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Investigation of the “Elevated Heat Pump” Effect on the Asian Summer Monsoon using Cloud Observations from METEOSAT-5

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The onset and intensity of the Asian Summer Monsoon is influenced by many factors, including El Nino/Southern Oscillation, the Indian Ocean Dipole, and other dynamical conditions. Recently, a theory has been postulated that aerosol-induced anomalous mid- and upper-tropospheric warming above the Tibetan Plateau leads to early onset and a northwestward shift in monsoon rainfall—the so-called “elevated heat pump” effect. In particular, dust from western China, Afghanistan, Pakistan, and Southwest Asia, as well as black carbon emissions from sources in Northern India, are the driving forces behind the anomaly. This concept was developed based on results from multiple runs of the NASA finite-volume general circulation model with and without radiative forcing from different types of aerosols. This study takes an observational approach to detect signatures of the elevated heat pump effect in the cloud cover and cloud type distributions as derived from Meteosat-5 data over the Asian Monsoon region.