Magnitude and mechanisms of submarine groundwater discharge (SGD) in the Arctic during warming climate: Case study from Alaska

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To better understand groundwater dynamics in high latitude areas, we conducted a field study at three sites in Alaska with varying permafrost coverage. We combined a groundwater tracer (^{222}Rn, radon) and electrical resistivity tomography (ERT) to examine the groundwater discharge magnitude and driving forces controlling discharge. Unlike in areas of temperate climate, topographically-driven flow was found not to be dominant in Alaska. At comparable fluxes, we found that different controls govern groundwater discharge in the representative sites. In areas with sporadic permafrost (Kasitsna Bay), the driver of SGD is tidal pumping, a result of large tidal oscillations, whereas at Barrow Point, a site with continuous permafrost and small tidal amplitudes, fluxes are mostly affected by seasonal permafrost thawing. Extended areas of low resistivity in the subsurface alongshore combined with high radon in surface water revealed that groundwater-surface water interactions might enhance heat transport into deeper permafrost layers promoting permafrost thawing, thereby enhancing groundwater discharge.