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The Cloud Slicing Technique- Measuring the Unmeasurable

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In satellite remote sensing clouds are usually considered an annoying interference. Satellite investigators go to unusual lengths to try to avoid clouds or to correct for their effects, and satellite data users routinely exclude cloudy data from analysis. Yet it was shown about a decade ago using TOMS data that for the study of tropospheric constituents, such as ozone, clouds can play a very beneficial role by allowing one to measure what otherwise cannot be directly measured from space. We call this technique "cloud Slicing". The so-called Convective Cloud Differential (CCD) method is one particular application of cloud slicing that has been applied successfully to data from TOMS and other similar satellite instruments to study the behavior of tropical tropospheric ozone at variety of spatial and temporal scales. However, there has been considerable confusion in the literature as to what exactly one measures from reflected sunlight instruments such as TOMS in cloudy atmospheres. We will discuss recently completed analysis of data taken by the Ozone Monitoring Instrument (OMI) on the Aura satellite in conjunction with several other instruments on the A-train satellite constellation to present new insight on how clouds affect absorption by aerosols and trace gases at reflected wavelengths (UV-SWIR). We will show several examples to illustrate how this insight is helping us to study the behavior of trace gases and aerosols in the atmosphere that cannot be studied by focusing only on cloud-free scenes.