



CHARACTERISTICS OF THE AVHRR PATHFINDER EXTENDED (PATMOS-x) CLOUD CLIMATOLOGY



Andrew Heidinger
NOAA-NESDIS
Andrew.Heidinger@noaa.gov

Amato Evan
University of Wisconsin-CIMSS
Amato.Evan@ssec.wisc.edu

Introduction

The AVHRR PATHFINDER Atmospheres Extended is an AVHRR climate data-set and processing system from NOAA/NESDIS that operates on the Advanced Very High Resolution Radiometer (AVHRR) on the POES and METOP platforms (1981-2012). Due to its length, the AVHRR data record provides a unique resource of multi-decadal climate studies. PATMOS-x has recently been analyzed as part of the GEWEX cloud climatology assessment panel. One goal with PATMOS-x is to improve the quality of the data-set through our work with recalibrating and re-navigating the data. Our main goal is derive climate records that can be with confidence to study climate variability over the last 30 years and that used in conjunction with the data-records from the AVHRR's successors (MODIS and VIIRS). The goal of this poster is to

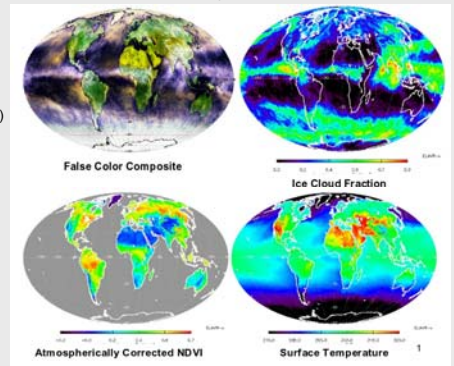
1. Provide a summary of our attempts to use new data to characterize the performance of PATMOS-x
2. Present some of the characteristics of the data-set that have been revealed to date.

PATMOS-x Products

- 0.5° equal-area grid
- Includes morning and afternoon data
- Daily maps for each satellite node
- Monthly maps for each satellite and node
- Monthly maps for all data (diurnal average)
- Full suite of cloud properties
- Other products include dust fraction and aerosol optical thickness over ocean
- Surface temperature and NDMI
- Radiance statistics
- Data is available (see link)

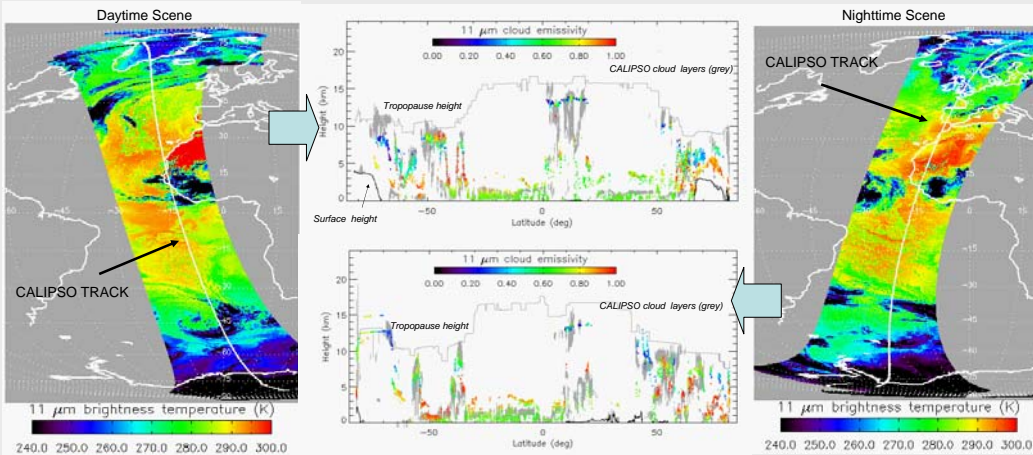
<http://cimss.ssec.wisc.edu/clavr/patmosx>

Example Images of PATMOS-x Data

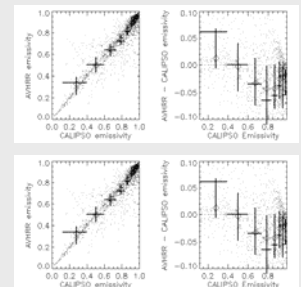


Using CALIPSO to Characterize PATMOS-x

Fortunately, the AVHRR data record extends into period with data from CALIPSO and CloudSat on the EOS A-Train. We have developed analyses to use CALIPSO data to characterize the performance of the AVHRR cloud detection and height-/emissivity estimation. Though their orbits differ, the orbits of NOAA-18 and CALIPSO do align periodically. The images below example AVHRR and CALIPSO scenes during a period where the orbits were aligned. We have analyzed months of data to analyze the global performance of AVHRR cloud products. The scatterplots on the right show the AVHRR-CALIPSO results for August 2006.



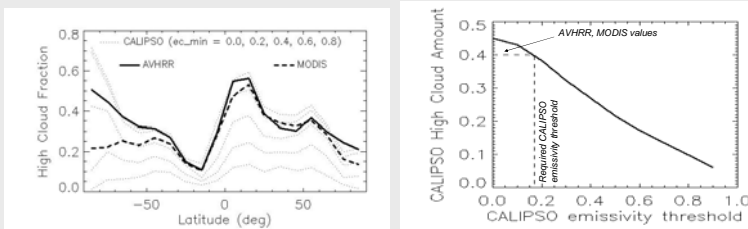
Results of all CALIPSO-AVHRR matches for August 2006. Performed on PATMOS-x gridded data (0.5 degrees).



Instantaneous CALIPSO comparisons indicate that AVHRR results can be very wrong. Pursuing new techniques to mitigate these issues. Global comparisons do indicate good performance overall. For these orbits, 90% of the AVHRR clear pixels where also clear in the CALIPSO data and nearly 97% of the AVHRR cloudy pixels where cloudy in the CALIPSO data.

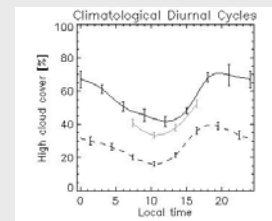
Using CALIPSO to Characterize the Sensitivity of PATMOS-x products to the Presence of Cloud

Using the 11 micron radiance from the AVHRR, the computed clear radiances and the CALIPSO cloud heights, one can compute an 11 micron cloud emissivity from the CALIPSO data. One can then filter the CALIPSO results based on this emissivity to simulate what CALIPSO would see if could see clouds with emissivities larger than a threshold. The figures below show this analysis applied to High Cloud Amounts derived from AVHRR/PATMOS-x, MODIS and CALIPSO. The MODIS values are from the MOD06 Collection 5 data from NASA Goddard. The zonal distributions show that AVHRR and MODIS agree well except near the poles. The image on the right shows what CALIPSO emissivity threshold is needed to match the AVHRR and MODIS values in the Tropics (which are both about 40%). This analysis indicate CALIPSO matches AVHRR and MODIS if clouds with emissivities less than 0.2 are ignored.

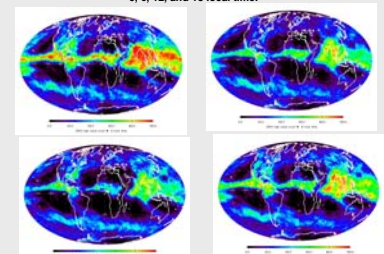


Correcting for Orbital Drift

A problem plaguing any climatology based on POES data is the limited and variable diurnal sampling. We have attempted to derive cloud amounts that are adjusted to common observation times. We did this by developing climatological diurnal cycles using all of the diurnal sampling present in the PATMOS-x data from morning and afternoon AVHRR's. We then used the climatological diurnal cycles to adjust the individual cloud amounts to a common observation time. The figure below shows an example diurnal cycle of high cloud amount in one grid-cell. The four maps below provide images of the adjusted high cloud for 0, 6, 12 and 18Z. Our goal is to use this diurnal adjustment to improve our long term time series.

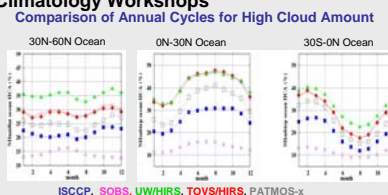


Diurnal Cycle of High Cloud for July 2004 produced at 0, 6, 12, and 18 local time.



Characteristics of PATMOS-x Revealed in GEWEX Cloud Climatology Workshops

- The second workshop report is being drafted by Claudia Stubenrauch as focused on layered cloud amounts. Based on this work, we can summarize the characteristics of PATMOS-x as
- PATMOS-x (and all satellite climatologies) produce similar seasonal cycles outside the polar regions.
- PATMOS-x tends to classify a higher fraction of clouds as high than ISCCP.
- PATMOS-x total cloud amounts tend to be slightly less than ISCCP and significantly less than the TOVS based climatologies.
- PATMOS-x missed cloud over cold land during night



ISCCP, SOBS, UWHRIS, TOVS/HRIS, PATMOS-x