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How the Equatorial Pacific Ocean reacts to global warming

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Ocean and atmosphere are linked through processes which take place at the surface and which are modulated by atmospheric and oceanic circulation. ENSO (El Nino Southern Oscillation) is one of the dominant events in the Tropical regions which involve the coupling between atmosphere and ocean. Nowadays, the most powerful instruments to study those kinds of phenomena are coupled general circulation models (CGCMs). In this study, a CGCM is used to study ENSO and the variability of the Equatorial Pacific Ocean in extreme CO2 conditions. In particular, the experiments performed and analyzed have carbon dioxide concentrations multiplied by a factor of 2, 4 and 16. The basic idea is that when the heat fluxes are strongly perturbed a net effect is a change in the thermal structure of the ocean, and in the case of the Equatorial Pacific Ocean the interannual variability appears interestingly modified respect to the control experiment. Among the results of this study we found out that when the CO2 concentration is doubled with respect to the present-day value a warming of the Equatorial Pacific Ocean is reproduced with an El Nino-like oscillation of a constant frequency of about 2 years, in agreement with previous studies. Furthermore, when the CO2 concentration is increased above 16 times the present-day value, the warming in the Equatorial Pacific Ocean is characterized by a decrease in the zonal temperature difference between the eastern and the western part of the basin. In those conditions, the warmer isotherms deepen, preventing the upward movement of cold water in the eastern part of the Pacific Ocean and favouring surface warm conditions. Furthermore, the analysis of the interannual variability in the eastern equatorial Pacific Ocean by means of the NINO3 SSTA index shows that, in the experiments where the CO2 concentration is increased by a factor of 2 and 4, there is an increase of the variance of the index introduced. On the other hand, in the experiment where the CO2 concentration is increased by a factor of 16 the variance of the NINO3 index decreases respect to the

control experiment, suggesting a weakening of the El Nino-like oscillation.