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Supplement of

Satellite observations of changes in snow-covered land surface albedo during spring in the Northern Hemisphere

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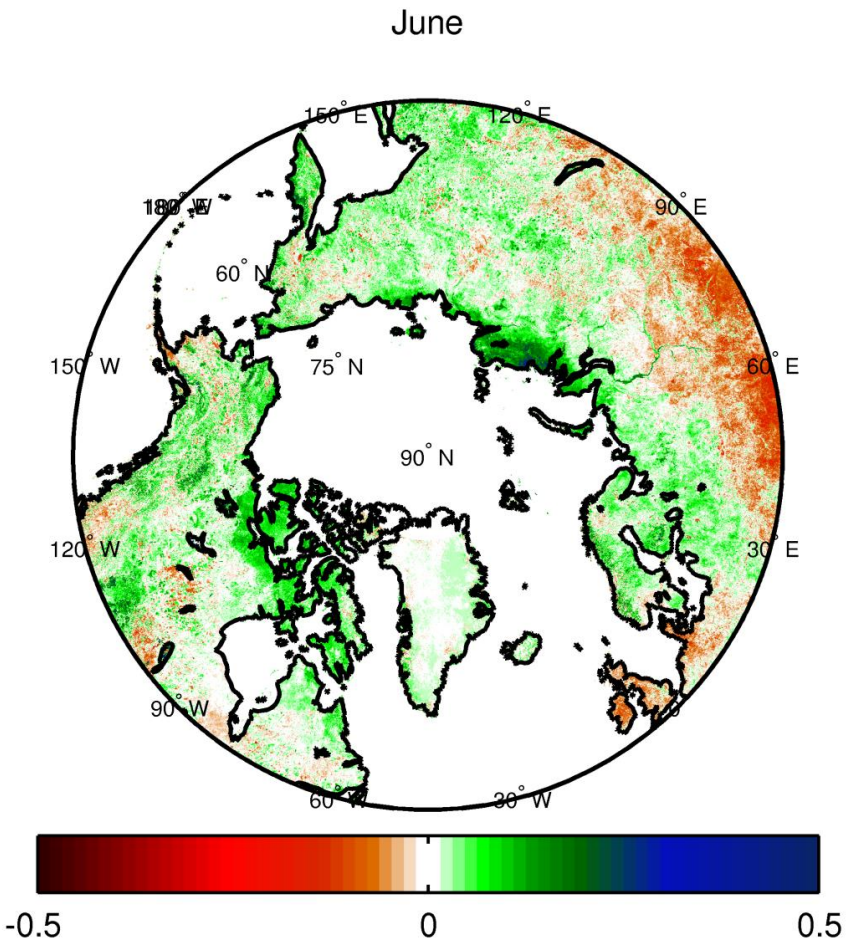

Figure S1. June EVI changes for the years 2000-2012.

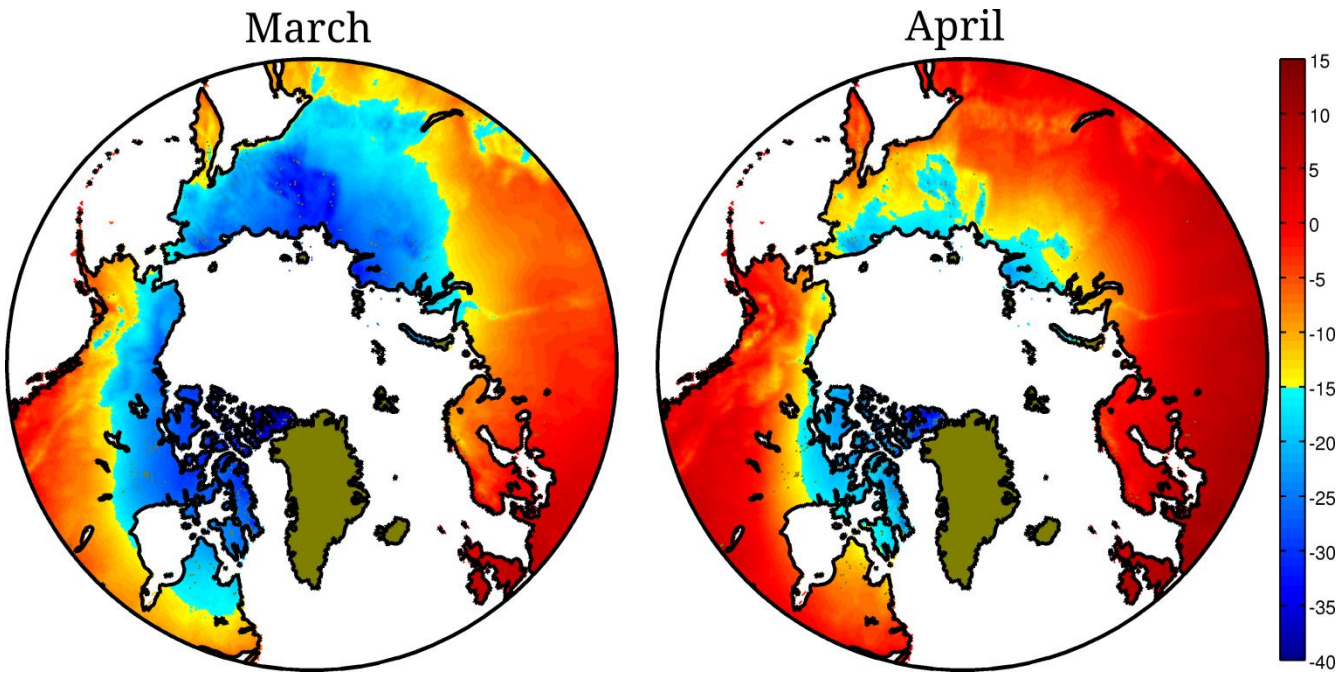

Figure S2. Mean air temperatures in March and April for the years 2000-2012.

Effect of the temporal data resolution on the obtained results

To study the effect of the temporal data resolution on the effects described in the manuscript, we analyzed NCEP North American Regional Reanalysis NARR data (Mesinger et al, 2006). It is the high resolution combined model and assimilation dataset that provides 8-times daily, daily and monthly means of various meteorological parameters at the surface and at 29 pressure levels. It covers North America and has a spatial resolution of about 0.3 degrees (32 km). NARR is known to have a better accuracy in comparison with global reanalysis datasets due to the use of better/more observations, better assimilation techniques and model performance in combination with finer spatial resolution.

We analyzed 13 years of daily surface air temperature data. The dataset was reprojected and resampled to the 25km EASE grid to allow for direct comparison. We calculated mean values for each of the 16-days MODIS albedo product collection periods. Three regions were analyzed — Arctic Archipelago, North Canada and Labrador Peninsula. Masks equivalent to those of April (Fig 1. of the manuscript) in the main analysis were applied. Mean region values were calculated if at least 500 pixels with 100% SCF (312 500 km2) had valid data, which resulted in 168 data points for the Arctic Archipelago and North Canada, and 150 for Labrador.

Scatterplots of regionally-averaged values of albedo vs. air temperature are shown in Fig S3. Because the threshold of -15°C found in our work did not coincide with those described in the literature (e.g. Aoki et al, 2003), it is of interest to study whether substantially warmer temperatures occur within MODIS data collection periods. We counted the number of days in each of the 16-days intervals when the temperature exceeded the mean temperature for that period by half the value. For example, for a mean temperature of -10°C, days warmer than -5°C were counted. This number is shown with color in Fig S3. Such simple metric provides insight in the positive temperature fluctuations with emphasis on the temperatures range from -10 to -15°C. Similar to the main analysis, this graph reveals a relationship between albedo and temperature. However, for the warmer regions of Labrador and North Canada, the temperature threshold above which negative albedo-temperature correlation is observed, can be drawn at about -10°C. For the Arctic Archipelago, which is the coldest of the three regions studied, the threshold coincides with the one we found previously. The number of warmer than average days in the temperature range from -10 to -15°C is smaller in the Arctic Archipelago, yet surface albedo decreases at the lower temperatures than in warmer regions. Based on these findings we can conclude that regional differences exist, and in the colder regions snow covered surface albedo decreases at the lower temperatures.

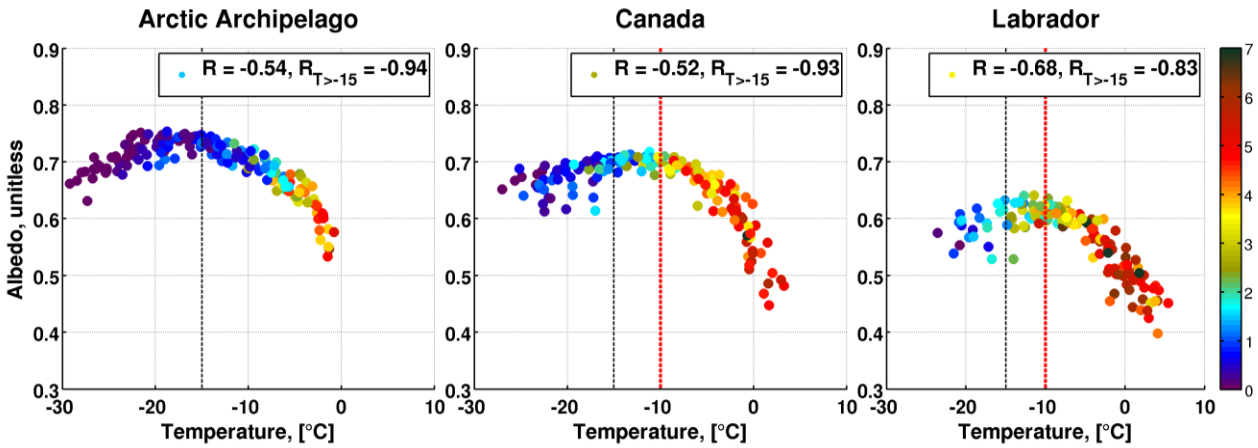

Fig S3. Snow-covered land area albedo vs. NARR mean regional air temperature for the selected regions. The correlations for all data points and for data points corresponding to the mean temperatures above -15°C are displayed in the legend. The black dashed line shows -15°C, and the red line -10°C. The colorbar shows the number of days for a given 16-days MODIS data accumulation period with temperatures exceeding the mean value by half in absolute values.

Reference:

Mesinger, F., DiMego, G., Kalnay, E., Mitchell, K., Shafran, P. C., Ebisuzaki, W., Jović, D., Woollen, J., Rogers, E., Berbery, E. H., Ek, M. B., Fan, Y., Grumbine, R., Higgins, W., Li, H., Lin, Y., Manikin, G., Parrish, D., and Shi, W.: North American Regional Reanalysis, Bulletin of the American Meteorological Society, 87, 343-360, 2006.