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Since the sea-ice retreat in summer 2007 reached far into the Arctic basin and was exceptional in terms of the usual sea-ice variability, one might argue that the Arctic sea ice is no longer in a metastable state and has already passed a "tipping point" toward thinner and less extensive sea-ice cover as discussed by Lindsay and Zhang (2005) . The thinning of the sea-ice cover is a major reason for its increased response to variations in the atmospheric and oceanic circulations. On the one hand, the ice-thinning was initiated by a strong decrease of thick multi-year ice during 1989-1990 when the Arctic Oscillation was in an extreme high-index phase and internal thermodynamic changes related to the positive ice-albedo feedback, not external forcing, have dominated the ice-thinning process afterwards. This means that greenhouse gas induced warming of the Arctic have not caused the ice-thinning but might only have contributed to maintain the trend.

On the other hand, the ice-thinning on its own does not represent a sufficient condition for the occurrence of extremely low sea-ice extent at the end of the summer, or even for its total disappearance. Model results by Dorn et al. (2007) show that an Arctic climate state without summer sea ice is not stable under forcing conditions for the 1990s. A model simulation without sea ice at the end of the summer 1989 generates an ice thickness distribution and ice extent at the end of the 1990s which is quite similar to a corresponding simulation with very thick ice cover in 1989 (see Dorn et al., 2007, their Figures 3 and 8). Furthermore, recent model predictions of Arctic sea ice for the spring and summer of 2008 by Zhang et al. (2008) show that another record low of summer sea ice can only be expected under similar atmospheric forcing conditions as in 2007. Forcing conditions as in the years from 2001 to 2006 will not result in further decline of the summer ice extent (see Zhang et al., 2008, their Figure 3). In summary, forcing conditions as in the recent past, except for 2007, are not sufficient for another record low of summer sea ice, in spite of the dramatic thinning of the ice cover in recent years.

Observational data show that the atmospheric circulation in summer 2007 was characterized by the typical, but exceptionally strong high pressure area over the Beaufort Sea (see Kay et al., 2008, their Figure 4). In addition, exceptionally low pressure occurred over Siberia, which led to advection of warm air from the North Pacific region into the inner Arctic and favored a wind-forced ice drift toward Greenland and out of the Arctic through Fram Strait.

Furthermore, the anticyclonic atmospheric circulation in summer 2007 was accompanied by anomalously low cloudiness (approximately 20%
below average) which led to a considerable increase in downwelling shortwave radiation (Kay et al., 2008). This should have led to enhanced surface ice melt and is consistent with warmer sea surface temperatures, which in turn enhanced lateral and basal ice melt as discussed by Kay et al. (2008).

In principle, the recurrence of such anomalous conditions as in 2007 is possible and would

reinforce the ice loss, maybe even induce abrupt
reductions as seen in climate model simulations by Holland et al. (2006). However, the persistence of all these anomalies that appeared in 2007 is rather unlikely, since they are at least partly not a result of a continuous climate change of anthropogenic origin. It is more likely that the coincidence of several favorable factors for low sea-ice extent is responsible for this extreme event.

Some of them are likely to persist or still strengthen in the near future and will preserve the vulnerability of the Arctic sea-ice cover to further decline, but the important role of internal climate variability in the recent decline makes a prediction for the sea-ice minimum in summer 2008 rather difficult if not impossible. A temporal return to previous conditions or stabilization at the current level can not be excluded just as further decline, depending on the atmospheric conditions in summer 2008, which unfortunately we are not able to predict.

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