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Multi-model climate change signals in the Pacific sector

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The sensitivity of climate phenomena in the low latitudes to enhanced greenhouse conditions is a scientific issue of high relevance to billions of people in the poorest countries of the globe. So far, most studies dealt with individual model results. In the present analysis, we refer to 79 coupled ocean-atmosphere simulations from 12 different climate models under 6 diverse IPCC scenarios. The basic question is as to which extent various state-of-the-art climate models agree in predicting changes in the main features of El Niño-Southern Oscillation (ENSO). The model experiments can be grouped to multi-model ensembles. Thus, climate change signals in the classical index time series, in the principal components and in the time series of interannual variability can be evaluated against the background of internal variability and model uncertainty.

There are large differences between the individual model predictions until the end of the 21st century, especially in terms of the Southern Oscillation index (SOI). The majority of the models tends to project La Niña-like anomalies in the SOI. However, the response barely exceeds the level of natural variability and the systematic model differences are larger than the impact of varied IPCC scenarios. Nonetheless, there is one prominent climate change signal, which stands out from model variations and internal noise: All forced model experiment agree in predicting a substantial warming in the eastern tropical Pacific. This oceanic heating does not necessarily lead to a modification of ENSO towards more frequent El Niño and/or La Niña events. It simply represents a change in the background state of ENSO. Indeed, we did not find convincing multi-model evidence for a modification of the wavelet spectra in terms of ENSO. Some models suggest an intensification of the annual cycle but this signal is fairly model-dependent. Thus, large model uncertainty about the future behaviour of climate in the low latitudes still exists. This has to be taken into account when

addressing climate change signals in individual model experiments and ensembles.