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Initial Result of Large Scale Permafrost ALT Estimation in Tibetan Plateau through InSAR and Modeling Techniques

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Permafrost, as one of the major elements of cryosphere, is very sensitive to global climate change. Changes of permafrost not only affect regional and global water circulation, carbon deposit and climate warming, but also influence ground ecological, geophysical, and biogeochemical processes in cold regions. The permafrost region of the Tibetan Plateau is the highest and largest permafrost area in the middle and low latitudes of the world. This study aims to use InSAR and modelling techniques to monitor the active layer thickness (ALT) of permafrost in Tibetan Plateau. The surface seasonal and annual deformation patterns were analysed using data of the C-band Sentinel-1 and the L-band ALOS satellites and the processing techniques of D-InSAR, PS-InSAR and SBAS. On the other hand, several permafrost modelling methods, including the Stefan model and multi-layer GIPL2 model, were tested and their parameter sensitivities were analyzed. Large scale remote sensing products such as MODIS derived land surface temperatures (LSTs) and ground observations such as soil thermal parameters were combined to carry out the modelling process. Surface deformation and temperature profiles from the in-situ borehole monitoring along the 1956 km (including 550 km permafrost) Qinghai–Tibet railway, from Xining to Lhasa, is being used for validation. At this point, the estimation from the InSAR technique is in a general agreement with the in-situ measurements in the test region. Future work includes the extension of the model to fit the InSAR data, and the goal is to build an InSAR based permafrost ALT map of Tibet Plateau.