Non-linearity in the pathway of El Niño-Southern Oscillation to the tropical North Atlantic

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El Niño-Southern Oscillation can influence the Tropical North Atlantic (TNA), leading to anomalous sea surface temperatures (SST) at a lag of several months. Several mechanisms have been proposed to explain this teleconnection. These mechanisms include both tropical and extratropical pathways, contributing to anomalous trade winds and static stability over the TNA region. The TNA SST response to ENSO has been suggested to be nonlinear. Yet the overall linearity of the ENSO-TNA teleconnection via the two pathways remains unclear. Here we use reanalysis data to confirm that the SST anomaly (SSTA) in the TNA is nonlinear with respect to the strength of the SST forcing in the tropical Pacific, as further increases in El Niño magnitudes cease to create further increases of the TNA SSTA. We further show that the tropical pathway is more linear than the extratropical pathway by sub-dividing the inter-basin connection into extratropical and tropical pathways. The extratropical pathway is modulated by the North Atlantic Oscillation (NAO) and the location of the SSTA in the Pacific, but this modulation insufficiently explains the nonlinearity in TNA SSTA. As neither extratropical nor tropical pathways can explain the nonlinearity, this suggests that external factors are at play. Further analysis shows that the TNA SSTA is highly influenced by the preconditioning of the tropical Atlantic SST. This preconditioning is found to be associated with the NAO through SST-tripole patterns.