Correction to "Changes in Arctic sea ice result in increasing light transmittance and absorption"

M. Nicolaus,[1] S. Arndt,[1] C. Katlein,[1] J. Maslanik,[2] and S. Hendricks[1]

Received 26 April 2013; accepted 30 April 2013; published 4 June 2013.

Citation: Nicolaus, M., S. Arndt, C. Katlein, J. Maslanik, and S. Hendricks (2013), Correction to "Changes in Arctic sea ice result in increasing light transmittance and absorption," *Geophys. Res. Lett.*, *40*, 2699–2700, doi:10.1002/grl.50523.

[1] In the paper "Changes in Arctic sea ice result in increasing light transmittance and absorption" by *Nicolaus et al.* (*Geophysical Research Letters*, *39*(24), L24501, doi:10.1029/2012GL053738, 2012), the presented data on solar surface irradiance are erroneous.

[2] In order to generate monthly means of the solar heat input into the Arctic Ocean, among others, the ERA interim (European Centre for Medium-Range Weather Forecasts) data set of solar surface irradiance was used. The original data set consists of eight time slices with integrated fluxes over 3 h each. But in the presented results, only the mean (not sum) of two slices (from 00:00 to 03:00 and from 12:00 to 15:00) was considered, resulting in too low fluxes, approx. by a factor of eight. As a consequence, two text passages (in paragraph 3.1 and 3.3) and three figures (Figure 4 of the main article and Figures S3 and S6 of the auxiliary material) contain too low fluxes. However, the main conclusions of the manuscript remain completely valid and unchanged, since those are only based on relative fluxes, which are not affected by this mistake. The corrected paragraphs read

3.1. Sea Ice Conditions in Summer 2011

[3] . . .

[4] Considering the entire Arctic, in August 2011, the sea ice extent was 5.5 million km^2 with a mean sea ice concentration of 63%, as observed from passive microwave satellite data (Figure S4). Sea ice age analyses [*Maslanik et al.*, 2011] reveal that 50% of the sea ice was First-Year Ice (FYI) and 50% was Multi-Year Ice (MYI), with MYI dominating along the Greenland and Canada coasts and FYI dominating between 60°E and 150°W (Figure S5). As noted in Maslanik et al. [2011], for the data set used, some FYI is likely to be present even in predominantly MYI locations. Hence, the age data to some degree underestimate total area of FYI, so the effects of the transition from a predominantly MYI pack are likely to be even greater than those described here. Mean solar surface irradiance was 110.2 Wm^{-2} (Figure S3), with similar fluxes around the mean in the most central Arctic and minima (66.0 Wm^{-2}) in the Barents Sea and maxima in the Laptev Sea (230.8 Wm^{-2}).

3.3. Arctic-Wide Under-Ice Light Distribution

[5] Based on the total transmittance (FYI: 0.11, MYI: 0.04) from the field measurements, and the additional data sets of ice types, ice concentration, and surface solar radiation, an Arctic-wide estimate of light transmission through summer sea ice was derived for August 2011. To do so, evapotranspiration (equation 1) was calculated for each grid cell at each day and averaged over the month. We consider August as the best-represented month from our measurements, when sea ice is covered with open and fully developed melt ponds. Also sea ice conditions are expected to be most consistent over the entire Arctic, because autumn freeze-up has not yet started [Markus et al., 2009]. Figure 4 shows a map of the Arctic-wide distribution of solar heat input through sea ice into the upper ocean, excluding fluxes through open water. This shows an absolute heat input into the ocean between 0 and 13 W m^{-2} for August 2011. Regions with predominant FYI show larger heat input than those with predominating MYI, but the absolute flux is also controlled by surface solar irradiance. Including fluxes through open water, the effect of sea ice concentration (Figure S4) becomes most obvious, particularly in the marginal ice zones, and fluxes within the sea ice extent reach more than 70 W m^{-2} (Figure S6). Mean heat flux through the sea ice over the entire Arctic was 4.70 W m^{-2} (mean transmittance: 0.08) in August 2011. Including open water within the sea ice extent it was 32.9 W m^{-2} (mean transmittance: 0.40). . . .

[1]Alfred-Wegener-Institut, Helmholtz-Zentrum für Polar- und Meeresforschung, Bremerhaven, Germany.

[2]Department of Aerospace Engineering Sciences, University of Colorado, Denver, Colorado, USA.

Corresponding author: M. Nicolaus, Alfred-Wegener-Institut, Helmholtz-Zentrum für Polar- und Meeresforschung, Bussestr. 24, Bremerhaven 27570, Germany. (Marcel.Nicolaus@awi.de)

0094-8276/13/10.1002/grl.50523

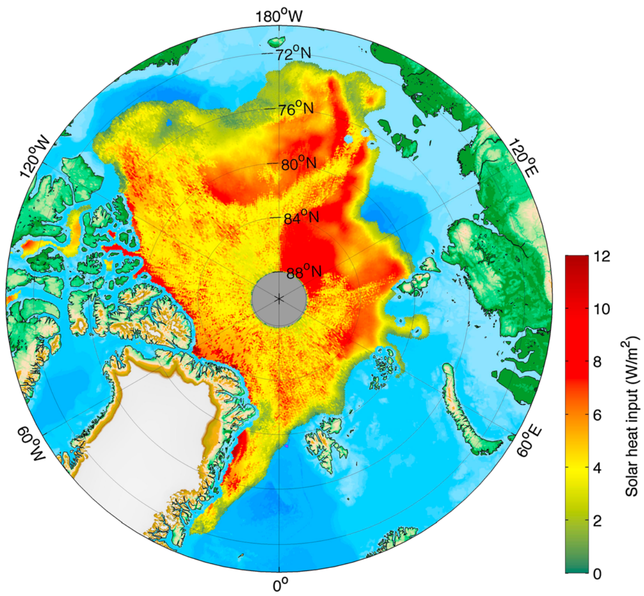

Figure 4: Solar heat input into the Arctic Ocean through sea ice. This map only considers fluxes through sea ice, excluding fluxes through open water, for August 2011.

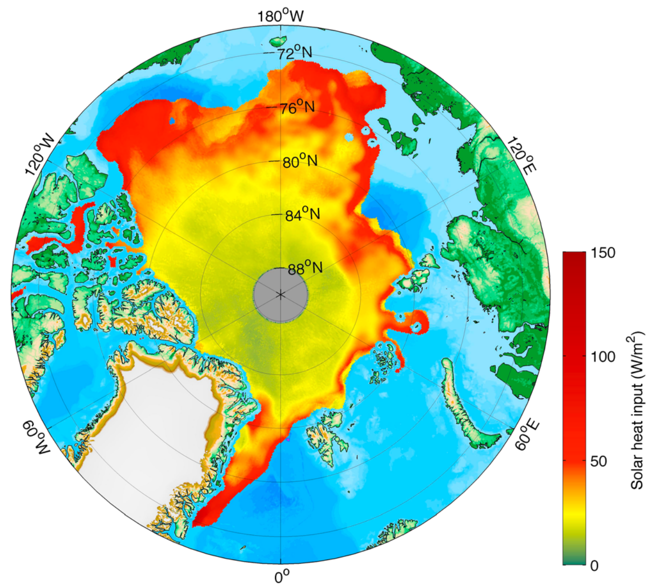

Figure S6: Solar heat input into the Arctic Ocean through sea ice and open water for August 2011. Compare to Figure 4 for fluxes through sea ice only.

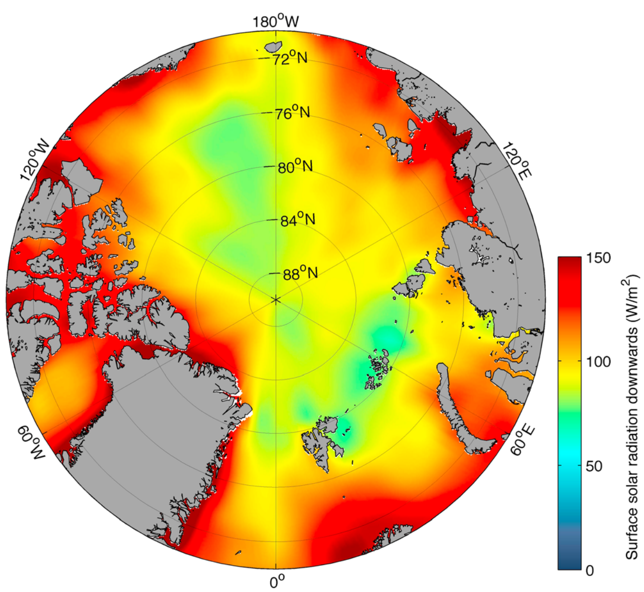

Figure S3: Monthly mean ECMWF ERA-interim surface solar short-wave irradiance for August 2011.