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Asian Monsoon Years (2007-2012) elucidating significance of land-sea coexistence in Earth's climate

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The seasonal (monsoon) and diurnal cycles induced by land-sea heat contrast are reconsidered mainly based on observational evidence over the Indonesian maritime continent (IMC). First, the Earth's climate sustaining liquid water is determined basically by an energy balance between the solar radiative heating (with annual and diurnal periodicity, latitudinal dependence and decrease by the parasol effect such as clouds) and the Earth's infrared cooling (returned partially to the Earth through greenhouse effect). However, it does not hold locally, and over-heating and -cooling occur in the equatorial and polar regions, respectively. The equatorial over-heating is also due to hydrological cycles (latent heating) making rainfall 2,000 mm/year, which cannot be fully explained by conditional instability over the warm water pool around IMC. These imbalances are compensated by poleward heat transport associated with atmospheric and oceanic circulation, through which the tropics affects extratropics and therefore the global climate. Secondly, if the Earth were a complete sphere, it woule be covered globally by liquid water, that is an "aqua-planet", and then the oceanic circulation should be almost zonal (like Antarctic circumpolar current) without Kuroshio and Gulfstream transporting heat poleward. Ocean-atmosphere interactions induce intraseasonal variations (ISVs) or super cloud clusters moving eastward as observed actually over Indian and Pacific Oceans. However, the Earth has been keeping the land-ocean ratio for the recent 400 Myears, and the IMC appears as a barrier against ocean circulation and ISV propagation since 50 Myears ago, which generates interannual variations such as El Niño. Thirdly, the Earth is rotating 365 times faster than its revolution along an almost circular orbit around the sun, and the rotation axis inclination makes hemispheric anti-phase annual periodicity of solar heating. If the revolution orbit were more elliptic, the annual cycle would be globally in phase. If the rotation were much slower, the diurnal and annual cycles were not distinguished. In the actual Earth, the annual (monsoon) and diurnal (sea-land breeze) cycles are dominant near extratropical and tropical coastal zones, respectively, mainly due to the land-ocean heat capacity contrast. The tropical diurnal cycle is self-enhanced by a sprinkler-like mechanism of precipitating convective clouds, which is different from extratropical ones dominant in clear days with infrared cooling in nighttime. In conclusion, the diurnal-cycle rainfall along the world's longest coastlines of IMC with many islands that generate the equatorial rainfall peak controlling the global climate. Amplitude modulations of the diurnal cycles are observed as correlations of tropical rainfalls with monsoons, as well as ISVs and interannual variations.