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Tracer Transport in Southeast Asia

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In Sumatra and Borneo, fire is commonly used to clear plantation land and logging debris. During dry spells, the fires readily burn out of control. Depending on the prevailing weather conditions, smoke and haze generated by the fires may disperse over hundreds of kilometres. Consequent reduction in visibility is a problem to aviation and shipping, and the fine aerosols present in smoke are health hazards. An extreme example of the phenomenon occurred during the El Niño episode of 1997-98, when Southeast Asia experienced an extended drought and haze enveloped the region for months. In this project, we simulate the dispersion of neutrally buoyant passive tracers in Southeast Asia during the SW monsoon season, with the aim of understanding the relative importance of advection by tropospheric winds and turbulent transports within the planetary boundary layer (PBL). The Coupled Ocean/Atmosphere Mesoscale Prediction System (COAMPS®) was used to simulate the weather and pollutant dispersion over Southeast Asia. Results show that the tracers are lifted out of the PBL by confluent low-level sea breezes over Sumatra island, and subsequently transported eastwards across South China Sea to Borneo by westerly winds above the PBL. The tracers are then entrained by daytime boundary-layer turbulence to reach the surface in west Borneo. We conclude that the COAMPS model is able to capture the transport processes that underlie pollutant dispersion in Southeast Asia, including the diurnal variations of PBL dynamics which impact surface air quality greatly.