

The Relationships between Large-scale Atmospheric Circulation and Surface Climate: a Case Study for Borneo

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Abstract

The principal aim of this project is to relate the large-scale atmospheric circulation (of Southeast Asian region) to the surface environmental elements of Borneo (especially the local climate). The understanding of the climatic processes that link these two aspects serves as the key theoretical basis. The two most significant synoptic forcings affecting the surface climatic elements of Borneo are the monsoon and the El Niño Southern Oscillation, which are mutually interactive.

Three stages of analyses were involved. Borneo was first divided into six climatic subdivisions according to similarity in surface climate. The long-term characteristics and trends for the local climate were then evaluated based on these climatic groups. This first stage also included the task to develop daily weather types (WTs) based on precipitation and temperature variability. The second stage was synoptic typing, which attempted to classify the large-scale atmospheric circulation (which consist of both monsoon and ENSO signals) into a few identifiable modes that can explicitly represent physical reality. The final stage was to establish relationships and teleconnections with surface environmental elements: i.e. precipitation and temperature. There are three main typing schemes developed in this thesis – i.e. the surface-based weather types (WTs – 8 types, but only 6 modes are significant in terms of occurrences), and the two synoptic-based circulation types employing: (i) absolute SLP data (combined season); and (ii) SLP anomaly (separate and combined seasons). These CTs, which produce eight circulation types each, have been related to surface environmental elements – precipitation and temperature.

The typing schemes have established reasonably good relationships with the surface climate – and successfully discriminates distinctive patterns of relationships based on seasonal and spatial factors. Generally, the relationships with precipitation were more clearly exhibited than with temperature. Another aim of this study was to examine which one of the large-scale variables (i.e. synoptic indicators or Circulation Types) performs better for estimating the surface climate of Borneo. In general, the synoptic indicators (i.e. ENSO/monsoon indices) were better correlated with temperature anomalies. However, the circulation types establish a much stronger (in terms of amplitude) correlation for precipitation variables.

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