Developing Arctic Modelling and Observing Capabilities for Long-term Environmental Studies

The European Integrated Project

DAMOCLES

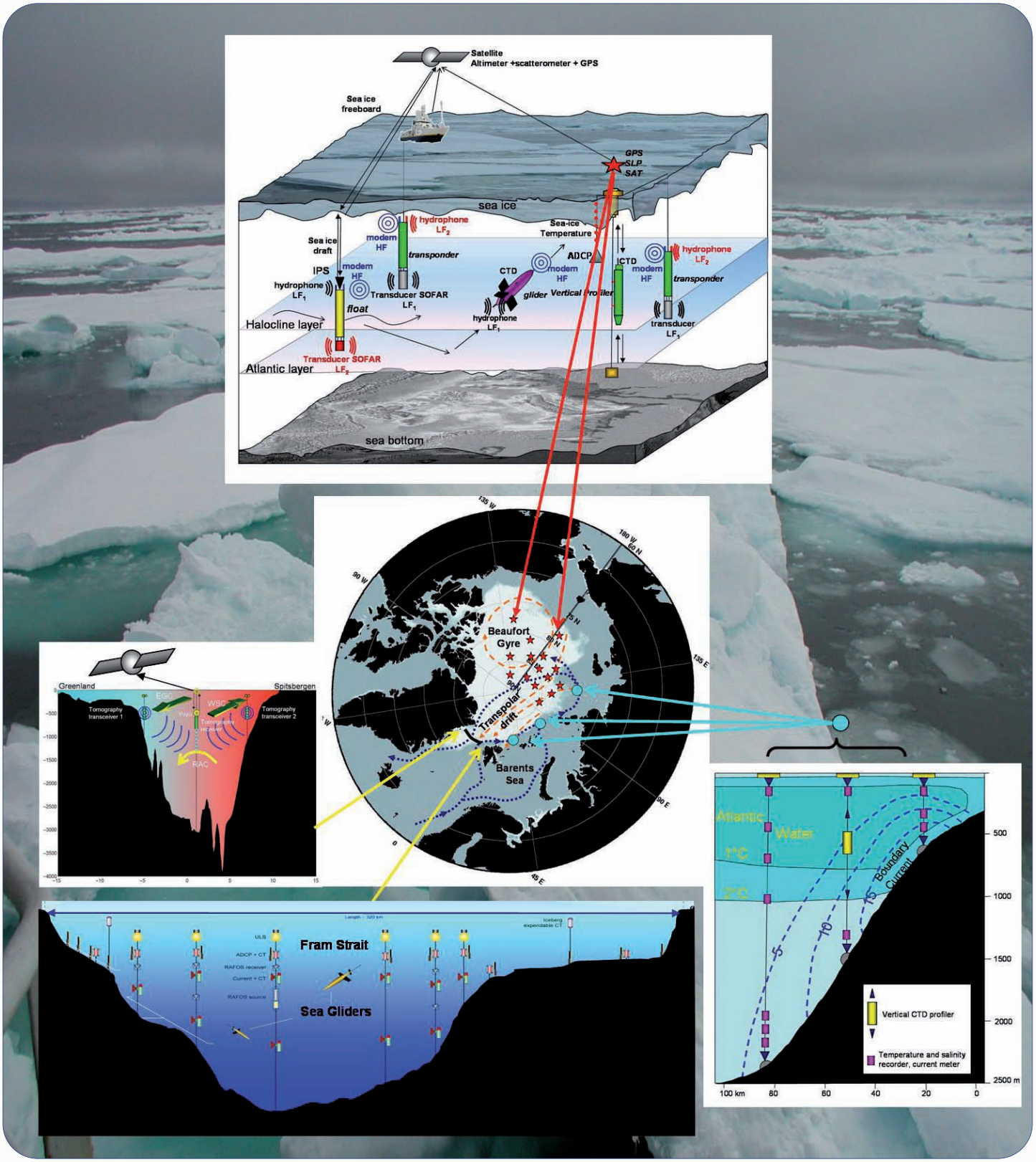
2005 - 2009

A European contribution to the International Polar Year

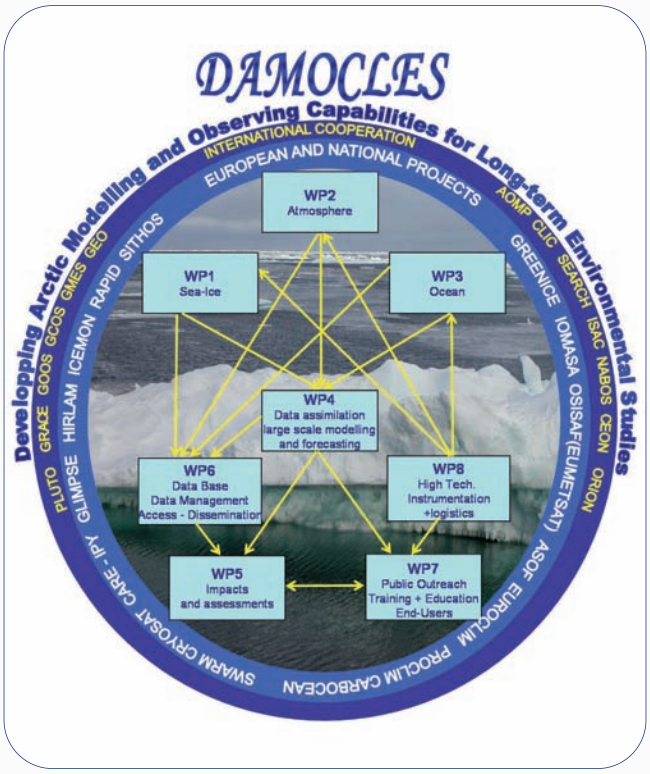
SIXTH FRAMEWORK PROGRAMME

The **DAMOCLES** Integrated Project

Is an integrated ice-atmosphere-ocean monitoring and forecasting system designed for observing, understanding and quantifying climate changes in the Arctic. An advanced observing system will be developed and deployed, providing for the first time, synoptic, continuous and long-term monitoring of the lower atmosphere, sea-ice and upper ocean. It is designed to evaluate and improve global and regional climate forecasting models based on validation, assimilation and integration of observed data. The ultimate goal will be to lengthen the lead-time of extreme climate changes predicted to occur in the Arctic within this century according to the Arctic Climate Impact Assessment (ACIA) and thus to improve the ability of society to mitigate for its impacts.



The Main **DAMOCLES** Objectives:



○ Synoptic observations of the Arctic Ocean Sea-Ice Pack.

The variability of sea-ice thickness, extent, concentration, ice-type and drift are monitored by remote and in-situ systems in near real-time. Sea-ice dynamics and thermodynamics are scrutinised to better understand their role for the large-scale ice-atmosphere-ocean system.

○ Synoptic observations of atmospheric key processes occurring in the Arctic Ocean.

Aimed at better predictability of the Arctic weather and climate, key processes are investigated in a combined observational/process/modelling effort. The effects of Arctic Cyclones (Polar Lows) on Sea-Ice in terms of heat and moisture transport, an improvement of boundary-layer physics over ice and ocean, an improvement of the radiative transfers and their interactions with snow, sea-ice and ocean.

○ Synoptic observations of the Arctic Ocean circulation and key processes.

An observational system is set up with the aim to improve the understanding of the large-scale circulation of the Arctic Ocean and its vertical and lateral exchanges as well as the communication between central basins and the shelves. New techniques are used to assess synoptically the state of the ocean under the ice and the fluxes of heat, salt and volume across the boundaries.

○ Integration and assimilation of observations with large-scale models.

Model sensitivities is investigated and performance improved by model-model and model-data intercomparisons, aiming at an improved predictability. Observations are enhanced by a set of assimilation activities to deliver re-analysed Arctic Climate variables in time and space.

Potential impacts of climate changes in the Arctic are addressed by the following specific objectives:

○ **Assessment of impact on environment and humans.** The observationally supported model improvements, the model sensitivities and past ranges of variability are combined with new field data. The aim is to evaluate improved predictability and its consequences, as well as the impact of projected changes on adaptation capabilities and vulnerability of the environment and human activities. Exploitation and dissemination of the results are key elements of DAMOCLES.

○ **User-friendly return of information to the community.** A website is available, giving the community updated information about the state of the Arctic (e.g. real-time information of key atmospheric, ice and ocean variables) as well as information about the progress of the science of DAMOCLES. Education is provided through workshops and student scholarships. Results are published both in scientific journals and in the popular-scientific press. The scientists make generally themselves available to the public to the best of their knowledge.

DAMOCLES provides a substantial step forward from the present state-of-the-art:

- **Improving** monitoring capabilities of the Arctic Ocean, Sea-Ice and Atmosphere through innovative technological advances.

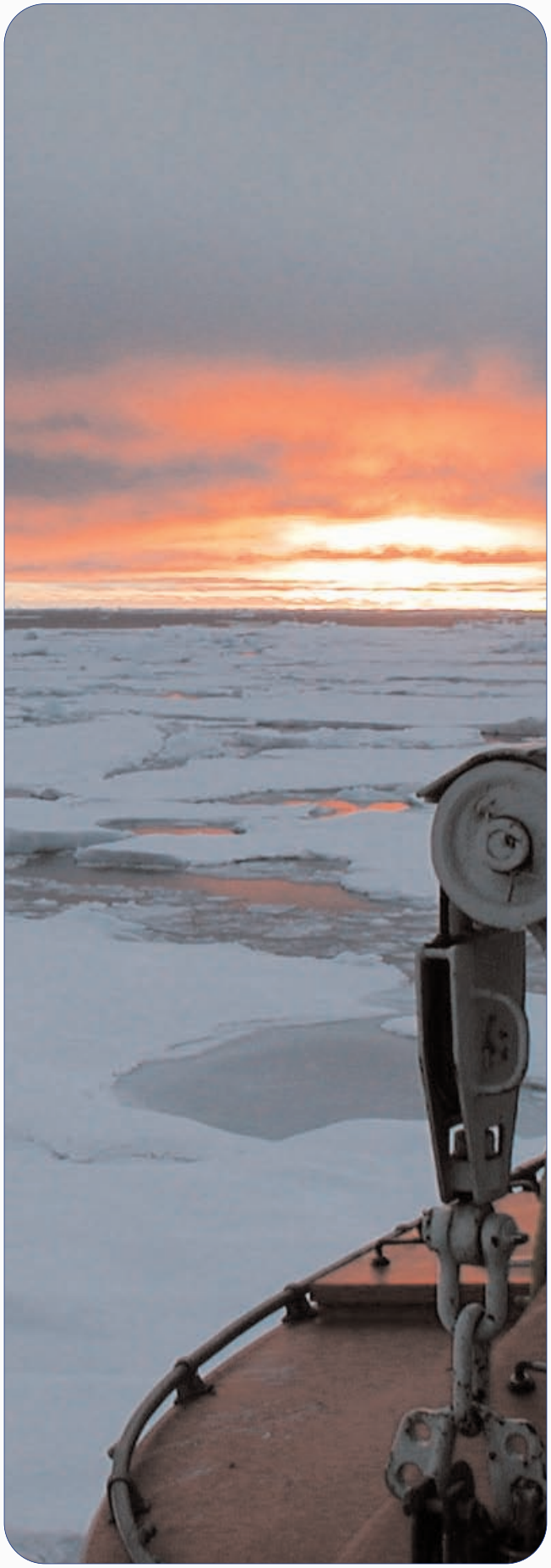
- **Increasing** the knowledge concerning dynamics and thermodynamics of Arctic Ocean Sea-Ice cover and the understanding of its interaction with the Ocean and the Atmosphere in the northern hemisphere climate system.

- **Improving** the data transfer from instruments to users, in near real time, the use of an operational databank and unprecedented data delivery and format agreements between all partners.

- **Contributing** to the development and implementation of observing and forecasting systems to make long-term systematic observations of marine and atmospheric parameters of the Arctic Environment necessary for management strategies in the context of Global Change.

- **Improving** significantly the ability to predict extreme climate events in the Arctic, such as the disappearance of the perennial ice-cover and its consequences.

- **Improving** the knowledge of the adaptive capacity and vulnerability of human activities in the case of extreme climate events, thus enhancing the European Union's preparedness in terms of environmental and societal terms.



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