

Integrating diverse data to characterize Antarctic biogeography

Gregory Larsen¹, Akash Mullick², Chelsea Tuohy¹, Hanna Varga³, Ziya Zhou¹, Zoe Wong¹, Aimi Wen², Catherine Brenner⁴, David Johnston¹

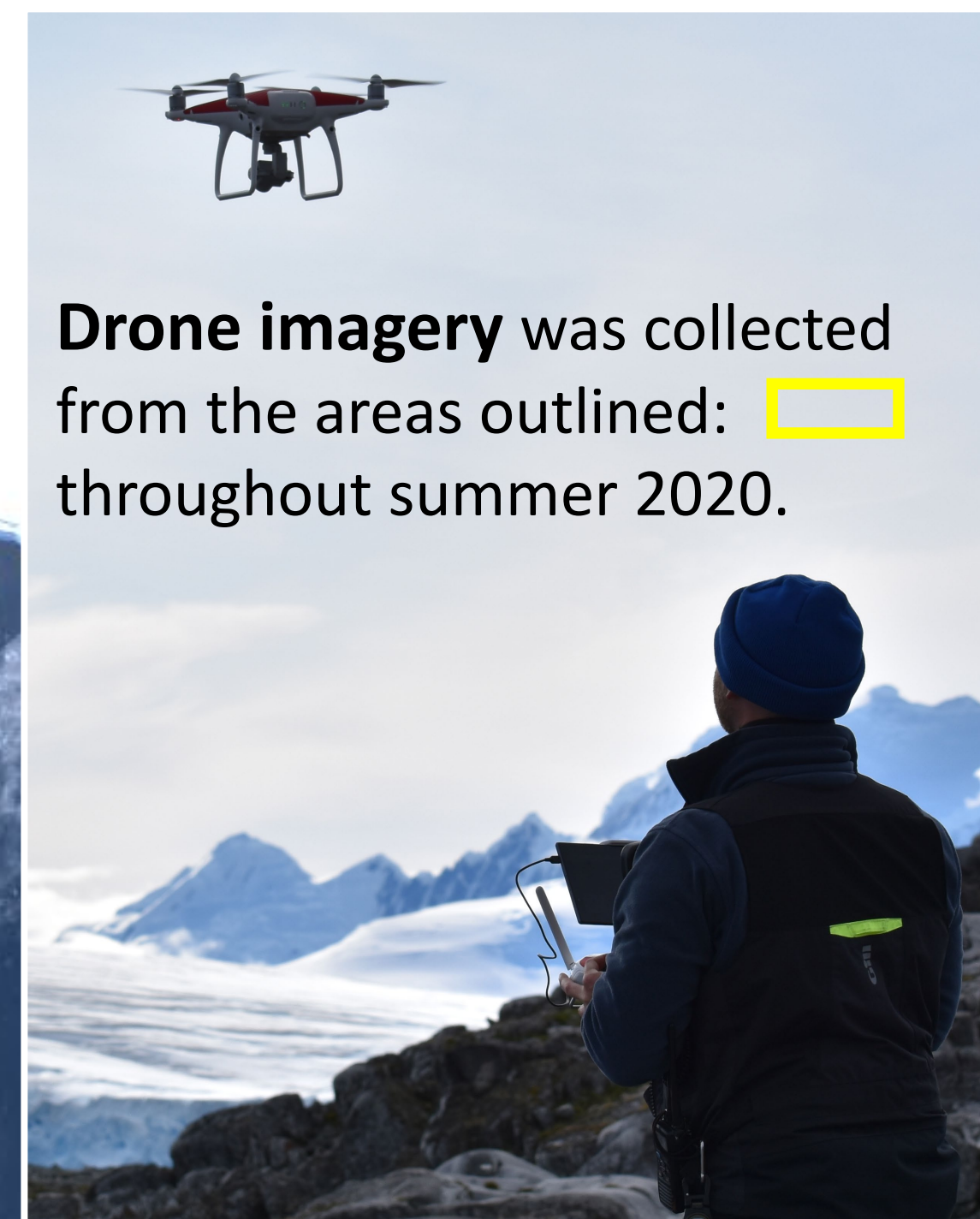
¹Nicholas School of the Environment, ²Trinity School of Arts & Sciences, ³Pratt School of Engineering, ⁴Duke Kunshan University

Introduction

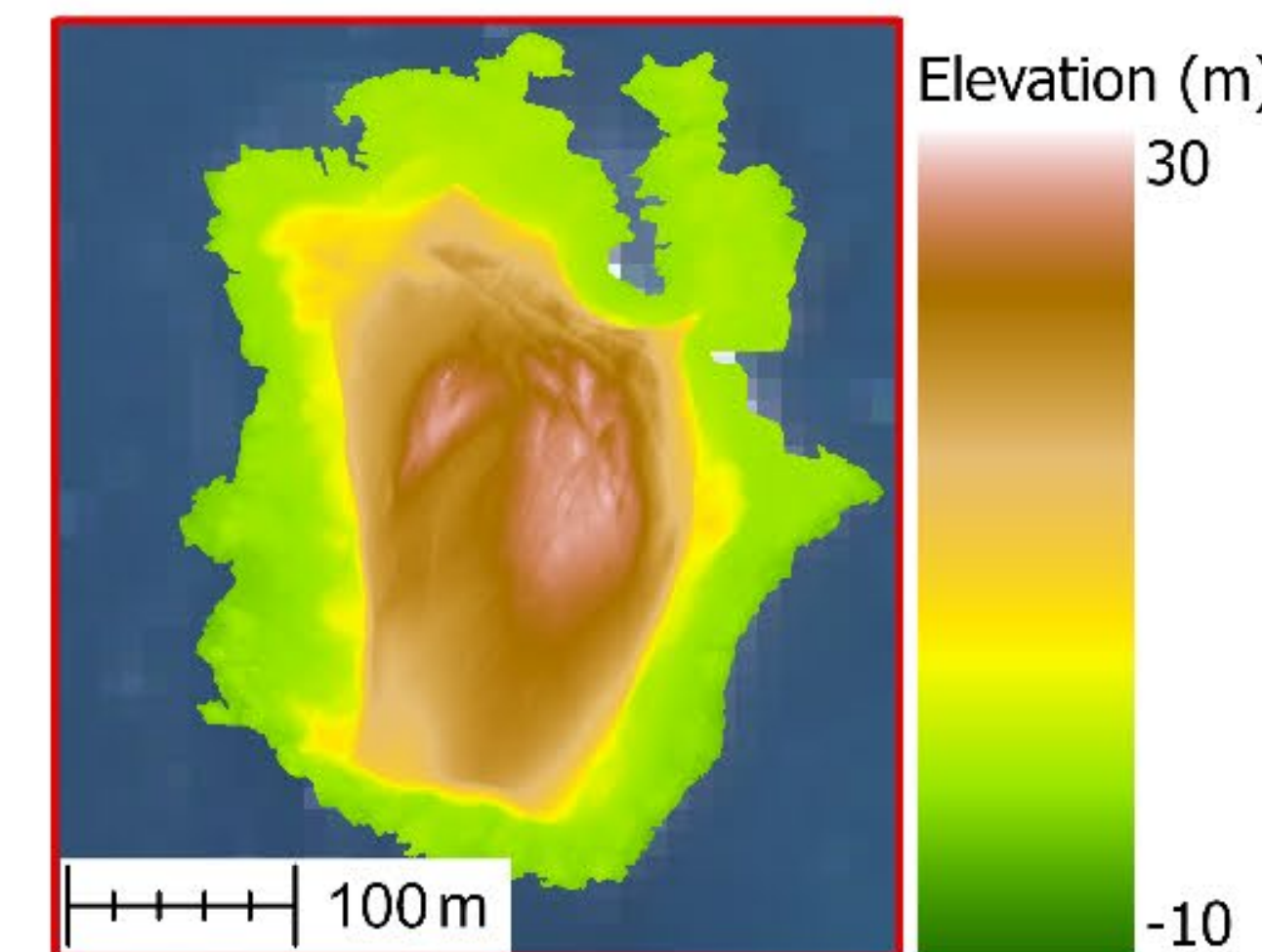
Climate change is transforming the coastline of **Maritime Antarctica**, but on-site Antarctic research is uniquely challenging. Many changes are unfolding without monitoring or even baselines to contextualize them. Increasing availability of resources and techniques in **remote sensing** can address these gaps with datasets that span a variety of scales in space and time, archiving observations for current study and future comparisons.

Our project explores ways to integrate remote sensing data—**drone and satellite imagery**—with on-site data and expertise from **Palmer Station, Antarctica**. By combining these resources, we describe new aspects of spatial ecology for the megafauna of Palmer Archipelago—including **Antarctic fur seals** (*Arctocephalus gazella*), **southern elephant seals** (*Mirounga leonina*), **Adélie penguins** (*Pygoscelis adeliae*), **southern giant petrels** (*Macronectes giganteus*)—and land cover changes in the region—retreating **glaciers**, blooming **vegetation**, and shrinking **penguin colonies**. Team members each spear-head a project examining these topics.

Our collected resources, processed data products, established methods and preliminary findings create new avenues for polar research, setting baselines and protocols for comparison as Maritime Antarctica continues to change.



Drone imagery was collected from the areas outlined: throughout summer 2020.



Structure-from-motion provides precise surface models from drone imagery. Pi Island broke out of its glacier on March 14, 2014, leaving a melting glacial remnant, modeled here 6 years later, on March 20, 2020.



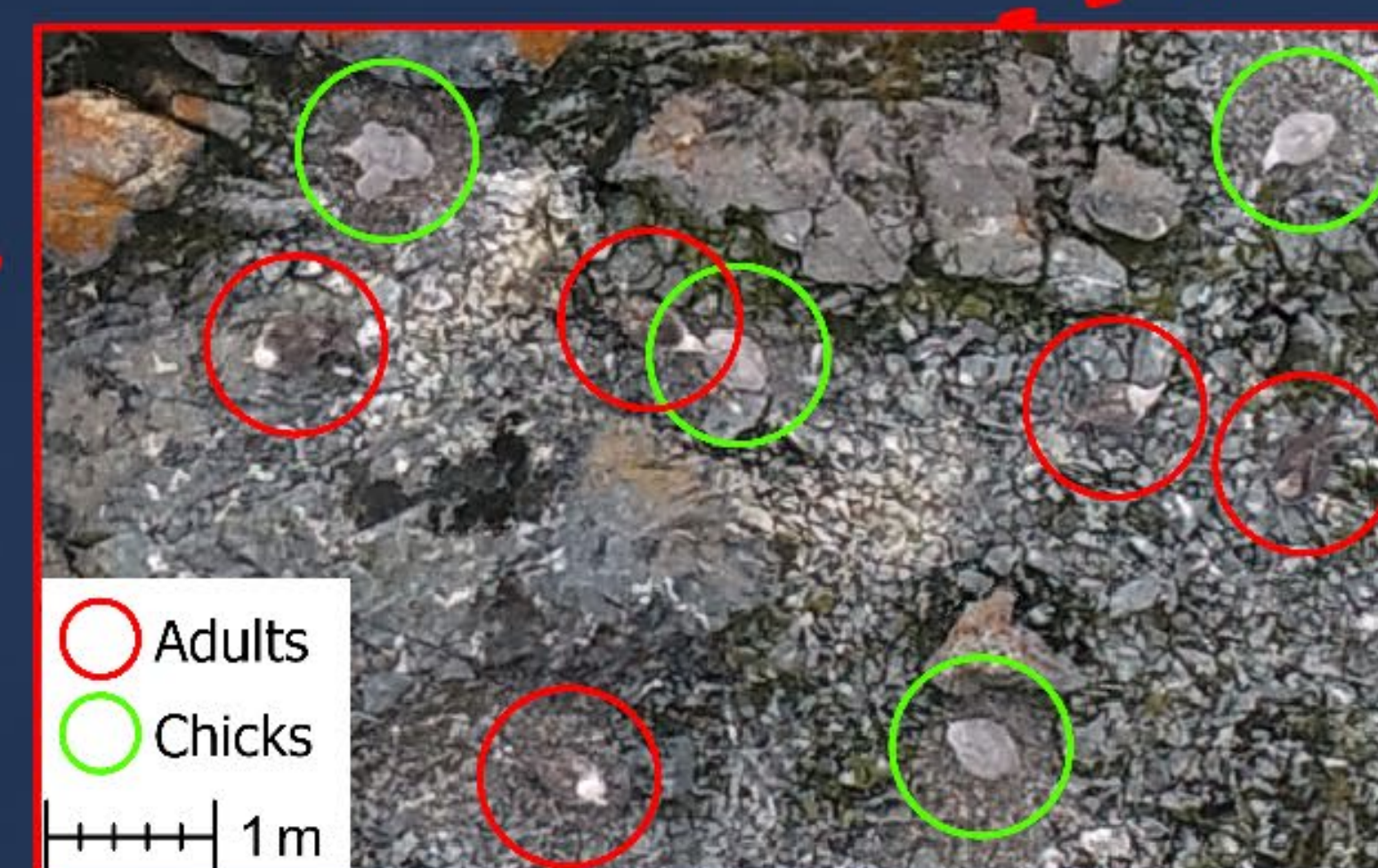
Palmer Station (est. 1968) is the smallest and northernmost US base in Antarctica, and hosts various on-site research and data programs, including:

- Daily meteorological records (est. 1989)
- The Palmer Long Term Ecological Research (LTER) program (est. 1990)
- Continuous tide-gauge measurements (est. 1993)
- A GPS continuous operation reference station (CORS, est. 1997)
- Continuous automated meteorological measurements (est. 2001)



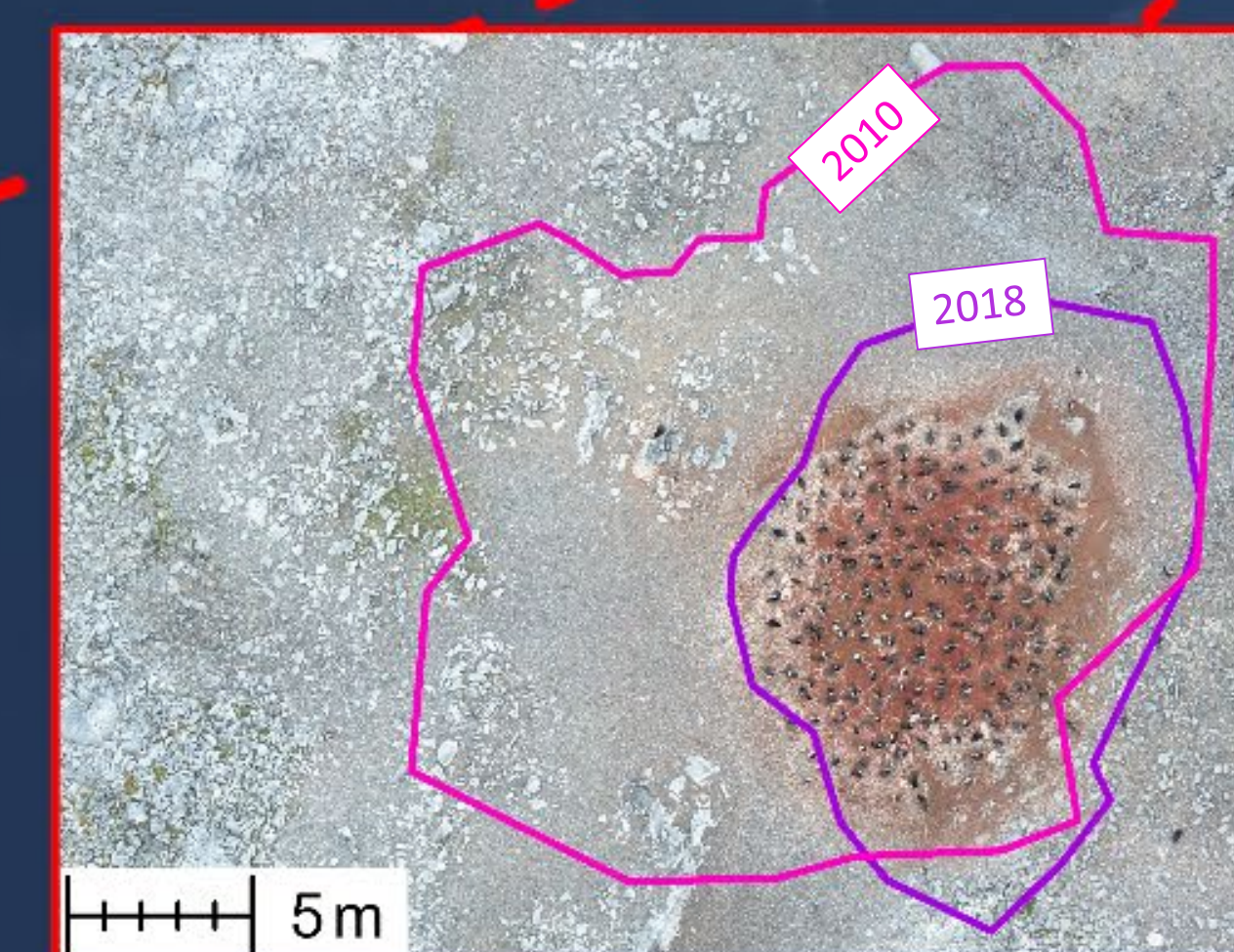
Where does vegetation flourish or fail?

- Modeling topography of water availability
- Observing use and impacts by fur seals



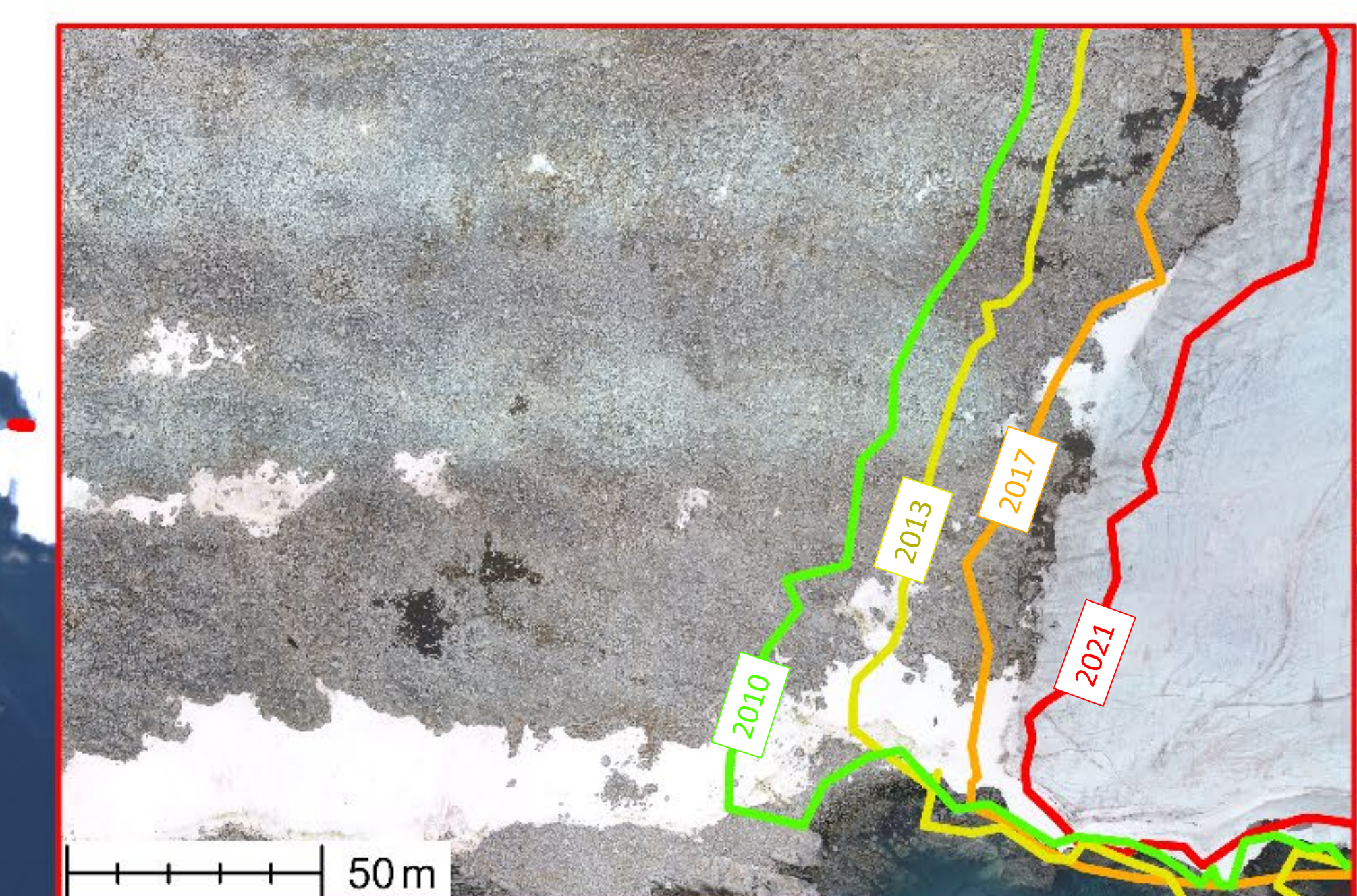
What makes a good giant petrel nest site?

- Modeling topography of selected nest sites
- Tracking chick survival within a season



Tracking declining Adélie colonies

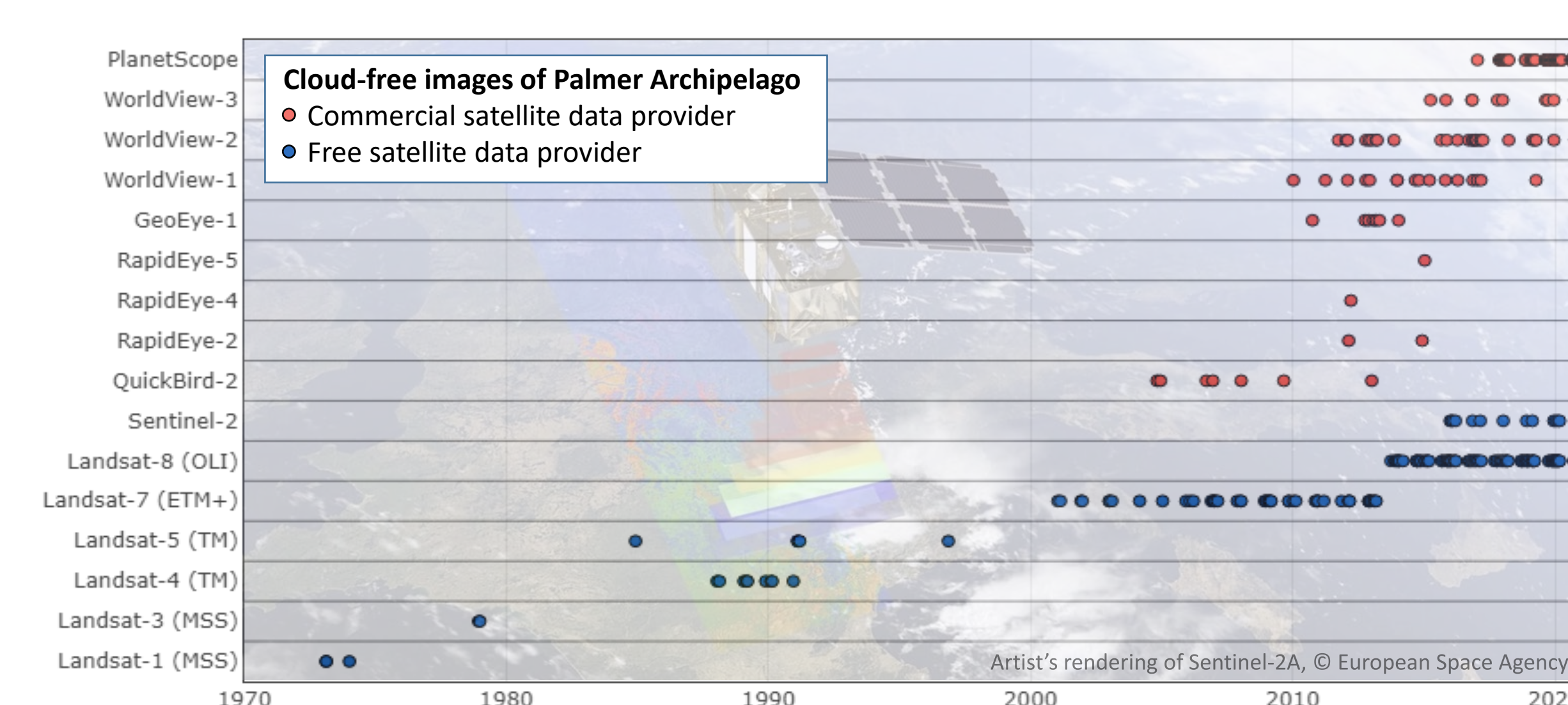
- Estimating colony size by guano
- Measuring past colony changes



How do species use habitat after glacial recession?

- Mapping glacier extents from archival imagery
- Quantifying plant and animal use during the summer

Increasing availability of satellite imagery over 47 years



Imagery of Palmer Archipelago is limited by light, clouds and orbits, but new platforms add increasing coverage and at ever higher resolutions.

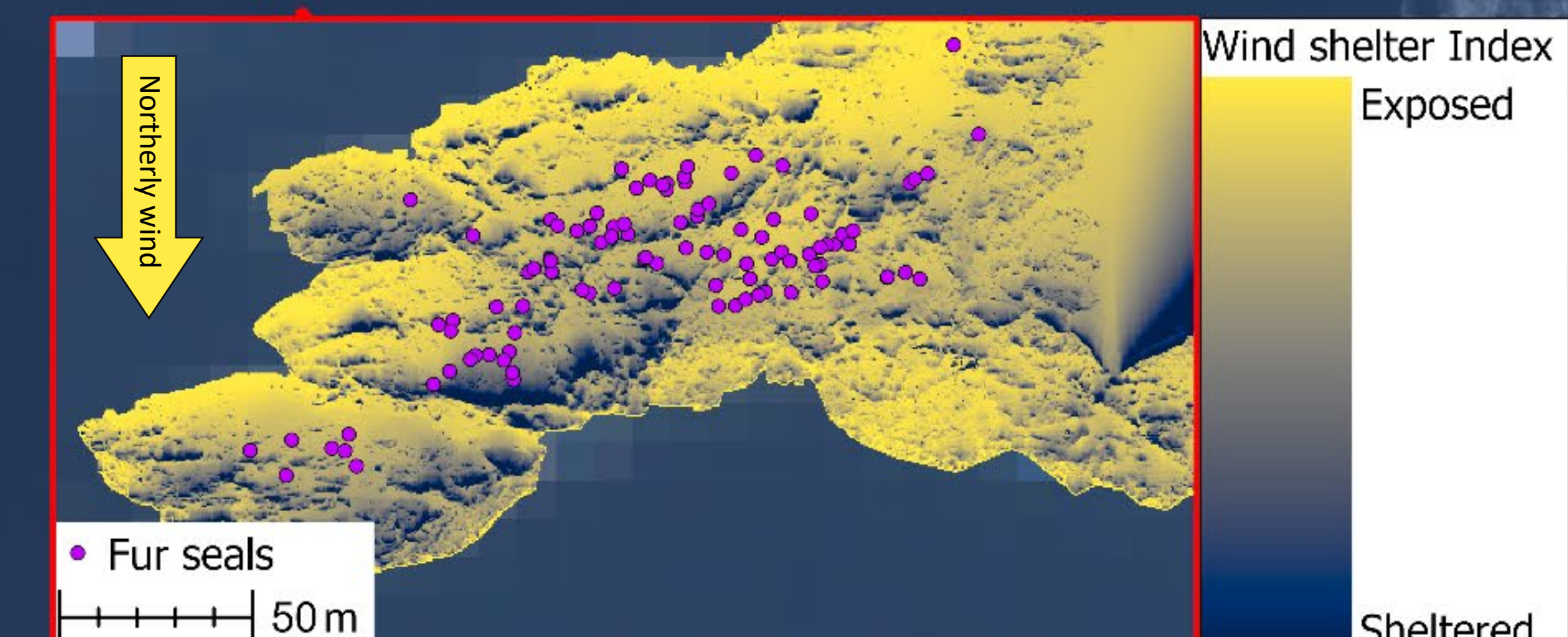


The Landsat Image Mosaic of Antarctica, situates Palmer (starred) within the continent



Do elephant seals "wallow" in specific terrain?

- Tracking seasonal attendance at wallow sites
- Modeling topography of wallow sites



Do pinnipeds use topography for wind shelter while on land?

- Quantifying prevailing wind directions over summer months
- Modeling directional wind shelter based on topography

Background imagery: Sentinel-2A scene L1C_T20DMP_A015422_20200218T131905, captured February 18, 2020

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