



Bundesministerium  
für Bildung  
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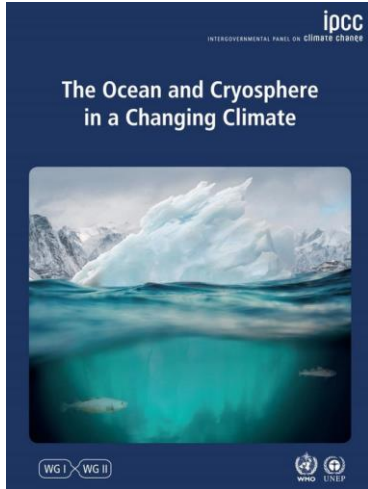


# Science for evidence-based decision-making The German Arctic Research Strategy

COP 25 Side Event - Evidence of change, global Implications, policy response  
Madrid, 6<sup>th</sup> December 2019



# The Ocean and Cryosphere in a Changing Climate



## *Changes in the Arctic*

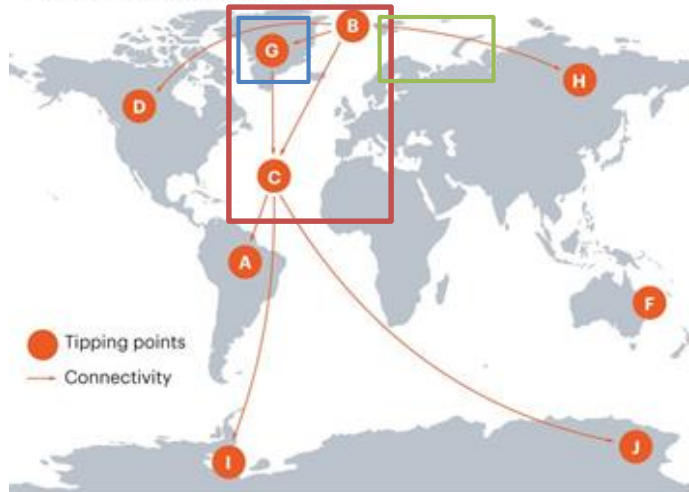
- **Ocean circulation** is influenced globally by polar processes
- **Sea ice** area and volume is declining, accelerating global sea level rise
- **Marine Ecosystems** face drastic changes, including species of cultural and commercial importance
- **Ice Sheets** and **glaciers** discharge freshwater influencing abiotic and biotic processes
- **Atmospheric feedbacks** connect polar cryosphere and ocean change to the global climate system
- **Permafrost thaw** adds an increasing amount of greenhouse gases to the atmosphere



# Climate tipping points - too risky to bet against (Lenton et al. 2019)

## RAISING THE ALARM

Evidence that tipping points are under way has mounted in the past decade. Domino effects have also been proposed.



**A. Amazon rainforest**  
Frequent droughts

**B. Arctic sea ice**  
Reduction in area

**C. Atlantic circulation**  
In slowdown since 1950s

**D. Boreal forest**  
Fires and pests changing

**F. Coral reefs**  
Large-scale die-offs

**G. Greenland ice sheet**  
Ice loss accelerating

**H. Permafrost**  
Thawing

**I. West Antarctic ice sheet**  
Ice loss accelerating

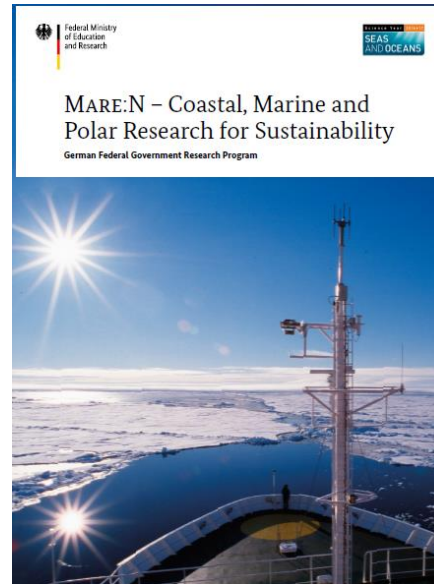
**J. Wilkes Basin, East Antarctica**  
Ice loss accelerating

©nature

- **Peanuts - EcoLight – DiatomArctic - ColdFish**
- **Abiotic Factors – Primary Productivity – Food Webs**
- **CACOON - PETRA**
- **Permafrost thaw and trace gas flux in the atmosphere**
- **GROCE – Greenland Ice Sheet Ocean Interaction**



# Research Program Mare:N and Germany's Arctic Policy Guidelines



## Changing Arctic Ocean – Arktis im Wandel: Challenges addressed

*Develop quantified understanding of the structure and functioning of Arctic ecosystems*

- Characterization of food webs and biogeochemical cycles in contrasting regions of ice cover
- Description of changing seasonality and its subsequent impact on biological and biogeochemical processes and ecosystems.

*Understand the sensitivity of Arctic ecosystem structure, functioning and services to multiple stressors and the development of projections of the impacts of change.*

- Assessment of the impact of changing inorganic and organic nutrient supply on ecosystem structure and function.
- Sensitivities to multiple stressors and development of models of the life-cycles of key species, food-webs, biogeochemical cycles and whole ecosystems.
- Projections of the impacts of change.



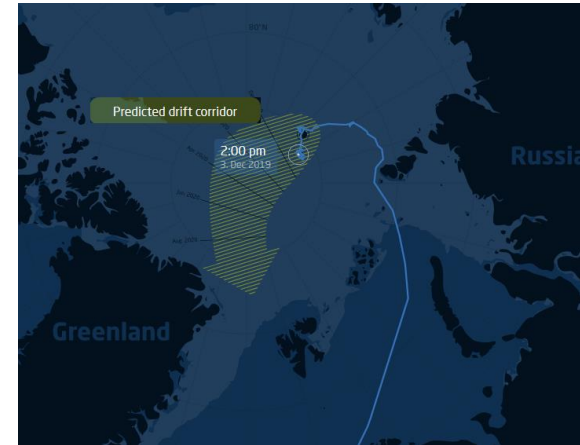
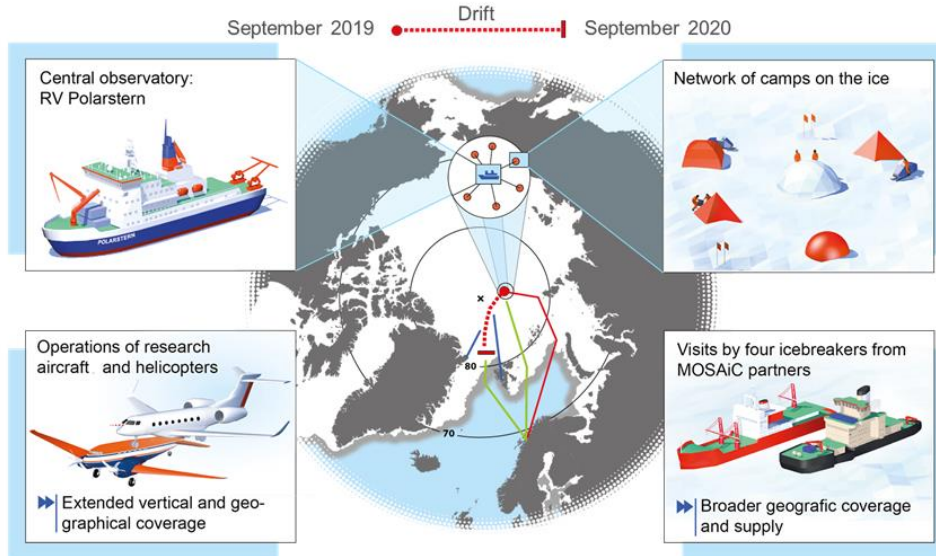
## Changing Arctic Ocean – Arktis im Wandel: Projects and Topics



- Nutrient cycling
- Implications of changing ice cover
- Primary productivity
- Food webs
- Permafrost thaw
- Trace gas exchange



# MOSAiC – Multidisciplinary drifting Observatory for the Study of Arctic Climate



<https://follow.mosaic-expedition.org>



## Second Arctic Science Ministerial



- **Arctic Science Ministerial**  
October 2018 in Berlin  
October 2020 in Japan
- **Arctic Funders Forum**  
October 2019 in Reykjavík  
during the Arctic Circle Assembly







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**Thank you!**