Addendum to the UK Report

Polar Ocean Physics Group, Department of Applied Mathematics and Theoretical Physics (DAMTP), University of Cambridge.

The group is led by Peter Wadhams, Professor of Ocean Physics, and includes Dr Martin Doble, Dr Joao Rodriguez and Arthur Kaletzky (postdocs), Nick Toberg (research assistant), Maxine Von Eye and John Fletcher (graduate students) and Miranda Canty (administrator).
Research efforts focused on the following areas related to aspects of the Arctic climate change:-

1. *DAMOCLES*. Peter Wadhams is a partner and Sea Ice Work Package leader (WP1) in the EU FP6 DAMOCLES project (Developing Arctic Modelling and Observing Capabilities for Long-Term Environmental Studies), co-ordinated by Jean-Claude Gascard (Université Pierre et Marie Curie, Paris). During 2008 the second DAMOCLES field season took place in which the group carried out an AUV survey of pressure ridging using a 3-D (interferometric) sonar from fast ice in Jolliffe Bay off Alert, Ellesmere Island.

2. *The Arctic Ocean's changing ice thickness*. In April 2004 the submarine HMS "Tireless" made a 9000 km-long survey of the Arctic Ocean, with NickHughes aboard to measure ice thickness along tracks previously covered in 1996, giving the possibility of a direct measure of the average rate of ice thinning over the past 8 years. Interpretation of the data will permit the ice thickness data to be compared with earlier datasets collected along similar tracks by the UK, thus giving an update to the rate of Arctic ice thinning. Planning began for a further submarine cruise with multisensor validation, to be carried out in spring 2007 at the same time as DAMOCLES field programmes.

3. *Chimney convection in the Greenland Sea*. With support from NSF via the SYNICE project (co-ordinator: Astrid Ogilvie, University of Colorado) Maxine Von Eye continued a theoretical study of the generation, survival and dissipation mechanisms of long-lived convective chimneys and their role in water mass transformation, and coupled the inferred water mass structure resulting from convection with the observed historical record of the occurrence of the Odden ice tongue in the Greenland Sea. The working

hypothesis is that ice tongue formation is necessary to achieve sufficient buoyancy flux for chimney formation.

4. *Arctic sea ice morphology by multibeam sonar*. During a cruise to NE Greenland in August 2004, in which P Wadhams was Chief Scientist, some 500 km of high-quality upward-looking multibeam sonar data were obtained of the sea ice underside, showing in detail the structure of pressure ridges,shear ridges and undeformed ice of different ages. The data were worked upduring 2005 and published in 2006 in GRL. This is the first multibeamdataset obtained under sea ice by an AUV, and offers enormous possibilitiesfor a deeper understanding of ice mechanics and of the ice melt process. Further multibeam sonar work is planned for 2007 from an AUV and from a submarine.

5. *Physics of radar beam interaction with the sea ice surface*. John Fletcher continued a research project, funded by the NERC Cryosat cal-val consortium, on the physics of interaction of electromagnetic waves with snow-covered sea ice surfaces. The aim is to understand the nature and geometry of the reflection of radar altimeter (Envisat, Cryosat-2) and laser altimeter (ICESat) beams, in order to improve confidence in converting observed apparent freeboard into sea ice thickness. Work in 2008 included theoretical model development and field work from KV “Svalbard” on a cruise north of Fram Strait, using a scanning laser to measure small-scale snow surface topography.