning sounding at 08:00 local time.

From the take-off [13:00 UTC, Porto Velho (8°S, 64°W – in the southwest of Amazonia)] up to the landing time [16:30 UTC, Palmas (10° S, 49°W – in the southeast Amazonia and at the central South America)], seven dropsondes (13:17, 13:57, 14:20, 14:44, 15:07, 15:33, 15:48 UTC) were released (**Fig. 1**), providing information about the structure of the mid-lower troposphere (mostly within the convective boundary layer - CBL).

Mixing ratio and potential temperature profiles were used to characterize the thickness of the mixed layer, its structure and time evolution.

3. RESULTS

It was observed a remarkable evolution of the boundary layer along the course of the aircraft. At the departure point, the CBL was very wet (specific humidity around 15-16 g/kg) and cold (mean potential temperature around 300 K), presenting a height of 500-700 m, as well as a maximum in the wind speed at low levels (13:17 up to 14:20, **Figs. 2a**). Those are typical features of (tropical) forested area between 09:00-10:00 local time (near onset time of local convection). Similar features were found by [3].

Moving to the landing point, the CBL heated up (due to the solar heating but also due to change of surface vegetation and consequently to the sensible heat fluxes) to values of 305-306 K (**Figs. 2c**). Also, the CBL became drier (specific humidity around 13 g/kg) and its height deeper (around 1000-1200 m) (**Figs. 2d**). This behavior is associated with the landscape, which varied

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from tropical forest (Porto Velho area) to savannah biome (at Palmas). Meanwhile, the maximum in the wind speed occurred in mid levels (14:44 up to 15:48, **Figs. 2a**).

During all the dropsonde releases, the wind direction profiles showed a noticeable counterclockwise turn with height: from southeasterly (between surface and the top of the boundary layer) to easterly and then northerly-northwesterly (above the top of the boundary layer) (**Figs. 2b**).

At the same time, infrared satellite imagery (provided by NOAA and INPE) indicated the presence of convective clouds in the area of the flight (**Figs. 3a to d**). Cumulonimbus clouds often influence the main features of the CBL (either in their developing, mature and dissipative stages [**4**]), but further studies will be needed in order to analyze this sort of mesoscale evidences in the SAMBBA data.

4. CONCLUSIONS

This study used dropsonde data from the SAMBBA field campaign (held during September/October 2012) in Amazonia. Our preliminary results showed a remarkable evolution of the convective boundary layer (CBL) along surface heterogeneity, and in the presence of clouds. In the middle of the morning (local time), over tropical florest area, the CBL tended to be shallow, cold and wet. In the early and middle afternoon (local time), the CBL deepened in response to the surface heating, and at the same time became drier due to the change of landscape (flight over savannah areas). The maximum in the wind speed occurred in the low levels in the morning and in the middle levels in the afternoon.

For further studies, we intend to compare dropsonde+rawinsondes profiles and energy flux measurements in order to obtain a better overview of the structure of the mid-lower troposphere (specially within the CBL). We also are interested in identifying and analyzing the influence of cloud processes on the vertical profiles during the Sept 26 flight.

5. ACKNOWLEDGMENTS

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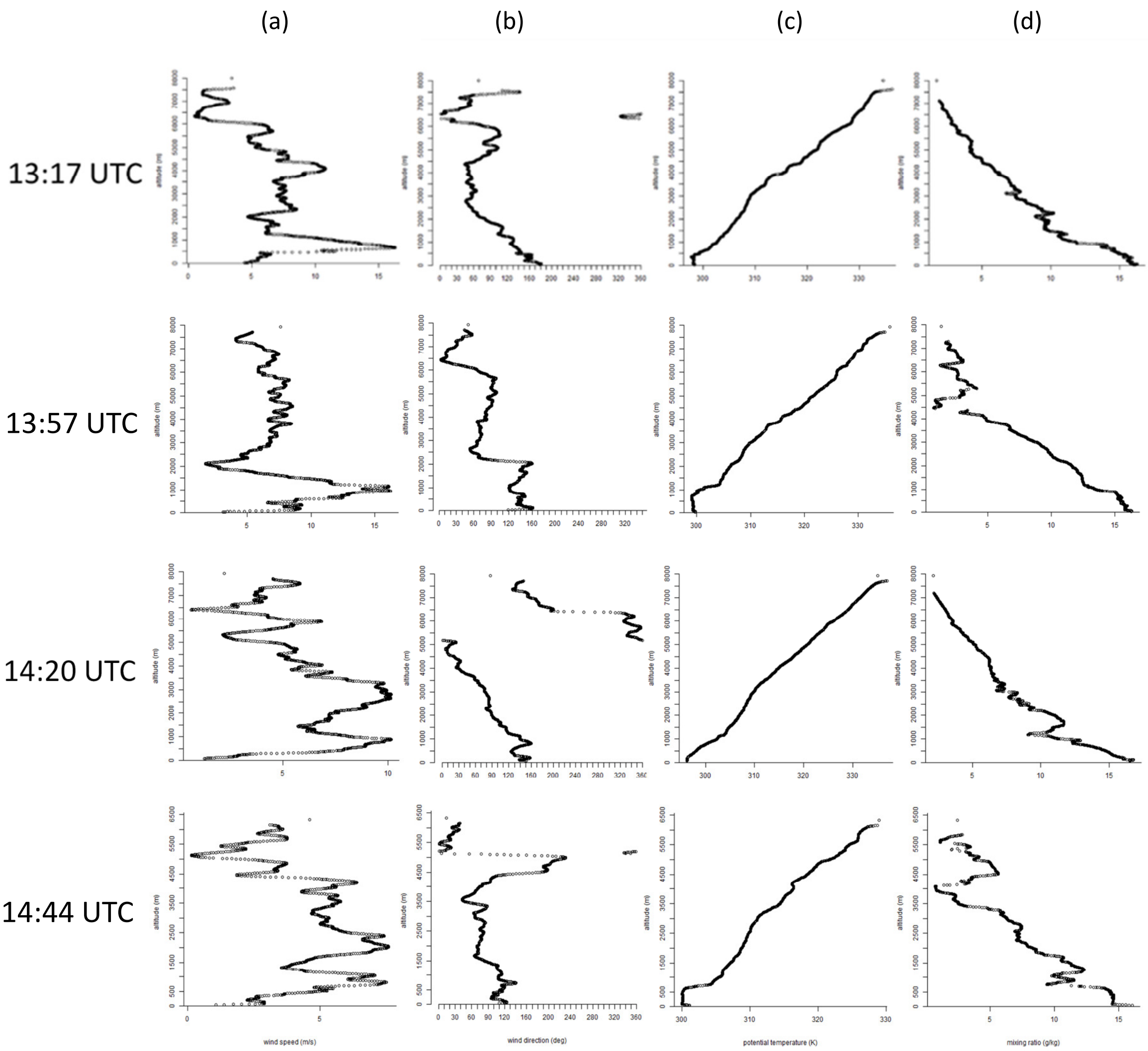
Fig. 1: Aircraft route (red line) during the Sept 26, 2012 flight on Southeastern Amazonia from Porto Velho to Palmas (orange pins). Dropsonde releases and their respective times (UTC) are marked along the way (yellow pins). Maps generated from Google Inc.



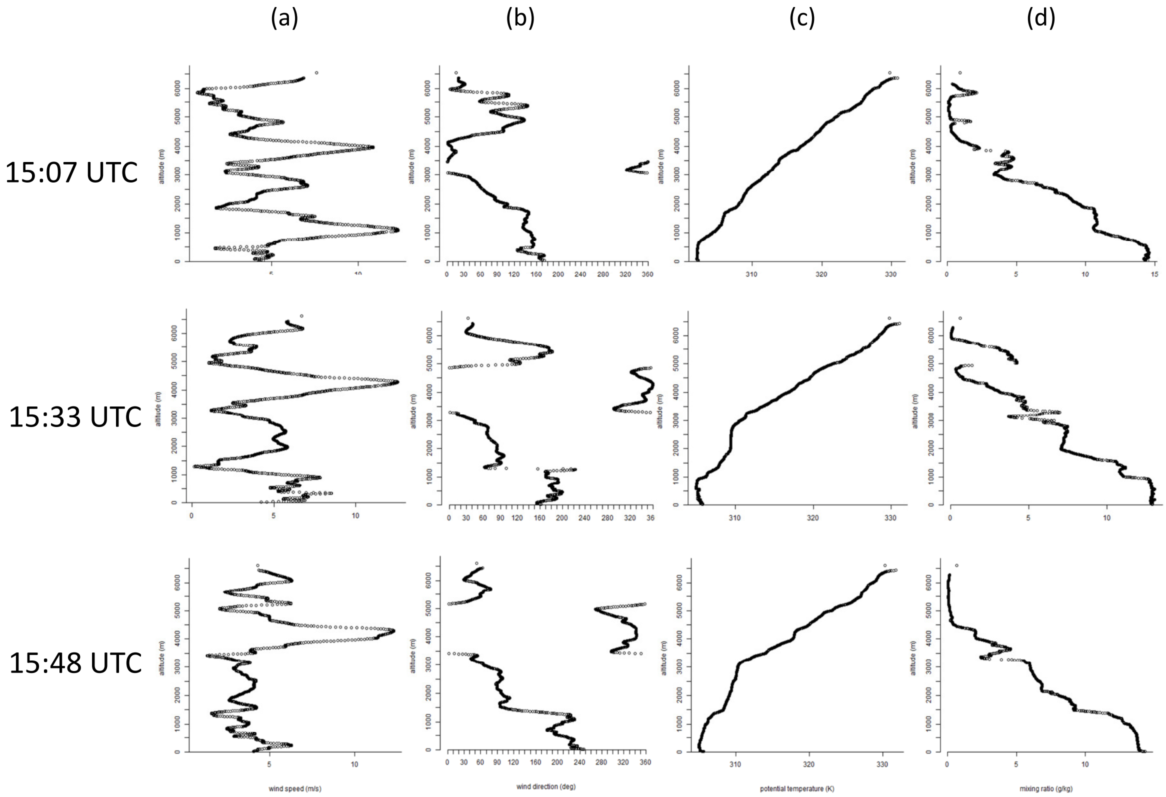


Fig. 2: Vertical profiles of (a) wind speed [m/s] (b) wind direction [deg], (c) potential temperature (K) and (d) mixing ratio [g/kg] for seven dropsonde releases made during the Sept 26, 2012 flight over Southeastern Amazonia. Profiles obtained from SAMBBA data set.

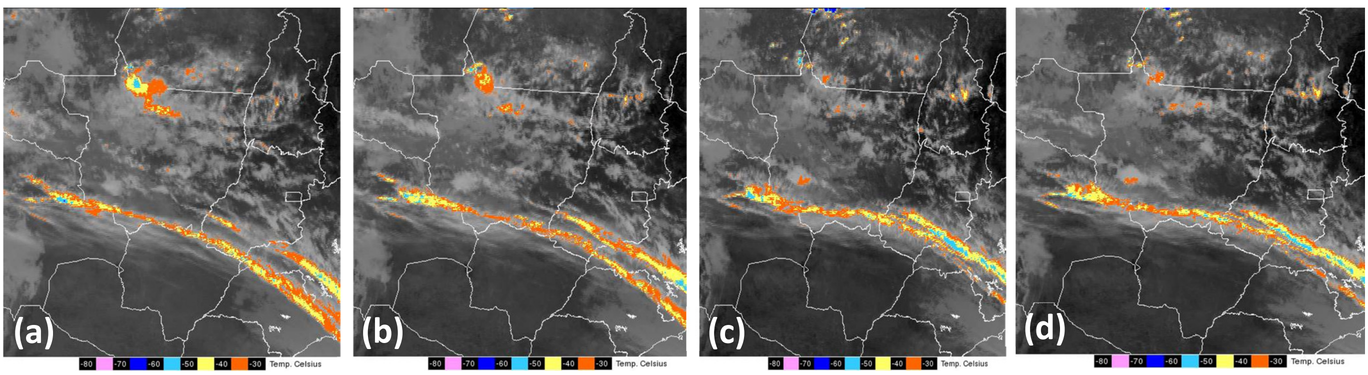


Fig. 3: Infrared GOES-12 satellite images of Central South America in Sept 26, 2012 at (a) 13:15, (b) 14:15, (c) 15:30 and (d) 16:00 UTC, showing convective clouds along the path of the BAe-146 aircraft. The shaded color scale refers to the temperature (℃) of the top of the convective clouds. The set of images was provided by NOAA and INPE.