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A numerical simulation of the variation of the surface turbulence fluxes during 2004 and 2013 on the Tibetan Plateau and its surrounding

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The exchange of heat energy, momentum and mass are key variables of land surface process, which is effected by atmospheric circulation and climate, on the contrary, is feedback for the atmospheric dynamic and climate change. The Tibetan Plateau (TP) is the largest alpine ecosystem with an average altitude of more than 4,000 m with including 25 longitudes. Because of its effect to the energy and water cycle in the region and whole world, the Plateau is subject of climate study since middle of last century (Yeh et al., 1957, Flohn, 1957). The series of atmospheric science expeditions were carried on the Tibetan Plateau (for example, the first Tibetan Plateau meteorology science experiment in 1979', continually many times 'Tibetan Plateau surface heat resource observation'(Ji et al., 1986), 'the second Tibetan Plateau meteorology science experiment(TIPEX)'(Xu et al., 2002)[U+FF0C]'coordinate intensive observation project of Asian-Australia Monsoon-Tibet'(Wang et al., 1999; Koike et al., 1999; Ma et al., 2005, Ma et al., 2006), recently, the Chinese National Key Programme for Developing Basic Sciences and the Third Pole Environment (TPE) was complimented on the Tibetan Plateau and its' surrounding area. By using this observational data set, dynamical and thermodynamic effects of Tibetan Plateau were explored. It shows that the sensible heat flux transfer is dominating before Asian monsoon, while the latent heat flux prevails during the monsoon period except for the western of the Tibetan Plateau (Chen et al., 1985). Energy imbalance was obvious on the monsoon season (Bian et al., 2001; Yang et al., 2004). Previous studies show that before the onset of the monsoon, the plateau is the major energy source by providing sensible heat flux to the atmosphere (e. g. Li and Yanai, 1996). During the rainy season, the latent heat released to the atmosphere is the dominant heat source over the eastern plateau[U+FF0C]whereas the sensible heat flux is comparable to the latent heat flux over the western plateau (e.g. Chen et a1., 1985). However uncertainties of those approaches remain large and land–biosphere–atmosphere interactions may regulate the temporal variation of the surface sensible and latent heat fluxes.

In this study, by using meso-scale WRF model coupled the NoahLSM with improved dynamical roughness lengths, the variation of the surface turbulence fluxes was analyzed during 2004 and 2013 on the Tibetan Plateau and its surrounding. The results show that the sensible heat flux increased from 2004 to 2013 on the central TP and southeast of the TP, which decreased on others of the TP. The sensible heat flux increased on the Hengduan Mountains, Yunnan-Kweichow Plateau and Chiang-nan Hilly Region and it reduced on the other area of the surrounding of the TP. The latent heat flux increased on the eastern of the TP and it decreased on the other area of the TP. The latent heat flux reduced on the east side of the TP, Bay of Bengal and the north side of the TP and it increased strongly on the southeastern part of China (Figure).