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Low-level precipitation sublimation on the coasts of East Antarctica

Jacopo Grazioli (1), Christophe Genthon (2), Jean-Baptiste Madeleine (3,4), Florentin Lemonnier (4), Hubert Gallée (2), Gerhard Krinner (2), and Alexis Berne (1)

(1) EPFL, EPFL-ENAC-IIE-LTE, Lausanne, Switzerland (jacopo.grazioli@epfl.ch), (2) LGGE, Grenoble, France, (3) Sorbonne University, UPMC Univ Paris 06, UMR 8539, Laboratoire de Météorologie Dynamique (IPSL), Paris, France, (4) CNRS, UMR 8539,Laboratoire de Météorologie Dynamique (IPSL), Paris, France

The weather of East Antarctica is affected by the peculiar morphology of this large continent and by its isolation from the surroundings. The high-elevation interior of the continent, very dry in absolute terms, originates winds that can reach the coastal areas with very high speed and persistence in time. The absence of topographic barriers and the near-ground temperature inversion allow these density-driven air movements to fall from the continent towards the coasts without excessive interaction and mixing with the atmosphere aloft. Thus, the air remains dry in absolute terms, and very dry in relative terms because of the higher temperatures near the coast and the adiabatic warming due to the descent.

The coasts of Antarctica are less isolated and more exposed to incoming moist air masses than the rest of the continent, and precipitation in the form of snowfall more frequently occurs. Through its descent, however, snowfall encounters the layer of dry air coming from the continent and the deficit in humidity can lead to the partial or complete sublimation of the precipitating flux.
This phenomenon is named here LPS (Low-level Precipitation Sublimation) and it has been observed by means of ground-based remote sensing instruments (weather radars) and atmospheric radio-sounding balloons records in the framework of the APRES3 campaign (Antarctic Precipitation: REmote Sensing from Surface and Space) in the coastal base of Dumont d' Urville (Terre Adélie), and then examined at the continental scale thanks to numerical weather models.
LPS occurs over most of the coastal locations, where the total sublimated snowfall can be a significant percentage of the total snowfall. For example, in Dumont d' Urville the total yearly snowfall at 341 m height is less than 80% of the snowfall at 941 m height (the height of maximum yearly accumulation), and at shorter time scales complete sublimation (i.e. virga) often occurs.
At the scale of individual precipitation events, LPS is overall inversely proportional to the intensity of precipitation, because more developed systems can extend further into the continent and eventually saturate the low levels of the atmosphere.
This contribution presents the data, models, and analysis used to characterize LPS over the coastal regions of East Antarctica and discusses the possible implications for predicting climate change in Antarctica.