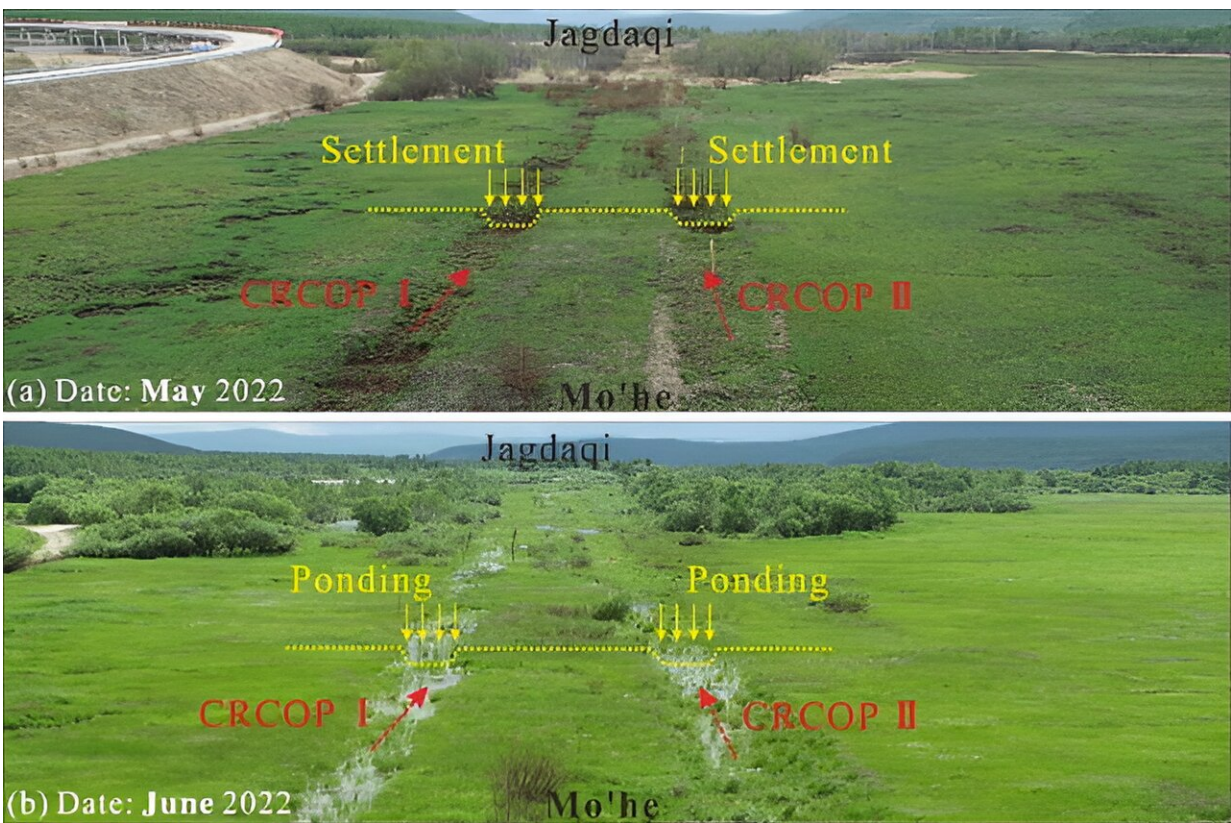


Exploring effects of thawing permafrost on topography and periglacial environment along China-Russia crude oil pipeline

June 13 2024, by Zhang Nannan



Surface subsidence and water ponding along the CRCOP. Credit: NIEER

The buried China-Russia Crude Oil Pipeline (CRCOP), with its oil temperature above 0°C, interacts with the permafrost environment in a

complex way, causing permafrost degradation, frost geohazards, and various environmental problems along its route.

Prof. Li Guoyu's team from the Northwest Institute of Eco-Environment and Resources (NIEER) of the Chinese Academy of Sciences established a comprehensive on-site monitoring system to detect the geomorphological reshaping and water erosion caused by thawing permafrost along the CRCOP.

The researchers observed a gradual increase in soil temperature, which caused the permafrost around the CRCOP to warm and thaw rapidly. At a distance of 2 m from the pipeline center, the permafrost table decreased at a rate of 0.68 m/a, reaching a depth of -11.4 m by 2022.

The thawing of the permafrost caused settlement of the pipeline and subsidence of the ground surface, resulting in thermal erosion, ponding of water in summer, and icing in winter. The area near the pipeline experienced significant surface subsidence, creating lowlands that resulted in water ponding in summer.

The thermal [erosion](#) of ponding accelerated the topographical changes. The subsidence rate in ponding areas was 8.18 cm/a, which was significantly higher than the rate of 4.81 cm/a in the non-ponding areas.

Additionally, they proposed a series of technologies to mitigate permafrost thawing and control pipeline settlement, including thermosyphons, air ventilation ducts, and air convection [pipeline](#) embankments, to ensure safe operation of the CRCOP.

Finally, they discussed the effects of climate warming, fire, and human activities on [permafrost](#) degradation, illustrating the evolution process of talik and surface characteristics under the influence of multiple factors. The study provides significant data for the safe operation and

maintenance of the CRCOP.

The study, titled "[Permafrost thawing caused by the China-Russia Crude oil pipeline based on multi-type data and its impacts on geomorphological reshaping and water erosion](#)," was published in *CATENA*.

More information: Kai Gao et al, Permafrost thawing caused by the China-Russia Crude oil pipeline based on multi-type data and its impacts on geomorphological reshaping and water erosion, *CATENA* (2024).
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