ALFRED-WEGENER-INSTITUT
HELMHOLTZ-ZENTRUM FÜR POLAR- UND MEERESFORSCHUNG

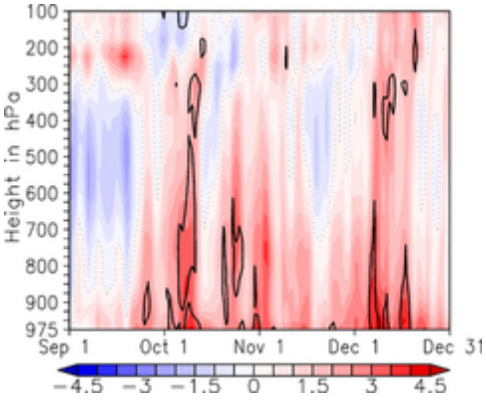
HELMHOLTZ GEMEINSCHAFT

26. January 2012: **New study shows correlation between summer Arctic sea ice cover and winter weather in Central Europe**

Potsdam/Bremerhaven, 26 January 2012. **Even if the current weather situation may seem to speak against it, the probability of cold winters with much snow in Central Europe rises when the Arctic is covered by less sea ice in summer. Scientists of the Research Unit Potsdam of the Alfred Wegener Institute for Polar and Marine Research in the Helmholtz Association have decrypted a mechanism in which a shrinking summertime sea ice cover changes the air pressure zones in the Arctic atmosphere and impacts our European winter weather. These results of a global climate analysis were recently published in a study in the scientific journal Tellus A.**

If there is a particularly large-scale melt of Arctic sea ice in summer, as observed in recent years, two important effects are intensified. Firstly, the retreat of the light ice surface reveals the darker ocean, causing it to warm up more in summer from the solar radiation (ice-albedo feedback mechanism). Secondly, the diminished ice cover can no longer prevent the heat stored in the ocean being released into the atmosphere (lid effect). As a result of the decreased sea ice cover the air is warmed more greatly than it used to be particularly in autumn and winter because during this period the ocean is warmer than the atmosphere. "These higher temperatures can be proven by current measurements from the Arctic regions," reports Ralf Jaiser, lead author of the publication from the Research Unit Potsdam of the Alfred Wegener Institute.

The warming of the air near to the ground leads to rising movements and the atmosphere becomes less stable. “We have analysed the complex non-linear processes behind this destabilisation and have shown how these altered conditions in the Arctic influence the typical circulation and air pressure patterns," explains Jaiser. One of these patterns is the air pressure difference between the Arctic and mid-latitudes: the so-called Arctic oscillation with the Azores highs and Iceland lows known from the weather reports. If this difference is high, a strong westerly wind will result which in winter carries warm and humid Atlantic air masses right down to Europe. If the wind does not come, cold Arctic air can penetrate down through to Europe, as was the case in the last two winters. Model calculations show that the air pressure difference with decreased sea ice cover in the Arctic summer is weakened in the following winter, enabling Arctic cold to push down to mid-latitudes.



Despite the low sea ice cover in summer 2011, a cold winter with much snow has so far not occurred here in Germany. Jaiser explains this as follows: "Many other factors naturally play a role in the complex climate system of our Earth which overlap in part. Our results explain the mechanisms of how regional changes in the Arctic sea ice cover have a global impact and their effects over a period from late summer to winter. Other mechanisms are linked, for example, with the snow cover in Siberia or tropical influences. The interactions between these influential factors will be the subject matter of future research work and therefore represent a factor of uncertainty in forecasts.”

It is the aim of the Potsdam researchers to find and analyse further mechanisms and to correctly show the Earth’s climate system with the help of these mechanisms in models. “Our work contributes to reducing the existing uncertainties of the global climate model and developing more credible regional climate scenarios – an important foundation to enable people to adjust to the altered conditions," explains Prof. Dr. Klaus Dethloff, Head of the Atmospheric Circulation Section at the Research Unit Potsdam of the Alfred Wegener Institute.

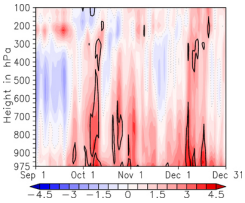
Title of the original publication: R. Jaiser, K. Dethloff, D. Handorf, A. Rinke, J. Cohen, Impact of sea ice cover changes on the Northern Hemisphere atmospheric winter circulation, Tellus A 2012, 64, 11595, doi:10.3402/tellusa.v64i0.11595 (http://www.tellus.net/index.php/tellusa/article/view/11595)

Notes for Editors: Your contact partners in the Research Unit Potsdam of the Alfred Wegener Institute are Ralf Jaiser (email: Ralf.Jaiser(at)awi.de) and Prof. Dr. Klaus Dethloff (Tel.: +49 (0)331/288-2104; email: Klaus.Dethloff(at)awi.de). Your contact partner in the press office is Dr. Folke Mehrtens (Tel.: +49 (0)471/4831-2007; email: Folke.Mehrtens(at)awi.de). Please send us a copy on publication.

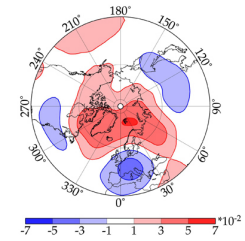
The Alfred Wegener Institute conducts research in the Arctic and Antarctic and in the high and mid-latitude oceans. The Institute coordinates German polar research and provides important infrastructure such as the research ice breaker Polarstern and research stations in the Arctic and Antarctic to the national and international scientific world. The Alfred Wegener Institute is one of the 18 research centres of the Helmholtz Association, the largest scientific organisation in Germany.

Printable Images

Ice floes
Ice floes in the Arctic. Photo: Alfred Wegener Institute
web print



Amplified warming of air masses above the Arctic ocean
This graphic illustrates the amplified warming of air masses above the Arctic ocean. Starting with the lowest sea ice cover in September evolving to the following winter temperatures are increased in years with less sea ice cover notably in the lower troposphere. Black contoured areas are particularly significant. scaling of x-axis: temperature diffenrence (Celvin) between means of years with low sea ice (2000-2009) and high sea ice (1989-1999) concentrations. scaling of y-axis: hight in hPa as pressure coordinates. Graphic: Ralf Jaiser, Alfred Wegener Institute
web print



Gekoppeltes Muster Meereiskonzentration und Luftdruck 2
Die Abbildung stellt die gekoppelten Muster der Meereisbedeckung im Sommer und dem Druck in der mittleren Troposphäre im Winter dar. Die Eisabnahme in den blau gezeigten Bereichen (Grafik 1) ist verbunden mit einer Druckzunahme in der Arktis und einer Druckabnahme in den mittleren Breiten (Grafik 2), wodurch der Luftdruckgegensatz zwischen diesen Regionen abgeschwächt wird. (Skala: relatives Maß der Abweichung von Meereis-Konzentration und geopotentieller Höhe). Grafik: Ralf Jaiser, Alfred-Wegener-Institut
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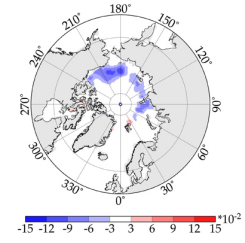

Gekoppeltes Muster Meereiskonzentration und Luftdruck 1
Die Abbildung stellt die gekoppelten Muster der Meereisbedeckung im Sommer und dem Druck in der mittleren Troposphäre im Winter dar. Die Eisabnahme in den blau gezeigten Bereichen (Grafik 1) ist verbunden mit einer Druckzunahme in der Arktis und einer Druckabnahme in den mittleren Breiten (Grafik 2), wodurch der Luftdruckgegensatz zwischen diesen Regionen abgeschwächt wird. (Skala: relatives Maß der Abweichung von Meereis-Konzentration und geopotentieller Höhe). Grafik: Ralf Jaiser, Alfred-Wegener-Institut
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back to list