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The monsoon is interpreted as an ITCZ (intertropical convergence zone) substantially away (more than ten degrees) from the equator and the existence of the ITCZ does not have to rely on land-sea contrast. Land-sea contrast can provide a favorable longitudinal location for the ITCZ but this role can be replaced by sea surface temperature contrast in the longitudinal direction. Thus our interpretation of the monsoon differs from the long-held fundamental belief that its basic cause is land-sea thermal contrast on the continental scale in the sense that we do not consider the existence of landmass a necessary condition for monsoons. Through general circulation model experiments we found support for our interpretation. The Asian and Australian summer monsoon circulations are largely intact in an experiment in which Asia, maritime continent, and Australia are replaced by ocean with sea surface temperature taken from that of the surrounding oceans (Fig.1). Thus in these areas land-sea contrast is not a necessary condition for monsoon. This also happens to the Central American summer monsoon. The same thing can also be said about the African and South American summer monsoons, if these continents are replaced by ocean of sufficiently high SST. It is also shown that in the Asian monsoon the change resulting from such replacement is due more to the removal of topography than to the removal of land-sea contrast. In the Asian and Australian winter monsoons land-sea contrast also plays only a minor role.

The origin of the ITCZ and their latitudinal locations have been previously interpreted by Chao (2000). The circulation associated with an off-equator ITCZ, previously interpreted by Chao and Chen through the modified Gill solution and briefly described in this paper, explains the monsoon circulation. The longitudinal location of the ITCZ is determined by the distribution of surface conditions. The ITCZ favors locations of high SST as in western Pacific and Indian Ocean, or tropical landmass, due to land-sea contrast, as in tropical Africa and South America. Thus, the role of landmass, when it is important, in the origin of monsoons can be replaced by ocean of sufficiently high SST. Furthermore, the ITCZ circulation extends into the tropics in the other hemisphere to give rise to the winter monsoon circulation there. Details of this work can be found in Chao and Chen (2001).

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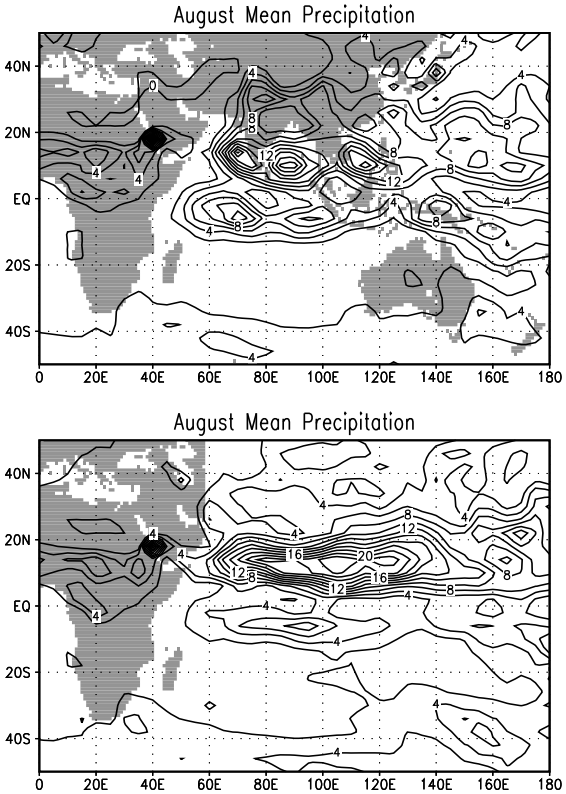

Fig.1: August precipitation averaged over last three years of a four-year integration for the control run (top) and the experiment where Asia, the martime continent, and Australia are replaced be oceans (bottom).

REFERENCES

Chao, W. C., 2000: Multiple quasi-equilibria of the ITCZ and the origin of monsoon onset. *J. Atmos. Sci.*, **57**, 641-651.

Chao, W. C. and B. Chen, 2001: The origin of monsoons. *J. Atmos. Sci.*, **58**, 3497-3507.