

## **The Asian-Australian monsoon: Air-sea interaction and formation of the Asian summer monsoon onset vortex over the BOB**

Guoxiong Wu<sup>†</sup>;

<sup>†</sup> Institute of Atmospheric Physics, China, People's Republic of

Leading author: [gxwu@lasg.iap.ac.cn](mailto:gxwu@lasg.iap.ac.cn)

In spring over the southern Bay of Bengal (BOB), a vortex commonly develops, followed by the Asian summer monsoon onset. An analysis of relevant data and a case study reveals that the BOB monsoon onset vortex is formed as a consequence of air-sea interaction over BOB, which is modulated by Tibetan Plateau forcing and the land-sea thermal contrast over the South Asian area during the spring season. Tibetan Plateau forcing in spring generates a prevailing cold northwesterly over India in the lower troposphere. Strong surface sensible heating is then released, forming a prominent surface cyclone with a strong southwesterly along the coastal ocean in north-western BOB. This southwesterly induces an in situ off-shore current and upwelling, resulting in cold sea surface temperatures (SSTs). The southwesterly, together with the near-equatorial westerly, also results in a surface anticyclone with descending air over most of BOB and a cyclone with ascending air over the southern part of BOB. In the eastern part of central BOB, where sky is clear, surface wind is weak, and ocean mixed layer is shallow, intense solar radiation and low energy loss due to weak surface latent and sensible heat fluxes act onto a thin ocean layer, resulting in the development of a unique BOB warm pool in spring. Near the surface, water vapor is transferred from northern BOB and other regions to southeastern BOB, where surface sensible heating is relatively high. The atmospheric available potential energy is generated and converted to kinetic energy, thereby resulting in vortex formation. The vortex then intensifies and moves northward, where SST is higher and surface sensible heating is stronger. Meanwhile, the zonal-mean kinetic energy is converted to eddy kinetic energy in the area east of the vortex, and the vortex turns eastward. Eventually, southwesterly sweeps over eastern BOB and merges with the subtropical westerly, leading to the onset of the Asian summer monsoon.