Atmos. Chem. Phys. Discuss., 8, S2942–S2944, 2008
www.atmos-chem-phys-discuss.net/8/S2942/2008/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Clouds-Aerosols-Precipitation Satellite Analysis Tool (CAPSAT)" *by* I. M. Lensky and D. Rosenfeld

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Received and published: 22 May 2008

The standardization of multi-channel color representations is an excellent idea. Most low Earth orbiting imagers have the necessary channels used in this article as will next-generation geostationary sensors. Just as grayscales are commonly understood and interpreted by satellite users worldwide (eg, black-to-white as visible channel reflectance increases; black-to-white as thermal temperatures become colder), a standardization of color representations for various depictions (microphysical, air mass, etc) would be beneficial.

Note: Plank should be spelled Planck throughout.

Day Natural Colors: In this rendition bare ground appears in a brownish color (1.6 um reflectance feeds the red) and vegetation appears green (0.8 um channel feed

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the green), which is a pseudo representation of what these (cloud-free) surfaces look like from space when viewed by eye. Is there a way to discriminate clouds from no-clouds using a decision-tree threshold in the RGB values? This would make for a cloud mask which would then allow the cloud-free representations to be transparent. Such a representation is appropriate for GIS systems, where one may not want the cloud-free regions to cover up any layers of data and/or other imagery. The use of an alpha PNG image format would allow this, which provides for not only the RGB representation used here, but an additional transparency layer (the alpha layer). When viewed from elevation, a certain amount of the underlying surface is transmitted through thin cloud layers. By using such an alpha layer, the representation could be made to provide even more realism. This is especially relevant in this era of “virtual globes” like Google Earth, which are ideal for displaying environmental satellite imagery of land, ocean, and atmospheric phenomena. (transparency-layer formats are supported in virtual globes).

Identifying Cloud-Free Regions: I realize that this study is an image depiction analysis and (intentionally) does not attempt any physical cloud/no-cloud discrimination. However, the image enhancements could be improved upon (as noted above) if the no-cloud regions could be indentified. Not only for cloud screening, but also because land surface properties change seasonally (Figures 5-11 only showed one example from one season), and also daily (surface temperature swings throughout the day as the sun heats and cools the surface, the rates of which vary with surface type). This would allow, for example, the RGB formulations to build differently for cloud and no-cloud regions. Various authors have tried to remove the cloud-free regions by building up the cloud-free background values in the channels sensitive to reflected sunlight, at different times-of-day to account for solar zenith angle changes, and over previous-day time windows to account for seasonal changes. For thermal channels, the background (surface skin temperature) could be estimated by using the analysis of a global NWP model and then adjusting for surface emissivity variations at the various channels. Both of these approaches have their pros and cons (ie, thermal contrasts between low clouds

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and the surface are poor) and work better when used over limited areas (rather than applied globally).

Adapting for satellites/sensors other than MSG/SEVIRI: These formulae have been developed explicitly for MSG/SEVIRI and associated imager channel characteristics. They could be adapted for other sensors with similar channel center wavelengths with some tuning which would likely be trial-and-error, in order to make the appearance to the eye to be seamless from one sensor to the next. An idea is to use a “reference standard” (a high quality sensor onboard a low Earth orbiting satellite) that passes over all areas covered by geostationary imagers several times per day. This is akin to how one of the NOAA AVHRR sensors is used as a reference for the multi-satellite ISCPP cloud dataset. Is such a referencing approach a viable option for the CAPSAT depictions? For example, the formulae of Table 1 would be built for MODIS which would be the reference sensors, and then adapted via the channel transfer functions (bandpass and S/N characteristics) of any other satellite.

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 4765, 2008.