Sensitivity of the warm conveyor belt of a deep cyclone to microphysics and turbulence schemes of the mesoscale model

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Introduction
Potential microrepresentation of diabatic processes through latent heat release along WCBs can lead to PV error along the jet stream — Prediction error in NWP models (Gray, 2014)

- Importance of microphysical processes among them (Joos and Wernli, 2012, Joos and Forbes, 2016) — big list of uncertainties

Among these uncertainties:
- IFS microphysics
- Parameterization of orography-induced turbulence

- Sensitivity of microphysics to turbulence schemes of the mesoscale model

Main diabatic processes along the warm conveyor belt

Trajectories ascending 300 hPa in 24 h: θ budget on the 24 hours

Focus on Stalalitie cyclone (observed during NAWDEX)

Observations:

- Mesoscale model:
  - Sounding at 120hPa
  - IWC (g/m³)

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Sensitivity to microphysics

On supercooled droplets repartition
In ICE3, it is possible to have supercooled droplets till -20°C, test is perform till -40°C (more consistent with literature)

On IFN concentration
In LIMA, from 10 000 000 to 10 000 000 U/L

On crystal shape
In LIMA, from plates to Bullet rosettes

On transition diameter ice/snow
In LIMA, from 125 µm to 250 µm

On CCN concentration
In LIMA, from 300 000 000 to 3 000 000 000 000 U/m³

On ice fallspeed (getting closer to the obs)
In LIMA,

On snow fallspeed (getting closer to the obs)
In LIMA,

Sensitivity to turbulence

On mixing length and from 1D to 3D
In ICE3, mixing length from 1D BL89 (Bougeault, 1989) to 3D Deardorff, 1980

In LIMA, mixing length from 1D BL89 (Bougeault, 89) to 3D Deardorff, 1980

- Notable impact on the PV at 320 K, but depend on the microphysical scheme used
  - Little impact on microphysical, more impact on the boundary layer.