Sea ice

What is the issue?

Sea ice is formed at the surface of the ocean and can persist through the summer to become multi-year ice. The high albedo of ice means that much of the incoming shortwave solar radiation to the Arctic region is reflected back to space without being able to warm the atmosphere, land or sea. Sea ice also helps directly to regulate the air-sea exchange of freshwater, heat and gasses. Its effect on light and plankton in the upper ocean leads to strong coupling with Arctic trophic structures. Changes in sea-ice also have an impact on the uses of the sea through improved access whether for transpolar shipping routes, fishing, oil and gas exploration or eco-tourism.

What has happened and how confident?

Satellite observations show that annual average sea-ice extent has decreased by 2.7 ± 0.6% per decade since 1978 with declines being particularly marked in summer. The summer minimum has been declining at a rate of about 7.4 ± 2.4% (IPCC, 2007a) per decade. In September 2007, the lowest extent ever recorded of about half the normal minimum of the 1950s (EEA, 2008) was caused to some degree by regional warming combined with an anomalous Sea Level Pressure pattern. It is not known what long-term impact an extreme event like 2007 can have, but the nature of the positive feedback to heating through lost albedo means that it could be long-lasting and strong. The minimum ice extent in the following summer (2008) had greater coverage than 2007, but remained low compared to previous years, and consisted of relatively young and thin ice.

Reductions in sea-ice extent have had significant impacts on the North-East Atlantic ecosystem. The UN Intergovernmental Panel on Climate Change (IPCC) reported in its Fourth Assessment report (AR4) with high confidence that “the reduction of Arctic sea ice has led to improved marine access, increased coastal wave action, changes in coastal ecology/biological production and adverse effects on ice-dependent marine wildlife, and continued loss of Arctic sea ice will have human costs and benefits” (IPCC, 2007a).

What might happen?

Rising temperatures would be expected to continue the downward trend. A recent study, based on IPCC AR4 model simulations, projected mean reductions of annually averaged sea-ice area in the Arctic by 2080–2100 of 31%, 33% and 22% under the A2, A1B and B1 SRES scenarios (Zhang and Walsh, 2006).

The observed trend for much greater sea ice loss in summer compared to winter is a feature of future models (see Figure 3.1.2) and it is possible that Arctic sea ice may disappear at the height of the melting season in the coming decades (EEA, 2008). In contrast, the area of seasonal (winter-only) sea-ice coverage actually increases in many models (IPCC, 2007b).

Are there any OSPAR regional differences?

Sea ice is regularly evident in OSPAR Region I (Arctic Waters). In particularly hard winters, limited areas of sea ice can also occur in Region II (Greater North Sea).

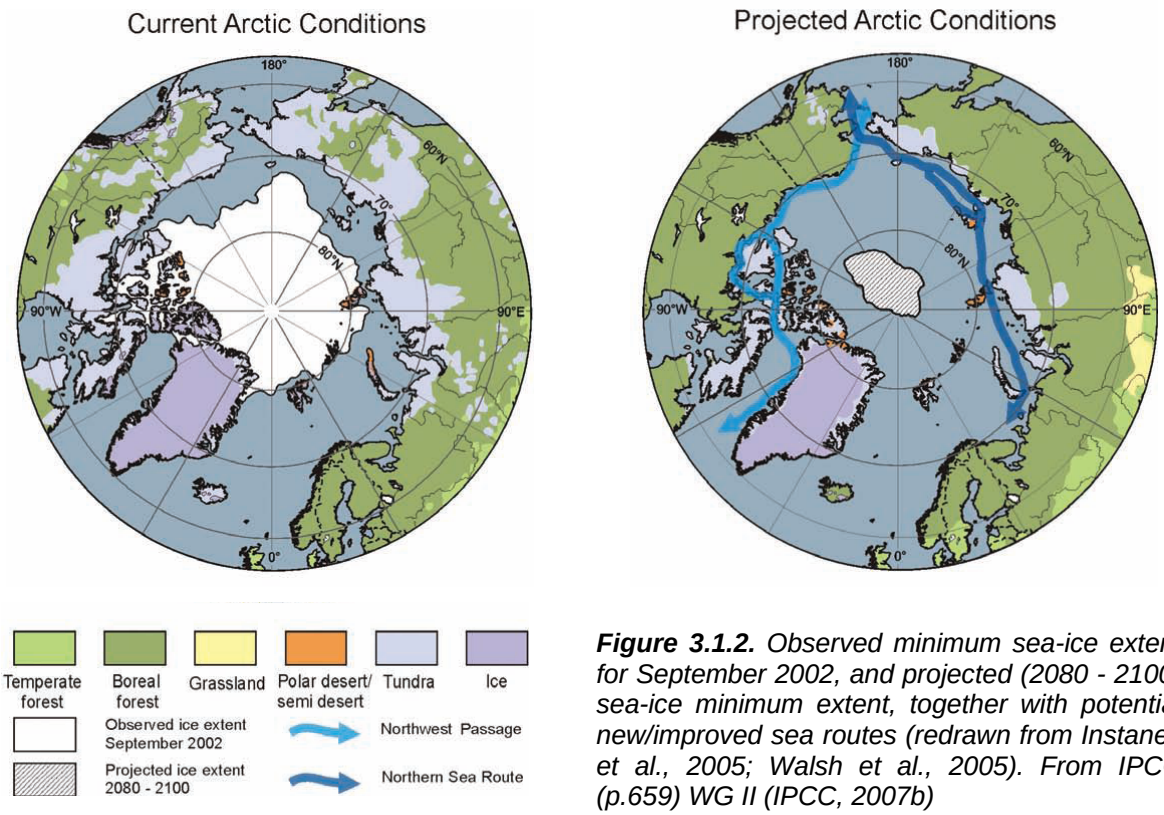

Figure 3.1.2. *Observed minimum sea-ice extent for September 2002, and projected (2080 - 2100) sea-ice minimum extent, together with potential new/improved sea routes (redrawn from Instanes et al., 2005; Walsh et al., 2005). From IPCC (p.659) WG II (IPCC, 2007b)*

➥ *Go to the full QSR assessment report on impacts of climate change (publication number 463/2009)*

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