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Teleconnections between Ethiopian rains and Equatorial Pacific SST

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Rainfall is the most important climate parameter in Ethiopia as in many part of Africa since the economy is based mainly on rain fed agriculture. Understanding the mechanisms that lead to anomalous rainfall is therefore a great significant for seasonal prediction. Although the statistical link between tropical Pacific (warm/cold) and Ethiopian rainfall (deficit/excess Kiremt (JJAS) and excess/deficit Belg (FMAM)) is well known, the physical mechanism for the observed relationship is not well understood. In this study, the mechanisms for the link between equatorial eastern and central Pacific and Ethiopian rains are studied using observational and modelling studies.

In the observational study, two sets of composites were analysed. The first set was composite of large scale atmospheric features based on excess and deficit rains to understand the large scale rainfall controls. The second set was also composite of large scale atmospheric features but based on warm and cold SSTs over equatorial Pacific. The observational study suggests that warm/cold equatorial Pacific SSTAs are linked to excess/deficit summer rainfall via the strength of ITCZ, Tropical Easterly Jet (TEJ), the East African Low Level Jet (EALLJ) and westerly anomalies from Atlantic and north-southward shift of African Easterly Jet (AEJ). In the modelling study, Atmosphere only General Circulation Model (HadAM3) forced with observed (HadISST) and idealised SSTA patterns was used to investigate whether there is a causal link between rainfall and SST and also to understand the mechanism of the link (if the link is causal). The HadISST forced HadAM3 run shows that the model captures the inter-annual variability of rainfall associated with ENSO. The idealised SST experiments confirms that warm equatorial Pacific indeed directly causes deficit rainfall in Kiremt and excess rainfall in Belg seasons. The physical mechanism for these teleconnections is suggested. For Kiremt season; warm SSTA in the tropical Pacific triggers planetary waves (Kelvin and Rossby) in the equatorial Pacific and these waves transfer the anomalous energy over Africa and Asia and affect the large scale controls over Africa (suppressing the ITCZ over northeast Africa, weakening the strength of TEJ and EALLJ, reducing the moisture influx from Atlantic and Indian ocean in to east Africa and shifting the AEJ to the south) and ultimately reduce the rainfall in Kiremt season.