Project information

Keywords
Remote sensing, arctic vegetation, Svalbard, snow cover, growing season length, snow melt, phenology

Project title
Arctic Growing Season Length (Arctic GSL): Remote sensing of growing season length on Svalbard's Arctic tundra, in relation to snow melt date.

Year
2017

Project leader
Elisabeth J. Cooper

Geographical localization of the research project in decimal degrees (max 5 per project, ex. 70,662°N and 23,707°E)
Adventdalen: N 78.1702, Ø 16.0387

Participants

L. Nilsen, Frans-Jan Parmentier, P.R.Semenchuk, M.A. Mörsdorf (UiT), H. Tømmervik (NINA), Stein Rune Karlsen (NORUT)

1 external PhD student Friederike Gerhmann (Uni Helsinki)

Flagship
Terrestrial

Funding Source

Terrestrial Flagship WP2: Effekter av endringer i årstider og frekvens av ekstremhendelser

Summary of Results

1. We have analysed a long-term phenology data set to elucidate and better describe the drivers of plant phenological phase shifts for 8 common Svalbard vascular plants. The timing of phenological events is dependent on the timing of snowmelt, but the amount of thermal time needed to complete each phase is fixed. This means that the species we studied are periodic and their growing season length is fixed and does not get longer with an earlier snowmelt.

2. Determination of growing season length changes over a larger spatial scale require accurate remote recording of plant developmental timing. Remote sensing technologies offer novel methods of continuously recording these processes and other environmental features with minimal disturbance. However, in order to produce of robust landscape level mapping products detailing length of the growing season it is necessary to validate the data by in-situ measurements. We carried out such plot-scale measurements and compared methodology and instruments for use it the field. We will later be able to incorporate the findings of our phenological studies at the plot and plant community scale to the landscape level and set them within a wider spatial and ecosystem context.

Master and PhD-students involved in the project

1 external PhD student Friederike Gerhmann (Uni Helsinki)

This project's results are used in teaching at UNIS and UiT as well as University of Toyama and SOKENDAI Japan, and the Japanese National Institute for Polar Research.

For the Management

We have been gathering and analysing remotely collected data at the plot and landscape scale and comparing with manually collected phenological data and vegetation indices in order to provide methodology and data to describe the changing timing of High Arctic plant phenology and effects on growing season length, and forage availability and quality.

Published Results/Planned Publications

2017:

Anderson, H.B., Nilsen. L., Tømmervik, H., Karlsen, S.; Nagai, S.; Cooper E.J. 2017. Correction: Anderson, H.B. et al. Using Ordinary Digital Cameras in Place of Near-Infrared Sensors to Derive Vegetation Indices for Phenology Studies of High Arctic Vegetation. [*Remote Sens*. 2016, 8, 847.] *Remote Sens*. 2017, 9, 1003;4pp, doi:10.3390/rs9101003

Morsdorf MA, Elberling B, Baggesen NS, Cooper EJ. Nutrient dynamics during growing season are determined by snow depth during the wintertime – evidence from the high Arctic tundra. *Submitted*

Pirk, N., Sievers, J., Mertes, J., Parmentier, F. J. W., Mastepanov, M. and Christensen, T. R.: Spatial variability of CO2 uptake in polygonal tundra: assessing low-frequency disturbances in eddy covariance flux estimates, Biogeosciences, 14(12), 3157–3169, doi:10.5194/bg-14-3157-2017, 2017.

Prevey, J., Cooper, E.J., et al. 2017. Greater temperature sensitivity of phenology at colder sites: implications for convergence across northern latitudes. *Global Change Biology* 23: 2660–2671, doi: 10.1111/gcb.

Saunois, M., Bousquet, P., Poulter, B., Peregon, A., Ciais, P., Canadell, J. G., Dlugokencky, E. J., Etiope, G., Bastviken, D., Houweling, S., Janssens-Maenhout, G., Tubiello, F. N., Castaldi, S., Jackson, R. B., Alexe, M., Arora, V. K., Beerling, D. J., Bergamaschi, P., Blake, D. R., Brailsford, G., Bruhwiler, L., Crevoisier, C., Crill, P., Covey, K., Frankenberg, C., Gedney, N., Höglund-Isaksson, L., Ishizawa, M., Ito, A., Joos, F., Kim, H.-S., Kleinen, T., Krummel, P., Lamarque, J.-F., Langenfelds, R., Locatelli, R., Machida, T., Maksyutov, S., Melton, J. R., Morino, I., Naik, V., O'Doherty, S., Parmentier, F.-J. W., Patra, P. K., Peng, C., Peng, S., Peters, G. P., Pison, I., Prinn, R., Ramonet, M., Riley, W. J., Saito, M., Santini, M., Schroeder, R., Simpson, I. J., Spahni, R., Takizawa, A., Thornton, B. F., Tian, H., Tohjima, Y., Viovy, N., Voulgarakis, A., Weiss, R., Wilton, D. J., Wiltshire, A., Worthy, D., Wunch, D., Xu, X., Yoshida, Y., Zhang, B., Zhang, Z. and Zhu, Q.: Variability and quasi-decadal changes in the methane budget over the period 2000–2012, Atmos. Chem. Phys., 17(18), 11135–11161, doi:10.5194/acp-17-11135-2017, 2017.

Stanislaw Seniczak, Anna Seniczak, Radomir Graczyk, Hans Tømmervik, Stephen James Coulson, 2017. Distribution and population characteristics of the soil mites *Diapterobates notatus* and *Svalbardia paludicola* (Acari: Oribatida: Ceratozetidae) in High Arctic Svalbard (Norway) Polar Biology. 40:

2016

Anderson, H.; Nilsen, L.; Tømmervik, H.; Karlsen, S.; Nagai, S.; Cooper, E. J. Using Ordinary Digital Cameras in Place of Near-Infrared Sensors to Derive Vegetation Indices for Phenology Studies of High Arctic Vegetation. *Remote Sens*. 2016, 8, 847.

Communicated Results

We have presented and discussed our methodology in various workshops, eg Arctic Biomass Longyearbyen, 9-12 Oct 2017, and also used in teaching at UiT, UNIS and Toyama Uni and NIPR Japan.

Interdisciplinary Cooperation

Remote sensing scientists, plant ecologists, also soil scientists, biogeochemists and entomologists.

Budget in accordance to results

We have used all our funding to work with this project and intend to apply for continuation for 2018.

Could results from the project be subject for any commercial utilization

No

Conclusions

This project is ongoing but we have made good progress this year in developing methodology for upscaling from plot to landscape level phenology using remote sensing methodology.