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Evaluation of the linkage between evapotranspiration and precipitation over Tibetan Plateau based on WRF model and remote sensing products

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Evapotranspiration, an important process representing a considerable amount of moisture lost to the atmosphere from the soil both by evaporation and by transpiration from the plants growing thereon, is the link between water and energy cycles of the Earth, is the direct effect to local available precipitation. With the global warming, higher temperature is likely to lead to more evaporation, then lead to more precipitation. Tibetan-Plateau, as the third pole in the world, is improved to be the amplifier of global change, where the climate changes much sharper than the other regions. It is necessary to make clear the evapotranspiration change with the global warming over TP, and clarify the contribution of local evapotranspiration to precipitation. In our study, weather research and forecasting model (WRF) coupled with NOAH land surface model, being supplemented by MODIS evapotranspiration remote sensing product, TRMM 3B42 V6 precipitation product and TRACE remote sensing product, is used to illustrate the water and energy cycle over TP considering the heterogeneities of elevation, landuse, and landscape, to quantify the contribution of evapotranspiration to precipitation over entire TP, to explore the effect of global warming on atmospheric environment over TP region. Based on the long-term WRF simulation and remote sensing products, the trends of energy cycle elements including net radiation, latent heat flux, sensible heat flux, ground heat flux, and water cycle elements including evapotranspiration, rainfall, snowfall, runoff, soil moisture, ground water are analyzed, and then precipitation recycling over TP is disclosed. The results show that with global warming, land surface is feeding more moisture to the atmosphere by increased evapotranspiration and a growing recycling ratio, the contribution of evapotranspiration to local precipitation will be strengthen. Evapotranspiration yielded by WRF model agrees well with MODIS product, regional climate models can be considered a powerful complement to scarce observational networks, especially for forecasting over complex terrain regions.