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Estimation of the land surface temperature and land-atmosphere energy transfer over the Tibetan Plateau by using Chinese geostationary satellite data

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Land surface temperature and Land-atmosphere energy transfer is of great importance in land-atmosphere interactions and atmospheric boundary layer processes over the Tibetan Plateau (TP). They all have high temporal variability, especially in their diurnal cycle, which cannot be acquired by polar-orbiting satellites alone because of their low temporal resolution. Therefore, it's of great practical significance to retrieve land surface temperature and land heat fluxes by a combination use of geostationary and polar orbiting satellites. In this study, a time series of the hourly LST was retrieved from thermal infrared data acquired by the Chinese geostationary satellite FengYun-2C (FY-2C) over the TP. The split window algorithm (SWA) was optimized using a regression method based on the observations from the Enhanced Observing Period (CEOP) of the Asia-Australia Monsoon Project (CAMP) on the Tibetan Plateau (CAMP/Tibet) and Tibetan observation and research platform (TORP). The derived LST was validated by the field observations of CAMP/Tibet and TORP. The results show that the retrieved LST and in situ data have a good consistency (with root mean square error (RMSE), mean bias (MB), mean absolute error (MAE) and correlation coefficient (R) values of 1.99 K, 0.83 K, 1.71 K, and 0.991, respectively). Its spatial patterns are in good accordance with the land surface status. The retrieval of the LST is also found to be superior to the MODIS LST product over the TP. Together with other characteristic parameters derived from polar-orbiting satellites and meteorological forcing data, the energy balance budgets have been retrieved finally. A combination use of geostationary and polar-orbiting satellite is proved to be feasible to retrieve land surface heat fluxes with reasonable accuracy (average RMSE of validation for net radiation flux, sensible heat flux, latent heat flux and soil heat flux are 65.01 Wm-2, 52.4 Wm-2, 45.3 Wm-2 and 43.2 Wm-2, respectively).