

Dynamics and cloud properties of Arctic cyclones as simulated with the new limited-area configuration of the DYNAMICO-LMDZ model

L. Raillard¹, É. Vignon², G. Rivière², J.B. Madeleine¹, Y. Meurdesoif³, A. Caubel³, M. Wimmer², S. Fromang³, J. Delanoë⁴, O. Jourdan⁵.

¹SU, Laboratoire de Météorologie Dynamique, Paris, France.

²CNRS, Laboratoire de Météorologie Dynamique, Paris, France.

³CEA, Laboratoire des Sciences du Climat et de l'Environnement, Saint-Aubin, France.

⁴UVSQ, Laboratoire Atmosphères- Milieux- Observations Spatiales, Guyancourt, France.

⁵UCA, Laboratoire de Météorologie Physique, Clermont-Ferrand, France.

Extra-tropical cyclones transiting into the Arctic are of great importance for the heat and moisture budgets of the polar atmosphere and strongly modulate the sea ice variability. Arctic cyclones are also systems that lead to the formation of clouds, and in particular mixed-phase clouds, whose amount of supercooled liquid water strongly determine the radiative effect thereof. Correctly representing those clouds in atmospheric models is crucial to properly simulate precipitations and the surface energy budget in a region warming twice as fast as the rest of the globe.

In August 2022, the Rali-Thinice campaign took place in Svalbard and aimed to characterize the dynamical and microphysical structure of Arctic cyclones. A research aircraft equipped with measurement systems such as two radars, a lidar and microphysical probes flew over the Arctic Ocean sampling several cases of summer cyclones. The data acquired during this campaign are extremely valuable to carry out an in-depth evaluation of the ability of atmospheric models to simulate Arctic cyclones and their associated clouds.

LMDZ is the global atmospheric component of the IPSL-CM Earth System Model, actively and historically involved in the CMIP exercises. The new DYNAMICO-LMDZ configuration which consists of the physics of LMDZ coupled to the recent icosahedral dynamical core DYNAMICO is run in a new regional configuration on a domain surrounding the Svalbard archipelago. The representation of the dynamics and thermodynamics of cyclones as well as cloud properties is assessed using the set of measurements acquired during Rali-Thinice campaign complemented with surface station data and radiosondes.