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# Evaluation of soil moisture- precipitation feedback theories: Statistical approach using a convection permitting model over Indian subcontinent

Mansi Bhowmick (1), Douglas J. Parker (1), Stuart Webster (2), Cathryn E. Birch (2), Luis Garcia-Carreras (3), and John H. Marsham (1)

(1) School of Earth and Environment, University of Leeds,Leeds,United Kingdom (eemb@leeds.ac.uk), (2) UK Met Office, Exeter, United Kingdom (cathryn.birch@metoffice.gov.uk), (3) Department of Meteorology, Stockholm University, Sweden (L.Garcia-Carreras@leeds.ac.uk)

Abstract:-
In South Asia, precipitation is mostly convective. An important control on the rainfall is the interaction of the atmosphere with land conditions. The purpose of this study is to test the usability of various existing theories (Haiden 1997, Findell and Eltahir 2003a, Taylor et al 2012) in the context of soil moisture – precipitation feedback mechanisms over the South Asian region during the monsoon season. To test these theories we have evaluated the relationships between soil moisture, fluxes and rainfall in a convection-permitting atmospheric model (UK Met Office Unified Model), run with 4km grid-spacing. Since, more generalized conditions have been tested, so some other parameters like wind convergence and the impact of topography have also been examined, to get a deeper insight into the problem.

Four different sub-domains of the Indian subcontinent have been chosen, which fulfil various topographic and soil moisture conditions. Various statistical analyses have been performed in the immediate vicinity of a region that has received afternoon rainfall, using i) antecedent soil moisture, ii) topography, iii) the Convective Triggering Potential-Humidity Index (CTP-HI) framework (Findell and Eltahir 2003a) and other parameters.

From soil moisture analysis it has been found that the different regions have different preferences for afternoon rainfall. The North Indian, comparatively flat, and the South Indian complex terrain domains have more dry advantage rainfall events (i.e. there is a preference for rainfall to fall over comparatively dry region relative to surrounding) whereas for Central India, which has complex orography, there is a wet advantage. Further analysis of complex domain with topographic analysis showed that over the Central domain, rainfall has two peaks; one over low-lying orography and the other over high-lying orography. For the higher land, rainfall has more preference over wet soil, whereas over the lower land both dry and wet soil has a significant number of rain events. On the other hand, over the Southern domain rainfall occurs mostly over high terrain. Using generalized soil moisture conditions in the CTP-HI framework, it seems there is a requirement for a more generalized or modified framework, to have universal threshold values to distinguish between dry and wet advantage rain events. The CTP-HI analysis along with subjective wind-field convergence analysis also shows that the 1-D boundary-layer evaluation is not sufficient to address all orographic and atmospheric conditions.

References:-
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