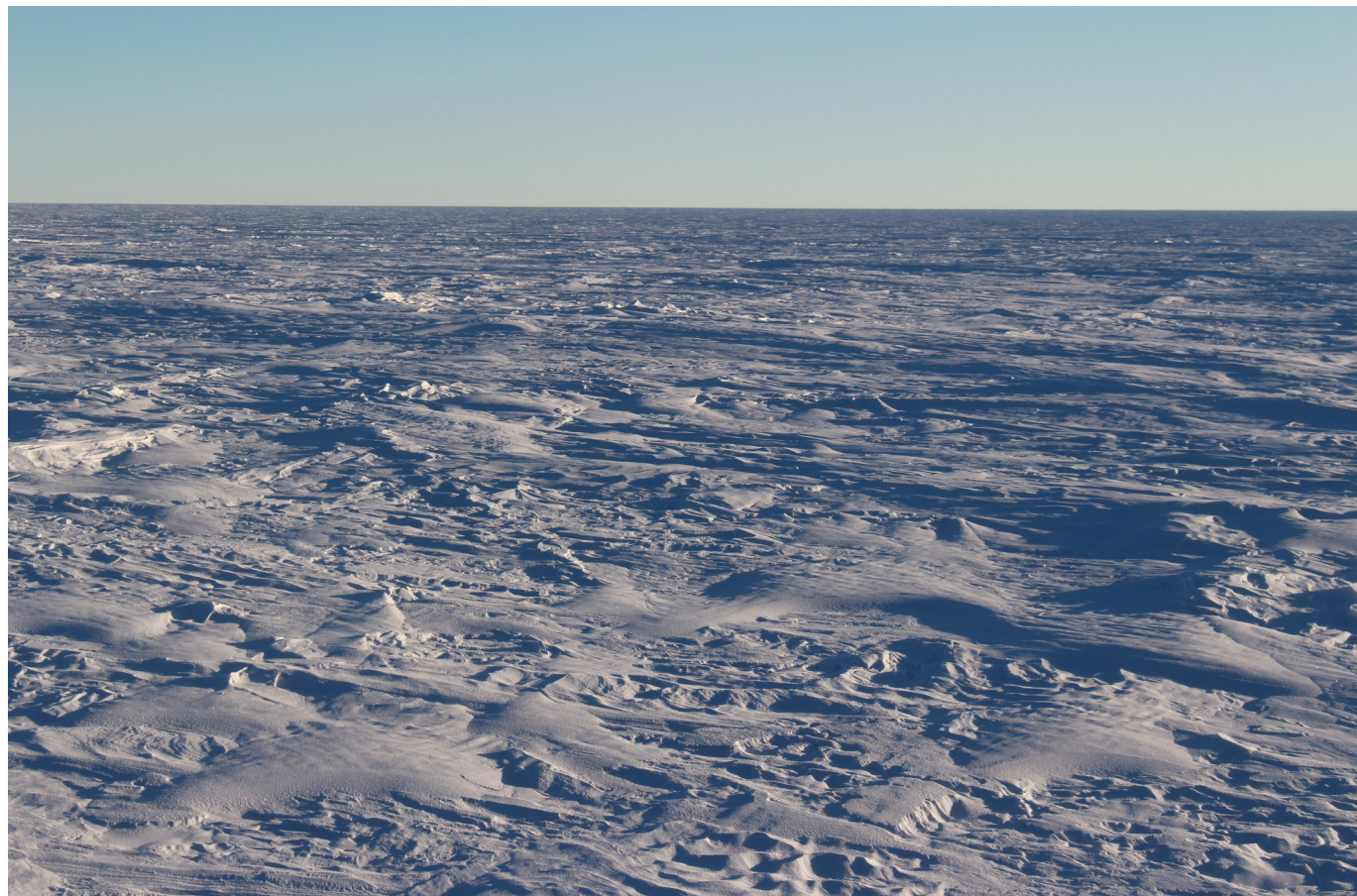


Snow dunes in Antarctica

M. Poizat¹, G. Picard¹, L. Arnaud¹, and C. Amory¹

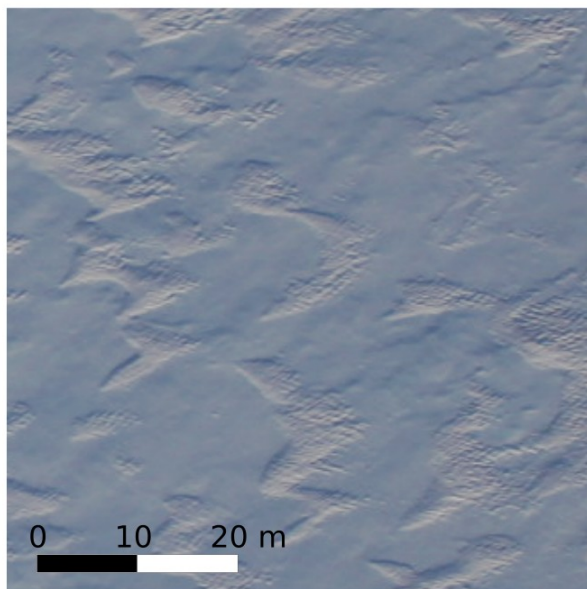
1. Univ. Grenoble Alpes, IRD, CNRS, Grenoble INP, IGE, 38000 Grenoble, France



View of the snow bedform near Concordia station, Antarctica

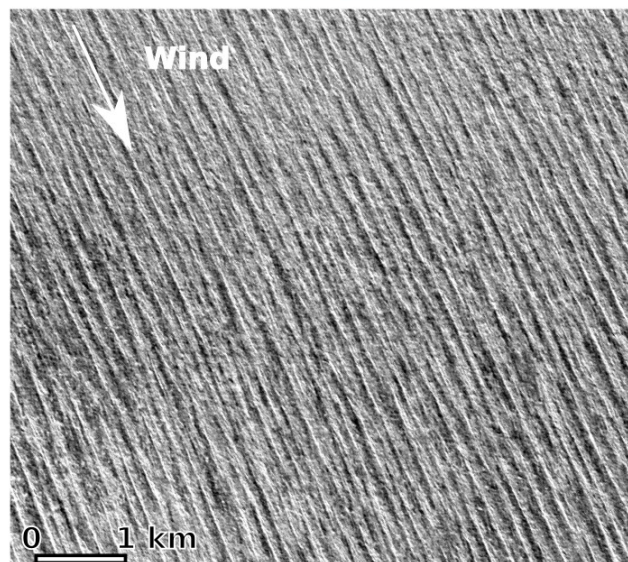
Snow bedforms

Barchans 10 m



Aerial photograph of barchans during ASUMA, 2017

Longitudinal



Sentinel-2 image 11/2021

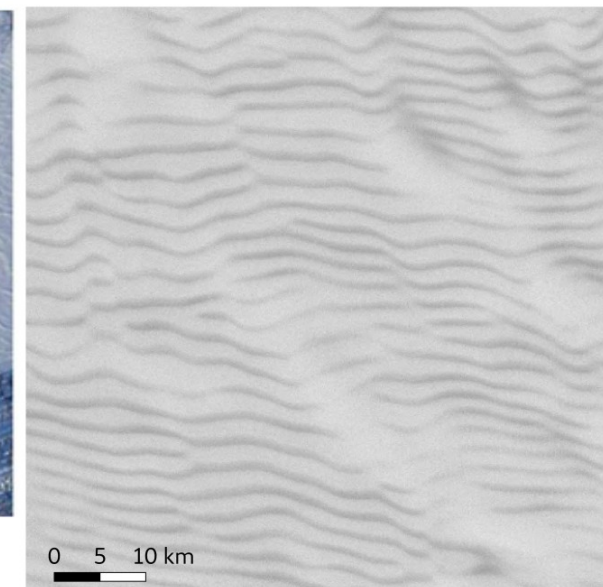
Linear 100 m

Transverse



Filhol and Sturm, 2015

Megadunes 4 km



RAMP Radarsat mosaic

And sastrugis, ripples, whalebacks... Large variety of different dune types
Dune morphology depends on the wind regime

Dunes distribution in Antarctica

How to explain the spatial distribution of the different type of dunes in Antarctica?

1. Observations :

- Map the snow dunes in Antarctica
- Remote location : observations?

Few aerial observations in summer

2. Modelling of the theoretical snow dunes distribution :

- Wind speed and snow properties data needed as input parameters
- Comprehension of the processes of the dunes formation and dynamics

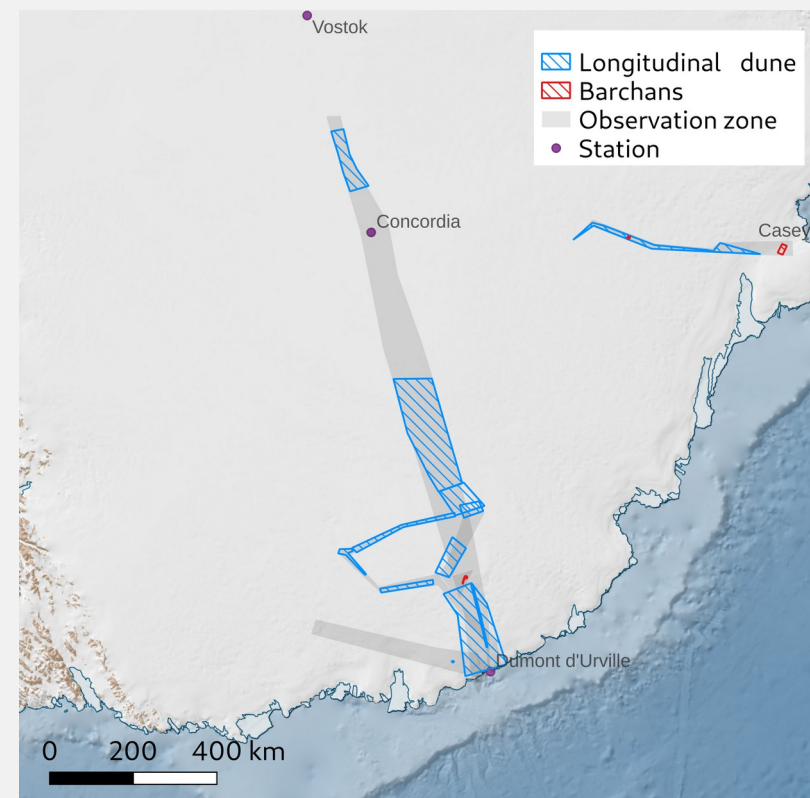
Mapping snow dunes

Observations



- 5 flights in 2016 and 2017, 6000 images
- Up to 20 cm resolution
- Barchans and linear dunes identified from these aerial photographs

Mapping snow dunes

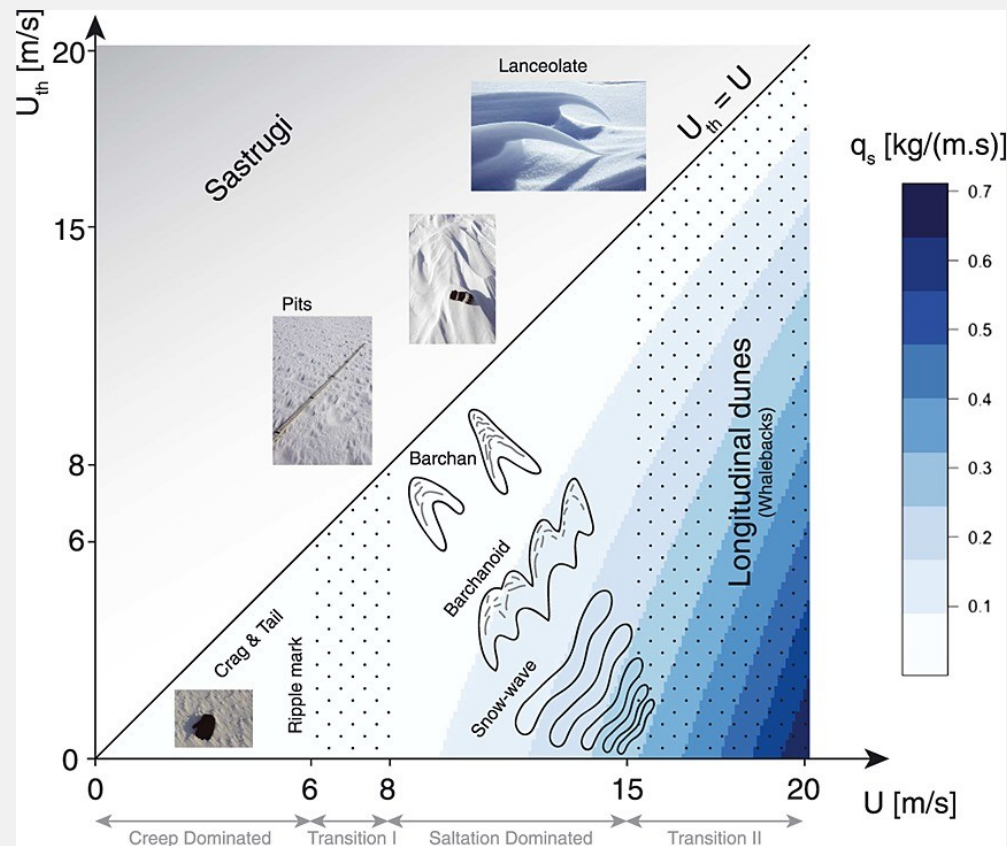


We acknowledge the Norwegian Polar Institute's Quantarctica package

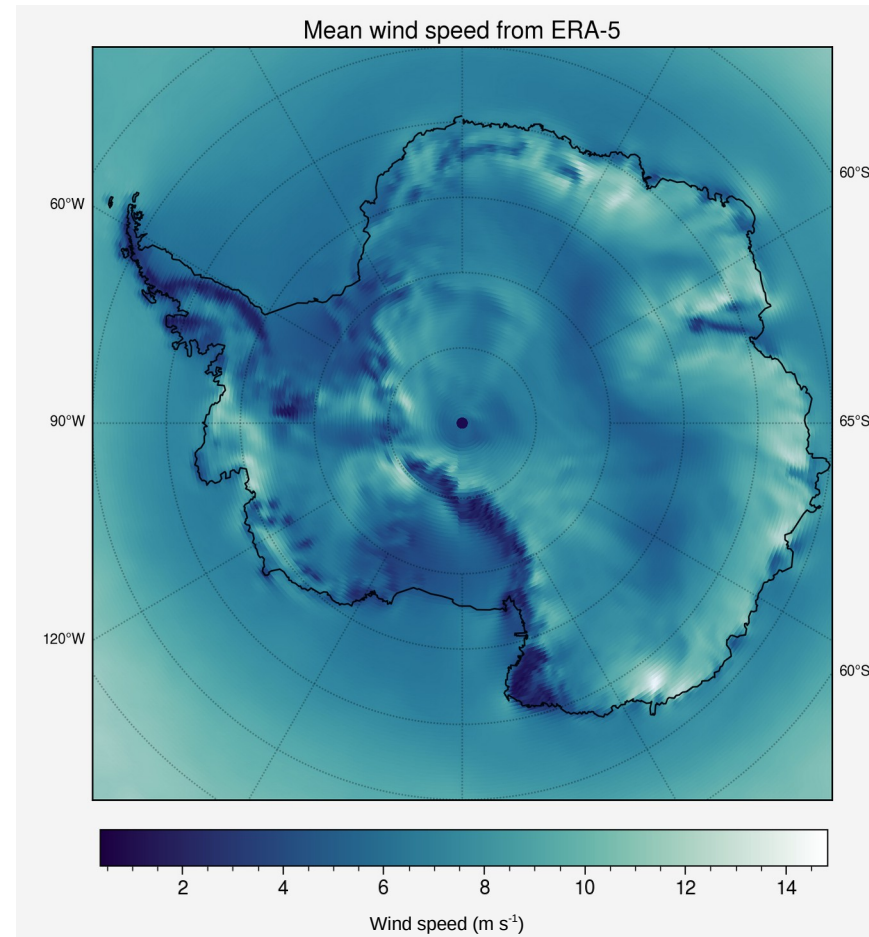
- Large areas with longitudinal dunes
- Few small barchan areas

Modelling of the snow dunes

Predicting snow dunes ?



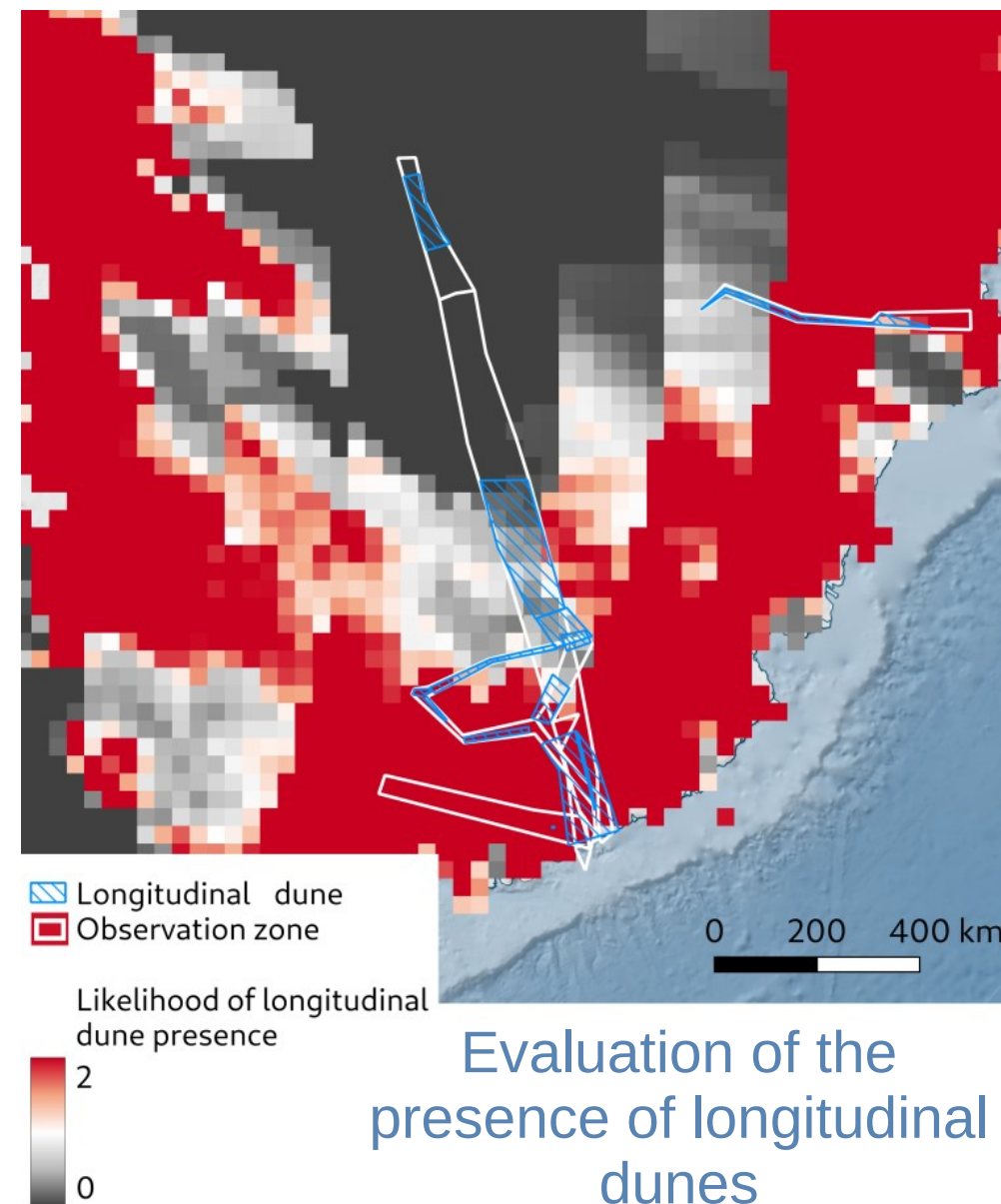
Filhol and Sturm, 2015 dune prediction model needs threshold wind speed and wind speed



Wide range of meteorological conditions → potential for large variety of different dunes

Results

- Assume a constant threshold wind speed u_{th} around 6 m s^{-1}
 - Wind speed u from ERA-5 reanalysis
 - Longitudinal dunes :
 - $u > 15 \text{ m s}^{-1}$
 - $u_{th} < u$
- ⇒ Presence of longitudinal dunes expected near the coast
- ⇒ Unexpected longitudinal dunes over the Antarctic plateau



Conclusion and perspectives

Conclusion

- Longitudinal dune is the dominant type over the different categories of dunes of Antarctica
- Modelling or hypothesis could not explain their presence

Perspectives

- Adapt sand dune knowledges to snow dunes
- Use optical remote sensing (Sentinel-2, Landsat-8) to identify the position of large dunes on wide areas all over Antarctica