The1 3 ATPp artnerin stitutions:

1Un iversityof T roms,Nor way (Coordinator).
2Con sejoS uperiord esI nvestigaciones Scientificas, Spain
3A kvaplan-nivaA S,Nor way
4S INTEFF iskeriogHavb ruk
5A arhusUn iversitet,Nat ionalE nvironmental ResearchI nstitute, Denmark
6I nstituteof Ocean ology, PolishA cademyof Sciences,P oland
7Un iversityof Camb ridge,Dep artmentf or AppliedMat hemathics and Theoretical Physics,Un itedK ingdom
8Un iversitP ierreet Mar ieCu rieP aris6, France
9Cen treof Mar ineS ciences,P ortugal
10S hirshovI nstitute of Oceanology, Russian Academyof S ciences,R ussianF ederation
11Gr eenland Institute for Nature Resourses, Greenland
12Th eR oyalS wedish Academy of Science, BeijerI nstitutef orE cologicalE conomics, Sweden
13Max -PlanckGes ellschaft zur Fr derung derW issenschaftene.V .Max -Planck-Institutf rMet eorologie,Ger many

Allp hotography:Ru diCaeyer s,UI T

ExpectedP roductsan dOu tcome

- Identified climate thresholds and tipping points for key Arctic marine ecosystem components and processes
- Modelled future trajectories, tipping points and regime shifts through coupled physical/ biological and regional climate models
- Development of early warning indicators of climatic thresholds for major phytoplankton taxa
- Evaluation of expected changes in relationships between a) climate forcing and biological responses and b) ecosystem components and their inter-relationships during regime shifts
- Assessments of the implications of changes in the Arctic for socioeconomic activities and governance of arctic resources
- White paper evaluating different policy options in avoiding exceeding tipping points for Arctic ecosystems

European 7th framework project on climate change impacts and thresholds on Arctic Ocean systems: Arctic Tipping Points (ATP) - 226248

Total EU contribution: 5 mill Euros
Period: FEB 2009 - JAN 2012

eu-atp.org

There is mounting evidence that ecosystem response to certain types or magnitudes of extrinsic pressures (climate, human impacts, etc.) is often abrupt and non-linear, leading to significant reorganization of system properties and processes. These ecosystem changes are known as regime shifts. Regime shifts arise, for instance, from introduction of alien species to or the loss of key species in ecosystems. These changes can result in alterations of the most basic ecosystem parameters, including food-web structure, the flow of organic matter and nutrients through the ecosystem, or the patterns of space occupation, leading to a cascade of ecosystem changes. Climate drives both community structure and key organismal functions. It is thus hardly surprising that regime shifts identified from marine ecosystems are often linked to climate

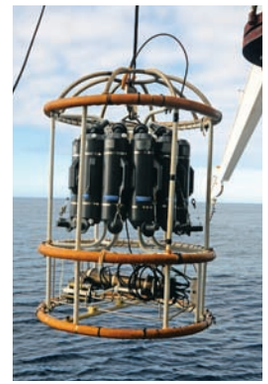
The term tipping point commonly refers to a critical threshold at which minor perturbations can qualitatively alter the state or development of a system. Because the Arctic is warming about two times faster than the global rate, Arctic ecosystems are likely to encounter climate-driven thresholds and tipping points that lead to abrupt changes much sooner than other ecosystems. The spectacular recent acceleration of Arctic ice loss suggests that climate change has entered a new phase. Indeed, the Arctic ice pack has been identified as one of the key tipping elements in the world climate system, making change in the Arctic significant on a global scale. Current models suggest that the Arctic Ocean will be largely ice-free in late summer at the end of the next decade already. Such extensive changes in sea ice will have unprecedented effects on Arctic ecosystems in the nearest future. Establishing where and when these tipping points will be reached is, therefore, a matter of urgency.

The7 w orkp ackagesin ATP:

WP 1: Scientific management
Responsible: paul.wassmann@uit.no

WP 2: Arctic climate changes and future projections and scenarios
Compilation of historical records of Arctic climate change and projections of future changes in Arctic sea climate (physical oceanography and ice systems).
Responsible: p.wadhams@damtp.cam.ac.uk

WP 3: Extraction of Arctic regime shifts and tipping points from time series records
Time series of Arctic ecosystem components analysis using novel statistical tools to detect regime shifts and ecological thresholds and tipping points, and evaluate their sensitivity to climatic forcing.
Responsible: jac@dmu.dk



WP 4: Experimental exploration of climatic tipping points for Arctic marine ecosystem components
Experimental manipulations and comparative analyses across broad climatic ranges to detect climatic thresholds and tipping points of Arctic organisms and ecosystems. Genome-wide analyses to develop genomic markers of climate-driven stress useful as early-warning indicators of the proximity of tipping points
Responsible: carlosduarte@imedea.uib.es

WP 5: Future trajectories of Arctic ecosystems
Applying a biological-physical coupled 3 D model to generate future trajectories of Arctic ecosystems under projected climate change scenarios (regional climate model REMO, scenarios B1, A1, A1B) and to identify their consequences for the Arctic ecosystem
Responsible: Ingrid.Ellingsen@sintef.no

WP 6: Socio-economic opportunities and risks emerging from climate-driven impacts
Impacts of abrupt changes in the Arctic ecosystems for activities of strategic importance for the European Arctic and the associated impacts on employment and income. Policies and legislative frameworks to adapt and mitigate these impacts.
Responsible: knut.heen@uit.no

WP 7: Integration, training, policy dissemination and outreach
Examination of the effectiveness of possible alternative, post-Kyoto policies and stabilization targets in avoiding climate-driven thresholds in the Arctic ecosystem. Results and projections will be conveyed to policy makers, economic sectors and the public in general
Responsible: carlosduarte@imedea.uib.es