Observational study on convection at Sumatra Indonesia

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The Indonesian maritime continent is one of the regions where the most active convection occurs anywhere on the globe [1]. Sumatra is one of the largest islands in the Indonesian Maritime Continent. However, the formation process of convection over Sumatra has never been studied. In this paper, the convective activity over Sumatra and its relationship to large-scale disturbances are studied as the case study during October-December 2001. Tropical cirrus develops with deep convection in the troposphere plays an important role in the radiation processes [2]. However, the formation and maintain processes of cirrus are not still understood well. Formation of cirrus and its relationship to the vertical wind in the upper troposphere are studied using data derived from a VHF-band wind profiler (Equatorial Atmosphere Radar; EAR) [3], lidar, and radiosondes observed over Sumatra.

During 15 October-31 December 2001, deep convection over Sumatra occurred with three kinds of large-scale disturbances. These are (1) eastward-moving Super Cloud Clusters (SCCs), (2) circulation disturbance over the Indian Ocean, and (3) East-Asian cold surge. Deep convection over Sumatra was observed when six eastward-moving SCCs developed over the Indian Ocean passed over it. When low-level moist air in the Indian Ocean supplied to Sumatra by circulation disturbance, the convective activity induced by local circulation was strengthened. During the strong cold-surge events, large low-level northeasterly flow over the South China Sea caused the formation of low-level convergence over Sumatra. Deep convection formed in the cold-surge-induced convergence region.

During 5-9 May 2004, eastward-moving SCCs passed over Sumatra. Figure 1 shows time variations of vertical winds observed with the EAR averaged over 8-15 km. Updraft exceeding 5 cm/s prevailed in the upper troposphere while large-scale convective envelope existed over Sumatra. During 6-7 and 7-8 May, the cloud top of cirrus existed below the continuous downdraft (> 5 cm/s) region. Radiosonde results showed that 55-90 % of downdraft observed by the EAR can be explained by the northeasterly flow along the isentropic surface.

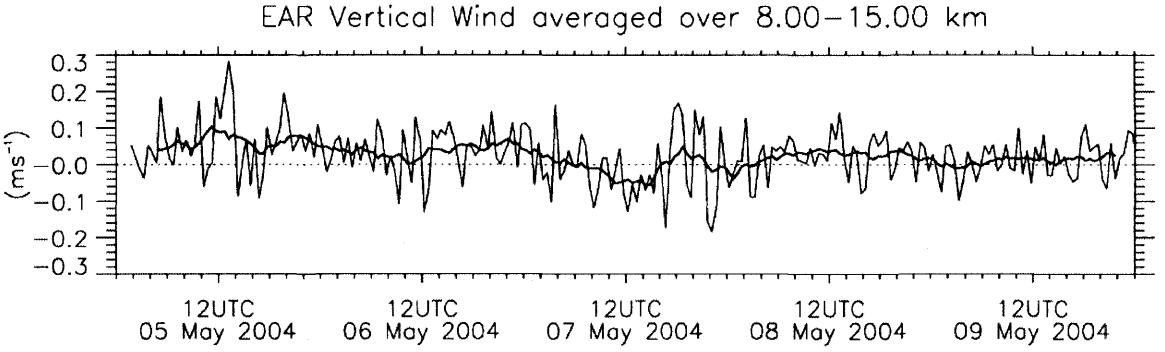

Figure 1: Time variations of vertical winds observed with the EAR averaged over 8-15 km during May 5-9, 2004.

REFERENCES

[1] Ramage, C. S. (1968) Role of a tropical "maritime continent" in the atmospheric circulation, Mon. Wea. Rev., 96, 365-370.
[2] Liou, K.-N. (1986) Influence of cirrus clouds on weather and climate processes: A global perspective, Mon. Wea. Rev., 114, 1167-1199.
[3] Fukao, S., H. Hashiguchi, M. Yamamoto, T. Tsuda, T. Nakamura, M.K. Yamamoto, T. Sato, M. Hagio, and Y. Yabugaki (2003) The Equatorial Atmosphere Radar (EAR): System description and first results, Radio Sci., 1053, doi:10.1029/2002RS002767.