TROPICAL ATMOSPHERIC DYNAMICS

Geophysical fluid dynamics (GFD) is the study of the behaviour of the atmosphere and the ocean as fluid bodies, governed by the basic laws of physics. Theories on the phase-space dynamics of these fluids are researched in recent years. Concepts for tropical atmospheric dynamics based angular momentum and entropy are fundamental to our understanding of tropical weather and climate.

NUMERICAL WEATHER PREDICTION IN SOUTHEAST ASIA

Numerical weather prediction (NWP) has reached unprecedented skill in that state-of-the-science predictions are good for up to one week in temperate regions. However, forecasts of tropical weather are hardly reliable even within the same day. In collaboration with Temasek Laboratories @ NTU, our team do research to improve NWP in Southeast Asia, using up-to-date mesoscale computational models and data assimilation techniques.

Figure 1 (above) shows COAMPS simulation of tropical storm Vamei hitting the southern tip of the Malay Peninsula and Singapore on 27 Dec 2001 at 0600 UTC (1400h Singapore Time). Arrows denote 850mb-winds and shading (with the zero contour in magenta) represent the absolute vorticity (a measure of local rotation) in the flow.

REGIONAL CLIMATE MODELLING IN SOUTHEAST ASIA

Maritime Southeast Asia affects global climate through the release of large amount of latent heat during rainfall. The small islands with elevated terrain and shallow seas are not well resolved by global models. We address the question of regional climate variability and change by regional atmospheric modelling in collaboration with Earth Observatory of Singapore.

TRANSPORT AND MIXING IN CONVECTIVE ATMOSPHERES

The motion of a particle in the atmosphere is inherently chaotic even in seemingly regular flows. In the tropics, the weather is dominated by deep cumulus convection, which chaotically mixes substances vertically before quasi-horizontal transport. How pollutants are dispersed by the circulation in convective atmospheres is an environmentally important subject of investigation.

Figure 2 (right) shows a cloud (yellow) of tracers representing haze smoke emitted from central Sumatra island transported eastward by winds (magenta streamlines) to Borneo island, mixed into the surface boundary layer by convective turbulence. The white contours on the surface denote regions where boundary layer heights greater than 1000m.

Selected Publications


