

## **Regional dependence in the rapid loss of Arctic sea ice**

Sally Close, Marie-Noëlle Houssais, and Christophe Herbaut

Sorbonne Universités, LOCEAN, Université Pierre et Marie Curie, Paris, France

The accelerating rate of sea ice decline in the Arctic, particularly in the summer months, has been well documented by previous studies. However, the methods of analysis used to date have tended to employ pre-defined regions over which to determine sea ice loss, potentially masking regional variability within these regions. Similarly, evidence of acceleration has frequently been based on decade-to-decade comparisons that do not precisely quantify the timing of the increase in rate of decline. In this study, we address this issue by quantifying the onset time of rapid loss in sea ice concentration on a point-by-point basis, using an objective method applied to satellite passive microwave data. Seasonal maps of onset time are produced, and reveal strong regional dependency, with differences of up to 20 years in onset time between the various subregions of the Arctic. In certain cases, such as the Laptev Sea, strong spatial variability is found even at the regional scale, suggesting that caution should be employed in the use of geographically-based region definitions that may be misaligned with the physical response. The earliest onset times are found in the Pacific sector, where certain areas undergo a transition ca. 1992. In contrast, onset times in the Atlantic sector are much more recent. Rates of decline prior to and following the onset of rapid decline are calculated, and suggest that the post-onset rate of loss is weakest in the Pacific sector and greatest in the Barents Sea region. Coherency is noted in the season-to-season response, both at interannual and longer time scales. Our results describe a series of spatially self-consistent regional responses, and may be useful in understanding the primary drivers of recent sea ice loss.