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Evaluation of near-surface wind speed simulations over the Tibetan Plateau from three dynamical downscalings based on WRF model

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As the highest plateau in the world, the Tibetan Plateau (TP) has experienced significant climate changes in recent years including wind speed, which strongly affects regional weather and climate as well as global atmospheric circulations. The research of wind speed using dynamic downscaling is necessary especially in the regions with complex terrain such as TP. This study uses three long-term WRF dynamical downscaling simulations to assess the near surface wind speed simulations. One of the WRF simulations used the ERA-Interim as forcing and coupled Noah land surface model (WRF1). Another WRF simulation used the same forcing as WRF1 but with Noah-MP land surface model (WRF2). WRF3 coupled the same land surface model as WRF2 and forced by CCSM4. The near surface wind speed and components in closest grid cells are compared with observed meteorological records at 83 stations in the TP as well as ERA-Interim in terms of climatology, linear trend and their elevation dependences. Results show that ERA-Interim overestimated the wind speed at most stations over the TP annually and seasonally. Different from the forcing, the overestimations for WRF simulations mainly occur in southern TP and cold seasons. The overestimated zonal wind plays a key role in the wind speed overestimation. Both ERA-Interim and WRF simulations overestimated the wind speed at the elevation 3500m and 4000m, which mainly contributed by the difference of the elevation between grid cells and stations. Land surface model plays important role in the simulation of the wind speed climatology. ERA-Interim can't capture the observed obvious decreasing trend and its elevation dependency. Affected by the forcing, WRF simulations also can't reproduce the wind trend and its elevation dependency accurately, however, WRFs outperform ERA-Interim in cold seasons. Since forcing has great effects on the wind speed trend simulation, it is important to choose proper driving data with high precision before the dynamic downscaling.