Modelling combined effects of ozone and climate stresses on Arctic and boreal species

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BACKGROUND
The project OzoNorClim will investigate combined effects of ozone and climate stresses on Arctic and boreal species. Interdisciplinary research questions are addressed, combining plant ecophysiology and atmospheric physics methods. The work consists of plant physiological and mycological experiments to quantify the effects of ozone polluted air under the particular conditions in Northern areas, and feeding the new information into widely used climate and tropospheric ozone injury models. The improved models will give a better representation of the interactions between tropospheric ozone, vegetation and climate in Arctic and tundra areas, and therefore a better foundation for political decisions.

OZONE IMPACTS IN LONG DAYS
The midnight sun at the high latitude areas gives bright or dim summer nights, without darkness. For instance, in Alta (70° N) there is 24 hr day (sun above horizon) in the period 17 May to 26 July (70 days) and the night is shorter than 10 hr for 163 days. In our previous studies of three clover species (Trifolium subterraneum, T. repens, T. pratense) subjected to ozone combined with long-day conditions, we found that the ozone sensitivity increased, compared to plants grown in short-day conditions during ozone exposure (Vollenes et al 2009; 2010; Futsaether et al 2015).

OZONE IN THE ARCTIC
With less sea ice in the Arctic Ocean, more ships are passing the coast of Northern Norway, causing increased emissions of ozone precursors, probably increasing the ozone exposure of the vegetation on land (Peters et al 2011, Ødemark et al 2012, Marelle et al 2016).

OZONORClim PROJECT WORKFLOW

- WP1 Current tropospheric ozone pollution
- WP2 Effects of ozone on meadow and tundra species
- WP3 Daylength dependency of ozone sensitivity
- WP4 Modelling of ozone impacts in the current and near past
- WP5 Modelling of combined ozone and climate effects on vegetation

REFERENCES:

LATICE - Land Atmosphere Interactions in Cold Environments
is a strategic research area at the University of Oslo. Regional (WRF) and global (NorESM) climate models are main tools. There is a focus on boreal and Arctic conditions.

LATICE studies climate variability and change including feedbacks through:
- Improving parameterizations of processes in global earth system models controlling the interactions and feedbacks between the land surface and the atmosphere
- Assessing the influence of climate and land cover changes on energy and water fluxes
- Integrating remote earth observations with in situ data and suitable models to allow studies of finer scale processes governing land-atmosphere interactions