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Ambient UV-radiation decreases photosynthetic performance on High Arctic plants

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It is hypothesized that natural UV-B radiation is a stressor that have negative impact on photosynthetic performance. The background for this hypothesis are that High Arctic plants live 'on the edge' by means of a harsh stress regime where plants are exposed to extreme climatic conditions and live on their limits of distribution. Moreover High Arctic plants may be poorly adapted to changes and load in UV-radiation due to the historically low exposure of UV-radiation in the past. In combination, also field and laboratory experiments supplementing UV-radiation have demonstrated various effects resulting in negative impact on biological processes potentially leading to i.e. decreased photosynthesis under in ambient UV-radiation exposure. In the context of stratospheric decrease in ozone driven increases in UV-radiation at the ground probably continues the next 40 years and thereafter cease, field studies on UV-effects in Arctic regions are important.

Therefore during summer, 2002, a UV-B exclusion experiment was established in the high arctic at Zackenberg, NE Greenland to investigate the possible effects of ambient UV-B on plant performance. Mylar filters were used to reduce the UV-B irradiance and Teflon filters served as controls. During almost a whole growing season gas exchange and transients of chlorophyll-a fluorescence were measured on *Vaccinium uliginosum*. Leaf area, leaf and stem biomass, C, N and UV-B absorbing compounds were determined by a late season harvest. In response to avoid ambient UV-B the plants were found to have a higher specific leaf area, leaf area index and content of UV-B absorbing compounds in ambient UV-B. Photosynthesis was reduced by 23% during the season in ambient UV-B, except in the late August senescence period where no difference between treatments appeared. By means of the so-called JIP-test, it was found that the potential of processing light through the photosynthetic machinery was slightly reduced in ambient UV-B, which indicates that UV-B induced stress on PSII can explain some of the observed reduction of photosynthesis in ambient UV-B, but also that other effects i.e. on the Calvin Cycle performance might be important. The 60 % reduction of the UV-B used in this study implies a higher relative change in the UV-B load than many of the supplemental experiments do, but the substantial decrease in photosynthesis does indicate the *Vaccinium uliginosum* is not acclimated to the current level of UV-B.