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Ecological consequences of a massive iceberg calving in Antarctica

Yann Méheust¹, Michelot C.¹, Bloch T.¹, Delord K.¹, Barbraud C.¹, Bost C-A.¹, Ropert-Coudert Y.¹, Kato A.¹ & Raclot T.²
¹CEBC, Chizé ²IPHC, Strasbourg
yann.meheust@cebc.cnrs.fr

Introduction

One of the major consequences of climate change in Antarctica is the **acceleration of icebergs calving**, due to the warming of coastal waters. While this acceleration of glacier movements has important consequences on the Antarctic Ice Sheet thickness and the global sea level rise, its impact on ecosystems is poorly understood. **In 2010, a major collision occurred between the giant Iceberg B9-B and the Mertz glacier tongue**, around 400 km East of the Dumont d'Urville research. This collision resulted in the detachment of the ice tongue from the continent, representing an ice surface of 2,545 km² and an estimated ice mass of 860 billion tons.

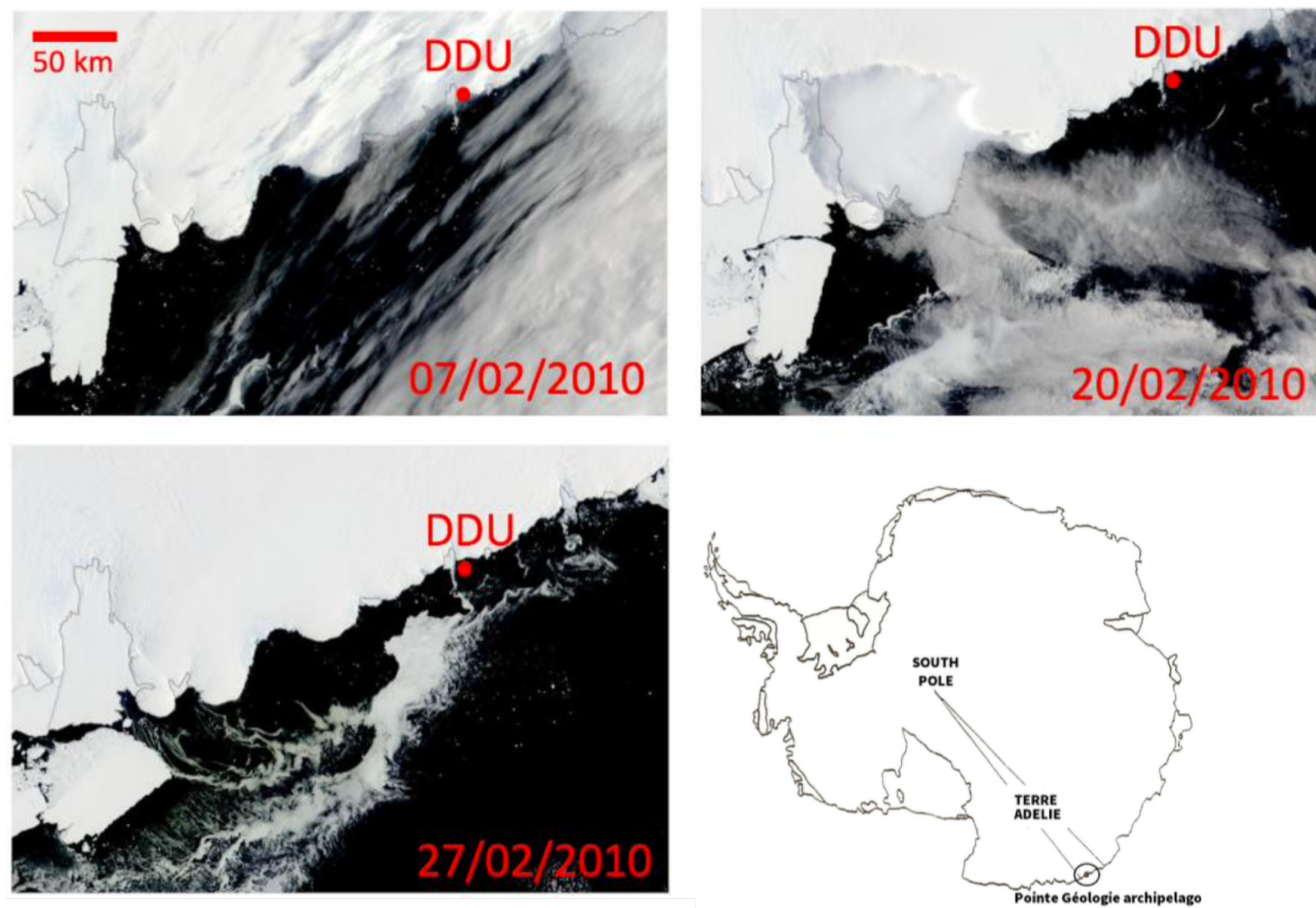
Aim of the study

The aim of this project is to shed light on the impact of the Mertz glacier fracture on the **demographic parameters** of a bio-indicator species, the Adélie penguin, and the **oceanographic parameters associated with pack ice**, before and after 2010.

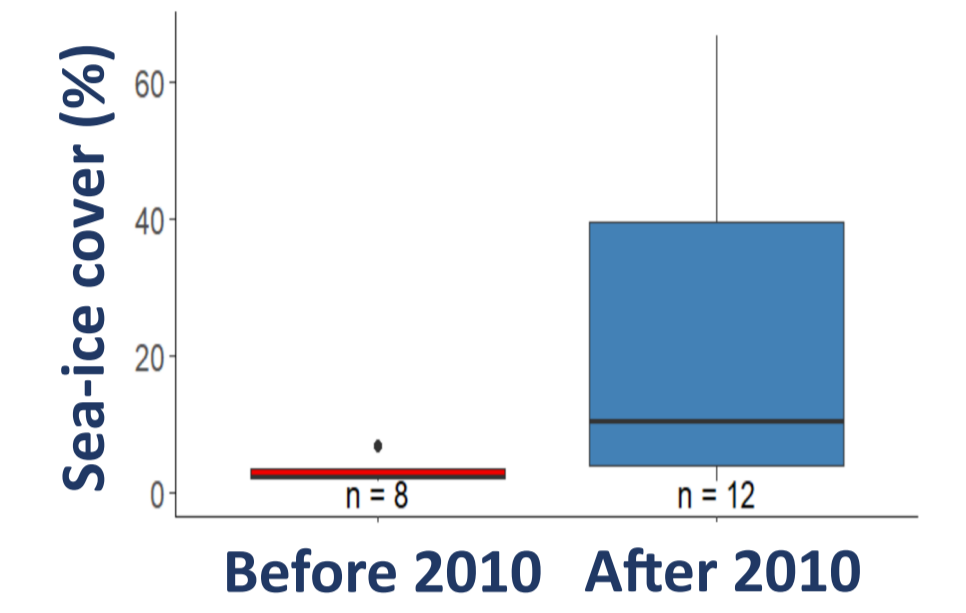
RATIONALE OF THE PROJECT AND FIRST ANALYSES

Massive Event

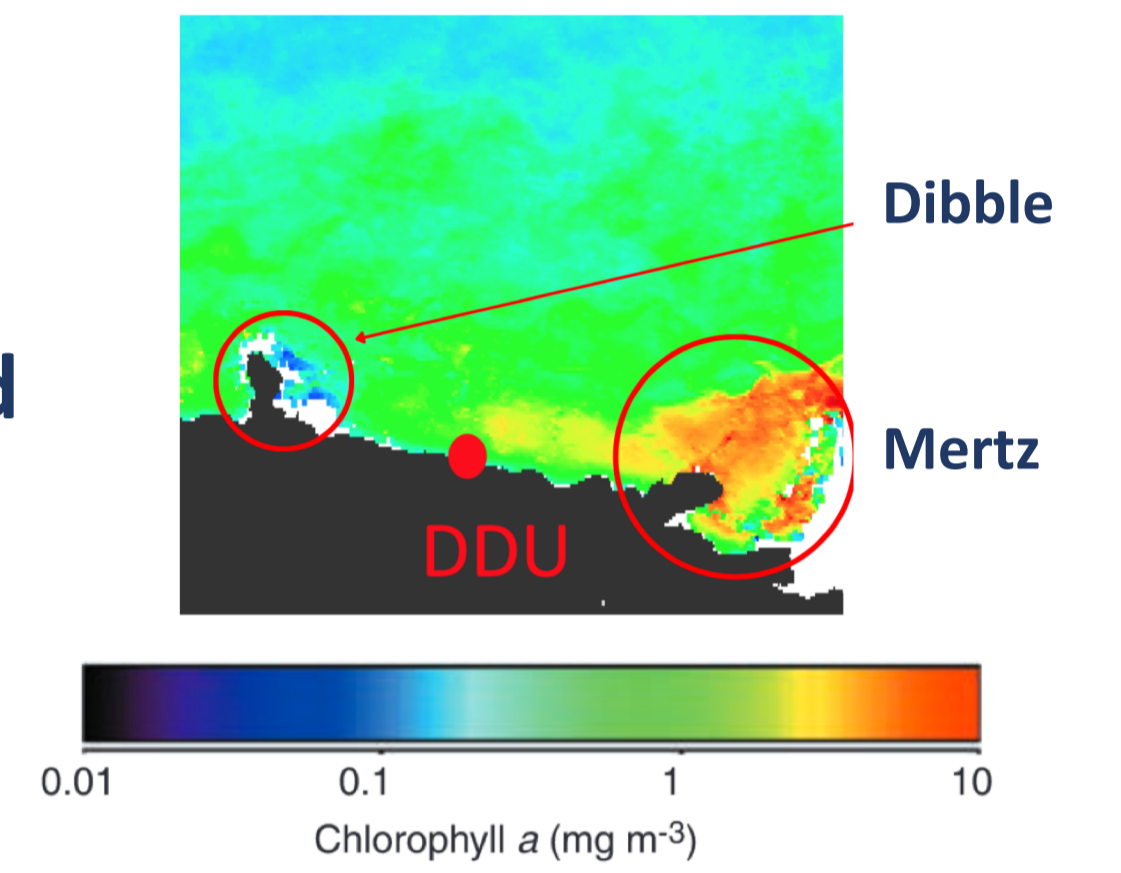
- The Mertz calving has modified the physico-chemical environment along the coast of Adélie Land.



Sea-ice accumulation in January near Dumont d'Urville Station

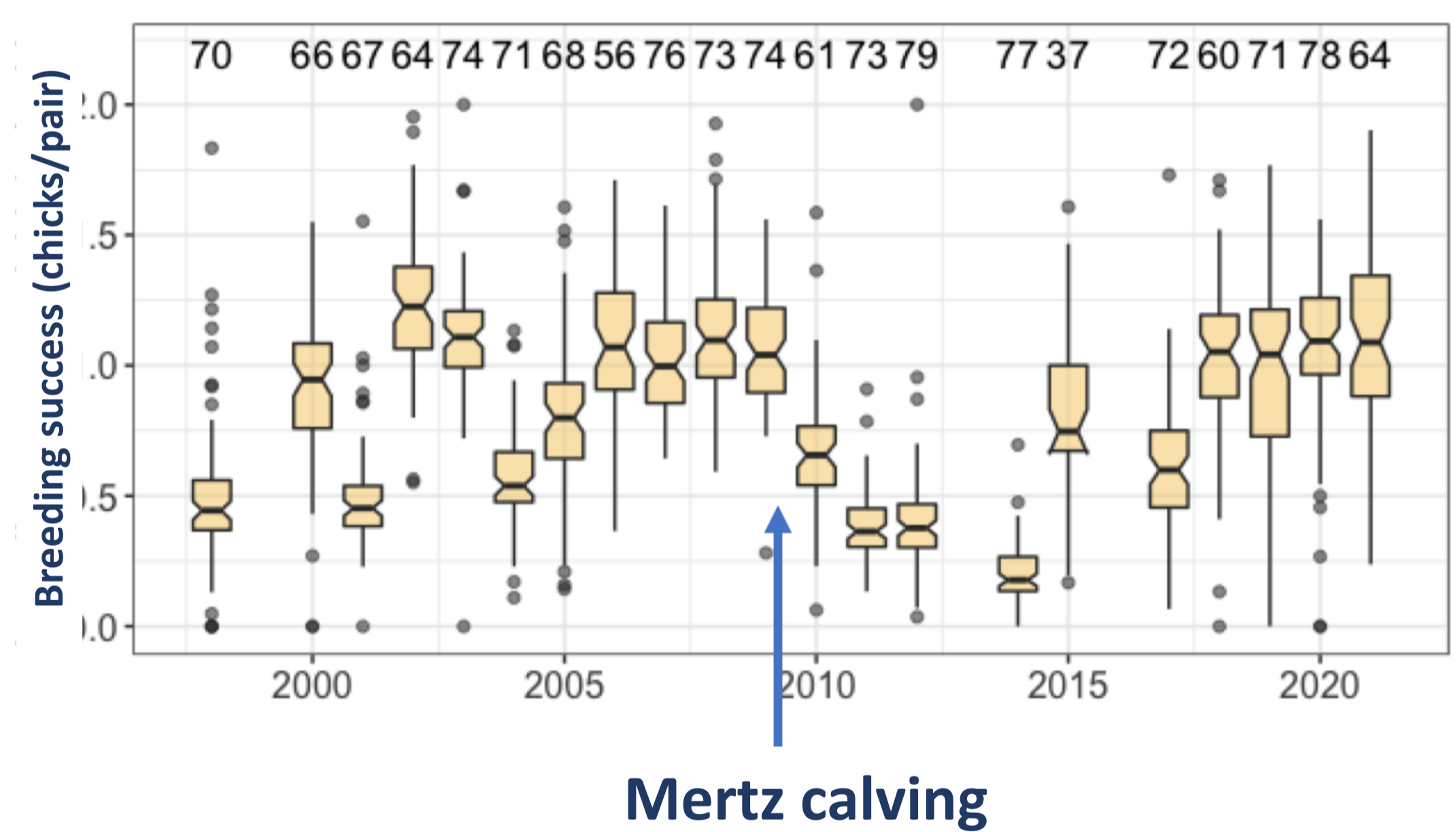
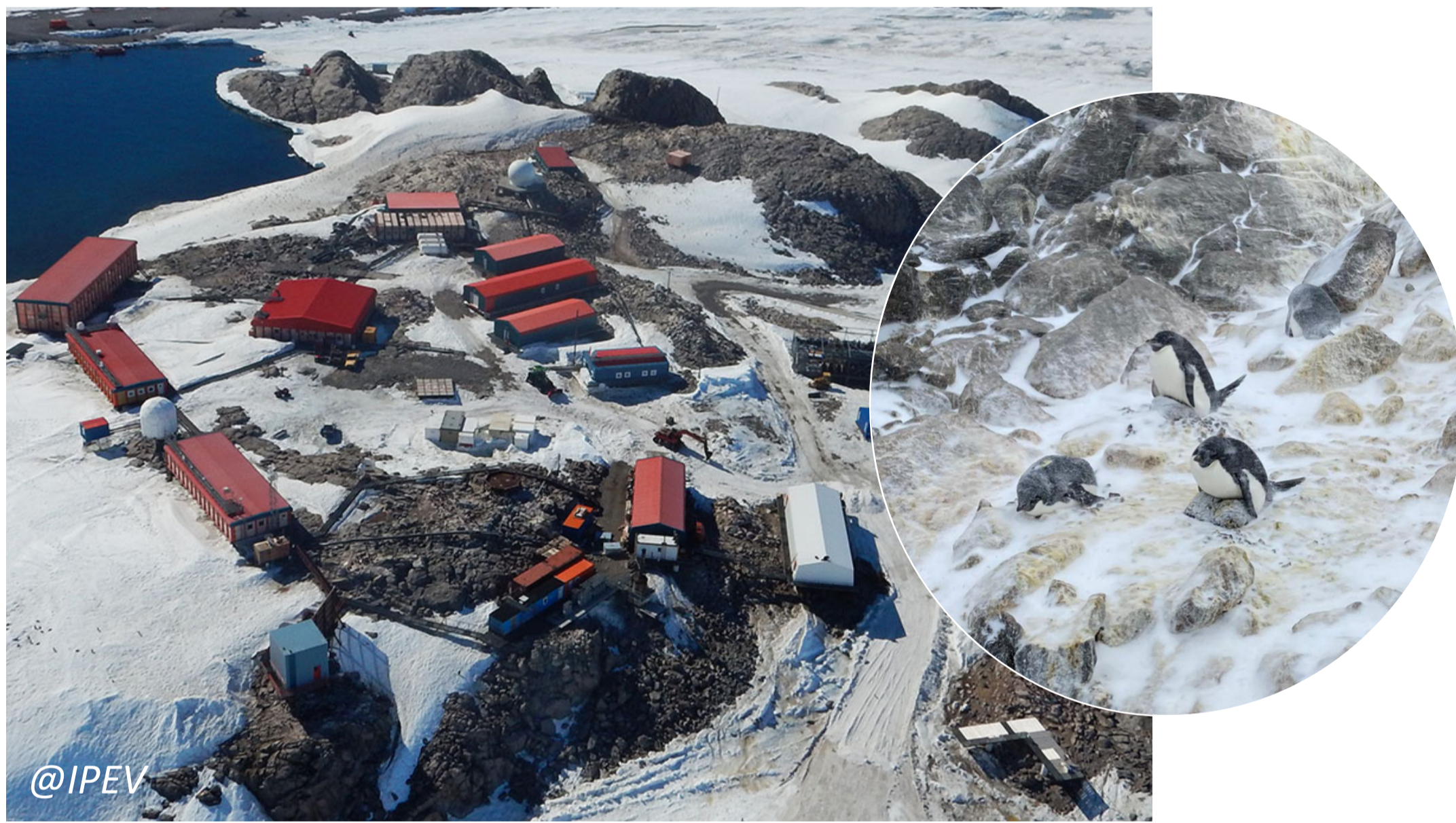


Primary productivity may have been affected around the former glacier tongue



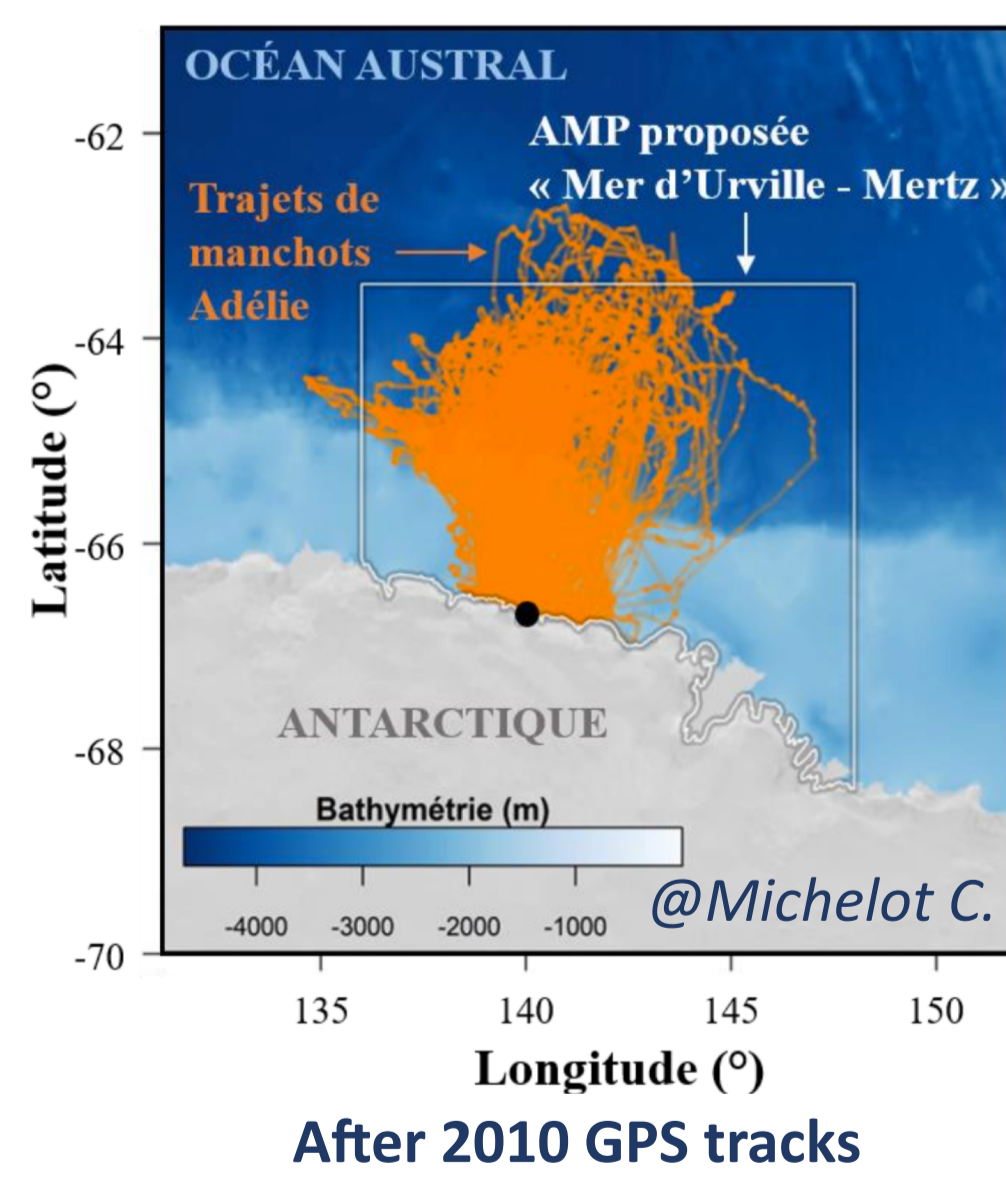
Demographic Effect

- Adélie penguins breeding success decreased for the five consecutive years in DDU.



What Mechanisms?

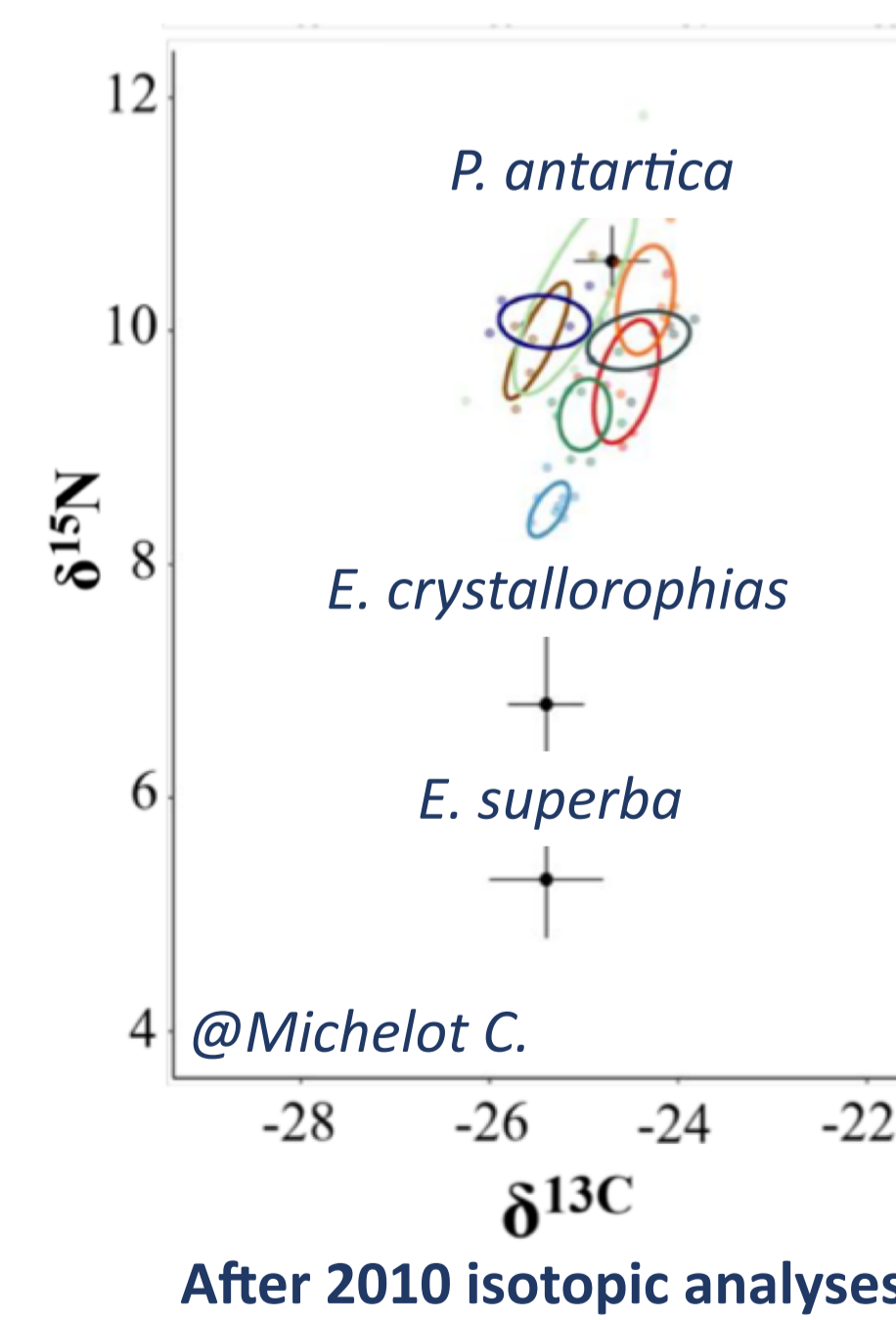
- HYP1: Sea-ice accumulation changed the foraging area of penguins, with potential consequences on foraging costs.



DID THE FORAGING BEHAVIOR OF ADELIE PENGUINS CHANGED BEFORE AND AFTER 2010?

Argos data; comparison of foraging areas; trip durations; distance to open water...

- HYP2: Reduced productivity in the Mertz region affected the krill development.



DID THE PENGUINS TROPHIC LEVEL SHIFTED TO A LESS ENERGETIC DIET?

Stable isotopes; stomach content; body mass...

Preliminary results

- Iceberg calving increased sea-ice concentration in DDU area.
- The Mertz tongue used to be a major area of primary productivity.
- Adélie penguins breeding success reduced for the five consecutive years following calving.

MORE RESULTS TO COME...

References:

Commission for the Conservation of Antarctic Marine Living Resources (2011) Delegations of Australia and France: proposal for a representative system of marine protected areas (RSMPA) in the East Antarctic planning domain, SC-CAMLR-XXX/11. Report of the Thirtieth Meeting of the Scientific Committee. Agenda Item No. 5(ii), 2011.
Two Recent Massive Breeding Failures in an Adélie Penguin Colony Call for the Creation of a Marine Protected Area in D'Urville Sea/Mertz. Ropert-Coudert, Y, Kato, A; (...); Raclot, T. Frontiers in marine science 2018.
When sea-ice clock is ahead of Adélie penguins' clock. Beaulieu, M; Dervaux, A; (...); Ancel, A. Functional Ecology 2010.

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