

Atmosphere-Ocean coupled regional modeling for dynamical downscaling of current and future climates

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We have developed regional downscaling system of the Regional Spectral Model for the atmosphere and the Regional Ocean Modeling System (RSM-ROMS) to improve the downscaling simulation accuracy of particularly coastal area, and we have achieved a dynamical downscale of the climate model simulation for 20th and 21st century forced by SST and atmospheric state from the global Community Climate System Model version 3.0 (CCSM3) for California area. The results indicate that the surface air temperature rise was decreased over San Francisco Bay area due to the effect of uplifting current at the Pacific coast. The projected change of extreme warm events is quite different between the coupled and uncoupled downscaling experiments, with the former projecting a more moderate change. The projected future change in precipitation is not significantly different between coupled and uncoupled downscaling. Both the coupled and uncoupled downscaling integrations predict increased onshore sea breeze change in summer daytime and reduced offshore land breeze change in summer nighttime along the coast from the Bay area to Point Conception. Compared to the simulation of present climate, the coupled and uncoupled downscaling experiments predict 17.5 % and 27.5 % fewer Catalina eddy hours in future climate respectively. Similar framework was applied for East Asian region, and preliminary results show quite significant change in surface temperature and precipitation field due to having dynamically predicted fine scale ocean currents. Particularly in summer to fall, when Kuroshio Current direction and prevailing surface wind direction are about opposite, coastal subsidence occurs so that it warms the coastal air temperature. This feature is opposite from the California's case, and potentially indicating the possible underestimation of warming. We will further investigate the detail of the influence of regional atmosphere-ocean coupling in the presentation, as well as the impact of fresh water input from the terrestrial runoff.

Keywords: Atmosphere-Ocean coupled regional model, coastal uplifting current, regional climate projection, dynamical downscaling