Submitted Abstract

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Abstract

Several studies report on elevation-dependent warming (EDW), i.e., when warming rates change with elevation. This study assesses future EDW in the Andes, using an ensemble of regional climate model simulations belonging to the CORDEX experiment. EDW was assessed by calculating the (minimum and maximum) temperature difference between the end of the century (2071-2100) and the period 1976-2005 and relating it to the elevation. For the maximum temperatures, a positive EDW (enhancement of warming rates with elevation) was identified in both the western and eastern side of the tropical and subtropical Andes and in all seasons. For the minimum temperature, while a positive EDW was identified in the Subtropics (particularly in the western side of the chain), the Tropics are characterized by a negative EDW throughout the year. The tropical boundary marks a transition between discordant EDW behaviours in the minimum temperature. In the Tropics, EDW drivers were found to be different for the minimum temperature (Tmin) and for the maximum temperature (Tmax). Changes in Tmin are mostly associated with changes in downward longwave radiation, while changes in Tmax are mainly driven by changes in downward shortwave radiation. This might explain the opposite EDW signal found in the tropical Andes during daytime and nighttime. Changes in albedo are an ubiquitous driver for positive EDW in the Subtropics, for both the minimum and the maximum temperature. Changes in longwave radiation and humidity are also EDW drivers in the Subtropics but with different relevance throughout the seasons and during daytime and nighttime. Besides the dependence on the latitude, we found that the western and eastern sides of the Cordillera might be influenced by different EDW drivers.