

Permafrost as a Shared Arctic Variable from ArcticPASSION

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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 35 partners from 17 countries led by the Alfred Wegener Institute (AWI).

The identification and implementation process of Shared Arctic Variables (SAVs) are a key element in Arctic PASSION. This work will be 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

In Arctic PASSION the objective is to define 2-4 SAVs. It has been decided that one of the proposed SAVs will be permafrost, but we will suggest naming it as "living in a frozen land" to reflect the multitude

approach of definition of SAV. As an example, but not as comprehensive justification, below how permafrost will fulfil the three above mentioned levels.

1. Thaw of permafrost will damage buildings and transportation and as such is crucial for Indigenous local communities
2. Greenhouse gases stored in permafrost can have unpredictable consequences to whole climate system as it contains roughly twice the amount of carbon as in the air³
3. In December 2020, more than 70 countries announced more ambitious nationally determined contributions as part of their Paris Agreement commitments; however, the carbon budgets that informed these commitments were incomplete, as they do not fully account for Arctic feedbacks.

Our process will include expert panel, from the ArcticPASSION 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 ROADS² 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 can not be highlighted enough how important is to engage indigenous and local communities into the process of defining Living in the frozen ground as an Arctic Shared Variable.

¹ Arctic PASSION Grant Agreement

² Starkweather, S., Larsen, J. R., Kruemmel, E., Eicken, H., Arthurs, D., Bradley, A. C., ... & Wilkinson, J. (2022). Sustaining Arctic Observing Networks'(SAON) Roadmap for Arctic Observing and Data Systems (ROADS). Arctic.

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