Surface layer at a transition region ocean–land

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1. Introduction

In the region of the Brazilian rocket launching center (CLA) at Alcântara, MA, there is an easterly flow from surface up to 8km during September (dry-season) (Fisch et al. 2010). The marine boundary layer is mechanically and thermally (Garratt1990) modified when it reaches the coast. We use turbulence measurements made near the surface at two different locations (100m apart) to investigate the turbulence modification within the surface layer as it is advected inland. The thermal modification will be left for a future study.

2. Data

The data used is correspond to measurements taken at the coastal line on the top of a plateau, 70m and 200m meters inland. The transition zone water to land is composed by a steep cliff of about 40m high, which delimits the border of a plateau. The surface cover (roughness) changes from water to small dense bushes, with typical height of 3m.

At 70m inland there was a 70m tall tower with a wind profile with six levels(6m, 10m, 16m, 28m, 43m, and 70m above ground level (AGL)), and a sonic anemometer CSAT3 at 9.5m (hereafter sonic B). At 200m inland there were another sonic anemometer installed at 9.5m on a mast (sonic A) . This site was located in a clearing with sparse small grass and was downwind from the tower with respect to the direction of predominant wind (northeast).

3. Results

The windrose for the tower shows that the predominant wind is from NNE to NEE, with ~ 70% of the time with winds coming from NE. The coastal line is approximately aligned NW –SE, therefore the winds flow from ocean to land. Due to drastic surface changes, an internal boundary layer (IBL) develops. However, here the situation is a bit more complicated than the discussed in the literature (e. g. Arya1988) because, there is also a topographical barrier, which according to Fisch et al. (2010), causes flow acceleration and recirculation near the edge of the of cliff, and a second IBL should develop at the clearing, where the sonic A was located.

The wind is stronger at the tower than at sonic A, but the fluxes and the TKE are smaller (Fig. 1 -a, b, c, and d). The z/L parameter is larger at the sonic-B than at sonic-A indicating that the flow is less neutral at the tower (Fig.1-e).

4. Conclusion

The flow regime at sonics A and B were different despite the small distance between them (~100m). The reasons for such difference were - different distances to the water and surface roughness. Comparing the adjusted wind profile over the water with the one at the tower (Fig. 1- f), shows that both profiles come together at $z = 65\ m$. Indicating that both sonics were in the region of the IBL, however an equilibrium was not reached within the fetch distance between the edge of the cliff and tower (sonic B). The second IBL with the flow acceleration and recirculation effects must have affected the first IBL.

Acknowledgments

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5. References

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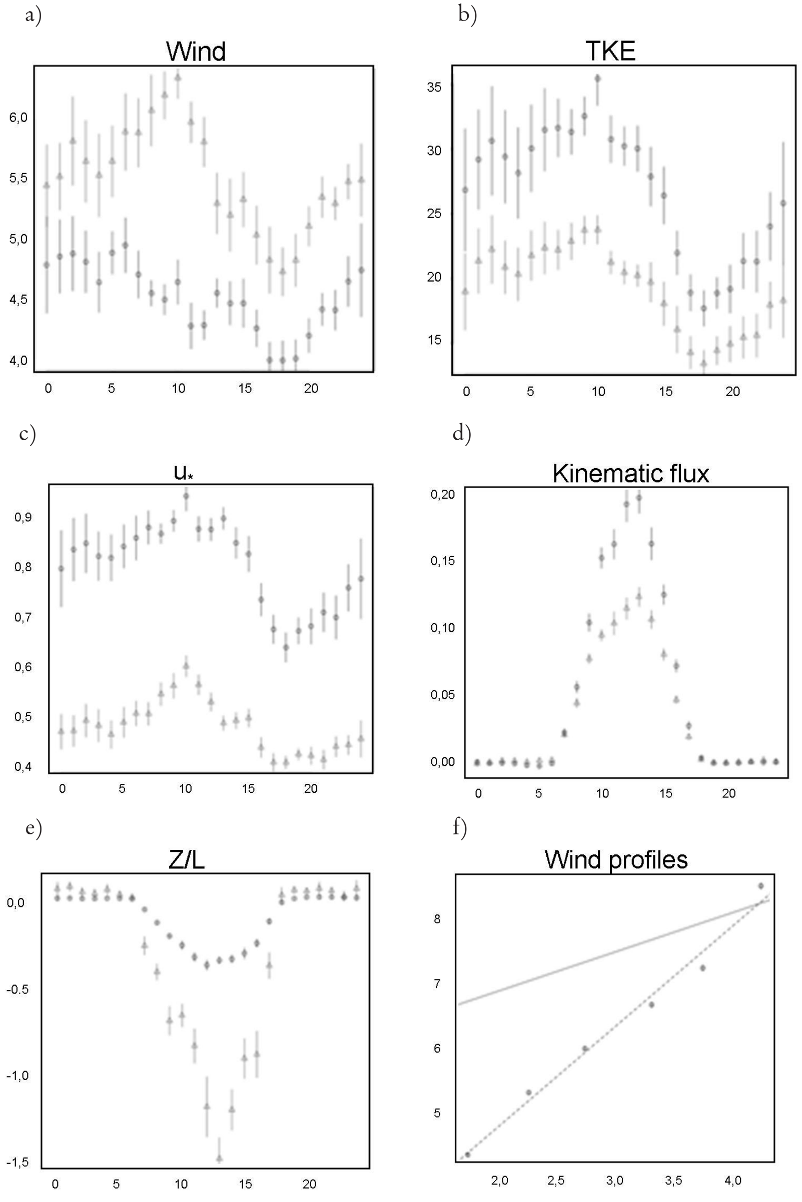

Figure 1. a), b), c), d), and e) represent, respectively, 24 hours average cycles for wind speed (m s^{-1}), turbulent kinetic energy (m^2 s^{-2}), friction velocity u_*. (m s^{-1}), kinematic heat flux (K m s^{-1}), and z/L stability parameter. The circles are the sonic-A and the triangles sonic-B. The time is the local standard time in hours. f) Points represent the tower average wind profile (m s^{-1}) as function of ln(z –d). Dotted line and solid lines are neutral wind profile, $U(z) = (u^*/k)\ ln(z/z_0)$, adjusted to the tower, and to the surface layer wind above the ocean, using wind buoy data at 0N35W from PIRATA experiment.