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Drivers of surface winds variability in Antarctica

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Surface winds in Antarctica are amongst the strongest and most persistent winds on Earth. They play a key role in defining the surface climate.
While new proxys are being developed in order to understand their past evolution, it is a crucial to understand the processes controlling their temporal variability.

Here, we investigate the drivers of surface winds variability in East Antarctica at present-day. To do so, we separate the wind-speed temporal variations from daily outputs of the regional atmospheric model MAR at 35 km resolution into different terms of the dynamic equations.
Our study focuses on a transect running through Adelie Land, where numerous meteorological measurements are being conducted.

We identify the combination of terms that correlates best in winter to the wind speed in this region.
On the Antarctic plateau, wind speed is controlled by the balance between large-scale pressure gradient acceleration and turbulence.
At mid-slope, the katabatic term is the greatest but does not correlate with wind-speed. One of the reason that explains this result is that increasing positive katabatic forcing is counteracted by increasing turbulence (negative term, deceleration effect). Consequently, the combination of the turbulence and katabatic terms correlates slightly better to wind-speed intensity.

At the coast, wind-speed intensity mainly results from the katabatic and thermal wind terms.

As a conclusion, the study of a smaller number of contribution terms in the budget equation will help evaluating the drivers of past and future evolution of wind speed in this region.