Ozone variations in the atmospheric boundary layer over the eastern tropical Pacific

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It is known that the eastern tropical Pacific is a characteristic region where the sea surface temperature (SST) is low and its seasonal variation is large. Here a thin layer of the temperature increase with altitude in the lower troposphere is often observed in the latter half of the year. This is called an inversion layer that is very stable and supposed to prevent vertical mass transport. However, only typical meteorological parameters such as temperature and relative humidity have been studied so far (*Bretherton*[2004]). In this study, we investigate seasonal variations of the inversion layer and its relation to vertical profiles of water vapor and ozone using high-resolution ozonesonde data which are semi-regularly obtained at San Cristobal Island, Ecuador (0.92S, 89.6W) in the eastern tropical Pacific.

In March the temperature decreases with altitude, while in September the inversion layer is often observed at about 1000m. Then we defined the inversion layer as a layer in which the potential temperature increases over 2.0K in a 100m height range, and calculated a frequency of inversion layer formation in each month. Figure 1 shows the result together with the seasonal variation of SST. The high formation frequency of the inversion layer was closely related to the low SST. It is also found that relative humidity just below the inversion layer was as much as 90% in the latter half of the year, suggesting the presence of low level clouds. At the same time horizontal wind speed has a maximum at 400- 500m and a minimum just above the inversion layer.

Figure 2 shows a time-height section of monthly mean ozone mixing ratio. From February to April, ozone mixing ratio was relatively low below 3000m and there is a minor maximum around 1000- 2000m. By contrast, from July to November ozone mixing ratio was almost constant below the inversion layer. This might be due to vertical mixing caused by the strong wind shear around this time. Moreover, there is a local minimum of ozone just above the inversion layer. Considering that low level clouds exist persistently just below the inversion layer, photodissociation may become intense just above the inversion layer because of the solar reflection by clouds (*Madronich* [1987]). Taken with a wind speed minimum there, air parcel can stay this region for a long time, and then ozone would be destructed easily.

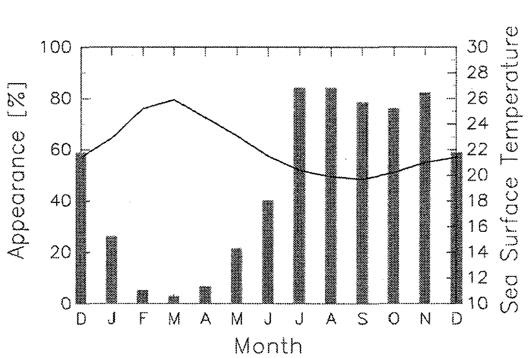

Figure 1: Frequency of inversion formation

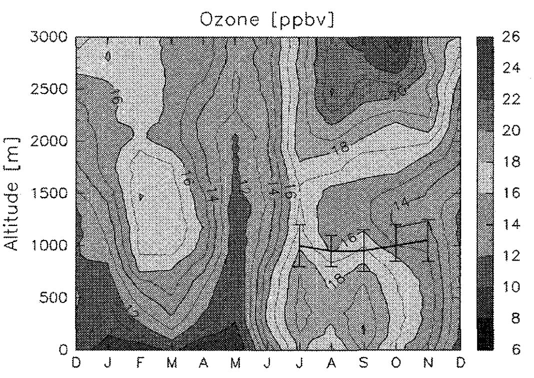

Figure 2: Time-height section of ozone mixing ratio

REFERENCES

[1] Bretherton, S., The EPIC 2001 Stratocumulus Study, *BAMS*, July 2004.
[2] Madronich, S., Photodissociation in the Atmosphere: 1. Actinic Flux and the Effects of Ground Reflections and Clouds, *J.Geophys. Res.*, 92, 9740- 9752, 1987.