

## T-MOSAIc—A new circumpolar collaboration

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Atmospheric temperatures over northern regions of the world are rising at twice the global average, and one of the most conspicuous effects is the rapid and ongoing decline in summer sea ice in the Arctic Ocean. To improve understanding about the causes and consequences of this decline, the project ‘Multidisciplinary drifting Observatory for the Study of Arctic Climate’ (<https://www.mosaic-expedition.org/>) commenced in September 2019, under the auspices of the International Arctic Science Committee (IASC). This project is an ambitious year-round set of observations of multiple aspects of the Arctic Ocean, sea ice and atmosphere, involving five icebreakers (notably the German vessel *Polarstern* that was frozen into the Arctic pack ice), and 600 science personnel from more than 20 nations.

The changes in sea ice are also likely to have major effects on the geosystems, ecosystems and human systems on lands that surround the Arctic Ocean, and IASC therefore identified the need for a related project on Arctic terrestrial environments.

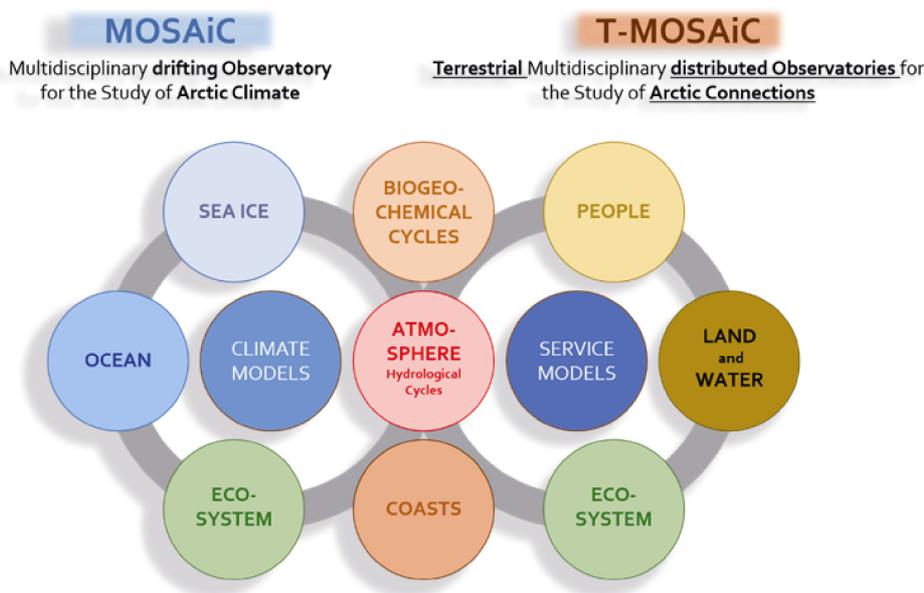
The project ‘Terrestrial Multidisciplinary distributed Observatories for the Study of Arctic Connections’ (<https://www.t-mosaic.com/>) has been formulated as an international, circumpolar initiative cutting across all five disciplinary working groups of IASC. Its aim is to generate new insights into the changing Arctic, targeting key

system-level topics such as gradients, connectivity, thresholds, extreme events, discontinuities and emergent properties, and with hypotheses and questions that extend across sites and disciplines. MOSAIc and T-MOSAIc are complementary projects, with points of intersection as shown in the diagram.

T-MOSAIc is coordinated by a Secretariat funded by the Portuguese Government and the University of Lisbon, and located at the University of Lisbon. The chair of the project is Professor João Canário, from Instituto Superior Técnico (University of Lisbon) (Portugal), and the co-chair is Professor Warwick F. Vincent, from Laval University (Canada). The Executive and Steering Committees have representatives from more than 15 nations. IASC has provided workshop funding for early career researchers, and additional networking funds have been contributed by scientific partners including the Centre for Northern Studies (CEN), Sentinel North, and ArcticNet. The project aims to build on and connect existing largescale projects and networks, including INTERACT, RATIC, GEM, Nunataryuk, MOSES and the Permafrost Climate Change Initiative (ESA), but smaller scale projects are also welcome to join. Participation by indigenous peoples and early career researchers is especially welcome.

The T-MOSAIc Science Plan (available at <https://www.t-mosaic.com/science-plan.html>), identifies the scientific goals and approaches, and was presented at the T-MOSAIc Planning Workshop in Ottawa, Canada, at ArcticNet

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**Figure 1** The relationship between MOSAiC and T-MOSAiC, with thanks to Markus Rex (Alfred Wegener Institute, Germany) and Taneil Uttal (National Oceanic and Atmospheric Administration, USA) for their conception of this diagram at the T-MOSAiC Science Planning Workshop, Davos, 2018.

2018, with implementation plans subsequently developed at the 4th T-MOSAiC Workshop (<https://eos.org/meeting-reports/understanding-the-terrestrial-effects-of-arctic-sea-ice-decline>) in Arkhangelsk, Russia, in May 2019. Given that MOSAiC will take place during 2019–2020, T-MOSAiC aims to achieve as much overlap as possible, with emphasis on the period January to December 2020. Projects focused on environmental monitoring and paleoclimate studies will place this T-MOSAiC/MOSAiC observation period in a broader temporal context.

As a first step towards the implementation of T-MOSAiC, a number of Action Groups (TMAGs) have been formulated to address overarching themes (from Arctic Gas Fluxes to Arctic Infrastructure), while still maintaining a multidisciplinary approach. The chairs of each of these TMAGs are leading authorities in Arctic science and have identified specific objectives, activities, researchers and other partners for work in 2020, including connections with other TMAGS to address crosscutting themes. In order to visualize the geographical distribution of research and

monitoring related to the goals of the project, an online T-MOSAiC Polar Catalogue is now in development. All data sets will be made available via open access repositories, in order to promote merged, interoperable data compilations. T-MOSAiC-MOSAiC interactions will also promote the exchange of data sets on climate observations both from land and ocean stations.

As we face the growing changes in the northern regions of the planet, a greater understanding of the Arctic has become an urgent concern. There is a pressing need for ongoing collaborative efforts by way of networks of researchers, and for coordination of Arctic scientific resources across countries and disciplines. In this sense, we invite all interested researchers to collaborate with T-MOSAiC, as this multidisciplinary collective approach will help us better understand the fast-changing Arctic, and its influence on the rest of the world.

**Note:** Queries and discussions on this article should be made by E-mail directly with the corresponding author.