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Characterizing the high latitudinal treeline ecotone using multi-source remote sensing data

The term treeline refers to the climatic limit of tree growth, occurring where seasonalmean temperatures decline to around 6 ℃ with a growing season of at least 3months (Körner 2020). Thereby, the treeline defines the boundary of the tree as a lifeform. However, treelines are shaped by various environmental factors and appear indifferent forms, typically classified as diffuse, abrupt, islands and krummholz.Characterizing changes in Arctic tundra vegetation is directly linked to understandingthe long-term dynamics in the high-latitudinal treeline. With longer vegetation periods and decline of permafrost stability, trees potentially migrate towards higher latitudes which can cause local shifts of the treeline and, consequently, a squeezing of the land area available for Arctic tundra.

The imagination of the treeline in the sense of hard boundary can be misleading as the turnover from forest to tundra is rather gradually following local conditions. These landscape gradients, also known as forest-tundra ecotones, are dynamic ecological transition zones where vegetation changes from tall trees to prostrate shrubs.

The inconsistent use of terminology and varying definitions of trees and treelineshave hindered standardized assessments of treeline dynamics as climate changeindicators so far. There is no single best method for monitoring forest-tundra ecotones and a multiscale approach integrating multiple methods is needed to provide a comprehensive understanding of changes and the factors influencing themRemote sensing data serve as one valuable source for understanding and monitoring changes in tree cover at large spatial extent without need for field access, which can be a particularly challenging limitation in the pan-Arctic region.

However, currently available remote sensing-based forest cover products lack the level of detail to characterize the high-latitudinal treeline ecotone.
In the session, we will discuss their major limitations and present ideas for improvement that include the application of single-tree detection from high-resolution multisource remote sensing data.

Primary author: Dr LUDWIG, Antonia (Leipzig University)

Co-author: FEILHAUER, Hannes (Universität Leipzig)

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