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## A space-based perspective on cloud phase partitioning over the Southern Ocean

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Liquid cloud droplets freeze homogeneously at  $-40^{\circ}\text{C}$ . For temperature between  $-40$  and  $0^{\circ}\text{C}$ , clouds can be either liquid, ice, or mixed-phase. Several variables determine the cloud phase: droplet size, ice nuclei concentration, meteorological parameters, etc. But, parameters which trigger, enhance or inhibit the phase transition are still poorly understood and disagreements remain between theory and observations. The phase transition is nonetheless important to determine cloud effects on climate.

In the present study, we analyse satellite observations from the geostationary passive instrument SEVIRI. We used the CLAAS-2 dataset to retrieve cloud top microphysical and optical properties from 2005 to 2015 over the Southern Ocean.

Cloud objects that contain liquid and ice pixels are identified for cloud top temperatures within specific temperature ranges: between  $-30$  and  $-20^{\circ}\text{C}$ , between  $-20$  and  $-8^{\circ}\text{C}$ , and between  $-8$  to  $0^{\circ}\text{C}$ . The distributions of different cloud properties for mixed-phase, liquid or ice clouds are compared. For example, preliminary results show that cloud ice fraction increases with the cloud droplet size for cloud top temperature between  $-8$  and  $0^{\circ}\text{C}$ . Indeed, ice fractions greater than 0.8 are associated with a median cloud droplet effective radius of 7 micrometers whereas ice fractions less than 0.2 are associated with a median cloud droplet effective radius of 12 micrometers. We hypothesize that this result can be associated to a secondary ice production process (e.g., the Hallet-Mossop process is the splinter production associated with riming process for temperature between  $-8$  and  $-3^{\circ}\text{C}$  and it can increase the ice particle concentration by several orders of magnitude). In line with our results, the Hallet-Mossop process is more efficient with larger cloud droplets. The spatial distribution of liquid and ice pixels within the cloud objects is also studied to better understand the phase partitioning of mixed-phase clouds.