Time-space characteristics of daily rainfall over Sarawak, Borneo island

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The Southeast Asia Maritime Continent (including Borneo island, Malaysia), where the complexly-distributed several islands with elevated orography exist, receives much rainfall through frequent and deep convective activity. The role as atmospheric heat source through latent heating of this region is very large and influence global climate in several time scales. Heavy rainfall and deep convection occur particularly during boreal winter (northeast monsoon regime) over Borneo, though seasonality of rainfall is very week compared with other tropics. In addition, rainfall is also one of the important driving force for ecosystem dynamics of the tropical rain forests in this region.

However, characteristics of temporal and spatial variations of rainfall have not comprehensively been studied yet. The objective of this study is to scrutinize temporal and spatial characteristics of rainfall variations by using density rainfall network.

We used the daily rainfall data of 5 yeas form 1999 to 2003 at 42 stations in Sarawak, selected from the daily rainfall data set of the Department of Irrigation and Drainage Sarawak (DID-Sarawak) and the Malaysian Meteorological Service (MMS). An empirical orthogonal function (EOF) analysis was applied to 5-day running mean daily rainfall over this region.

The eigenvector pattern of the first component (Fig. 1) shows positive values over the whole region. The time score of this score (Fig. 1) shows a dominant periodicity of about 30-60 days, which may closely be associated with the intraseasonal convective activity of the so-called Madden-Julian Oscillation (Madden and Julian, 1971; 1972). The second component shows positive values over the northeastern part (including Miri area) and negative values over the southwestern part (around Kuching) of Sarawak (Fig. 2). This component is likely to be related to the low-level northeasterly wind principally during boreal winter, which sometimes provides heavy rainfall over southwestern part of Sarawak located at downwind side of the northeasterly monsoon wind over the South China Sea. On the other hand, the northeastern part of Sarawak located parallel to the northeasterly wind or downwind from interior area, shows less rainfall, which correspond to the area of negative values in the EOF-2 pattern. This north-south dipole rainfall pattern is also related to occurrence of synoptic-scale disturbance called Borneo vortex. The other component shows a dipole pattern between the coastal and the interior area of Sarawak, presumably associated with orographically-induced local convection systems. The atmospheric circulation patterns associated with these dominant EOF patterns of rainfall will also be discussed in the presentation.

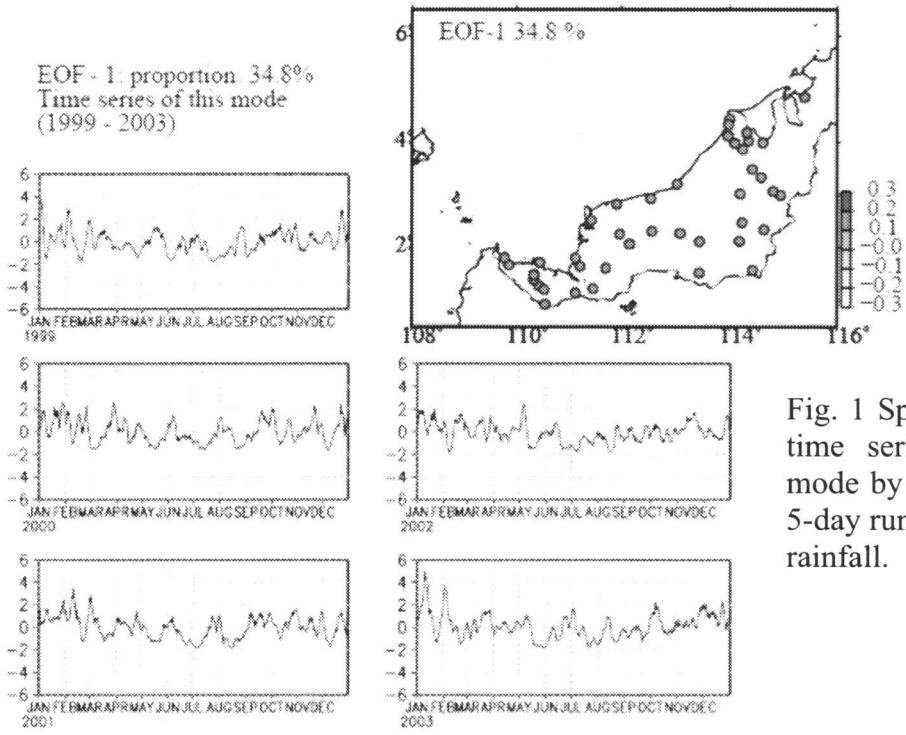

Fig. 1 Spatial pattern and time series of the first mode by EOF analysis to 5-day running mean daily rainfall.

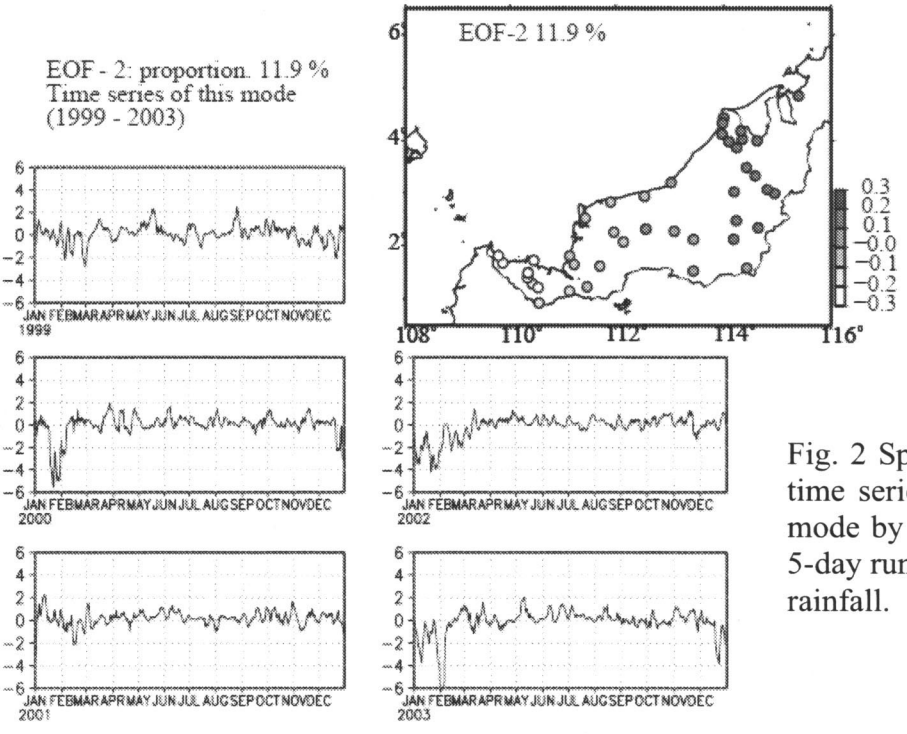

Fig. 2 Spatial pattern and time series of the second mode by EOF analysis to 5-day running mean daily rainfall.