Poster N° 227

Thermodynamic Phase transition Analysis by Cloud Tracking

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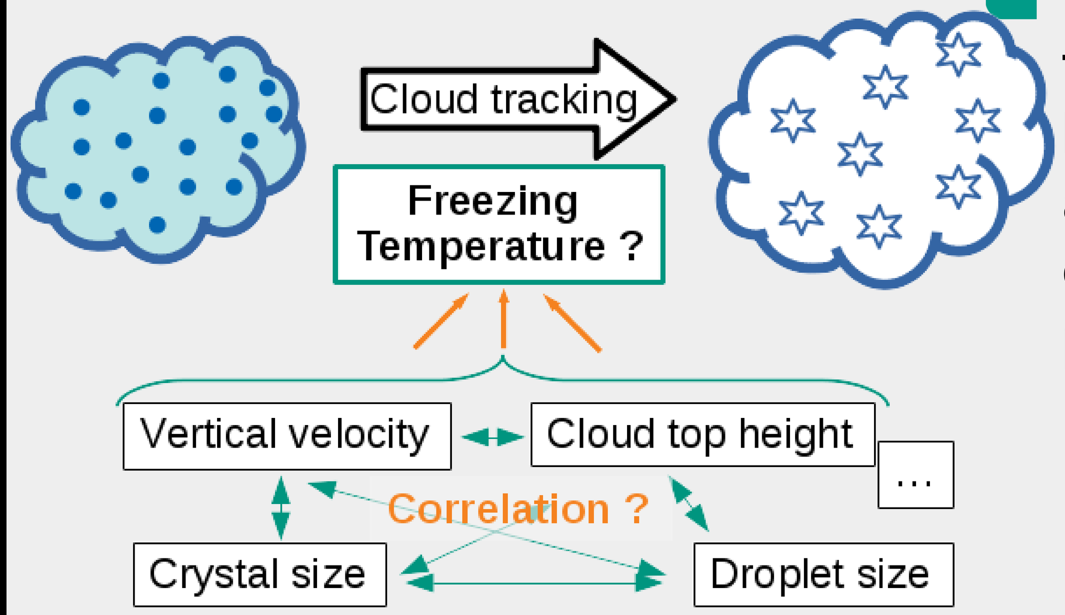
Introduction



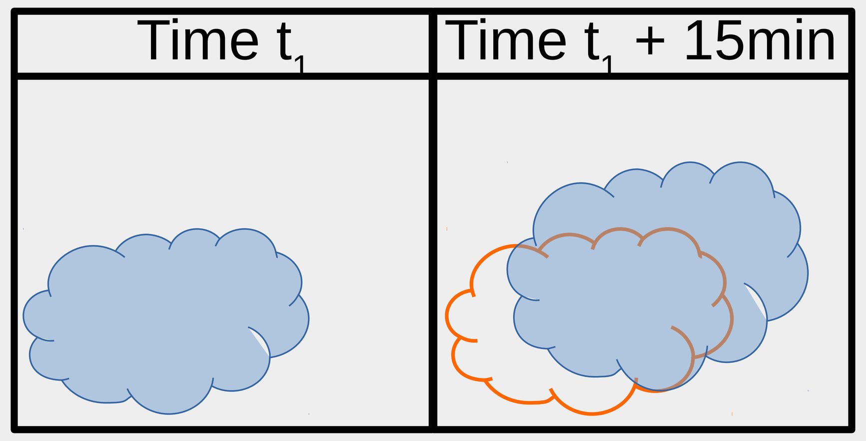
- The **cloud phase transition** from liquid to ice has an impact on **cloud radiative properties**
- Our understanding of the cloud phase transition is incomplete: Which parameters **enhance or inhibit the phase transition** ?

1. Data Used:

- Spinning Enhanced Visible and Infrared Imager (**SEVIRI**), on board of the **geostationnary** satellite plateform Meteosat, does measurements in 12 channels (visible and infrared)
- Cloud property dAtAset using SEVIRI – Edition 2 (**CLAAS-2**)
- Temporal resolution: **15 min**
- Spatial resolution: **0.05°x0.05°**
- Parameters are retrieved at **cloud top**: r_{eff}, T, τ…

2. Cloud Tracking:

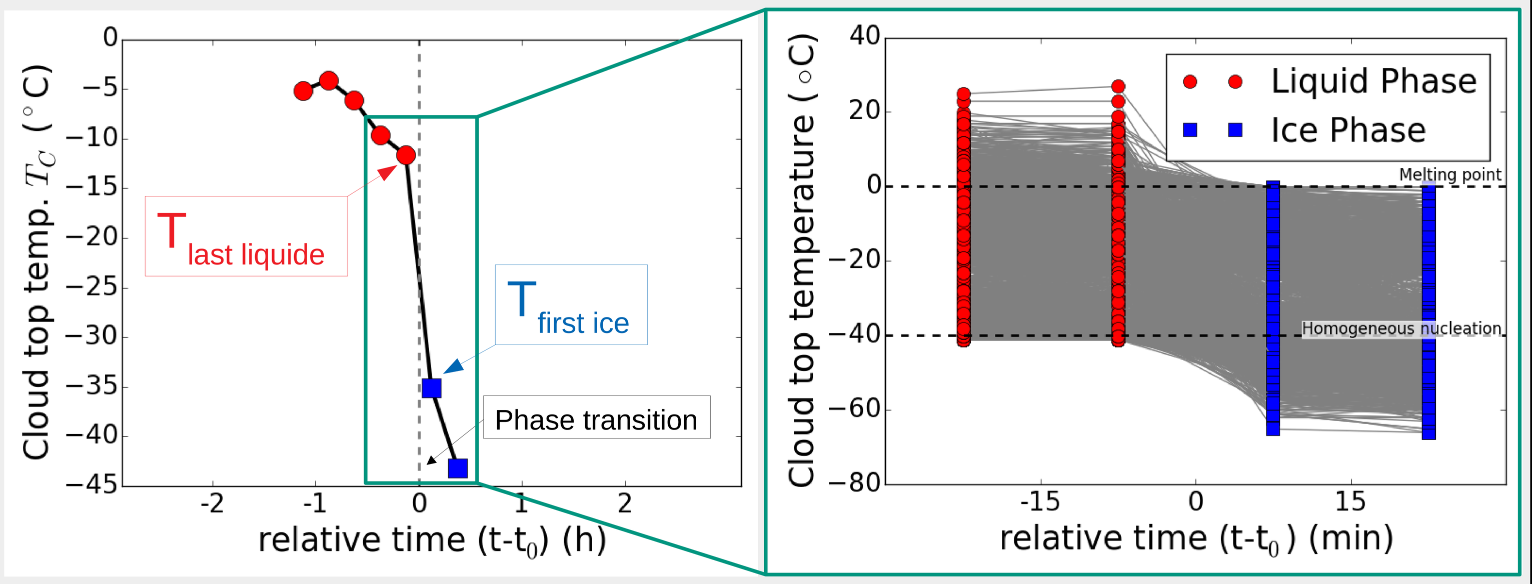
- The tracking algorithm is based on the **overlap of clouds**: Two sucessive clouds in time are considered as the same cloud if there is an overlap of at least **50%**.
- We **avoid cloud splitting and merging** by setting **thresholds on area variations** and positions of coldest pixels
- All analysed clouds have been in the **liquid** phase for at least 30 min and in the **ice** phase for at least 30 min



3. We Focus on:

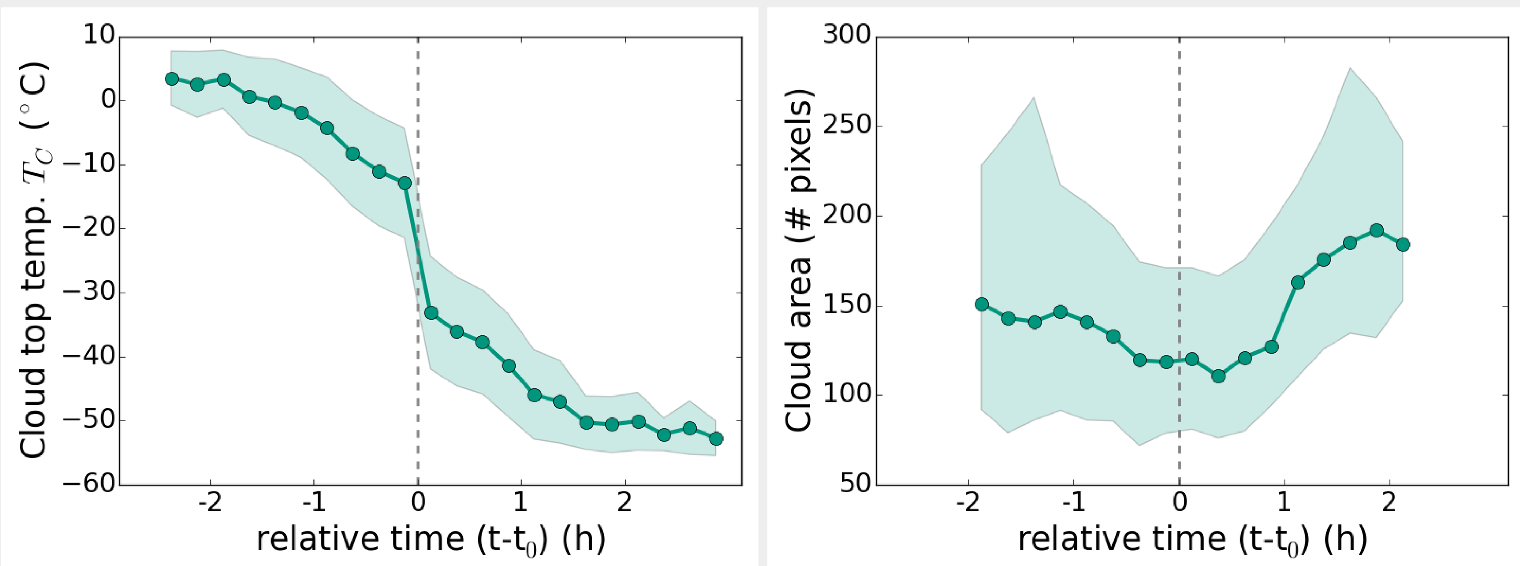
- Convective clouds for which we observe a phase transition **from liquid to ice** of the coldest pixel
- Clouds above **continental Europe** during June, July, and August (**Summer**) from **2004 to 2015**
- Understanding **cloud parameter evolution with time** and the **factors that influence the phase transition of clouds**

4. Evolution in Time of Cloud Parameters:



(Left:) Example of the temperature evolution of the coldest pixel for one tracked cloud and definition of the reference time at the phase transition. (Right:) Evolution of the tempertature at the two time steps before and after the reference time for the 880 tracked clouds.

- We infer the average **evolution in time of cloud parameters associated with their standard deviations for each time step**

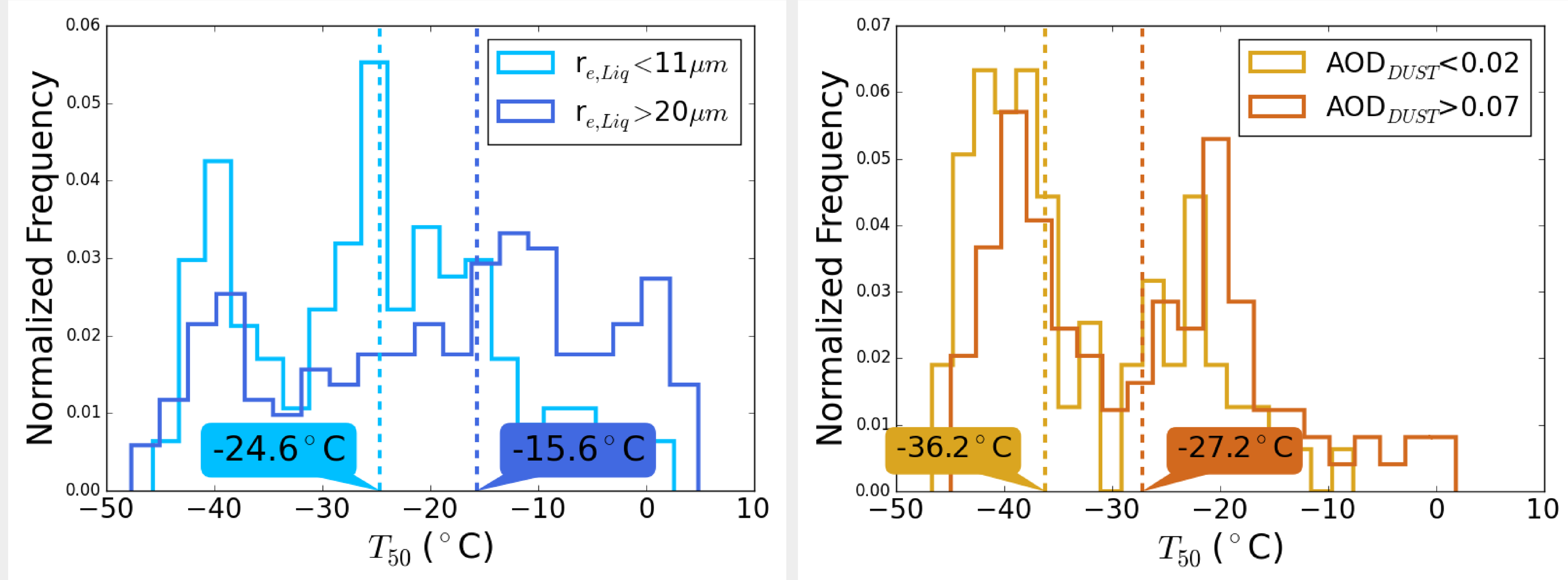


(Left:) Mean evolution of the cloud top temperature for the 880 tracked clouds. (Right:) Mean evolution of the area for the 880 tracked clouds.

- **Cloud top temperatures drop** at the phase transition: strong convection
- The area in the ice phase increases: **anvil expansion**

5. Large Cloud Droplets and High AOD of Dust Increase the Phase Transition Temperature

- Definition of the **freezing temperature**: $T_{50} = \frac{T_{Last\ Liquid} + T_{First\ Ice}}{2}$
- Distributions of T_{50} for **different cloud and atmospheric regimes**: small and large cloud droplets…



(Left:) Freezing temperature associated with liquid cloud droplets less than 11 µm and greater than 15 µm. The dashed lines correspond to the median for each distribution. (Right:) Same, but of different regimes of AOD_{DUST}, retrieved by MACC dataset (ECMWF).

6. Conclusion & Future Work

- We analyse **cloud property evolutions** based on a large database (1000 analysed clouds) before and after the phase transition
- We defined **several regimes** to understand which cloud properties **influence cloud phase transition :**
  - Large liquid cloud droplets enhance phase transition (+9°C)
  - High AOD of dust enhances phase transition (+9°C)
- Perform **statistical analysis** to find correlations between the different variables
- Comparing results with **different satellite phase distributions**
- Comparing with **model simulations** (ICON) on specific cases

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