OBSERVED CLOUD OPTICAL THICKNESS VARIABILITY:
SPATIO-TEMPORAL REGIME OF VALIDITY AND CLIMATOLOGY

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A quantitative measure of cloud optical thickness variability has been developed as an extension of work on the effect of inhomogeneous droplet distributions on radiative transfer carried out by Cairns, et. al. (JAS in press). Expression of the microphysical parameterization in terms of the optical thickness (necessary for its evaluation from satellite imagery and subsequent implementation in climate GCMs) imposes limits on the spatial scale over which the variability statistic is a useful quantity. Dynamical considerations (e.g. the time scale for the thermal response of the atmosphere through turbulent motion) are seen to impose additional limits on both the spatial and temporal scales over which the variablity statistic should be evaluated. The spatio-temporal regime of validity has important consequences relevant to current questions concerning the role of sub-grid-scale cloud fraction, 3D effects on optical thickness retrievals, spectra of variability, etc. Estimates will be made of the valid scales, and the scale dependence of the variability statistic within those limits will be examined using data from the International Satellite Cloud Climatology Project (ISCCP). Representative results from a global climatology computed at scales appropriate to GCMs will be presented, as will preliminary results relating boundary layer cloud variability to underlying turbulent processes.