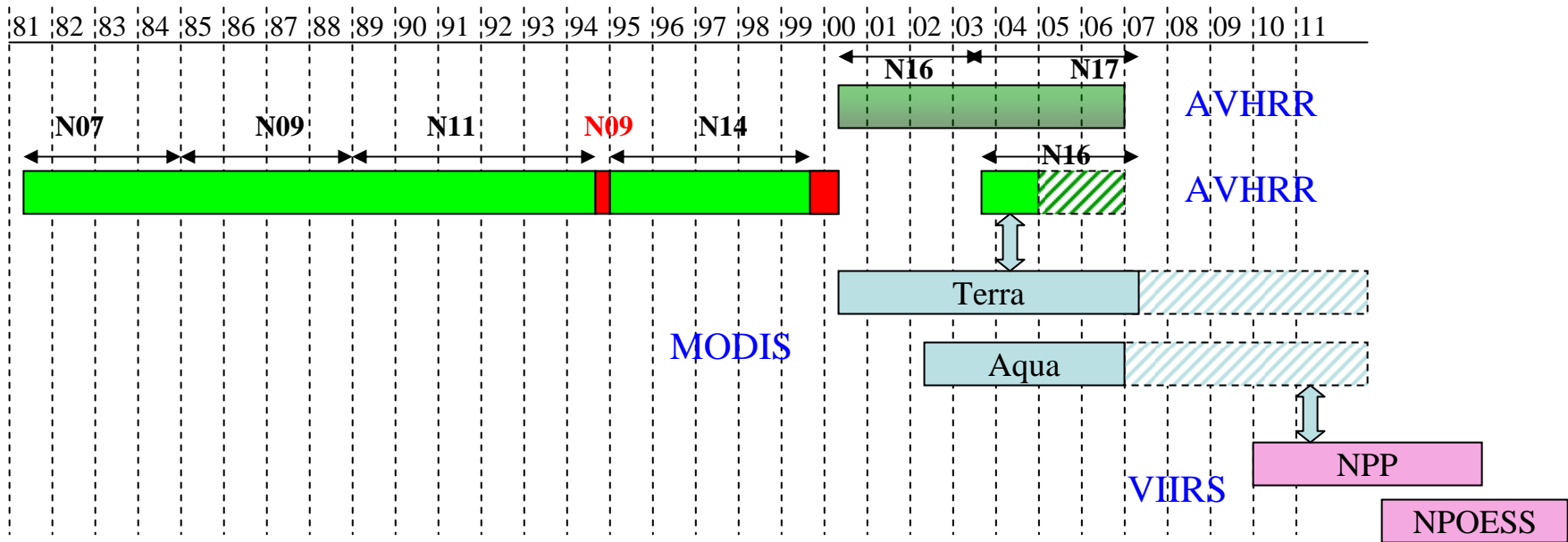# A 0.05 degree global climate/interdisciplinary long term data set from AVHRR, MODIS and VIIRS

- *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)
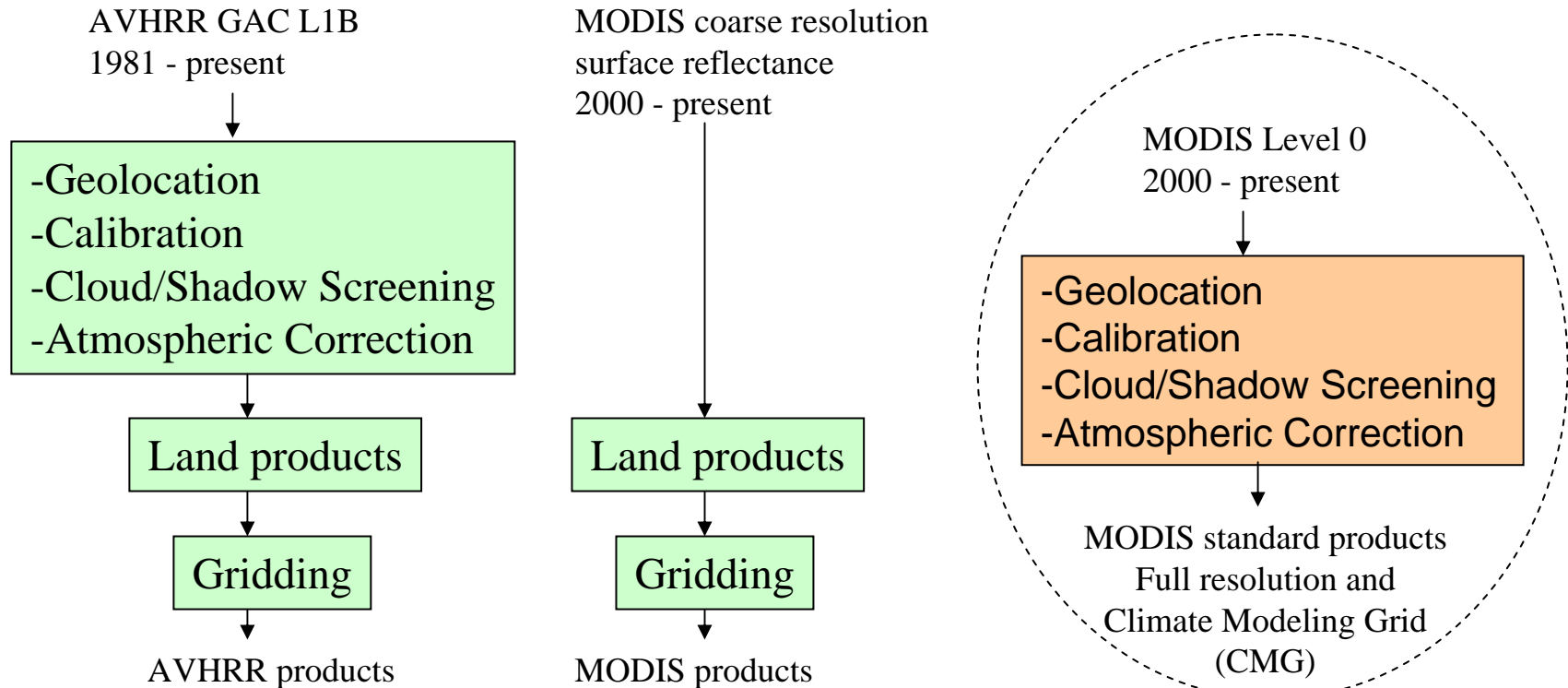- *Boston University:* Crystal Schaaf (BRDF/Albedo)

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

AVHRR GAC L1B
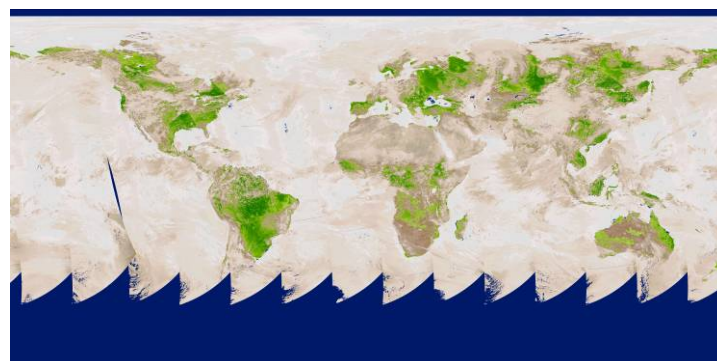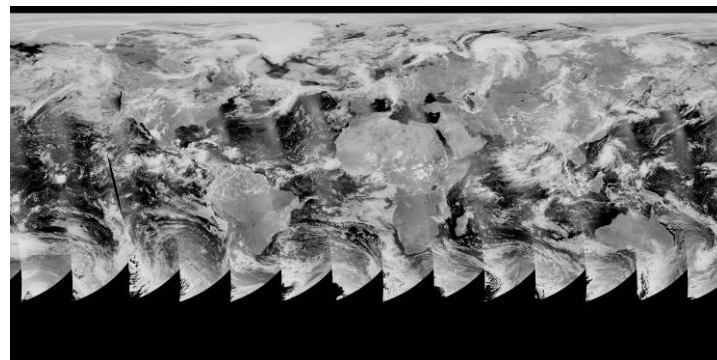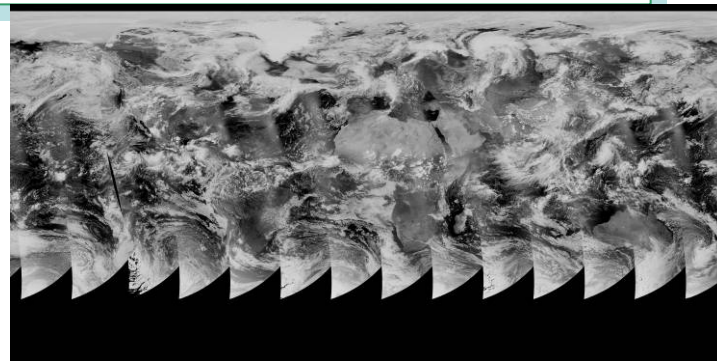1981 - present

MODIS coarse resolution
surface reflectance
2000 - present

MODIS Level 0
2000 - present

-Geolocation
-Calibration
-Cloud/Shadow Screening
-Atmospheric Correction

-Geolocation
-Calibration
-Cloud/Shadow Screening
-Atmospheric Correction

Land products

Land products

Gridding

Gridding

MODIS standard products
Full resolution and
Climate Modeling Grid
(CMG)

AVHRR products

MODIS products

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: 0.05º
    - 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

Land Long Term D

Glob

LTDRs 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 -- 1988-312
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

Collection 001

Julian day	Daily Surface Reflectance (AVH09C1)	Daily Vegetation (AVH13
1985 032 02/1		
1985 031 01/31		
1985 030 01/30		
1985 029 01/29		
1985 028 01/28		
1985 027 01/27		
1985 026 01/26		
1985 025 01/25		
1985 024 01/24		
1985 023 01/23		

Land Lo

NOAA-07, AV

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

8-d
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Veg

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Veg

Mo
Veg

◄ 1 day | 1 day ►

◄ 1 day | 1 day ►

Land Long Term Data Record

Global Browse Images

Data Set Evaluation

The calibration of the AVHRR has been thoroughly evaluated

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] SAIC and NASA GSFC Code 614.5, United States

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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%.
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Keywords: Calibration; AVHRR; MODIS

The coefficients were consistent within less than 1%

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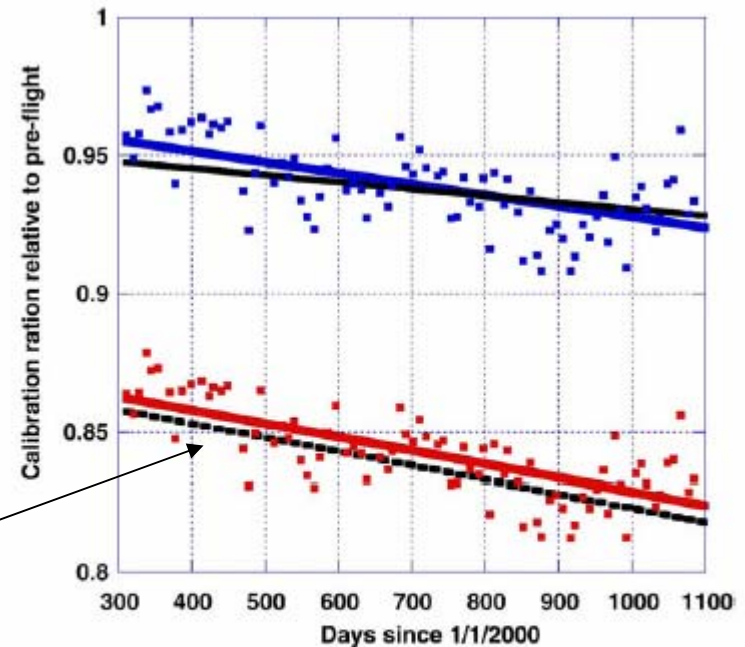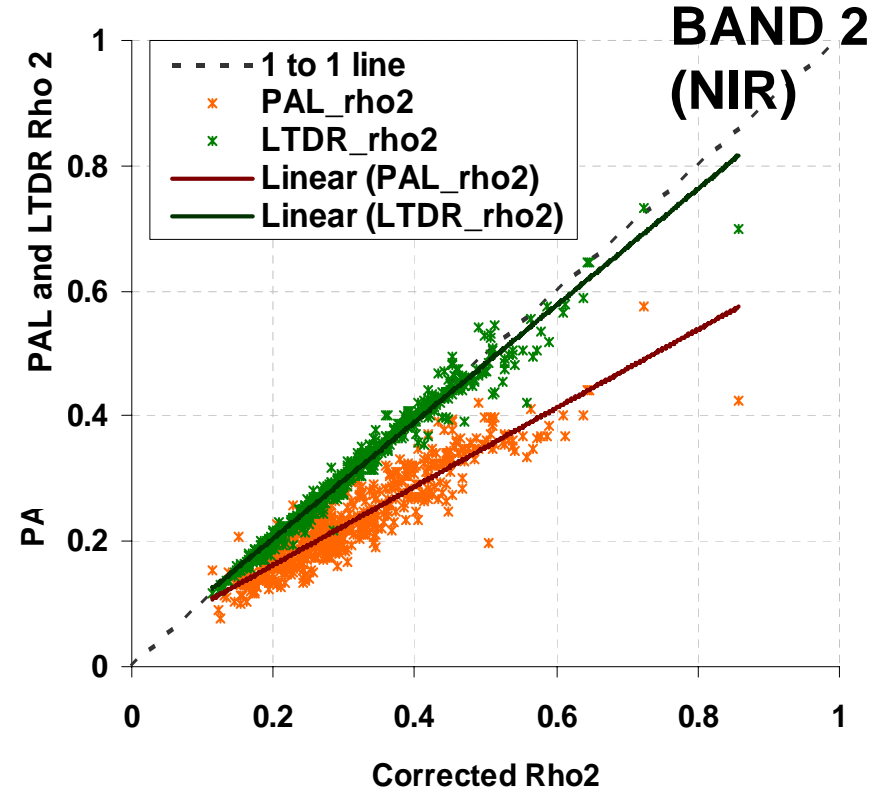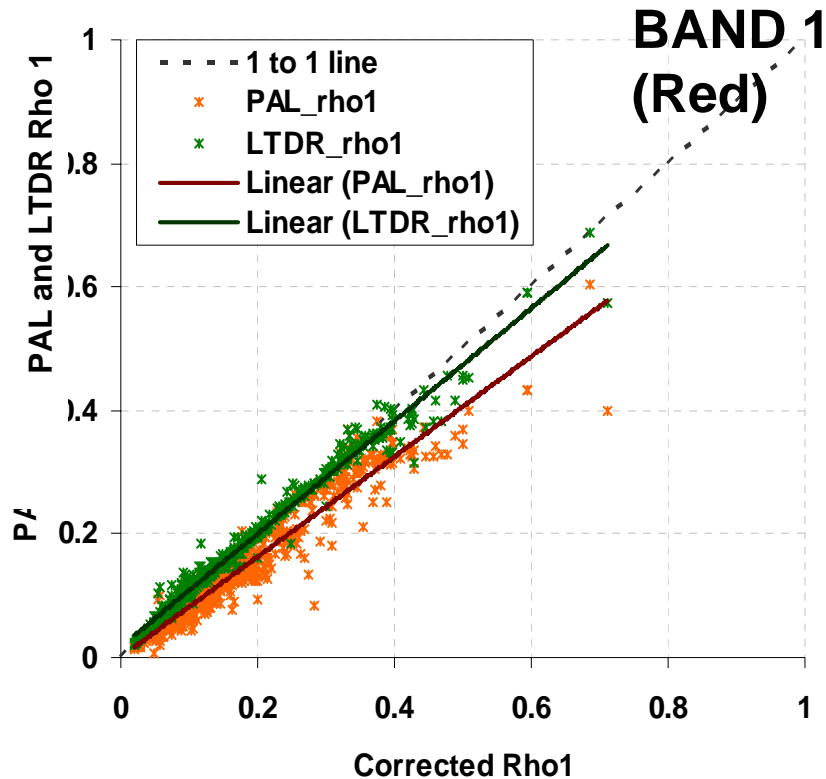
Fig. 11. Comparison of the desert calibration trends for band 1 (black solid line) and band 2 (black interrupted line), with the trends obtained using the Ocean and Clouds method (Vermote and Kaufman, 1995) for band 1 (blue line and square) and band 2 (red line and square).

Comparison of PAL with LTDR at AERONET sites

BAND 1 (Red)

BAND 2 (NIR)

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

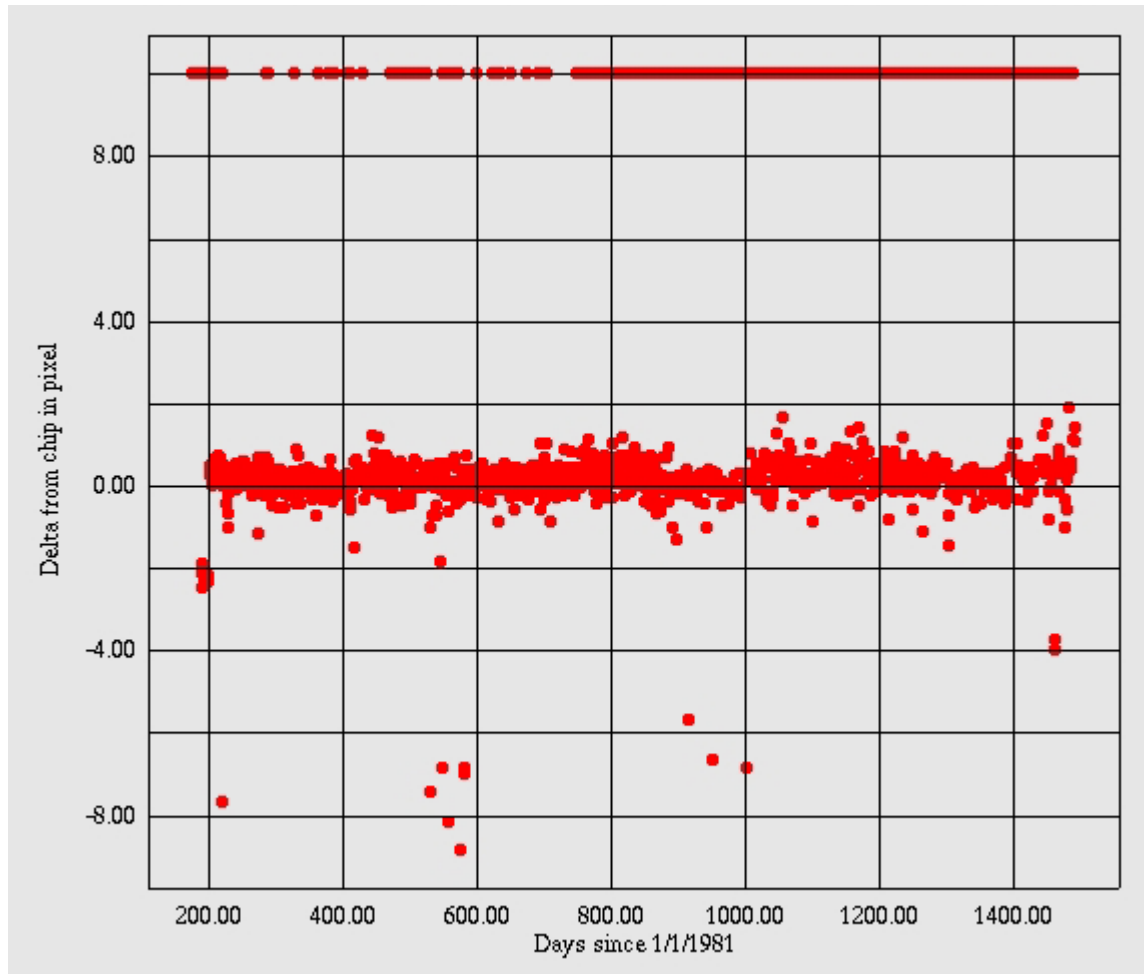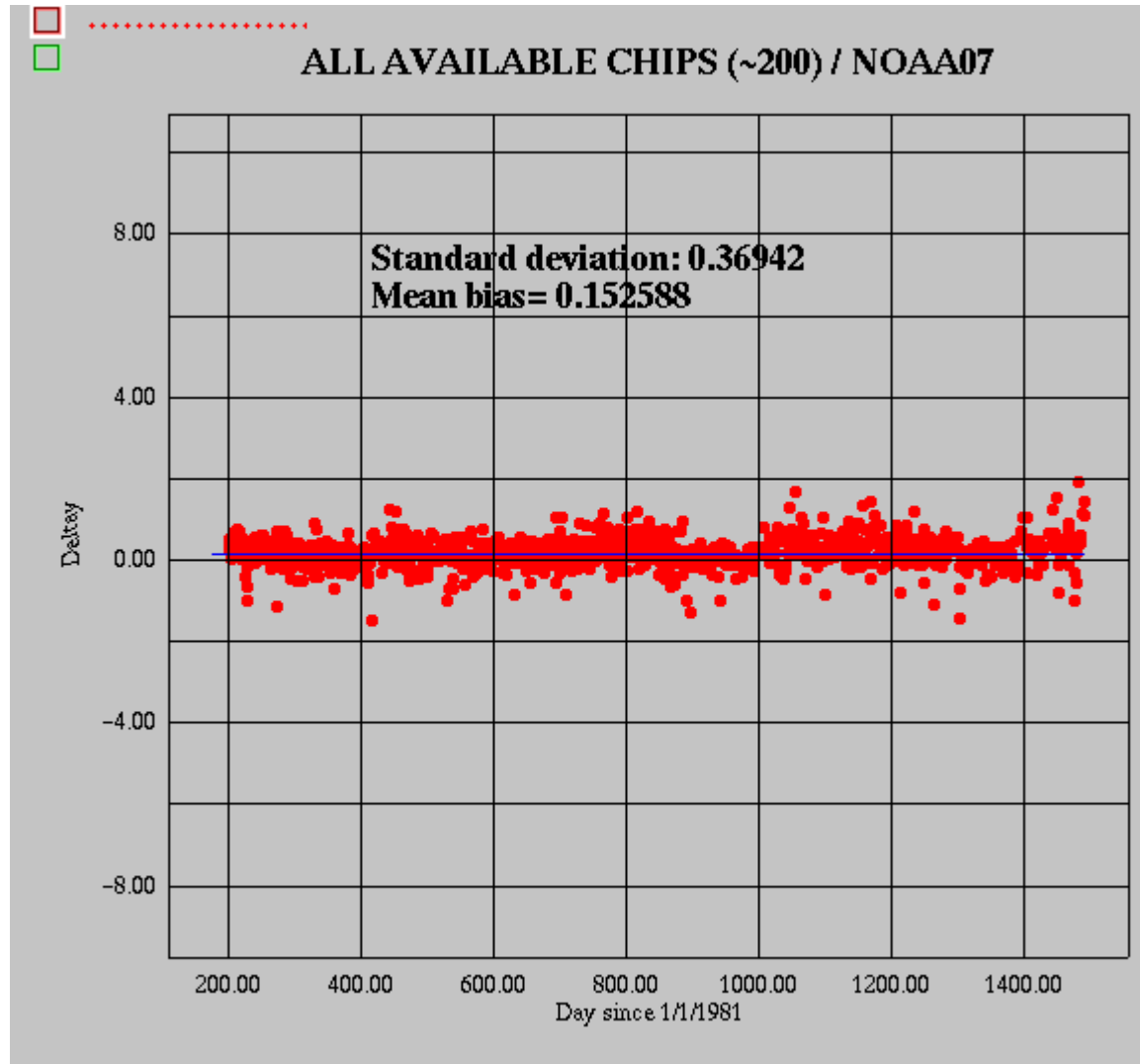http://ltdr.nascom.nasa.gov/ltdr/ltdr.html

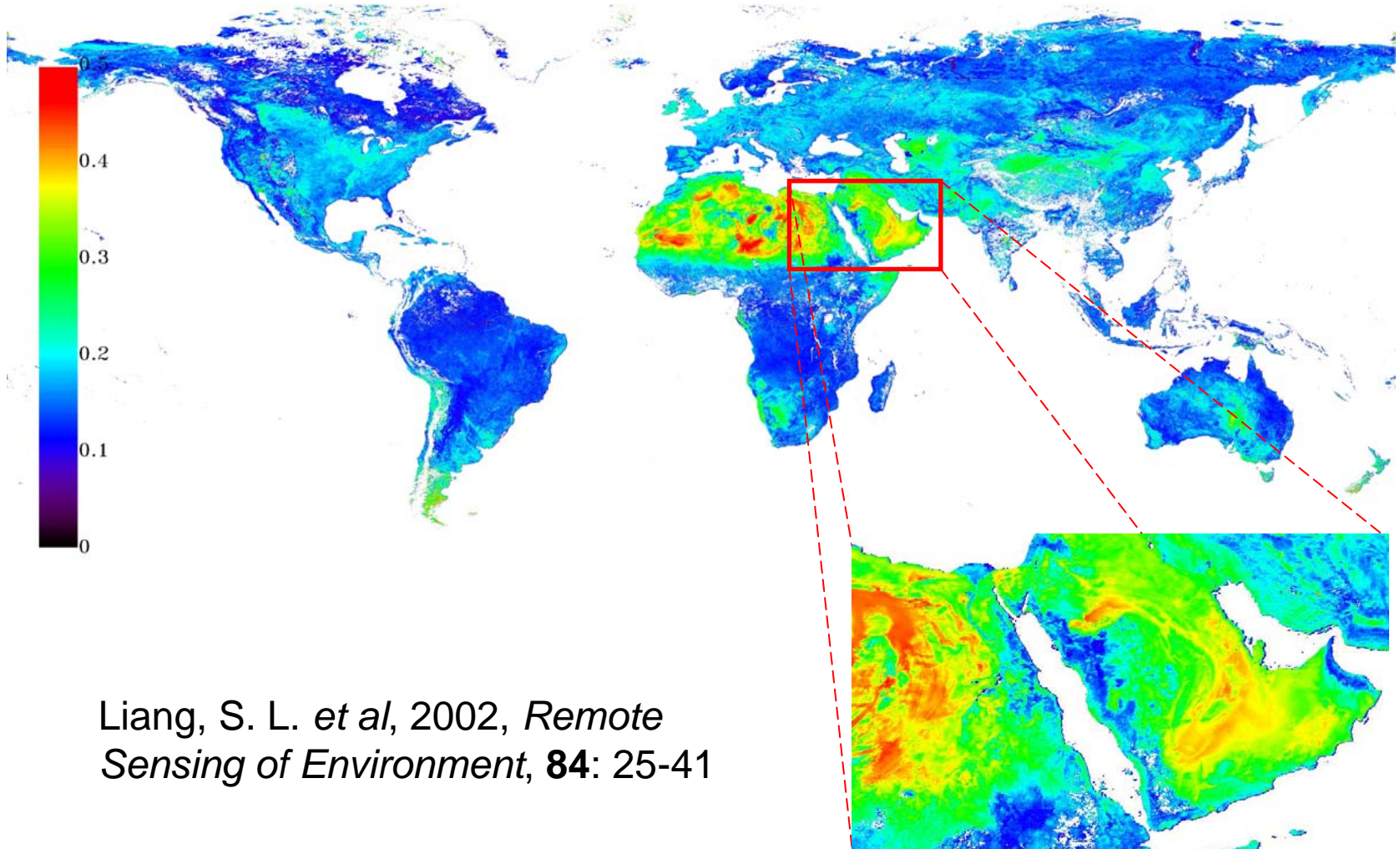# Geolocations issues/bad ephemeris data
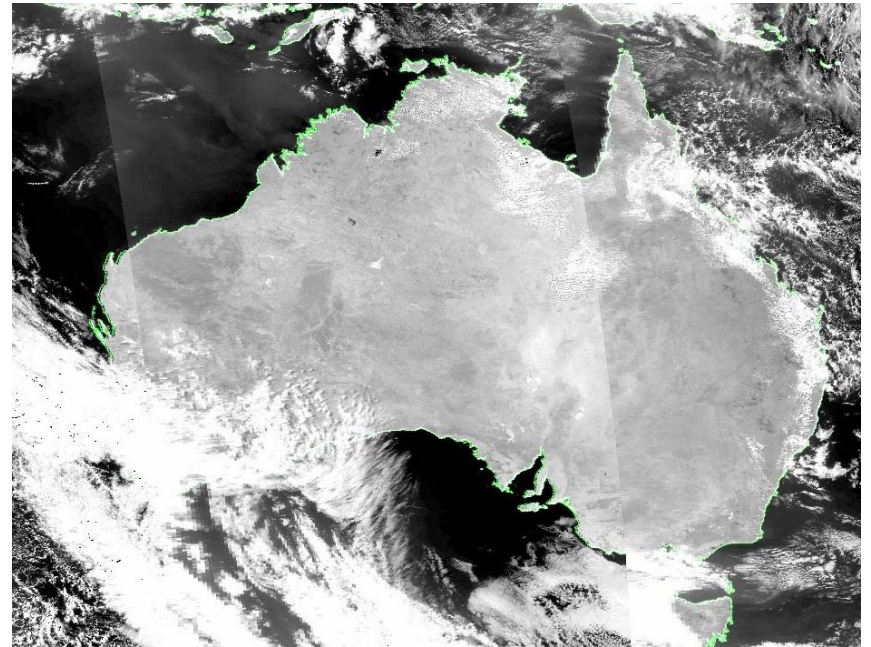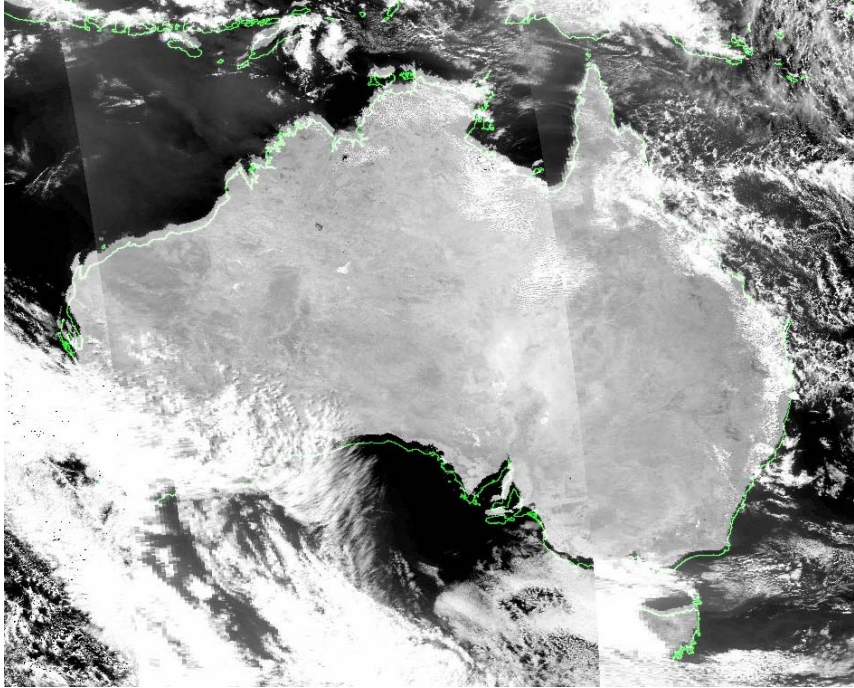
NOAA7: Geolocation accuracies based on ~ 100 chips

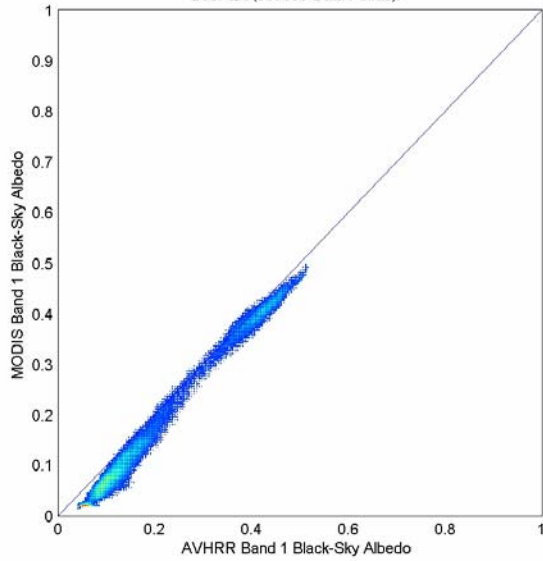# NOAA-7: Geolocation accuracies after filtering

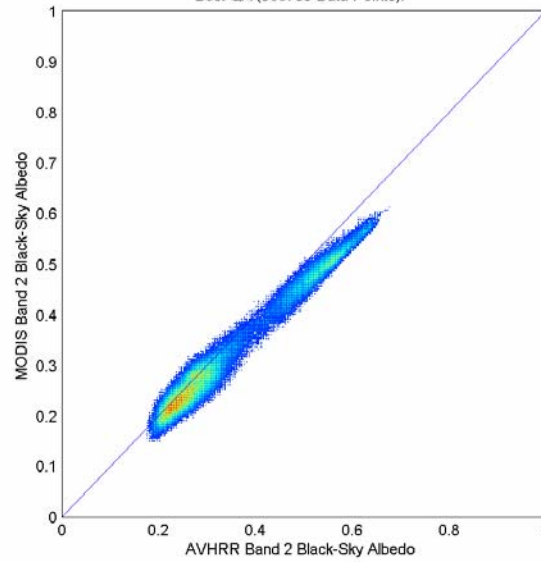# AVHRR BRDF/Albedo Product:
Broadband Black-Sky Albedo (July 1999)

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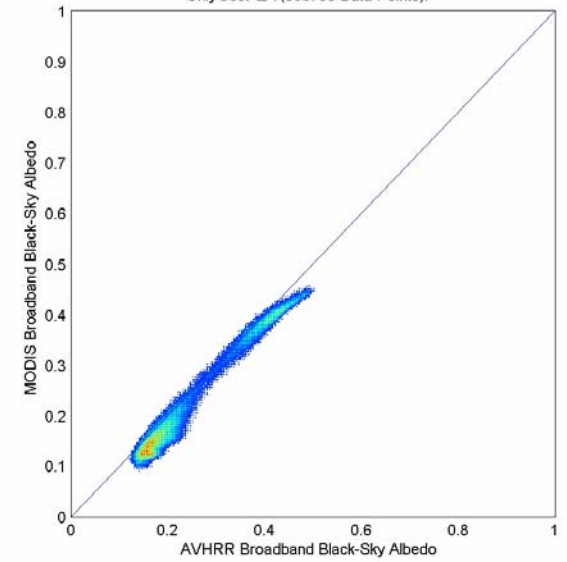
Albedo evaluation

2006 activities

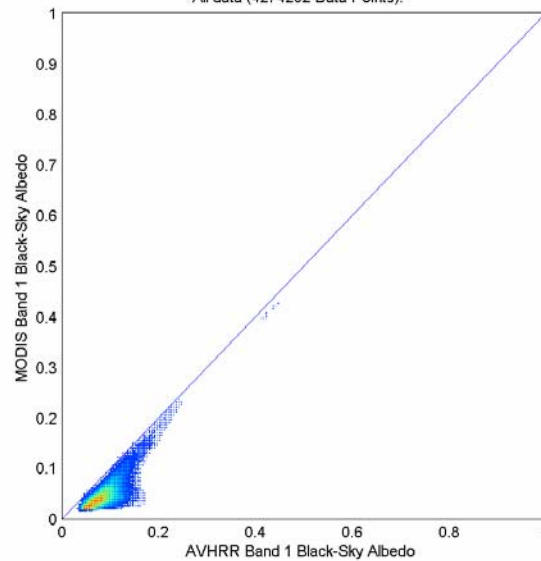- Produced an AVHRR surface reflectance and NDVI beta data set using Pathfinder 2 algorithms (vicarious calibration; Rayleigh, ozone and water vapor correction).

- 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.