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Seminar

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IBE-CNR

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Interactions in the Asian-African monsoonal system according to Gill's theory

The west African monsoon (WAM) originates in the coast of Guinea, when the intertropical convergence zone (ITCZ) makes its landfall; whilst, the south Asian monsoon (SAM) originates in the Indian ocean when the ITCZ crosses the equator. The dynamics of the fully developed Asian-African monsoonal system are here studied using Gill's model with an implanted Ekman frictional layer (EFL). The model shows that the Ekman pumping makes the lower monsoonal cyclone deeper and more compact than the upper anticyclone by transferring tropospheric vorticity into the EFL. WAM has an influence on SAM via eastwards propagating Kelvin waves, which drive the subsidence over the Tropical Indian ocean, and SAM has an influence on WAM via westwards propagating planetary waves, which drive the subsidence over North Africa.

In the absence of orography, air particles originating above nearby oceans spiral-in towards WAM or SAM, the latter appears to be a preferred ending destination. Conversely, the introduction of the orography substantially disrupt the regional circulation. The Himalayas, introduced as a barrier to SAM, strengthen the monsoonal winds by tightening the isobars.

The Somali mountains, introduced as a barrier in the EFL, divide the Atlantic marine air, which is fed into WAM, from the Indian ocean marine air, which is fed into SAM; thus, these mountains separate WAM's catch basin from SAM's catch basin.

The Indian Ghats, introduced as a semi-impermeable barrier in the EFL, deflect the marine air masses towards the center of the bay of Bengal, strengthening the south-eastern flank of SAM.

Thus, Gill's model is able to reproduce the main features of the Asian-African monsoonal system, highlighting the role of the Ekman friction in sustaining the monsoonal dynamics, along with the role of the African-Asian orography, and the indication of an influence of WAM over the Indian ocean, not documented before.

Keywords: *Asian-African monsoonal system; Air mass trajectories; Himalayas, Indian Ghats and Somali mountains.*

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