# DIURNAL WIND VARIATIONS OVER SUMATRA IN INDONESIA OBSERVED WITH THE EQUATORIAL ATMOSPHERE RADAR

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The Equatorial Atmosphere Radar (EAR), located at the equator in West Sumatra, Indonesia (0.2 degrees south, 100.32 degrees east) has been observing three-dimensional wind velocities and the intensity of turbulent eddies with half the radar wavelength (about 3 m) in the troposphere and the lower stratosphere (2-20km) since July 2001. In this paper, we show the diurnal cycle of wind variations and its relation to cloud activities during November 2001 and 2002, revealed by the results of simultaneous measurement with the EAR and radiosonde soundings.

Rainfall and TBB data also showed a similar diurnal variation during both observational periods. Heavy rainfall concentrates during 15-18 LT, and weak rainfall was observed during nighttime (19-06 LT). During 06-12 LT, little or no rainfall were observed. TBB was minimum around 13-16 LT and maximum around 22-01 LT. This result agrees with the previous studies. Convective clouds begin to develop around 12LT, raise rainfall during 15-18 LT, while stratiform clouds begin to develop in the same period. After 18 LT, stratiform cloud continue to develop until midnight (22-01 LT) and decays gradually until 06 LT. Weak rainfall is considered to occur associated with this time variation of stratiform clouds.

However, the rainfall amount was different more than twice in November 2001 (185mm) and in November 2002 (378 mm). Furthermore in November 2001, diurnal cycle of relative humidity showed conspicuous diurnal cycle at 4.0-8.0 km altitudes, while its value is small (less than 77%) and showed relatively small diurnal variations at 2.5-3.5 km altitudes, which were probably the altitudes of cloud tops. In November 2002, diurnal cycle of relative humidity was also conspicuous. However, they were not small at 2.5-3.5 km altitudes, and its value and hand smaller values than that in November 2001 at 3.5-8.0 km altitudes. Thus, the followings are inferred. (1) In November 2001, principal mechanism that cause a diurnal cycle of convection is different from that in November 2002. (2) In November 2001, each of clouds below 4.0 km altitude and those above 4.0 km altitude developed by different mechanisms. We examined the relation between the convective mechanisms and diurnal variations of horizontal wind.

As for the horizontal wind, eastward wind from the Indian Ocean prevailed at 4.0 km altitudes in November 2001, while westward wind from the Pacific Ocean prevailed at the same altitudes in November 2002. Above 4.0 km altitudes, westward wind from the Pacific Ocean also prevailed in November 2002, while weak westward or eastward wind were observed in November 2001. This indicates that the convections in the Indian (Pacific) Ocean is dominant for rainfalls at the radar site in November 2001 (2002), and that heavy rainfalls at the radar site are more prominent when the convection in the Pacific Ocean are dominant. From the TBB data, it was confirmed. In November 2002, strong convection occurred around 15 LT at the east coast of Sumatra island, moved westward and reached over the radar site around 18 LT, crossed over the radar site around 00 LT. In November 2001 such a horizontally moving convective systems were not observed by the TBB data.

In November 2001, very high clouds (TBB less than 230K) begin to develop around 18 LT over the highland area in Sumatra island, progress most around 21 LT, decays gradually from 00 LT. TBB obtained by GMS mainly reflects the cloud top motions above 4 km altitudes, and some mechanisms which cause the development of clouds at those altitudes may exist. The diurnal variations of zonal wind averaged during November 2001 showed a opposite phase between 4-8 km altitudes and 8-12 km altitudes, which indicates the existence of convergence (4-8 km) and divergence (8-12 km) of wind fields. It seems that clouds above 4.0 km altitudes develops by this convergent wind field at 4-8 km altitude, separately from the cloud systems below 3.5 km.