Scientists reveal shifting spring phenology of Arctic tundra with satellite and ground observation

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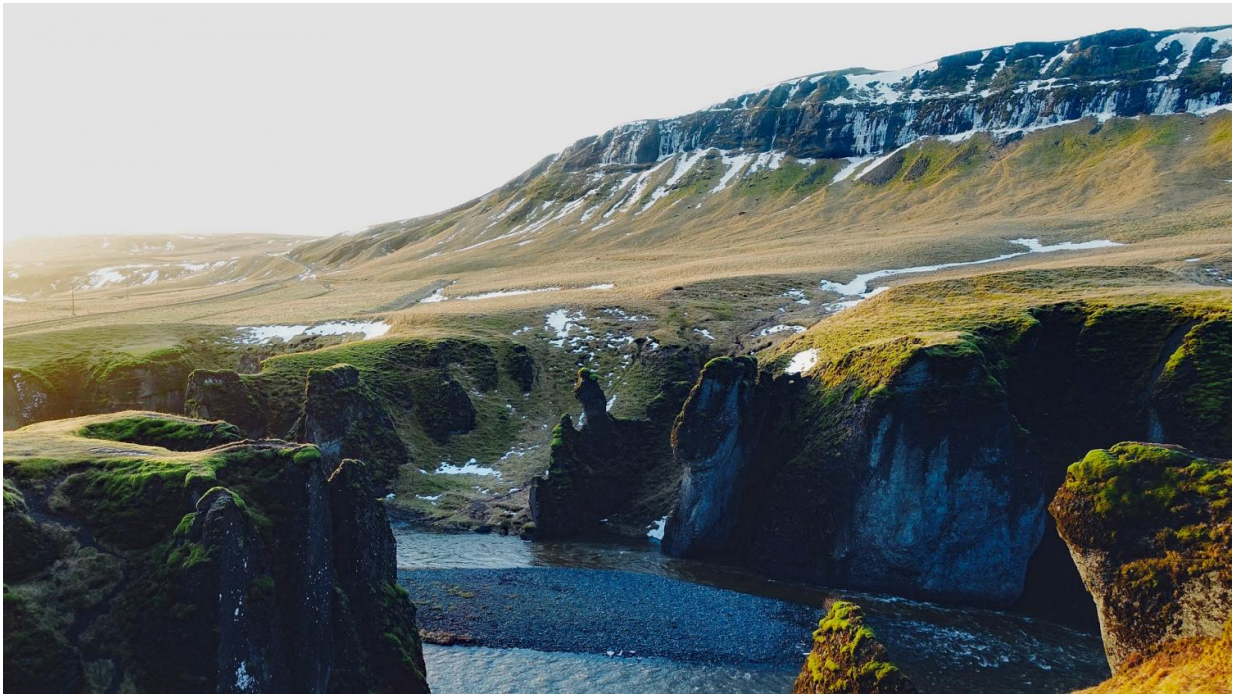

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Phenology represents the seasonal dynamics of vegetation, and is an important indicator of local and regional climate change. With stronger warming trends at higher latitudes, the seasonality of vulnerable Arctic tundra is more sensitive. Many studies have reported advances in the

start of growing season (SOS) in Northern Hemisphere, however, a delayed trend in SOS was reported in some recent studies.

A new study, published in *Science China Earth Sciences*, showed the temporal and spatial variations of the spring phenology at 29 sites in the Arctic tundra region using multiple remote sensing indices and ground observations from 2000 to 2018. The study was led by scientists from the Institute of Atmospheric Physics (IAP) of the Chinese Academy of Sciences.

"Due to restrictions of the environment and equipment conditions, there are fewer ground observation sites in high-latitude regions than in low- and mid-latitude regions." said Jiangshan Zheng, first author of this study. In this study, scientists used data from ground observations and remote sensing to analyze spatial and temporal variation of tundra SOS. The multi-source and multi-scale data are used to ensure data reliability.

"The estimated SOS usually differs among the various data sources, because temporal and spatial scales of observations and methods are differentm," said Zheng. "But we found that the SOS derived from remote sensing indices was consistent with ground observations in inferring latitudinal gradient and interannual variation of SOS."

According to this study, the SOS of almost all tundra types was delayed after 2016. High Arctic vegetation showed a stronger SOS delay trend than low Arctic vegetation in the past two decades.

"The spring phenology change in the Arctic tundra is driven by many environmental factors. The warming interval, spring frost, or reductions in winter chilling can lead to delayed SOS," said Dr. Xiyan Xu, one of the authors of this study.

"Under climate warming in the Arctic, vegetation growth in the High

Arctic is easily restricted by soil moisture because of dry and barren soils. While in the Low Arctic, soils contain more moisture that facilitates mosses and lichens to utilize carbon, nitrogen, and other nutrients," said Zheng.

This work investigated the spatial and temporal variations of SOS over the past 20 years and the differences in the spring SOS changes among plant communities, which has great significance in understanding the change and adaptation of the tundra ecosystem under climate change. "The response of spring phenology to climatic and environmental change at different scales, as well as the impact of phenological changes on carbon exchange in permafrost regions, require further exploration in our future works," said Xu.

More information: Jiangshan Zheng et al, Understanding the spring phenology of Arctic tundra using multiple satellite data products and ground observations, *Science China Earth Sciences* (2020). DOI: 10.1007/s11430-019-9644-8

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