Comparison with Cloud Ice Distribution Across Two Models

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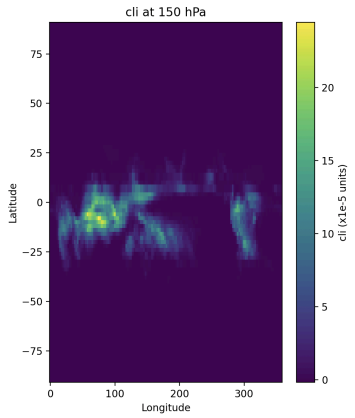
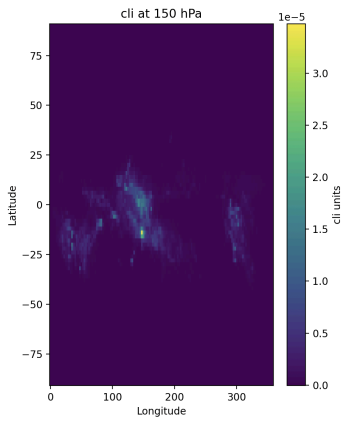
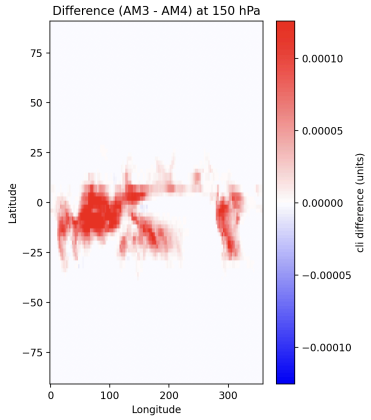
(a) Latitude v. Longitude Maps at Different Altitudes

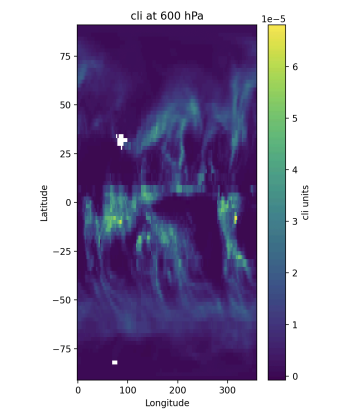
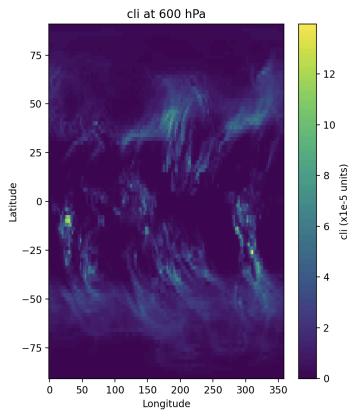
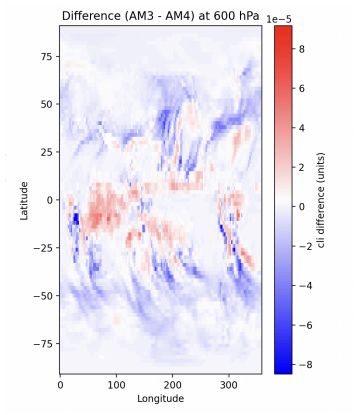
150 hPa

At 150 hPa, model AM3 shows slightly higher amounts of cloud ice near the equator compared to model AM4. This means that in tropical regions near the equator, especially towards the southern part, the AM3 model both contains more cloud ice overall and concentrates cloud ice more than model AM4 does.

		
Model AM3	Model AM4	Difference

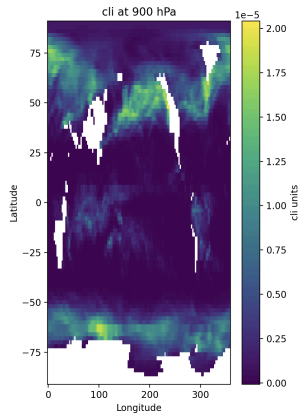
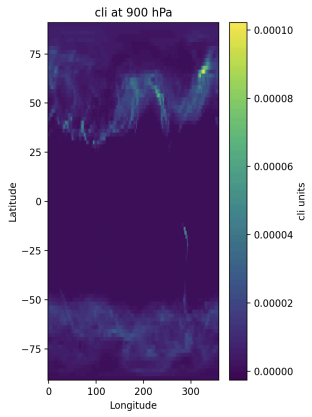
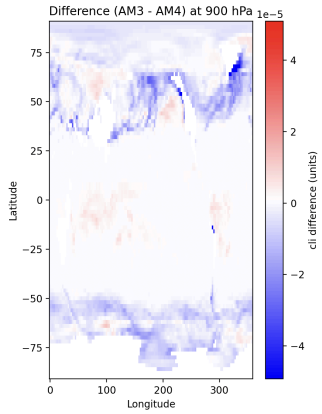
600 hPa

At 600 hPa, model AM3 generally has a higher concentration of cloud ice near the equator than model AM4, with few exceptions. Conversely, moving further away from the equator yields a cloud ice difference increasingly in favor of model AM4; the cloud ice concentration in AM4 progressively increases up to about 40 degrees in latitude away from the equator. Beyond that, the magnitude in which AM4 is greater than AM3 decreases and starts to approach a lesser, constant value.

		
Model AM3	Model AM4	Difference

900 hPa

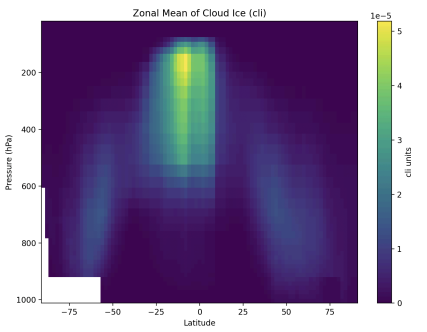
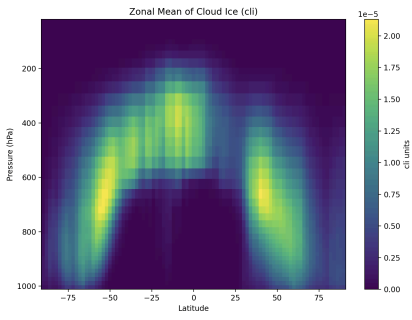
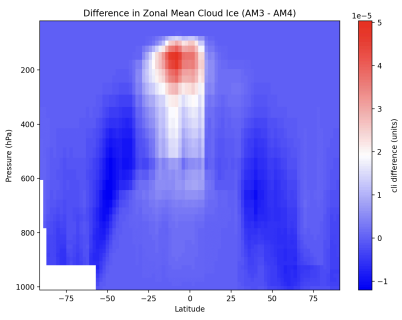
At 900 hPa (near the surface), AM3 almost never exceeds AM4 in cloud ice concentration, and even when such happens (near the equator), it only does so by a small margin. Moreover, AM4 has substantially low cloud ice levels, while AM3 shows comparatively higher concentrations. However, both AM3 and AM4 at 900 hPa have cloud ice that is more sparsely distributed from the equator than those observed at lower pressures (higher altitudes). Additionally, when compared with 150 hPa and 600 hPa, both models in 900 hPa observe lower overall cloud ice levels (as expected); furthermore, model AM3 has substantially fewer data points than model AM4, which suggests that AM4 is an improved model of AM3.

		
Model AM3	Model AM4	Difference

(b) Zonal Means

The zonal mean analysis is more concrete on how cloud ice varies with latitude and altitude. In model AM3, the zonal mean has high cloud ice concentrations at low pressures, particularly in the 100-300 hPa range, and most of such being concentrated at the equator. In contrast, however, AM4 has a wider distribution across all latitudes, and its maximum zonal mean is about 3 cli units lower than that of AM3.

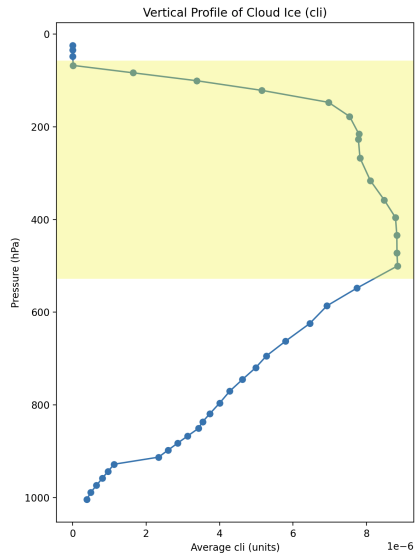
Despite the fact that AM4 has a more visible “wide” distribution, its overall distribution loosely relates with that of AM3, which suggests that AM4 might be a more improved version of AM3; a tip-off point for this is with AM3 having more noticeable gaps (notably in the lower left-hand corner). It is interesting, however, that the error/discrepancy between AM3 and AM4 is on the same order (10^-5) as that of the measured values, which shows more than just a minor experimental variation.

		
Model AM3	Model AM4	Difference

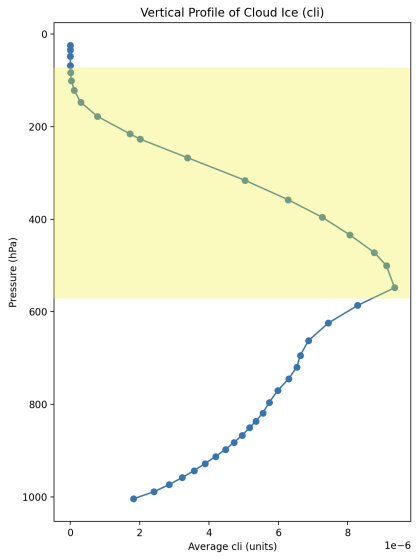
(c) Cloud Ice Profiles

Vertical profiles of cloud ice provide an aggregated view of cloud ice concentrations varied over different pressures which are then averaged over both latitude and longitude (instead of just longitude as in part b).

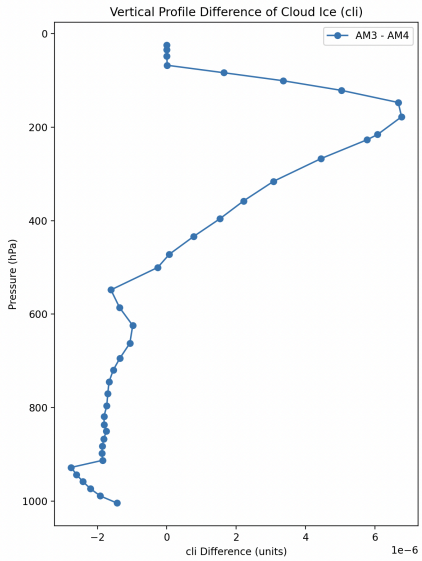
Model AM3 has a sharp "spike" – a fast increase in cloud ice concentration at higher altitudes, especially around 150-200 hPa, which is consistent with the earlier heatmaps. However, AM4 has a much smoother and more differentiable curve, with the peak being less dramatic: instead of a sharp slope, the increase in cloud ice with altitude is slow and gradual. A difference plot (AM3 - AM4) helps to describe this, too, that at high altitudes, AM3 generally predicts higher cloud ice concentrations than AM4, which is consistent with prior observations.



Model AM3



Model AM4



Difference

Overall Findings

Both models AM3 and AM4 have cloud ice distributions that rely on altitude. At high altitudes (150 hPa), model AM3 has more significant spikes near the equator, whereas AM4 has a more smoother, gradual increase. At medium altitudes (600 hPa), AM3 has higher concentrations near the equator but AM4 eventually overtakes AM3 at higher latitudes. Near the surface of the earth at 900 hPa, both the AM3 and AM4 models have low cloud ice levels, with AM3 slightly surpassing AM4 towards the equator.

Overall, model AM4's more uniform and smoother distribution with fewer data gaps suggest that it may be an improved version of model AM3.