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The impact of variations in tropical Atlantic SST on the eastern tropical Pacific

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The tropical Atlantic SST is influenced by a number of climate processes such as ENSO, NAO and the slowing down of the Atlantic meridional overturning. In addition the tropical Atlantic SST in global climate models often exhibits large biases. A natural question to ask is what are the regional and global influences of these natural variations or model biases? Here we focus on the direct impact of variations in the tropical Atlantic SST on the eastern tropical Pacific. Use is made of a regional coupled ocean-atmosphere model (ROAM). The ocean component spans the tropical Pacific, whilst the atmospheric component covers the eastern half of the Pacific and part of the Atlantic. Coupling in the model occurs over the eastern half of the tropical Pacific. With the Atlantic SST set to observed values the model captures both the mean and seasonal variability of the eastern tropical Pacific with remarkable fidelity, including the cold tongue SST, a northward displaced ITCZ and a stratus cloud deck in the SE tropical Pacific. Reducing the SST in the northern tropical Atlantic produces a large reduction in SST in the Pacific cold tongue. This is brought about by a combination of an intensification of the gap-wind in the Gulf of Panama and the colder SSTs driving stronger easterlies and upwelling through the Bjerknes feedback. Further north the ocean warms through a reduction in the gap-wind in the Gulf of Tehuntepec. Changes to the upper ocean heat budget will be discussed. In addition to the changes over the ocean, changes to the pattern of precipitation over land bring about substantial changes to the land surface temperature, particularly in northern South America. Additional experiments with the ROAM show the importance of the representation of the Central American mountains and the horizontal grid resolution. Results from the study suggest: (a) the direct impact of the tropical Atlantic SST on the eastern tropical Pacific is large, (b) the coupling between the ocean and atmosphere is important, (c)

such studies require models that capture the important physics, and (d) experiments with coarser global coupled models may substantially underestimate the impact.