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Estimate of land surface temperature from Chinese second generation polar orbit FengYun meteorological satellite (FY-3) data

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This paper addressed the estimate of the Land Surface Temperature (LST) from the second generation of Chinese polar orbit FengYun-3 (FY-3) meteorological satellite data in two thermal infrared channels 4 (wavelength centred at 10.8 μm) and 5 (wavelength centred at 12.0 μm), using a split-window algorithm developed by Sobrino et al. (1993). The numerical values of the split-window coefficients had been obtained using a statistical regression method from synthetic data simulated with an accurate atmospheric radiative transfer model MODTRAN 4 over a wide range of atmospheric and surface conditions. The LST, mean emissivity, and atmospheric Water Vapor Content (WVC) were divided into several tractable sub-ranges with little overlaps to improve the fitting accuracy. The experimental results showed that the Root Mean Square Errors (RMSEs) are proportional to Viewing Zenith Angles (VZAs) and WVC, and they are less than 1.0 K for the sub-ranges with VZA less than 30° or for the sub-ranges with VZA less than 60° and the atmospheric WVC less than 3.5 g/cm^2, provided that the Land Surface Emissivity (LSE) are known. A detailed sensitivity analysis in terms of the uncertainty of the Land Surface Emissivity (LSE) and atmospheric WVC as well as the instrumental noise had also been performed. In addition, a preliminary test, by taking into account a simulated dataset different from that one used to obtain the algorithm, had been done with the proposed LST split-window algorithm over a wide range of atmospheric and surface conditions. The results showed that the split-window algorithm is capable of producing LST from FY-3 satellite data with RMSE less than 1.0 K.