Turning up the heat on remote research plots without electricity

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The zero power warming (ZPW) chamber pictured on coastal tundra in Alaska. Credit: Alistair Rodgers, Brookhaven National Laboratory

Seeing how ecosystems respond to rising temperatures often requires heating a research plot. Working in the Arctic and other remote areas, scientists often build structures that rely on passive warming from the sun. This approach only warms the research plot by about 1.5 degrees Celsius. Scientists developed an alternative approach that uses modulating venting. The system requires no electrical power for fully autonomous operation. When tested on the coastal tundra of northern Alaska, the chambers doubled the warming achieved by existing approaches.

The chamber lets scientists study the effect of higher temperatures than possible with passive warming. This is particularly relevant for remote and challenging environments, such as the Arctic. Locations in the Arctic are projected to warm by more than the 1.5 degrees Celsius limit of current technology by the middle of the century.

The zero power warming chamber requires no electrical power for fully autonomous operation. It uses a novel system of internal and external heat exchangers that allow differential actuation of pistons in coupled cylinders to control chamber venting. This enables the zero power warming chamber venting to respond to the difference between the external and internal air temperatures, thereby increasing the potential for warming and eliminating the risk of overheating.

During the thaw season on the coastal tundra of northern Alaska, the zero power warming chamber elevated the mean daily air temperature 2.6 degrees Celsius above ambient, double the warming achieved by an adjacent passively warmed control chamber that lacked the hydraulic system. The approach to designing the chamber is highly flexible and tunable. The design enables customization for use in many different environments where significantly greater temperature manipulation than that possible with existing passive warming approaches is desired.

More information: Keith F. Lewin et al. A zero-power warming chamber for investigating plant responses to rising temperature, *Biogeosciences* (2017). DOI: 10.5194/bg-14-4071-2017

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