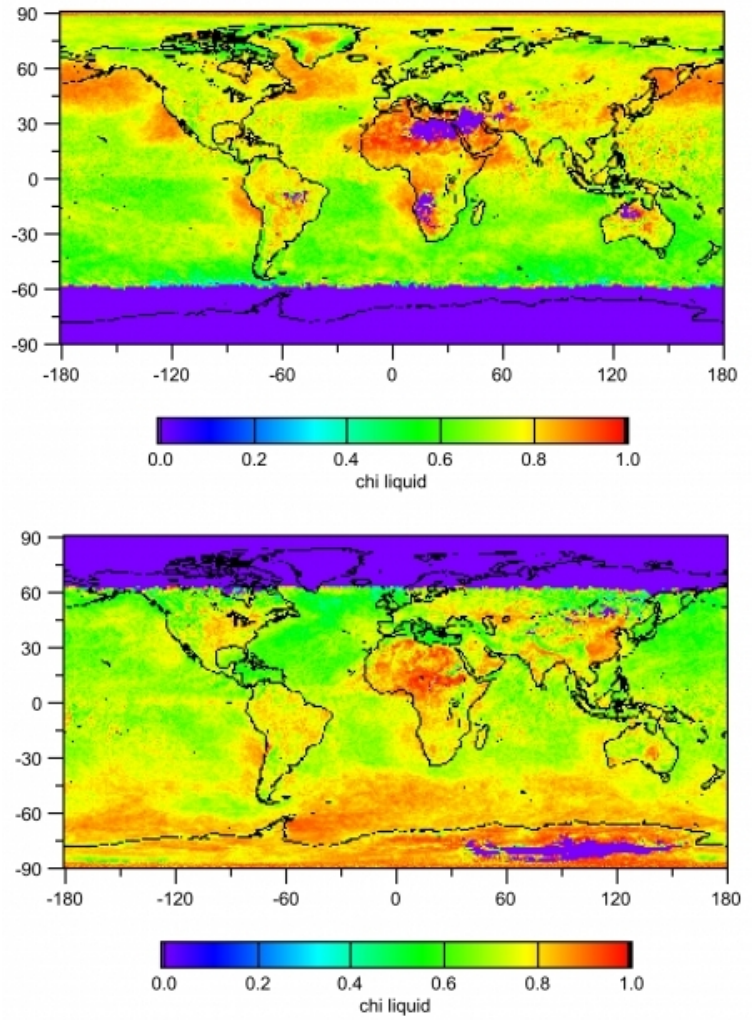
Cloud inhomogeneity from MODIS



Horizontally inhomogeneous clouds reflect, transmit, absorb, and emit different amounts of solar or thermal (infrared) radiation than their homogeneous counterparts. By quantifying cloud inhomogeneity on a global basis we hope to make advances in the representation of clouds of Global Climate Models. If the model clouds are not realistic, errors in the estimates of Earth's radiation budget will be inevitable without some kind of model "tuning". Assuming that one day we will be able to predict cloud variability in climate models, we would like to examine whether the modelled variability exhibits similar magnitudes and features as the variability in the observations. For example, work by Oreopoulos and Cahalan (see reference below) finds that clouds are more variable over oceans than over land, more variable during the winter than the summer, more variable in the afternoon than in the morning. Will the models be able to reproduce these results? The figure provides a global picture of cloud inhomogeneity at ~100 km (1x1 degree) scales from 1 km observations by the instrument MODIS aboard the Terra satellite. The top panel is for the month of July 2003 and the bottom panel for the month of January 2004. Only clouds consisting of liquid cloud droplets are represented in this figure. As a measure of cloud inhomogeneity we use the parameter chi, defined as the ratio of the logarithmic to the linear mean of cloud optical thickness corresponding to each 100 km region. This ratio is approximately the factor by which the mean regional optical thickness should be scaled in order to recover the correct domain-averaged solar flux reflected by clouds. The smaller chi is, the more inhomogeneous the clouds are. The figure shows that strong fluctuations of cloud inhomogeneity both geographically and seasonally take place.

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