

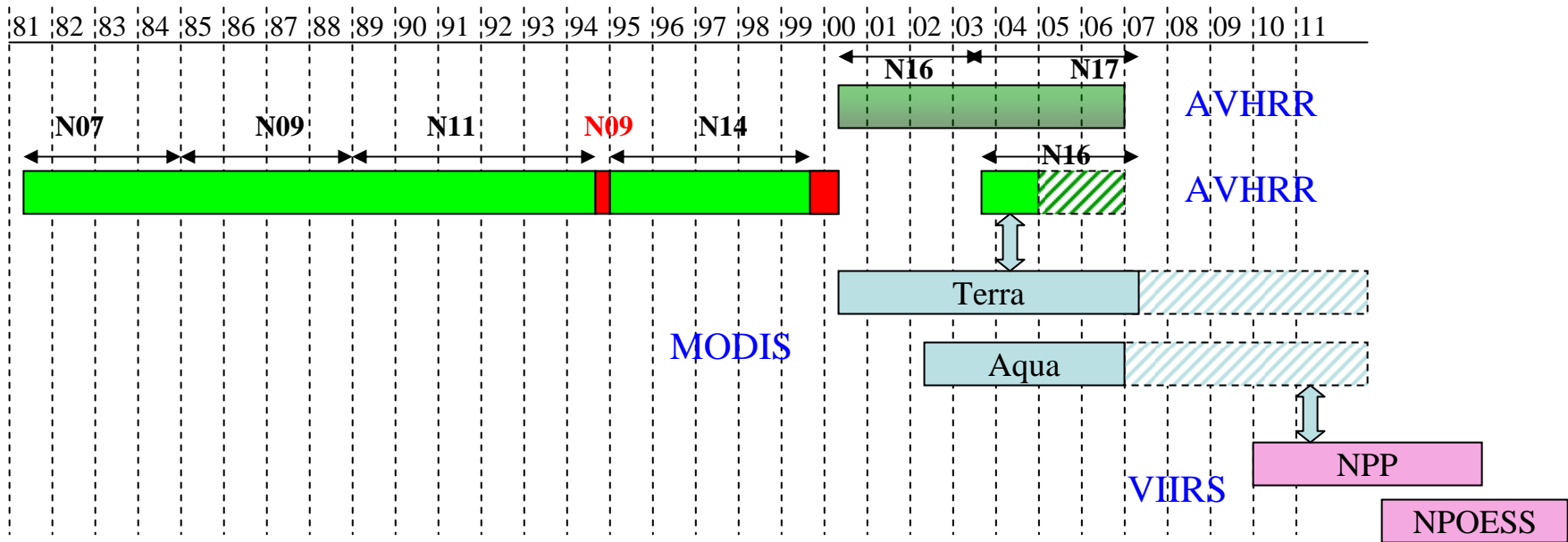
A 0.05 degree global climate/interdisciplinary long term data set from AVHRR, MODIS and VIIRS

- *NASA*: Ed Masuoka (MODAPS), Nazmi Saleous, **Jeff Pedelty (Processing)**, **Sadashiva Devadiga (Quality Assessment)**, Jim Tucker & Jorge Pinzon (Assessment)
- *UMD*: **Eric Vermote (Science)**, Steve Prince (Outreach), Chris Justice
- *NOAA*: Jeff Privette (Land Surface Temperature)
- *South Dakota State University*: David Roy (Burned Area)
- *Boston University*: Crystal Schaaf (BRDF/Albedo)

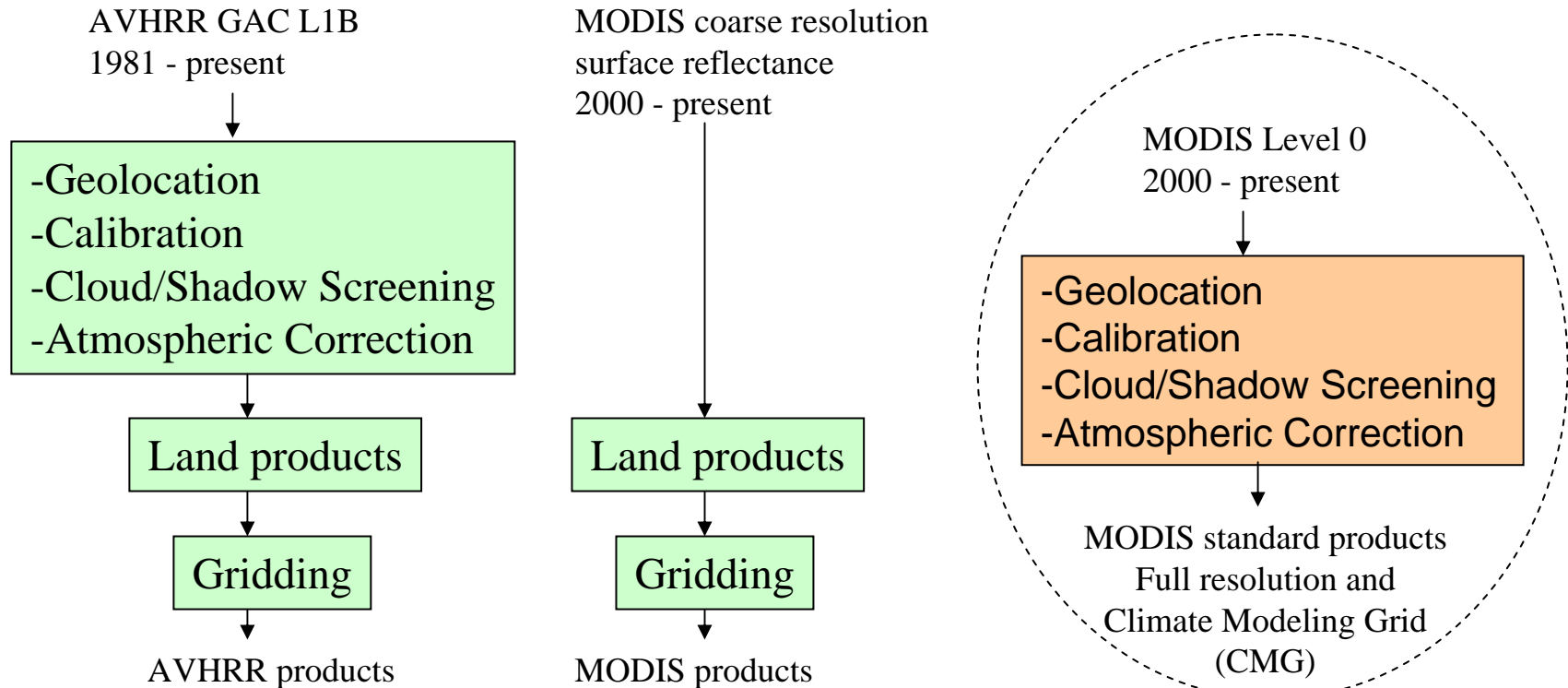
Land Long Term Data Record

- Develop and produce a global long term coarse spatial resolution (0.05°) data record from AVHRR, MODIS and VIIRS for use in global change and climate studies.
- Use a MODIS-like operational production approach including an operational QA team.
- Set up an advisory process.
- Make intermediate versions of the data sets available to the community through a web interface and solicit input from users.
- Hold community workshops for outreach and feedback.
- Prototype the development and production of a climate quality data record (CDR).

Data Sources



AVHRR and MODIS Production Systems



List of potential products:

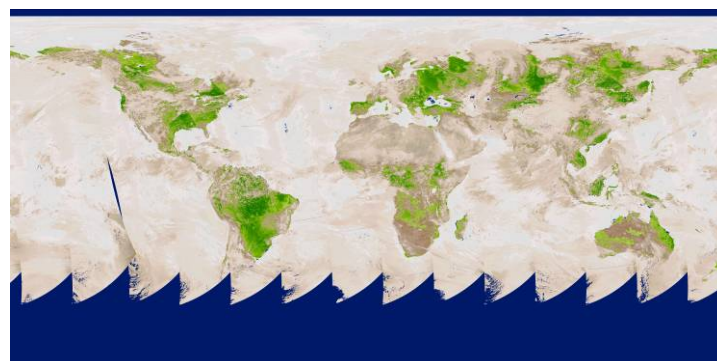
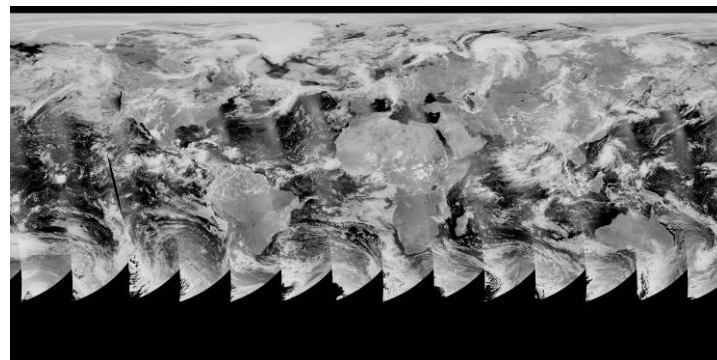
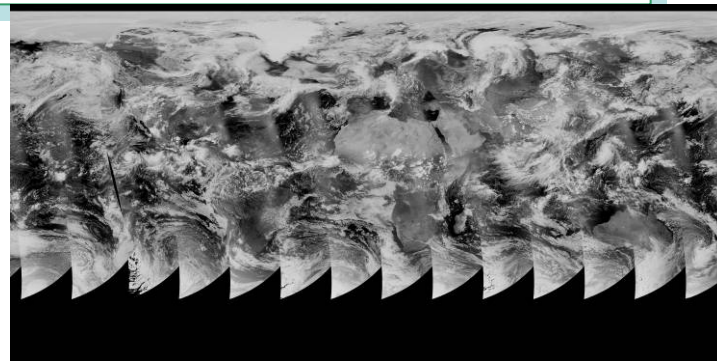
Surface Reflectance, VI,
Land surface temperature/emissivity,
Snow, BRDF/Albedo, Aerosols,
burned area, LAI/FPAR

Format:

HDF-EOS
Geographic projection 1/20° resolution
Daily, multi-day, monthly

Production of the Beta (Version 1) Data Set

- Algorithms:
 - Vicarious calibration (Vermote/Kaufman)
 - Cloud screening: CLAVR
 - Partial Atmospheric Correction:
 - Rayleigh (NCEP)
 - Ozone (TOMS)
 - Water Vapor (NCEP)
- Products:
 - Daily surface reflectance (AVH09C1)
 - Daily NDVI (AVH13C1)
 - 16-day composited NDVI (AVH13C3)
 - Monthly NDVI (AVH13CM)
- Format:
 - Linear Lat/Lon projection
 - Spatial resolution: 0.05°
 - HDF-EOS
- Time Period:
 - 1981 – 2000 **completed (Beta = ver 1)**
- Distribution:
 - ftp and web



NOAA-11 - 1992193 (7/11/1992) : Ch1,
Ch2 and NDVI

LTDR QA Home Page



GODDARD SPACE FLIGHT CENTER

[+ NASA Homepage](#)

Land Long Term Data Record

Quality Assessment

[LTDR Products](#)
[LTDR File Specification](#)
[Calibration](#)

[Global Browse](#)
[Time Series](#)
[Known Product Issues](#)
[Algorithm Test](#)
[QA Tools](#)

[Science Team Member](#)
[QA Personnel](#)
[FAQ](#)
[Feedback](#)

Welcome to the Land Long Time Data Record Quality Assessment Web Page

The objective of LTDR QA is to evaluate and document the scientific quality of the global LTDRs (Long Term Data Records) made from remotely sensed data acquired using AVHRR (Advanced Very High Resolution Radiometer), MODIS (Moderate Resolution Imaging Spectroradiometer) and VIIRS (Visible/Infrared Imager Radiometer Suite). LTDRs are currently being produced as single global data record for each science parameter at a coarse resolution of 0.05 deg. Any discrepancy in the data records or QA-related issues identified by the QA process are posted on the Known Issues web page. These issues are updated as new versions of data records are produced using improved algorithms.



[+ Privacy Policy and Important Notices](#)



Web Master: [Min Zheng](#)
NASA Official: [Ed Masuoka](#) Code 614.5
[+ LTDR QA Home Page](#)
[+ LTDR Home Page](#) Last Updated: May 3, 2006

Land Long Term I



LTDRe are produced as CMG (Climate Mo these data records are posted at this web site supports interactive selection of browse prod

Browse Availability:
 NOAA-07: 1981-176 -- 1984-365
 NOAA-09: 1985-001 -- 1989-312
 NOAA-11: 1988-313 -- 1994-365
 NOAA-14: 1995-001 -- 2000-365

Please direct your questions and comments

Please Select:

- Satellite:**
 NOAA-07
 NOAA-09
 NOAA-11
 NOAA-14
 NOAA-16
- Collection:**
 Collection 1

NOAA-07, AV

Select a region you w
Note: If you can not dr
 right: 900,450).

◀ 1 day 1 day ▶



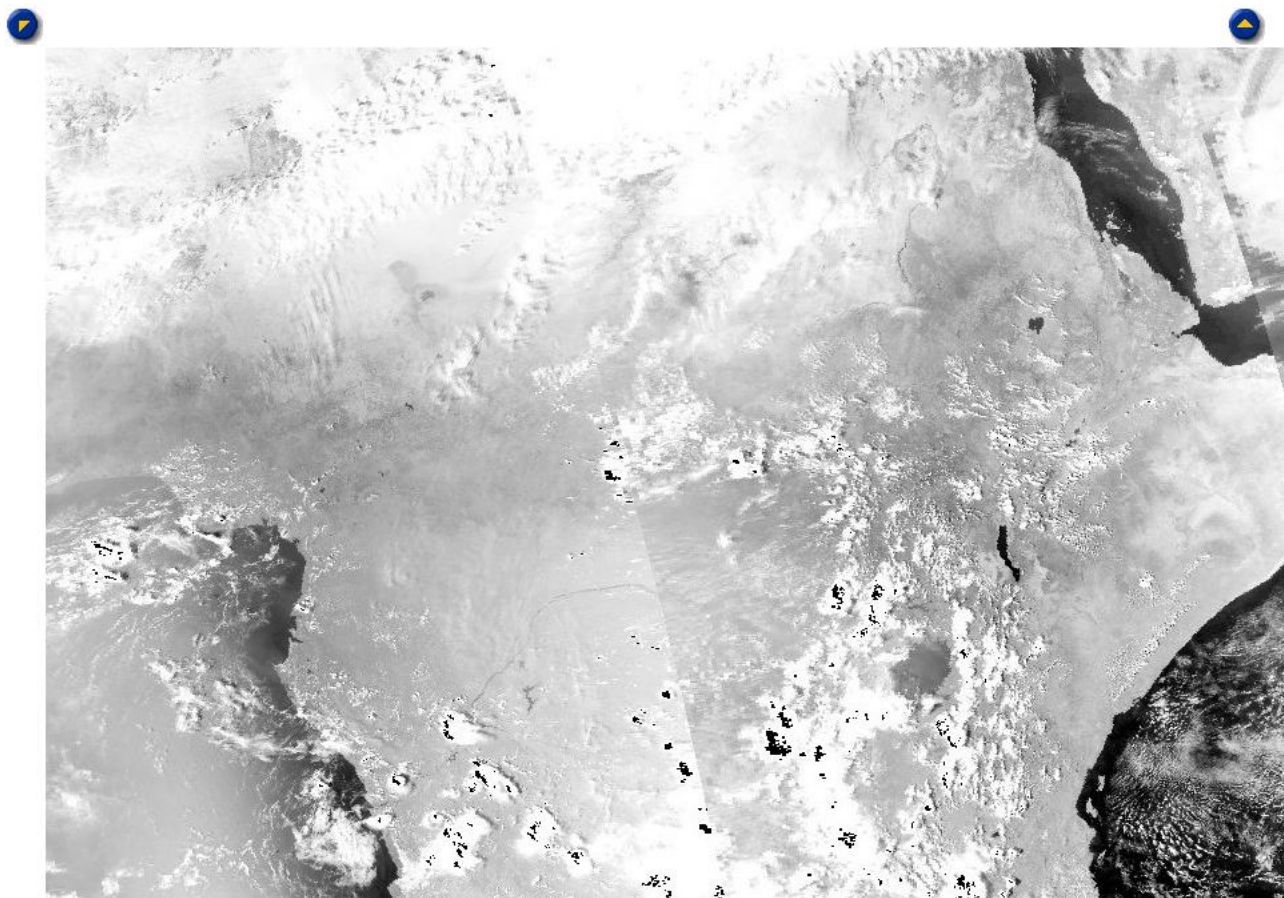
Collection 001

Julian Day	Daily Surface Reflectance (AVHRC1)	Daily Vegetation (AVH1D)
1985 022		
021		
1985 031		
01/01		
1985 030		
01/00		
1985 029		
01/29		
1985 028		
01/28		
1985 027		
01/27		
1985 026		
01/06		
1985 025		
01/25		
1985 024		
01/04		
1985 023		
01/03		

◀ 1 day 1 day ▶



Land Long Term Data Record



Data Set Evaluation



GODDARD SPACE FLIGHT CENTER

Land Long Term Data Record

Time Series

A time series of summary statistics derived from all the LTDR locations is maintained and monitored by the LTDR QA page on the internet. Time series statistics are extracted at all [Aeronet sites](#). Time series are important because they capture algorithm sensitivities (e.g. aerosol loading) and remote sensing (e.g. sun-surface-sensor geometry). They allow changes in the instrument characteristics and calibration to be detected (listed in alphabetical order) or tile and biome combinations.

First: Aeronet Golden Tile

Year:
1982
1983
1984
1985
1986
1987
1988
1989
1990

Aeronet area:
(Search areas beginning with the selected letter)
A
B
C
D
E
F
G
H
I
J

Tiles:
h09v05 (South Africa)
h11v03 (North America)
h11v08 (North America)
h11v11 (North America)
h17v07 (Savannah)
h20v11 (South America)
h24v04 (North America)
h26v04 (North America)
h30v11 (Central America)

Submit the Request



[+ Privacy Policy and Important Notices](#)



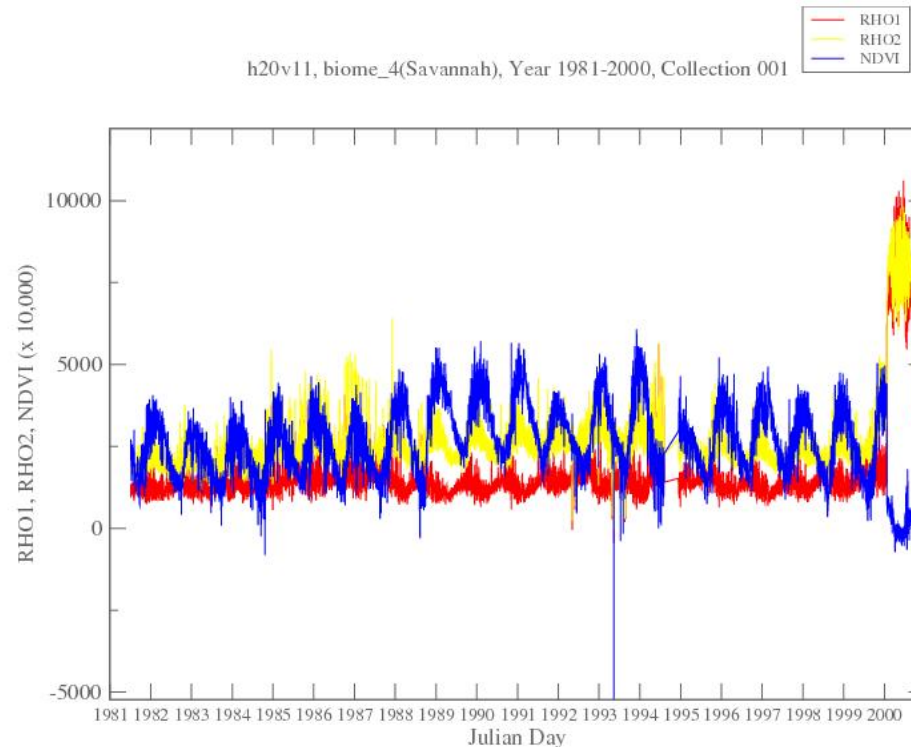
GODDARD SPACE FLIGHT CENTER

[+ NASA Homepage](#)

Land Long Term Data Record

Time Series

h20v11, biome_4(Savannah), Year 1981-2000, Collection 001



Fri May 5 11:27:00 2006

The calibration of the AVHRR has been thoroughly evaluated



Available online at www.sciencedirect.com



Remote Sensing of Environment xxx (2006) xxx–xxx

Remote Sensing
of
Environment

www.elsevier.com/locate/rse

Calibration of NOAA16 AVHRR over a desert site using MODIS data

E.F. Vermote ^{a,*}, N.Z. Saleous ^b

^a University of Maryland, Department of geography and NASA GSFC, Code 614.5, United States

^b SAC and NASA GSFC Code 614.5, United States

Received 24 February 2006; received in revised form 16 June 2006; accepted 27 June 2006

Abstract

This paper presents a new approach to AVHRR-sensors cross-calibration in the visible to shortwave-infrared spectral domain using an a-priori, well calibrated sensor (MODIS). The approach has been tested over a stable Sahara desert site and was initially applied to compare the absolute calibration coefficients of three different bands of the Terra and Aqua MODIS instruments. The observed agreement was better than 1% for bands 1 (0.67 μm), 2 (0.87 μm) and 7 (2.13 μm). The approach was then applied to cross-calibrate the AVHRR sensor onboard NOAA16. The absolute calibration coefficients derived for bands 1 and 2, using the Terra MODIS as a reference, were compared to the vicarious coefficients derived using the ocean and clouds method (Vermote E.F. and Kaufman Y.J. (1995). Absolute calibration of AVHRR visible and near-infrared channels using ocean and cloud views, International Journal of Remote Sensing, 16, 13, 2317–2340). The coefficients were consistent within less than 1%.

Keywords: Calibration; AVHRR; MODIS



Fig. 2. Location of the 20 km by 20 km calibration site (centered on the red square). The image represents an area of 1000 km by 1000 km.

The coefficients were consistent within less than 1%

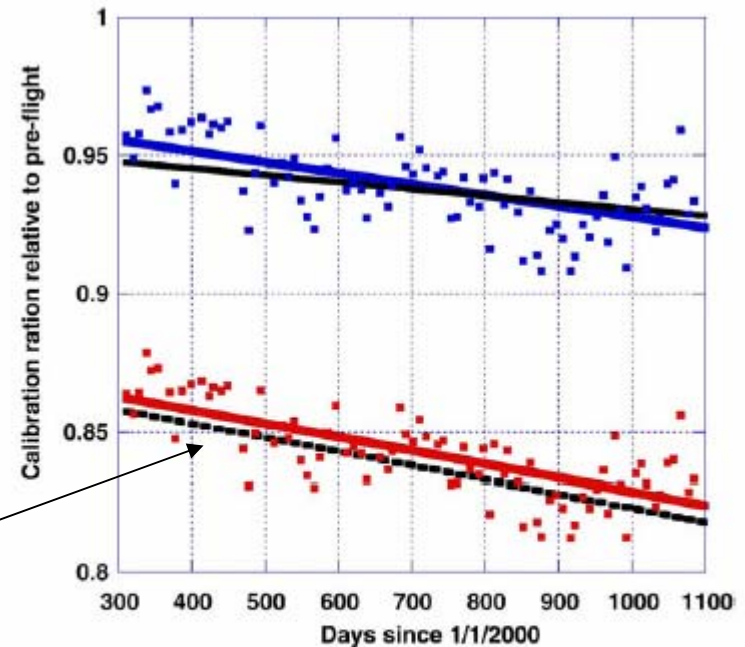
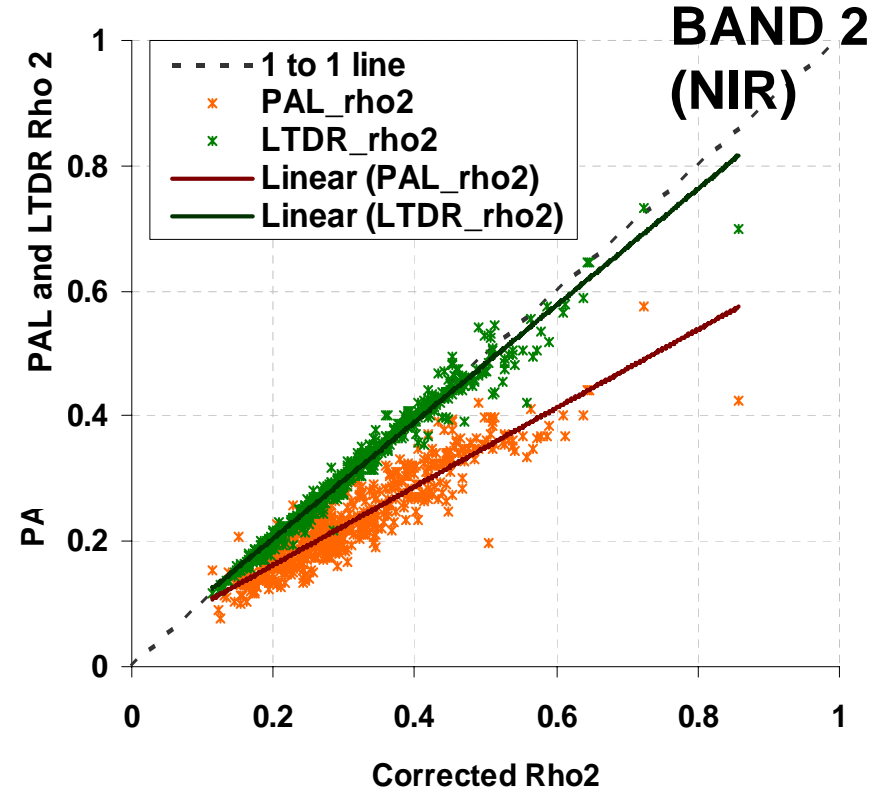
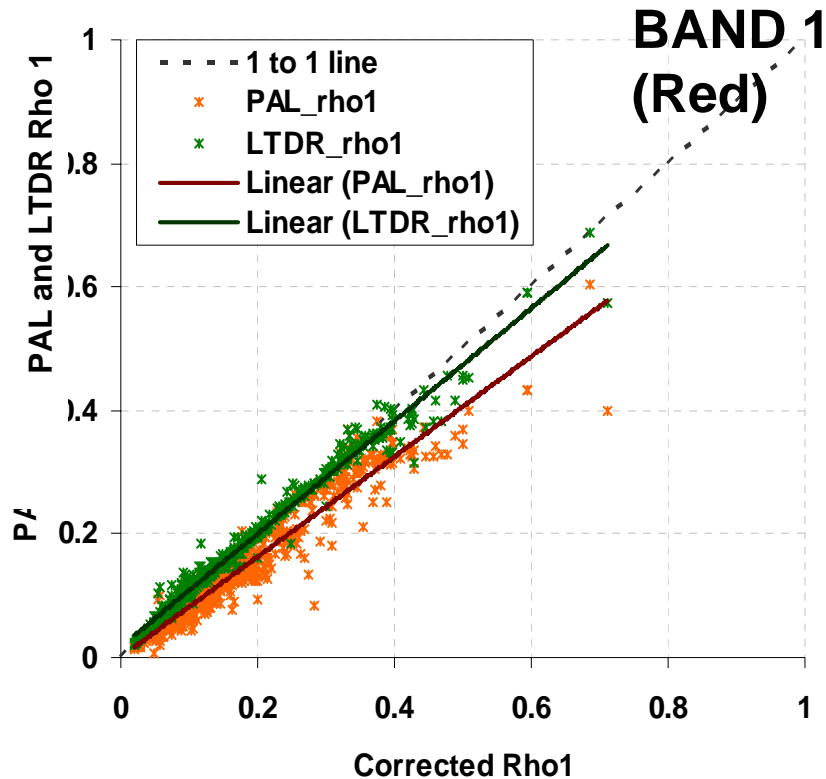


Fig. 11. Comparison of the desert calibration trends for band 1 (black solid line) and band 2 (black interrupted line), with the trends obtained using the Ocean and Clouds method (Vermote and Kaufman, 1995) for band 1 (blue line and square) and band 2 (red line and square).

Comparison of PAL with LTDR at AERONET sites



PAL is not corrected for water vapor absorption

Different Calibration:

- **PAL**: Stable desert target vicarious calibration (Rao and Chen, 1996)
- **LTDR**: ocean-cloud vicarious calibration (Vermote and Kaufman, 1995)

Outreach workshop

- LTDR workshop held January 18, 2007 at the UMUC Conference Center
 - Held in conjunction with MODIS Collection 5 workshop
 - Most in C5 workshop stayed for LTDR Outreach Workshop
 - Goal was to present project status, receive feedback on products/schedule
- Approximately 140 attendees, including MODIS/AVHRR project personnel.
- Presentations from LTDR folks (algorithms, science, QA, data formats, evaluation, intercomparisons with existing AVHRR products)
- Also presentations from international AVHRR experts
 - A. Trischenko (CCRS) “Developing the AVHRR and MODIS Long Term Data Records at the CCRS”
 - P. Frost (CSIRO) “Integration of Sensors Applied on South African Ecosystems (ISAFE)”
 - M. Leroy (CESBIO) “African Monsoon Multidisciplinary Analysis (AMMA)”
- Good interaction and feedback.

LTDR Web Page

The screenshot displays two browser windows. The left window shows the main LTDR website with the title "LTDR Land Long Term Data Record" and a description of the project. The right window shows the "AVHRR Calibration" page, which includes a paragraph explaining the calibration process and two scatter plots. The top plot shows "Degradation in channel 1 (from Ocean observations)" vs "Year" for NOAA satellites 7, 9, 11, 14, and 16. The bottom plot shows "Channel 2/Channel 1 ratio (from Clouds observations)" vs "Year" for the same satellites. A third browser window in the foreground shows an "Index of ftp://ltdr.nascom.nasa.gov/p" with a list of file names.

LTDR
Land Long Term Data Record

LTDR is a NASA-funded REASoN project to produce a global coarse resolution AVHRR, MODIS and VIIRS for Land studies. The project will create reflectance and NDVI at a resolution of 0.05 degrees. Higher order LAI/FPAR, albedo will be created at a coarser temporal resolution. AVHRR data onboard NOAA satellites from 1981 - present.

[Project Overview and Science Background](#)
[Documents and Presentations](#)
[AVHRR Vicarious Calibration](#)
[Data Products](#)
[Participants](#)
[Feedback](#)
[Updates/ Changes History](#)

Index of ftp://ltdr.nascom.nasa.gov/p

[Up to higher level directory](#)

- AVH09C1.A1983001.N07.001.2006027
- AVH09C1.A1983001.N07.001.2006027
- AVH09C1.A1983002.N07.001.2006027
- AVH09C1.A1983002.N07.001.2006027
- AVH09C1.A1983003.N07.001.2006027
- AVH09C1.A1983003.N07.001.2006027
- AVH09C1.A1983004.N07.001.2006027
- AVH09C1.A1983004.N07.001.2006027
- AVH09C1.A1983005.N07.001.2006027
- AVH09C1.A1983005.N07.001.2006027
- AVH09C1.A1983006.N07.001.2006027
- AVH09C1.A1983006.N07.001.2006027
- AVH09C1.A1983007.N07.001.2006027
- AVH09C1.A1983007.N07.001.2006027
- AVH09C1.A1983008.N07.001.2006027

AVHRR Calibration

Consistent and accurate calibration is a pre-requisite to creating a long-term data record. The AVHRR instrument suffers from the lack of onboard calibration for its visible to short wave infrared channels. Various vicarious calibration approaches were employed by users to account for the sensor degradation. For the LTDR REASoN project, we adopted the approach developed by Vermote and Kaufman (1995) that relies on clear ocean and accurate Rayleigh scattering computations to derive the sensor degradation in the red bands. This approach uses high clouds to predict the variation in the NIR to Red ratio and transfer the calibration to the NIR channel. This approach does not require any in-situ or aircraft measurements and is applied consistently across the AVHRR instruments onboard various NOAA satellites. Click on the satellite link to get the calibration coefficients for the corresponding AVHRR ([NOAA-7](#), [NOAA-9](#), [NOAA-11](#), [NOAA-14](#), [NOAA-16](#)).

Degradation in channel 1 (from Ocean observations)

Year

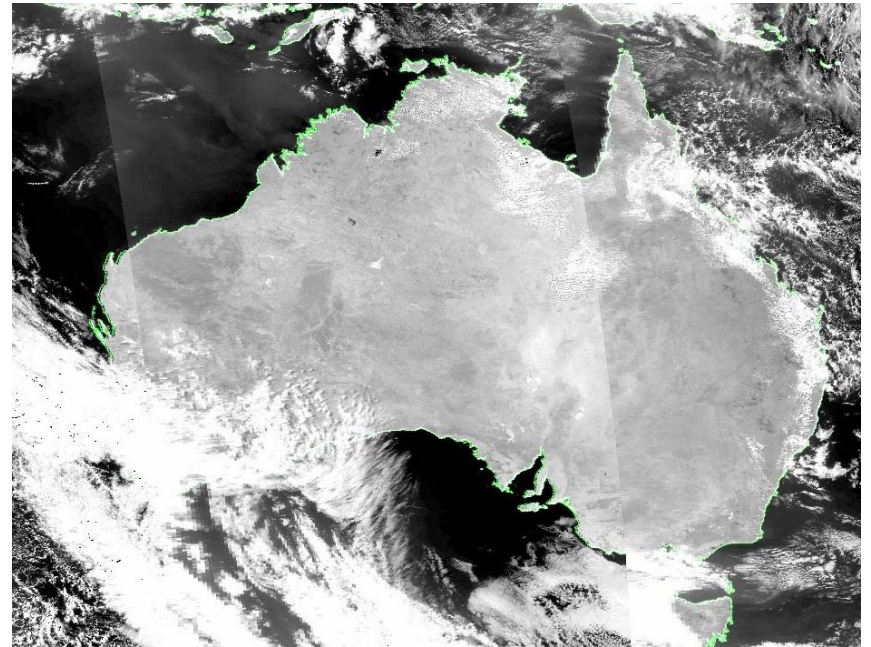
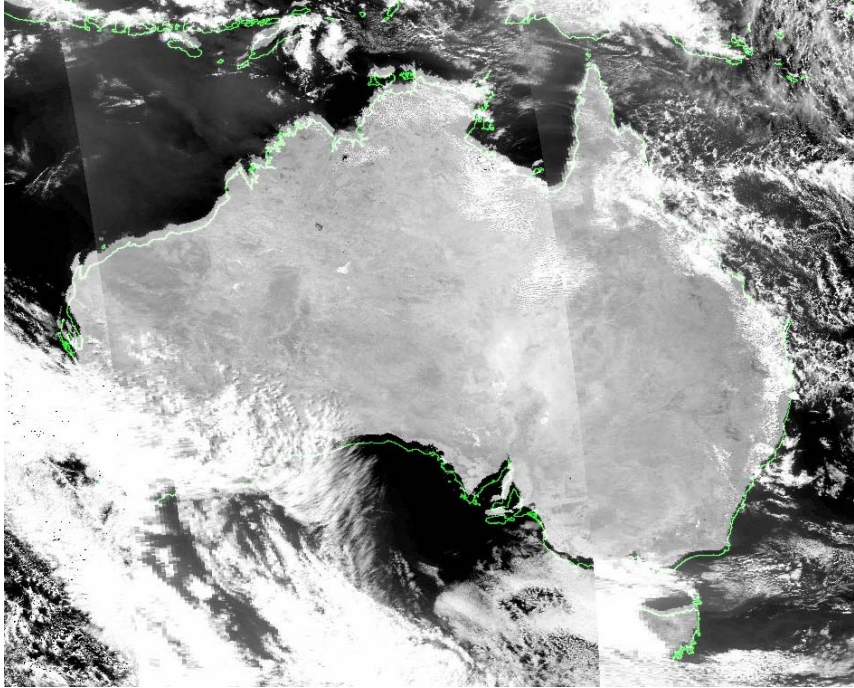
Channel 2/Channel 1 ratio (from Clouds observations)

Year

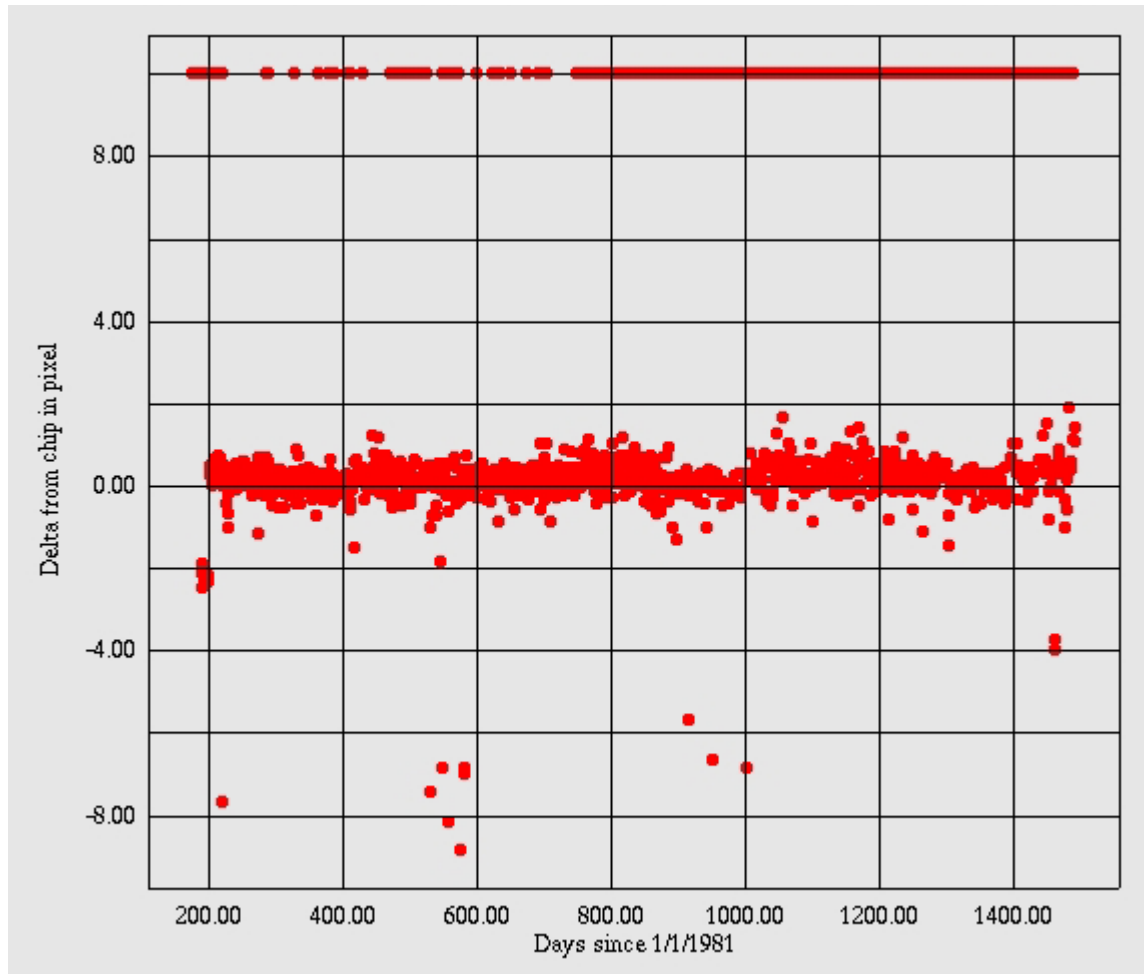
http://ltdr.nascom.nasa.gov/ltdr/noaa-09_calibration.html

<http://ltdr.nascom.nasa.gov/ltdr/ltdr.html>

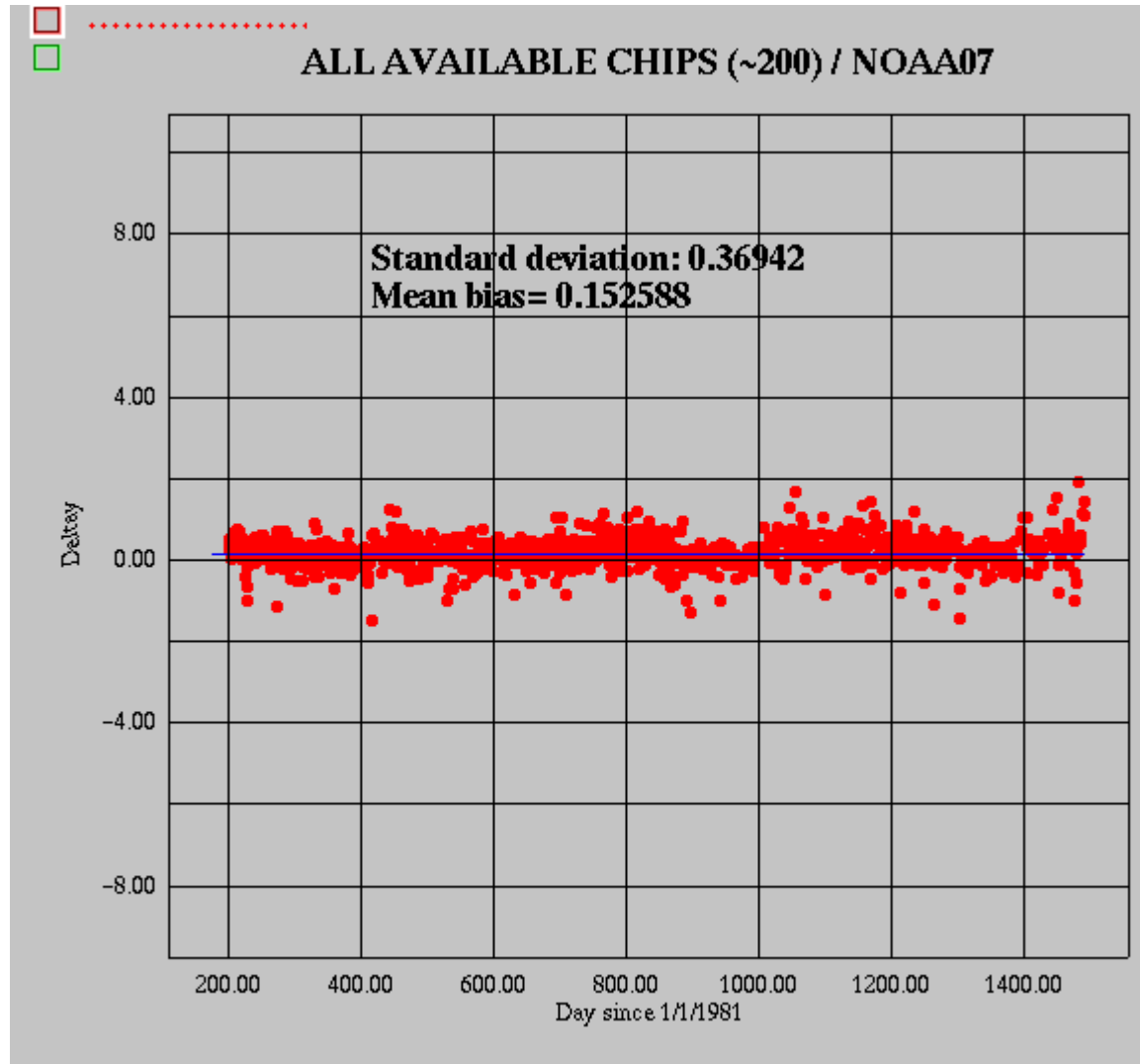
Geolocations issues/bad ephemeris data



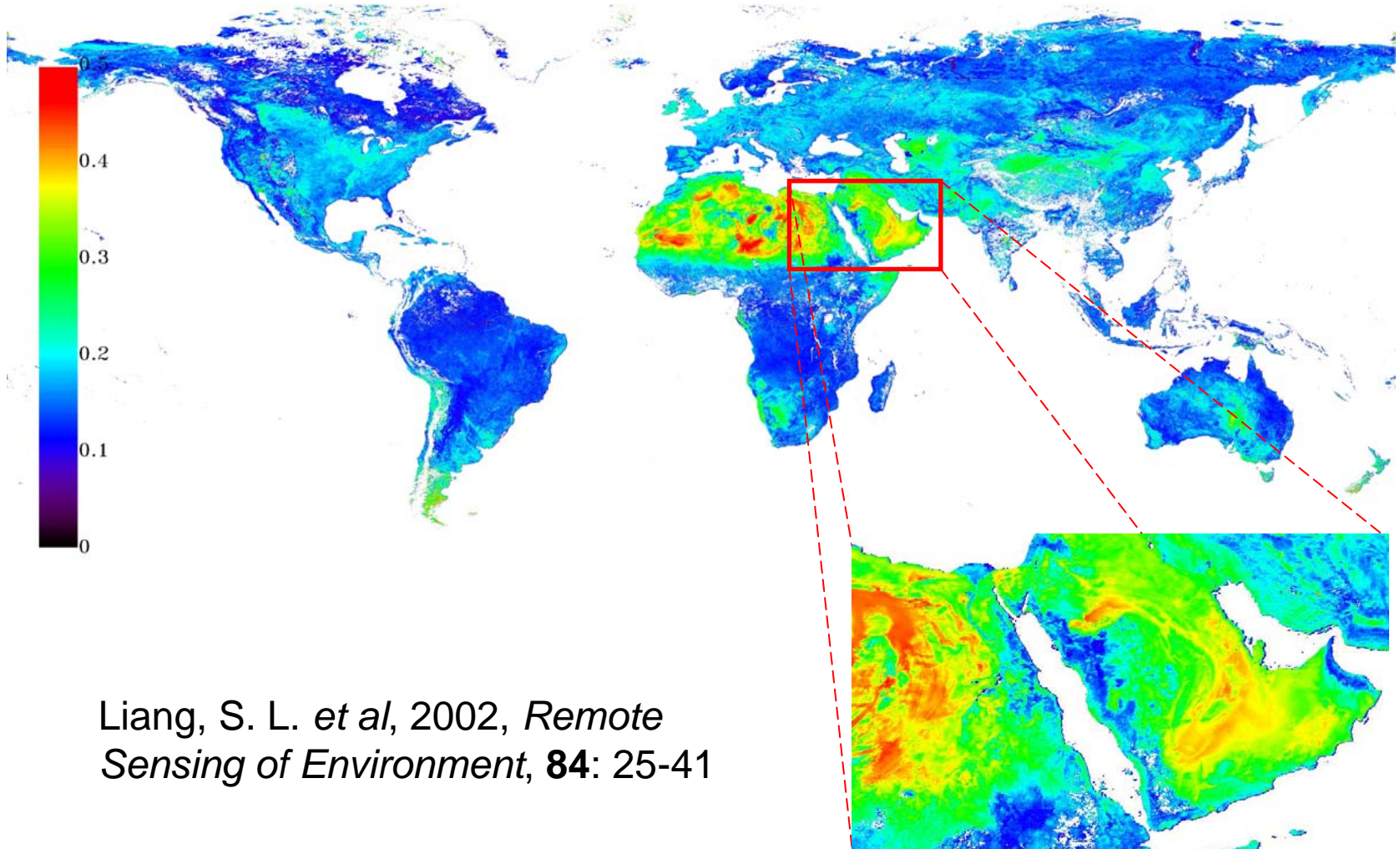
NOAA7: Geolocation accuracies based on ~ 100 chips



NOAA-7: Geolocation accuracies after filtering



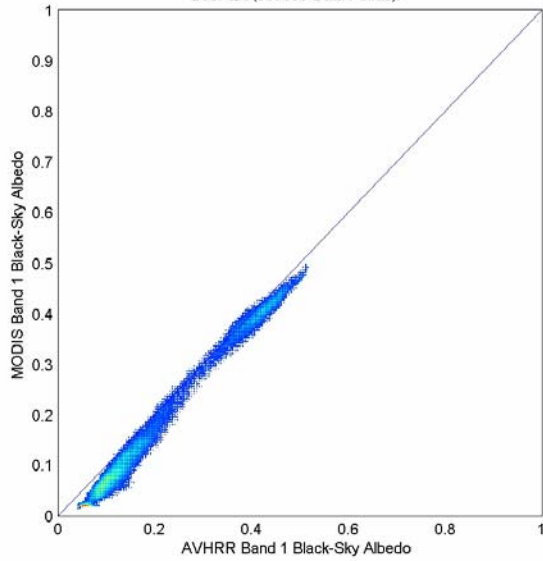
AVHRR BRDF/Albedo Product: Broadband Black-Sky Albedo (July 1999)



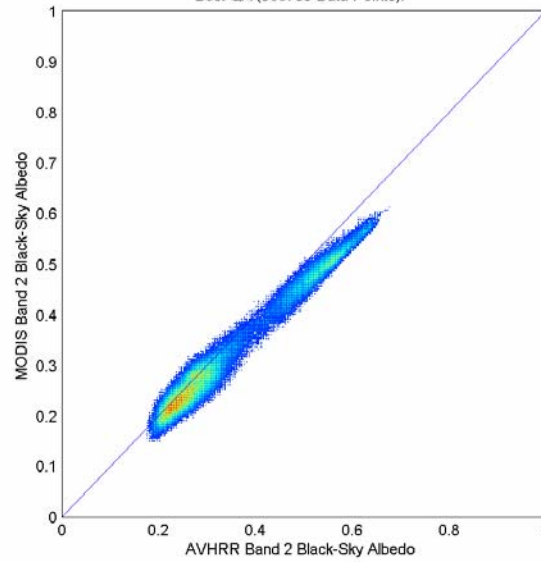
Liang, S. L. *et al*, 2002, *Remote Sensing of Environment*, **84**: 25-41

Albedo evaluation

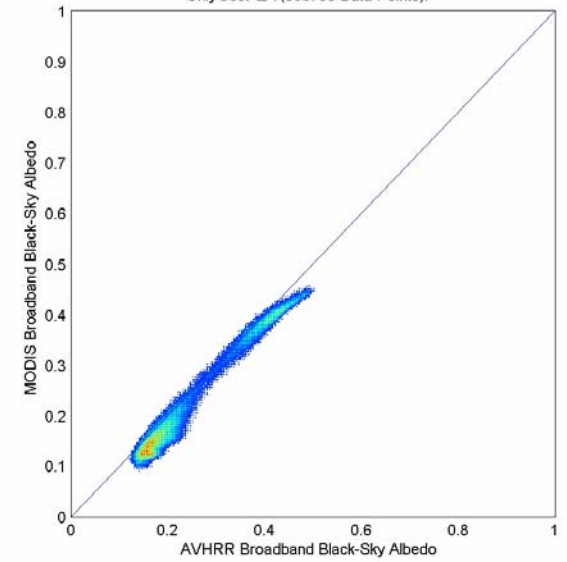
Best QA (907030 Data Points).



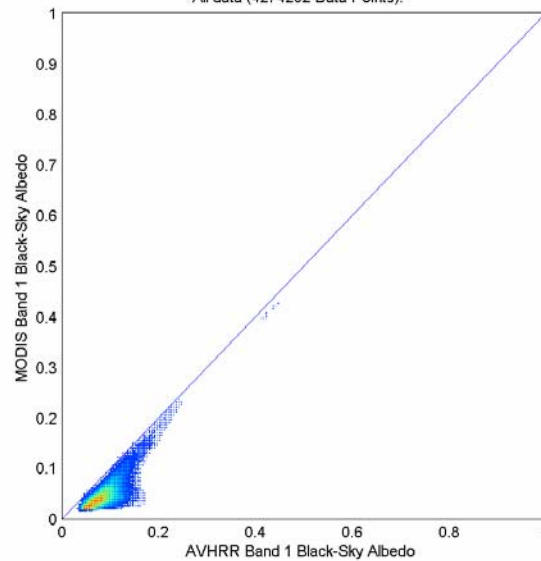
Best QA (906739 Data Points).



Only best QA (906739 Data Points).



All data (4274202 Data Points).



2006 activities

- Produced an AVHRR surface reflectance and NDVI beta data set using Pathfinder 2 algorithms (vicarious calibration; Rayleigh, ozone and water vapor correction).
- Set up a web/ftp interface for data distribution.
- Identified a set of validation sites for use in the evaluation of the products.
- Evaluated data set and started operational QA activity (global browse, known issues, time-series monitoring and trends).
 - Identified problems with geolocation, cloud screening, water vapor correction, QA bits, etc. in Beta (version 1) data set
 - Fixes have been made and will be incorporated in version 2 data set.

2007 and beyond

- Produce improved (version 2) surface reflectance and NDVI data set for 1981-1999 and 2003 [May-June]
- Produce preliminary aerosol-corrected data set for 1999 and 2003 [June]
 - *Use coincident MODIS and AVHRR data to improve aerosol retrieval and correction in AVHRR*
- Release aerosol-corrected surface reflectance and NDVI data set (version 3) [August]
- Produce BRDF/Albedo [August]
- Produce/Release Land Surface Temperature [Sept/Dec]
- Produce Burned Area [December]
- Release version 4 surface reflectance/NDVI data set incorporating fixes identified since vers 3 release [January]
 - Workshop will be held in conjunction with version 4 release.