Cloud Ice Level Analysis Test

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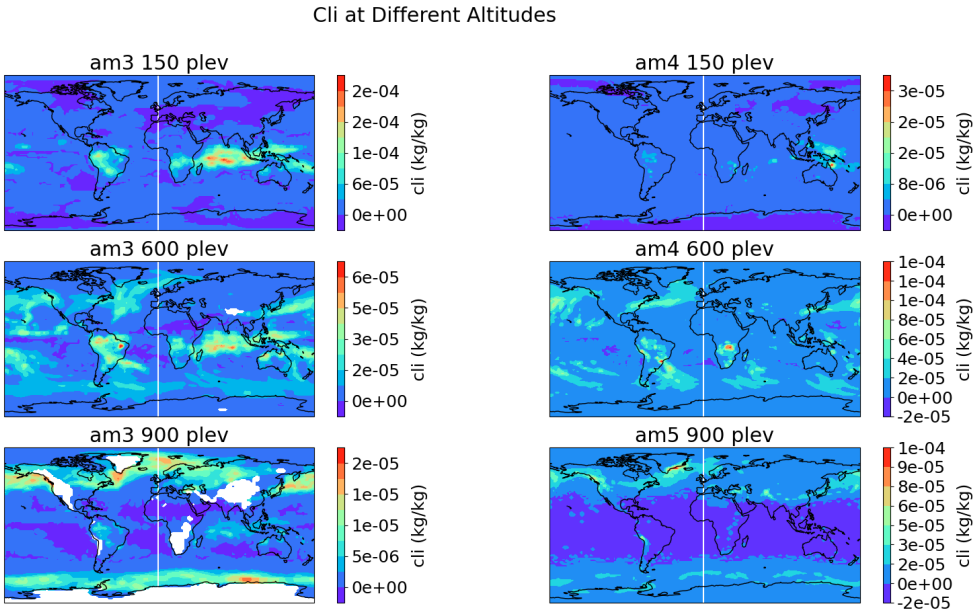
1 Overview

This report summarizes the differences between cloud ice data (CLI) simulated by two models, am3 and am4. The data has been examined in three perspectives, first in maps generated at selected altitudes, then by latitude and pressure level, and lastly by only pressure level. In all three perspectives, significant differences have been identified. Analysis was done in Python using matplotlib.

2 Data

2.1 Cloud Ice Levels at Different Pressures

Figure 1: Cloud Ice Level at 3 Pressure Levels



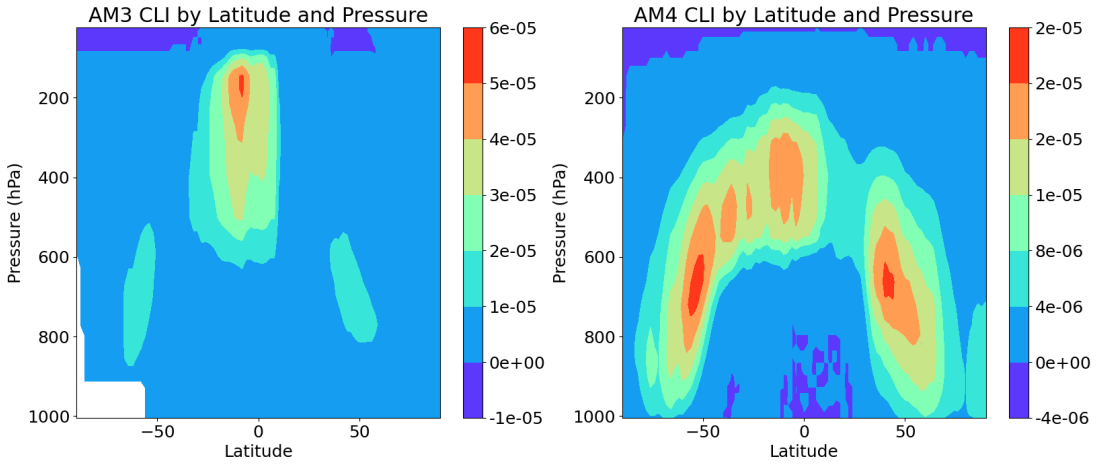
There is no data for some parts of am3 900 hPa map as some data was masked in the data files

To determine differences in cloud ice levels, the data from each model was graphed at three different pressure levels, representing altitudes, 150, 300, and 900 hPa. Upon visual inspection, at 150 hPa, in the am3 model, there are much higher amounts of ice in clouds over the Indian Ocean and South Africa. Additionally, there is ice in clouds over South America and Sotheast Asia. In comparison, in the am4 model,

there is little to no ice in any clouds at 150 hPa. The highest levels of cloud ice within the model are found in the am3 model over the indian ocean, as well as over South Aemerica, at 150 hPa. At 600 hPa, both models display some ice over the North Pacific, with more in the am4 model. Both models also display ice over South America, extending into the south Atlantic, and the North Atlantic, near Greenland and New England. A notable difference between the models at this altitude is that am3 displays sea ice over the Indian Ocean, while ice is completely absent there in am4. At 900 hPa, there is virtually no ice in the am3 model, while in the am4 model, there is some ice over the coast of northern Canada and Alaska, as well as in the Atlantic near the coast of Greenland.

2.2 Cloud Ice levels at Different Latitudes

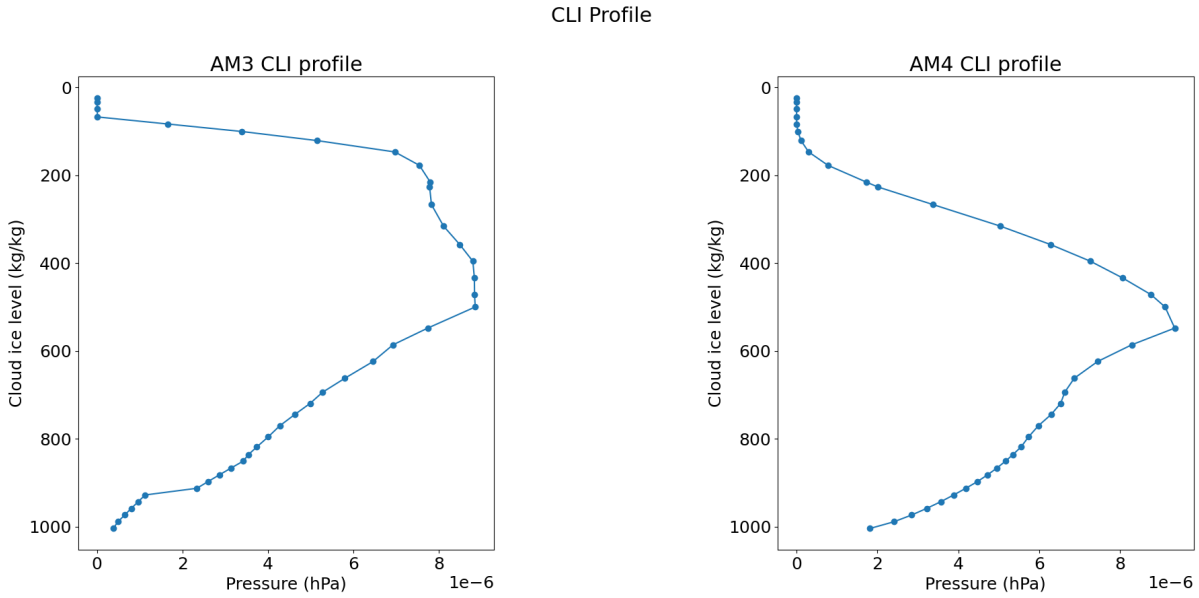
Figure 2: Latitude vs. Pressure Level



Regarding latitude and altitude, the overall shape of the model data is similar, with ice near the poles at low altitudes and near the equator latitude at high altitudes. Am3 differs from am4 in that there is an extremely high average cloud ice level, at approximately 6e-5 kg/kg at -10 latitude and 150 hPa. This is consistent with the results of Figure 1, where there are high amounts of cloud ice near 0 latitude and 150 hPa (over South America and the Indian Ocean). Am4 is more continuous, with cloud ice forming an approximately parabolic trend between -60 latitude and 800 hPa, -10 latitude and 400 hPa, and 50 latitude and 700 hPa.

2.3 Cloud Ice Level Profile

Figure 3: Cloud Ice Level Profile



Lastly, we will examine the distribution of cloud ice as it relates to altitude. Both models have maximums at similar pressures of approximately 550 hPa, reaching an average ice level of 9e-6 at the peak. However, while average ice levels increase smoothly from 100 to 550 hPa in am4, ice levels rise sharply from 0 to 8e-6 from 50 to 150 hPa in am3, and slowly increase from there to the a peak at 550 hPa. This is consistent with the data displayed in Figure 1, where there are high levels of cloud ice at 150 hPa, compared to very little cloud ice at 150 hPa in am4. From there, The average ice level of both models decrease as pressure increases and altitude decreases.

3 Conclusion

Both models simulate cloud ice levels with similar distributions at 600 hPa, and mainly differ in the high presence of cloud ice over South America and the Indian Ocean at 150 hPa, which is consistent across Figures 1, 2, and 3.