Statement for the 2022 Arctic Observing Summit

Permafrost proposed as a Shared Arctic Variable from Arctic PASSION

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Arctic PASSION ('Pan-Arctic Observing System of Systems: Implementing Observations for societal Needs') is a Horizon 2020 -funded project that aims to co-create a coherent, integrated pan-Arctic Observing System of Systems (pan-AOSS)[1]. The project aims to improve on the current limitations of Arctic observing systems by expanding monitoring capabilities through broad inclusion of Indigenous Knowledge and Local Knowledge, as well as coordinating and enhancing Earth Observation capacity and capability through refinements based on the needs of diverse user groups including local communities, academics, policymakers and industry. The plan also aims to provide much-needed improvements in Arctic data management and data interoperability, which contributes to helping address the needs for acute and relevant information of people living in the Arctic and provide value to the European and global society. The project work was initiated in July 2021, with a consortium of 43 partnering organizations, including 8 Indigenous Communities.

The identification and implementation process of Shared Arctic Variables (SAVs) are a key element in Arctic PASSION. This work is being done in support and guided by the ROADS (Roadmap for Arctic Observing and Data Systems) process of the Sustaining Arctic Observing Networks (SAON)[2]. The SAVs will be akin to the Essential Climate Variables (ECVs) of The Global Climate Observing System (GCOS) of the World Meteorological Organization, but are expected to address a multitude of needs.

By definition the term shared comes from the understanding that the interest in a variable can come from three levels:

1. Meeting community-identified benefits in Indigenous or local communities
2. Support fundamental understanding of Arctic systems and regional decision-making needs
3. Inform science and decision-making needs at the global scale and integrate with operational global networks

One of the main goals of Arctic PASSION is to define 2-4 SAVs. It has been decided that one of the proposed SAVs will be permafrost, but perhaps a more encompassing name such as "*Living on Frozen Ground*"

would better reflect the multitude approach of definition of SAV. Below we describe how permafrost will fulfil the three above mentioned levels, whereas our list should be understood as a first example and by no means as a comprehensive list.

1. Thaw of permafrost can damage infrastructure (roads, buildings, pipelines, etc) crucial for Indigenous and local communities and result in environmental hazards when associated with the release of contaminants.
2. The release of greenhouse gases associated with permafrost thaw will have consequences to whole climate system as permafrost contains roughly twice the amount of carbon as is currently store in the atmosphere[3].
3. In 2020, more than 70 countries announced more ambitious nationally determined contributions as part of their Paris Agreement commitments to reduce society's greenhouse gas emissions; however, the carbon budgets that informed these commitments were incomplete, as they do not fully account for Arctic feedbacks such as carbon release from thawing permafrost.

Our process will include the formation of Expert Panels (one for each SAV), from the partners of Arctic PASSION project together with external representatives. Inclusivity and collaboration with communities outside the Arctic PASSION project will be crucial for achieving our goals, with the inclusion of a wide range of expertise and views into the composition of the Expert Panels being a prime example of this. An important aspect will be aligning our efforts with the ROADS[2] process through dialogue with SAON, and following the guiding principles set out as part of ROADS. Collaboration and learning from experiences in the SAV definition process carried out elsewhere such as in the CoObs RNA project (https://sites.google.com/alaska.edu/rna-observations/) will be invaluable.

It cannot be highlighted enough how important is to engage indigenous and local communities into the process of defining *Living on Frozen Ground* as an Arctic Shared Variable. A dialogue with Indigenous and local communities enables us to see ways of how Indigenous knowledge, cultural indicators and ways of observation can enrich the SAV development. For example the Chukchi have dozens of words to describe the status of the tundra environment which would also benefit scientific understanding, the Sámi and Inuit have a range of snow and ice terminologies and so on. Most importantly the Indigenous and local communities will highlight life at present in this extremely dynamic and fast-changing region.

[1] Arctic PASSION Grant Agreement

[2] Starkweather, et al., 'Sustaining Arctic Observing Networks (SAON) Roadmap for Arctic Observing and Data Systems (ROADS), Whitepaper to the Arctic Observing Summit 2020, https://arcticobservingsummit.org/aos-2020-white-papers-and-short-statements -

[3]Susan M. Natali et al, PNAS, 2021, 118, https://doi.org/10.1073/pnas.2100163118