

Long Term Data Record Quality Assessment

Sadashiva Devadiga
January 18, 2007

Overview

- Post production QA
- Algorithm Testing
- LDOPE's QA Services for LTDR
 - Global Browsers
 - Time Series
 - Known Issues
- Future work

Post Production QA

- Data records are processed for one or more year using the revised version of the algorithm.
- Samples from the test are evaluated by the LDOPE staff
 - Check for intended performance
- Product issues are posted on the known issue page – accessible to science team only

Algorithm Testing and QA

- Data records are reprocessed using the recent version of the science algorithm. Current version is Beta version.
- Product samples are evaluated by the LDOPE staff
 - Compare with other datasets (PAL, GIMMS, MODIS)
 - Compare with the previous version of the LTDR
- Product issues are posted on the known issue page

LDOPE's QA Services for LTDR

- Global Browsers
 - Beta version: Daily Band 1 surface reflectance and NDVI
 - Coming: RGB composite of band 1, 2, and 3
- Time Series
 - Time series of band 1 and band2 surface reflectance and VI
 - At aeronet sites
 - LDOPE golden tiles

LTDR QA Home Page

GODDARD SPACE FLIGHT CENTER

[+ NASA Homepage](#)

Land Long Term Data Record



[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.

Your First Click to the U.S. Government

[+ 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



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

-Pr

Dal

Sur

Veg

8-d

Sur

Veg

16+

Veg

Mo

Veg

NOAA-07, AV

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

◀ 1 day 1 day ▶



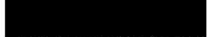
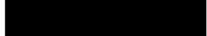
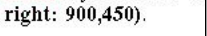
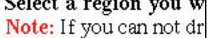
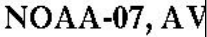
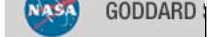
Collection 001

Julian day	Daily Surface Reflectance (AVH9C1)	Daily Vegetation (AVH12)
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		

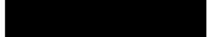
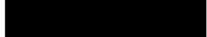
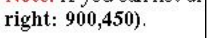
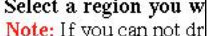
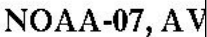
◀ 1 day 1 day ▶



GODDARD



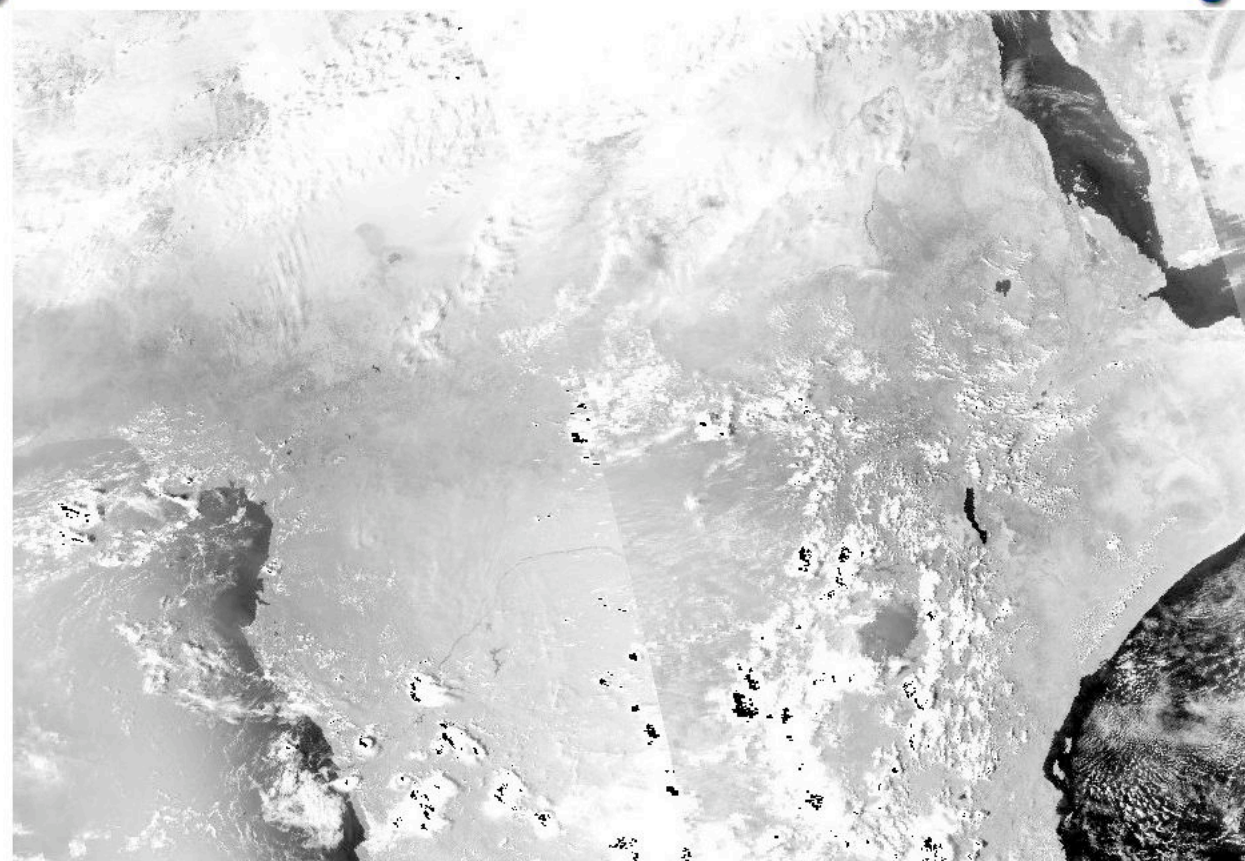
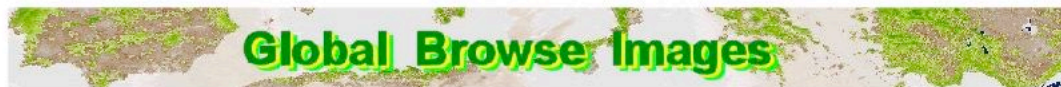
Land Lon



GODDARD SPACE FLIGHT CENTER

[+ NASA Homepage](#)

Land Long Term Data Record





GODDARD SPACE FLIGHT CENTER

[+ NASA Homepage](#)

Land Long

A time series of summary locations is maintained a internet. Time series stat series are important beca aerosol loading) and rem they allow changes in the site (listed in alphabetical

First:

Second:

Year:

1981
1982
1983
1984
1985
1986
1987
1988
1989
1990

Aer
(Search
beginning
the sel

Submit the Request

FIRSTGOV
Your First Click to the U.S. Government



GODDARD SPACE FLIGHT CENTER

[+ NASA Homepage](#)

Land Long T

Please click on the site you

MAARCO	MAL
MPI_Mainz	MUB
Mainz	Mam
Marseille	Maun
Mexico_City	Meza
Minsk	Missi
Mombassa	Monc
Monterey	Moon
Mt_Washington_ES	Mukd
Mwinitlunga	

FIRSTGOV
Your First Click to the U.S. Government [+ Privacy](#)



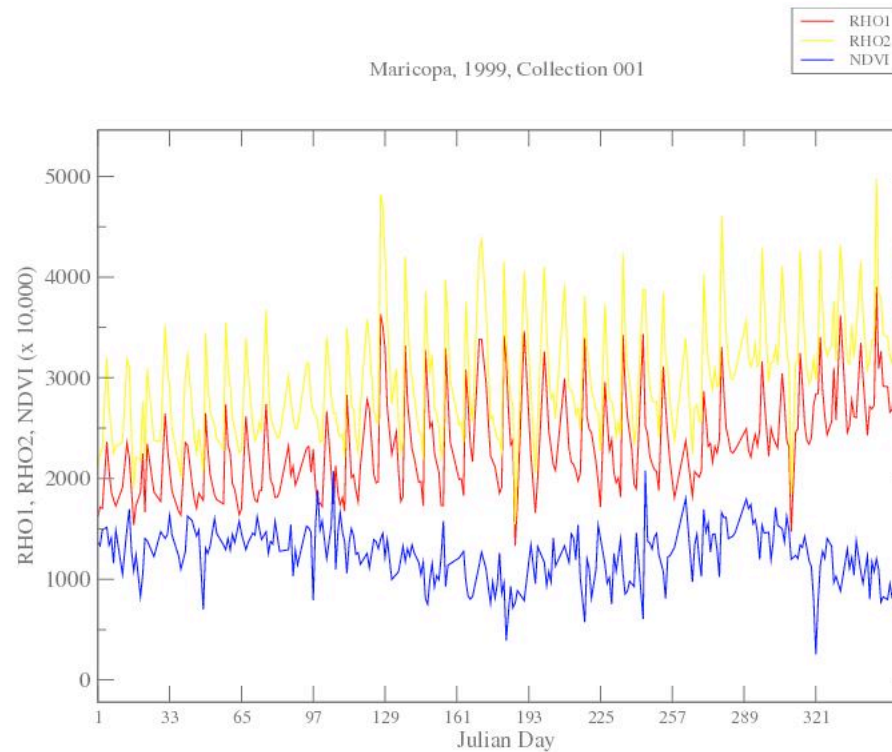
GODDARD SPACE FLIGHT CENTER

[+ NASA Homepage](#)

Land Long Term Data Record

Time Series

Maricopa, 1999, Collection 001



Tue Jul 25 18:59:21 2006



GODDARD SPACE FLIGHT CENTER

[+ NASA Homepage](#)

Land Long Term Data

Time Series

A time series of summary statistics derived from locations is maintained and monitored by the LTI internet. Time series statistics are extracted at all series are important because they capture algorithm aerosol loading) and remote sensing (e.g. sun-sun) they allow changes in the instrument characteristics site (listed in alphabetical order) or tile and biome

First:

Second:

☒

☐ Golden

Aeronet

Year:

1981
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:

Submit the Request

FIRSTGOV
Your First Click to the U.S. Government

[+ Privacy Policy and Important](#)

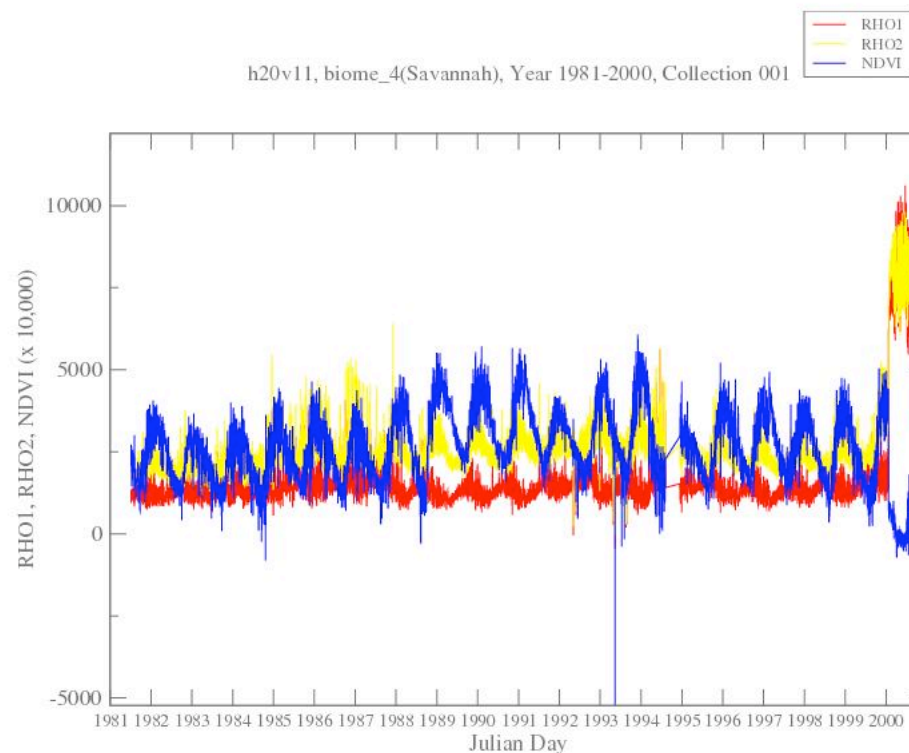


GODDARD SPACE FLIGHT CENTER

[+ NASA Homepage](#)

Land Long Term Data Record

Time Series



Fri May 5 11:27:00 2006



Land Long Term Data Record

Quality Assessment

Summary

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

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

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



Color Key Case pending Case closed Case reopened QA note

Case number

[CC_AVH09C1_0622](#)
[CC_AVH09C1_0619](#)
[CC_AVH09C1_0619](#)
[CC_AVH09C1_0613f](#)
[CC_AVH09C1_0613f](#)
[CC_AVH09C1_06111](#)
[CC_AVH09C1_06111](#)
[CC_AVH09C1_06111](#)
[CC_AVH09C1_06111](#)
[CC_AVH09C1_06111](#)
[CC_AVH09C1_06111](#)

..

..

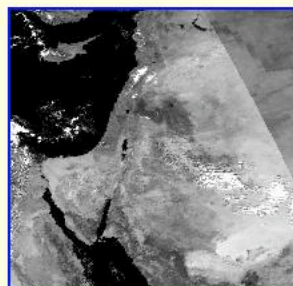
Last Updated: 08/14/

Detailed Description

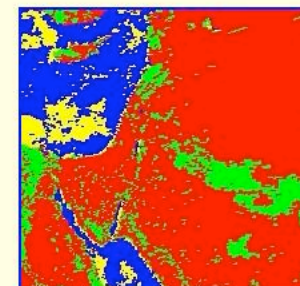
Color Key Case pending Case closed Case reopened QA note

Case #:CC_AVH09C1_06194 Opening date: 07/13/06 Last update: 07/13/06
Status: Pending

Some pixels along coastlines which appear to be in clear areas are flagged as cloud. This example is taken from an area including part of the Mediterranean Sea and Arabian Peninsula, on day 18 of 1997. In the first image, many coastlines are visible in areas that appear to be clear. The second image shows the clear/cloud and land/ocean quality flags for the same region and day. The land areas are red if flagged clear and green if flagged cloudy or partly cloudy. The ocean areas are shown in blue if clear and yellow if cloudy or partly cloudy. A strip of yellow and green pixels occurs along coastlines in some areas that are otherwise flagged as clear.



AVH09C1.A1997018.N14.001.2006034202854.hdf
SDS: RHO2(grayscale)



AVH09C1.A1997018.N14.001.2006034202854
SDS: QC
Red: land, clear
Green: land, cloudy or partly cloudy
Blue: ocean, clear
Yellow: ocean, cloudy or partly cloudy

Occurrence: All AVHRR Version 1 data.
PGE: v1.0

[Large Image](#)



GODDARD SPACE FLIGHT CENTER

[+ NASA Homepage](#)

Land Long Term Data Re



TEST2, AVH09C1, day 1999033

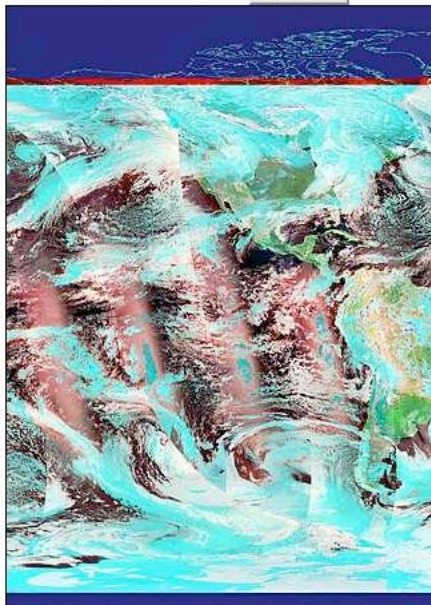
[LTDR Proc](#)
[LTDR File](#)
[Calibration](#)

Select a region you want zoom in:

Note: If you can not drag a box on the image, please
right: 900,450).

[Global Bro](#)
[Time Serie](#)
[Known Pro](#)
[Algorithm](#)
[QA Tools](#)

[Science Te](#)
[QA Person](#)
[FAQ](#)
[Feedback](#)

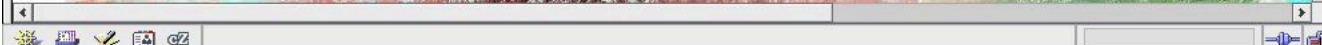
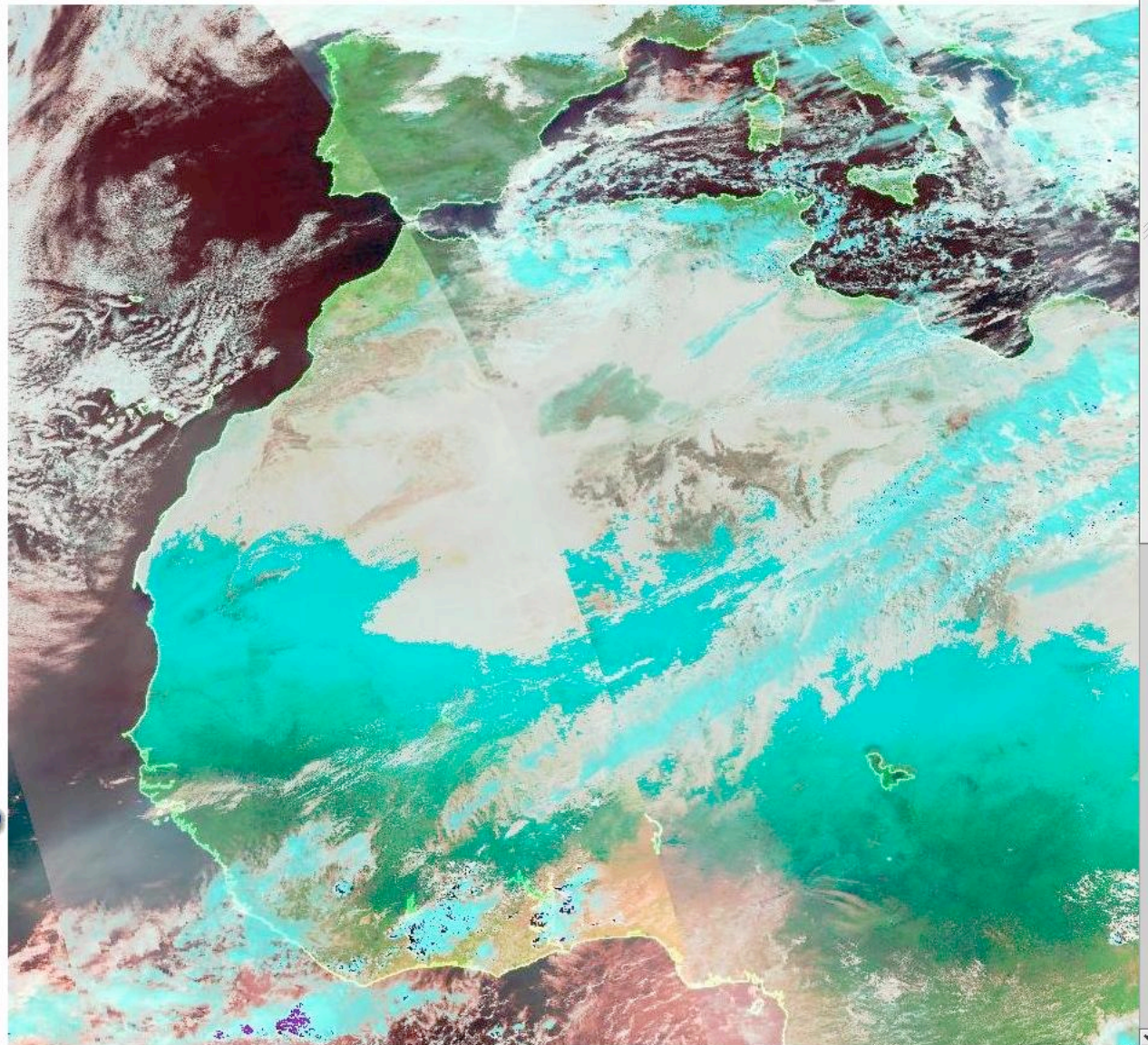


◀ 1 day 1 day ▶

Zoom In

[FIRST](#)
Your First Click to the

AVB09C1, day 1999033, TEST2





GODDARD SPACE FLIGHT CENTER

[+ NASA Homepage](#)

Land Long Term Data Record

Quality Assessment

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

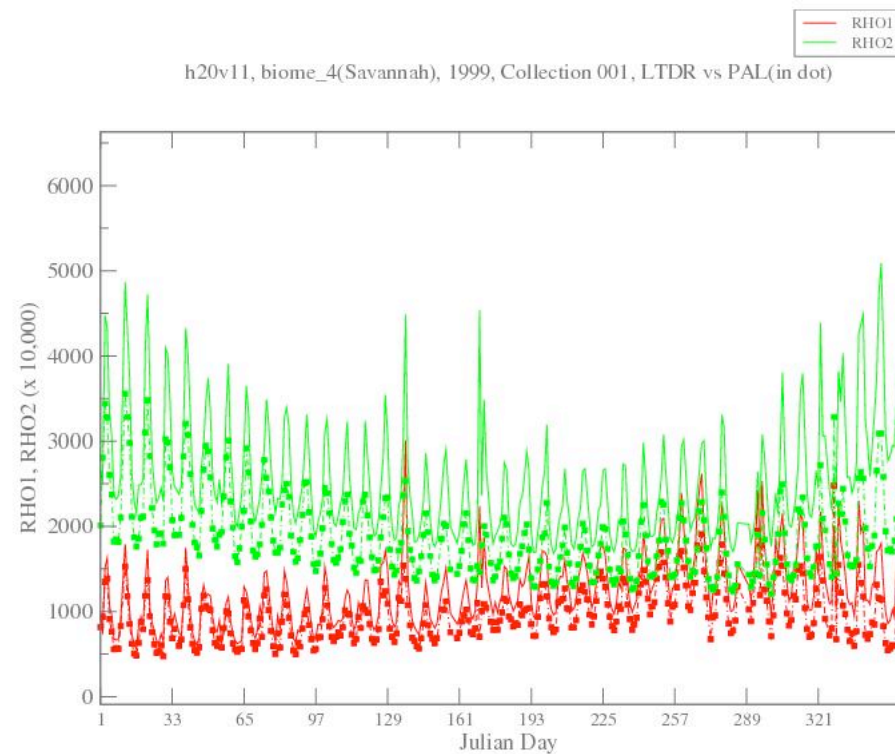
[Global Browse](#)
[Time Series](#)
[Known Product Issues](#)
[Algorithm Test](#)
[QA Tools](#)

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

AVHRR Algorithm Test

Test Date	Revision History	Global
10/2006		NOA
12/2006		NOA

h20v11, biome_4(Savannah), 1999, Collection 001, LTDR vs PAL(in dot)



FIRSTGOV
Your First Click to the U.S. Government

[+ Privacy Policy and Important Notices](#)



Mon Jan 15 14:54:21 2007



GODDARD SPACE FLIGHT CENTER

[+ NASA Homepage](#)

Land Long Term Data

Detailed Description



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

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

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

AVHRR Alg

Test Date	Re Hi
10/2006	
12/2006	

FIRSTGOV
Your First Click to the U.S. Government

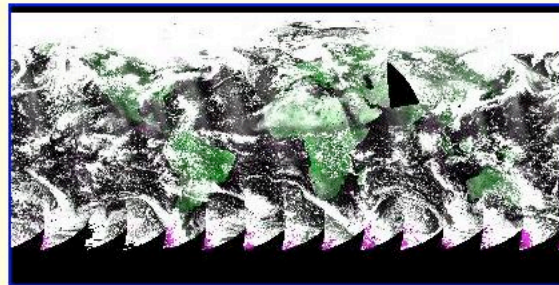
[+ Privacy Policy and Important N](#)

Color Key Case pending Case closed Case reopened QA note

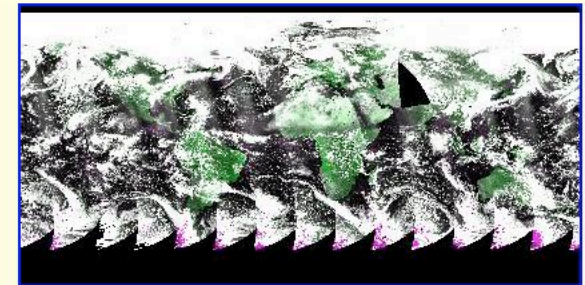
[Large Image](#)

Case #:T1_SD_AVH09C1_06319d Opening date: 11/15/06 Last update: 11/15/06
Status: Pending

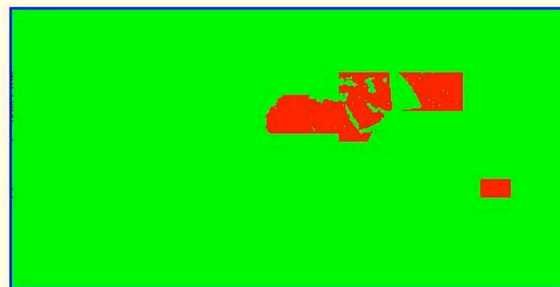
Desert flag is incorrectly populated in both the beta and the reprocessed version of NOAA-7
Following example shows an example global dataset and the cloud flag from the beta version and the reprocessed version.



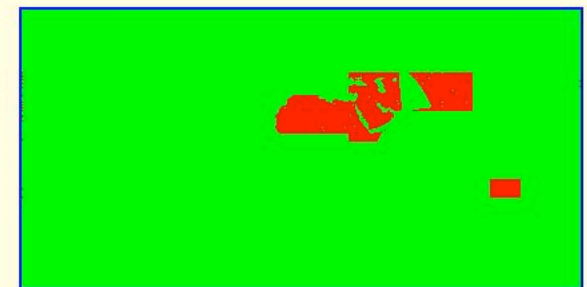
AVH09C1.A1983120.N07.001.2006029114357.hdf (beta version)
SDS: RGB Composite of ch 1, 2, and 1



AVH09C1.A1983120.N07.001.2006276025550.hdf (reprocessed version)
SDS: RGB Composite of ch 1, 2, and 1



AVH09C1.A1983120.N07.001.2006029114357.hdf
SDS: Desert flag(red: yes, green: no)



AVH09C1.A1983120.N07.001.2006276025550.hdf
SDS: Desert flag(red: yes, green: no)

Note: Most of the data days could show spatial shift in the data between the beta and reprocessed version. This above example uses a data day where the shift is less than a pixel.

Occurrence:
PGE:

Future Work

- Animation of
 - global browse
 - Regional browse
- Support new products
- Data Intercomparison time series

Intercomparison of LTDR and PAL Datasets

(using NOAA-14 year 1999 data)

Sadashiva Devadiga,
January 18, 2007

Overview

- PAL dataset
- Preprocessing of PAL data
- Filtering of PAL and LTDR data sets
- Spatial comparison
- Temporal comparison
- Conclusion

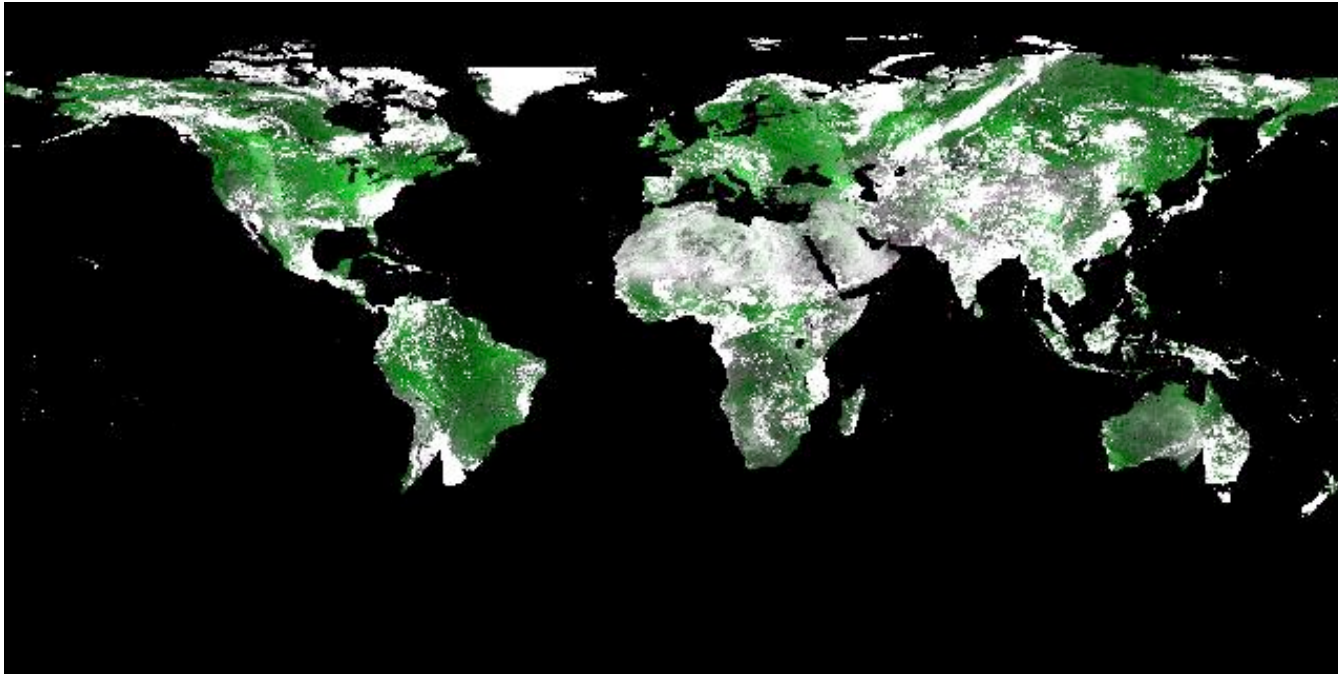
PAL Datasets

(Pathfinder AVHRR Land data)

- PAL Daily Dataset
 - Daily data sets are global, 8km terrestrial data mapped to an equal area projection.
 - Data sets include NDVI, surface reflectance from channels 1 and 2, brightness temperature from channels 3, 4, and 5, solar and scan geometry, CLAVR Flag, quality control flag, and date and hour of observation.
 - Each dataset is available as tiles in flat binary format.
 - Uses CLAVR algorithm for cloud detection.
 - Ch1 and ch2 are corrected for Rayleigh scattering and ozone absorption, **but not corrected for aerosol or water vapor.**

Preprocessing PAL data

- Stitch the tiles to make one global product for each parameter (8km resolution).
- Reproject the global data to 5km CMG using nearest neighbor resampling.



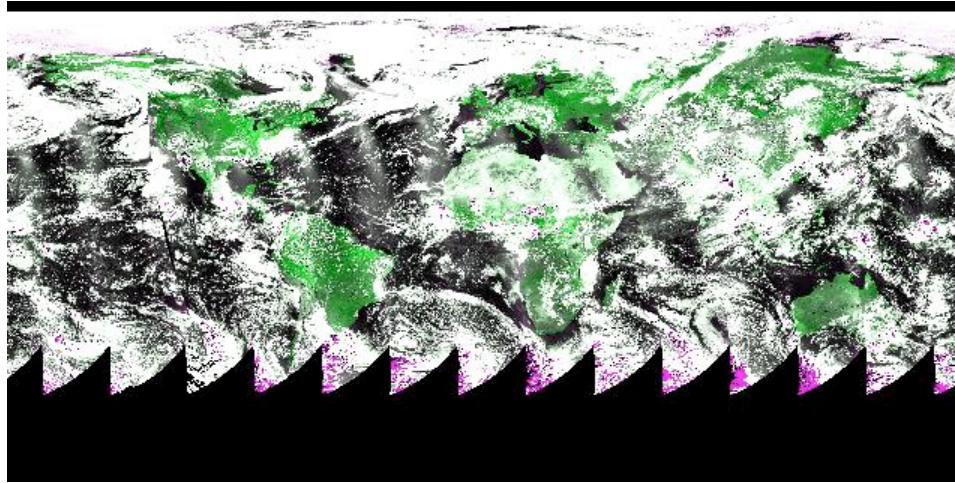
Day 1999-193 (July 12): RGB composite of ch1, ch2 and ch1

Filtering of PAL and LTDR Data

- Use Observations only if
 - Flagged as clear– use cloud flag in LTDR and CLAVR in PAL.
 - Channel is flagged as valid in LTDR
 - Valid observation in both data sets
- Use same observation sets from PAL and LTDR.

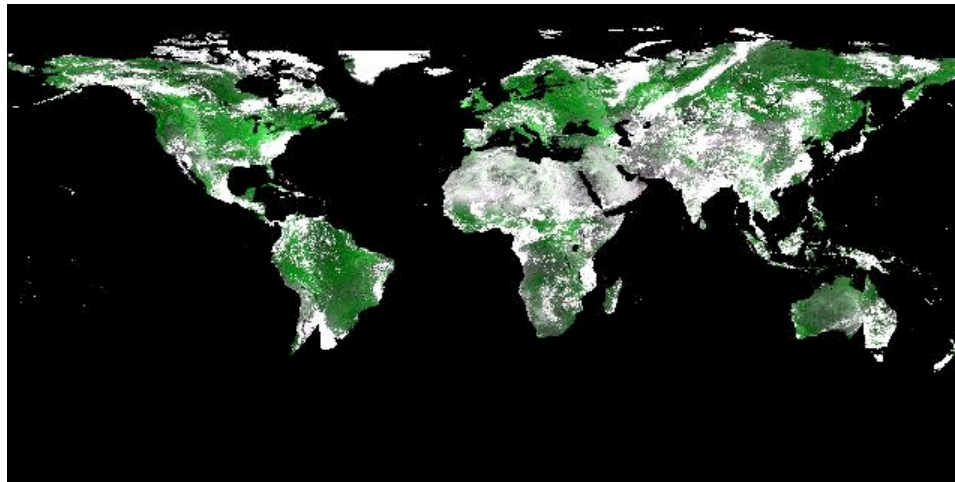
Filtering of PAL and LTDR Data

Data before filtering: RGB composite of ch1, ch2 and ch3



LTDR

1999-1993

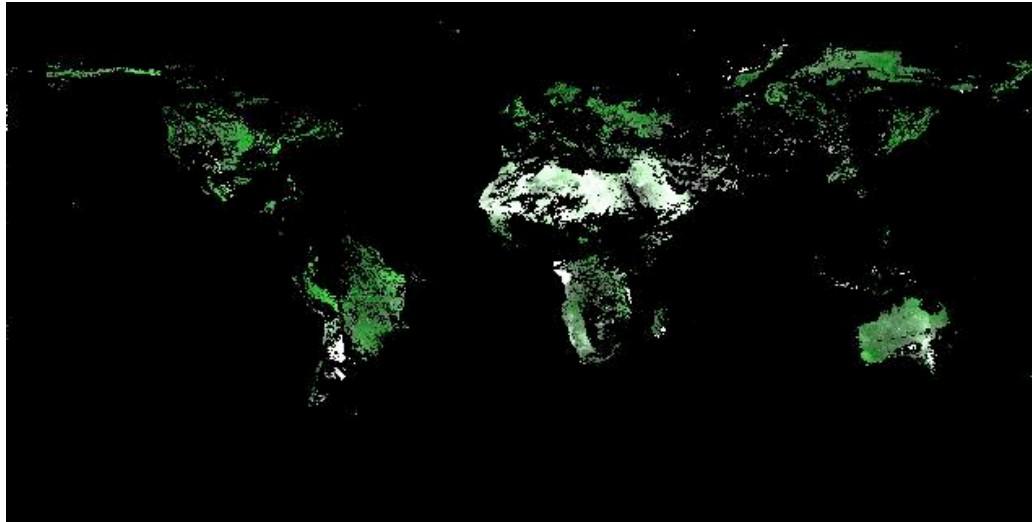


PAL

1999-1993

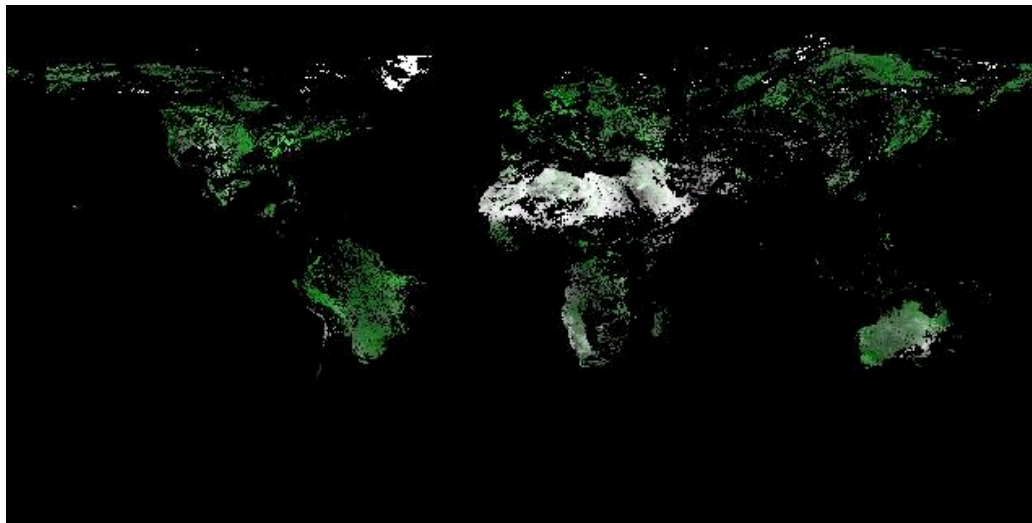
Filtering of PAL and LTDR Data

Data after filtering: RGB composite of ch1, ch2, and ch1



LTDR

1999-1993



PAL

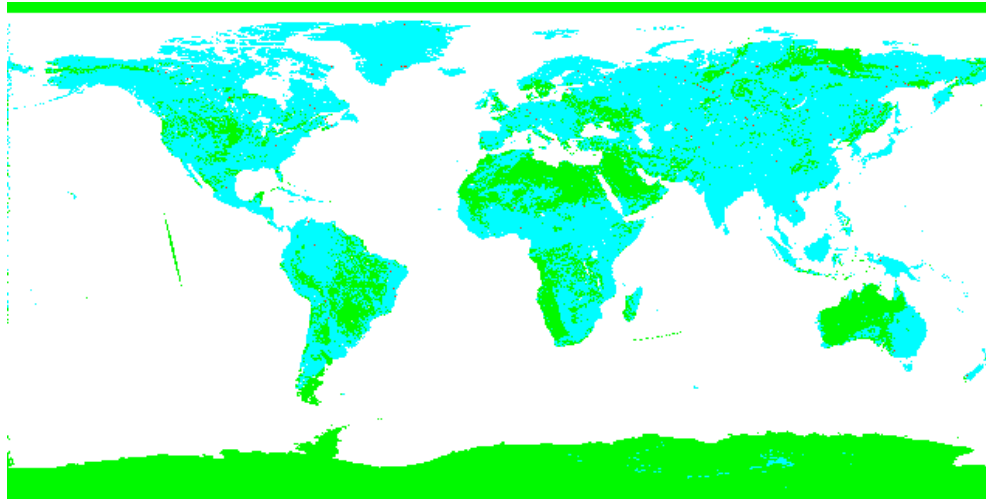
1999-1993

Spatial Comparison

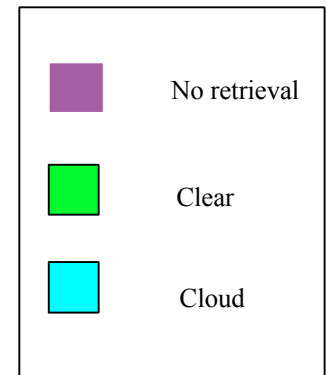
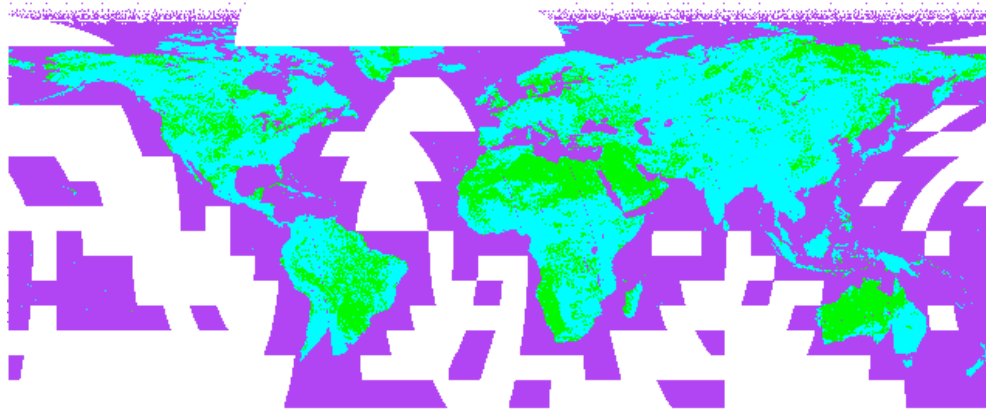
- Only filtered good quality observations are used in the intercomparison.
- Pixelwise difference are used to compare the data sets (global and spatial subset)
- Compared spatial subsets using scatter plots.

Cloud Flag Comparison - 1999193

LTDR

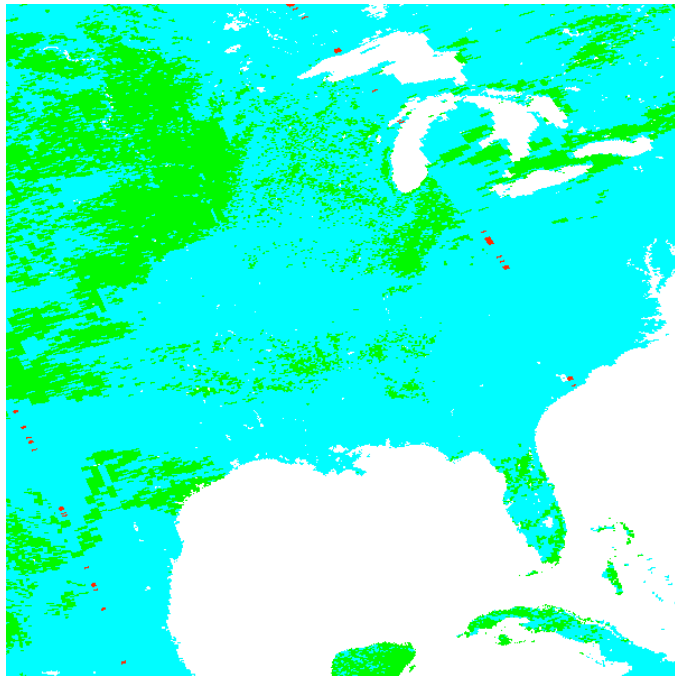


PAL

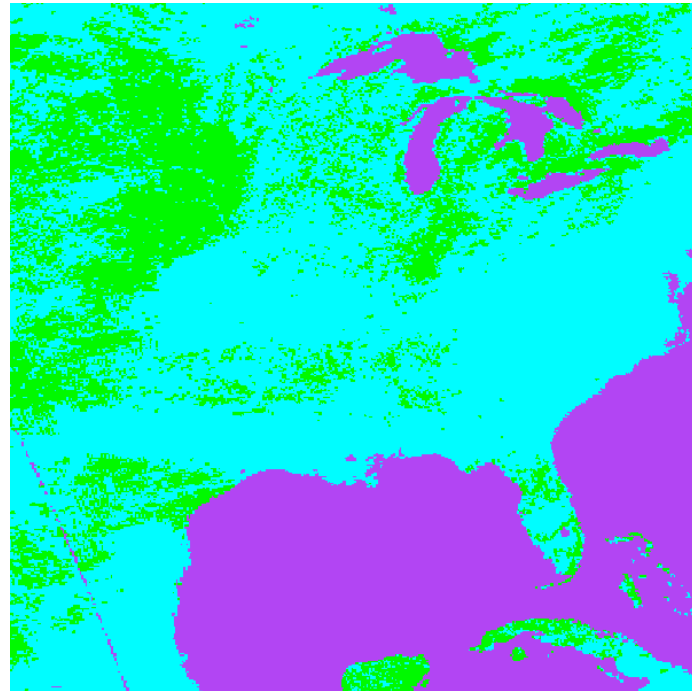


Cloud Comparison – 1999193

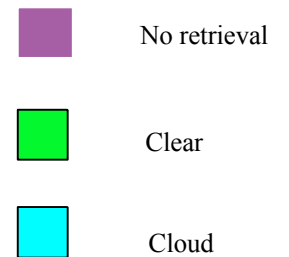
Spatial subset



LTDR

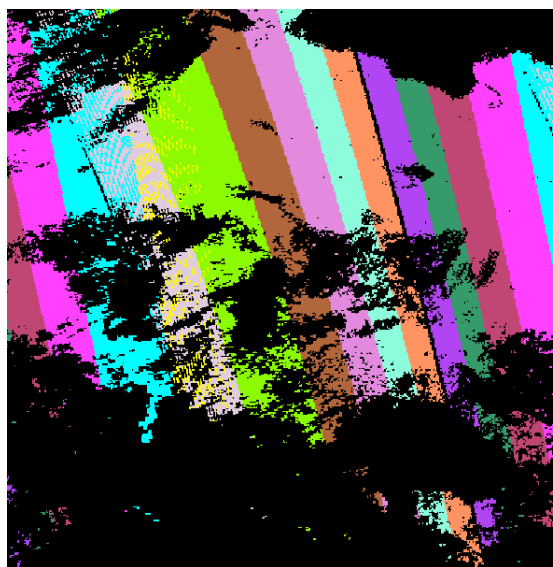
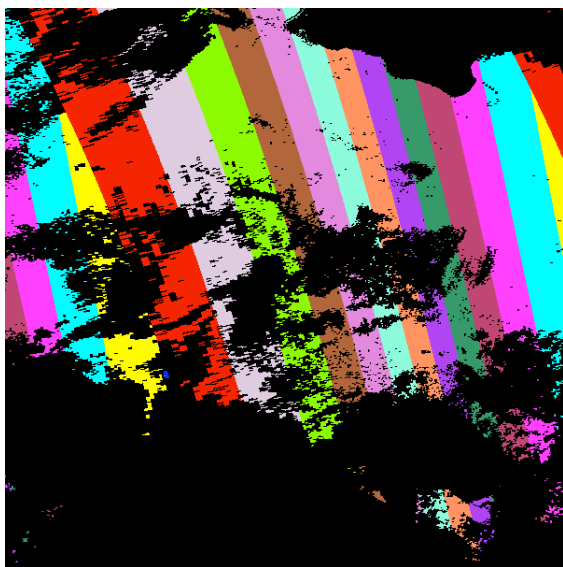
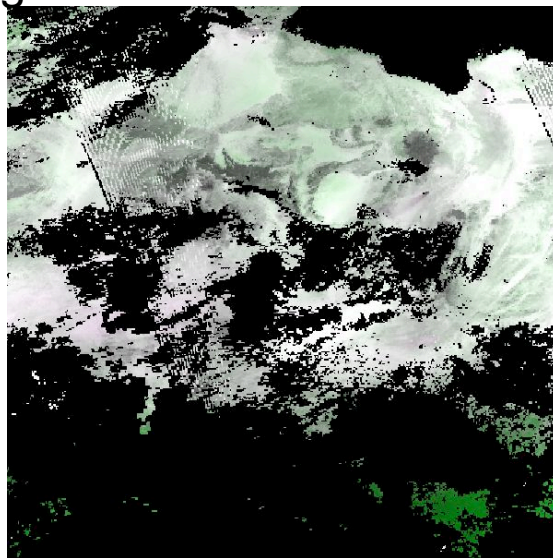
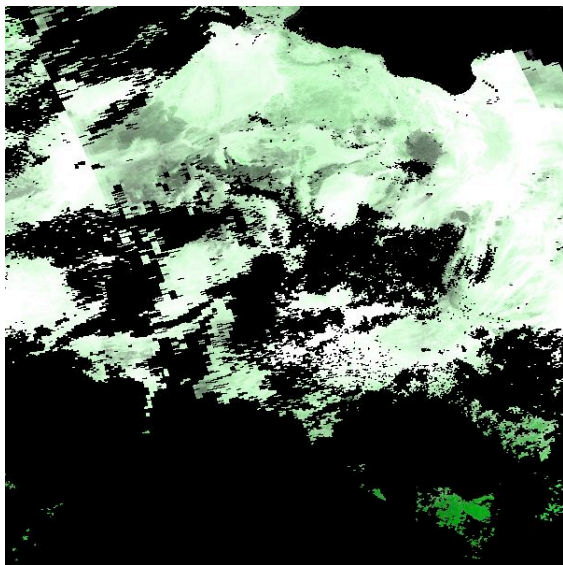


PAL



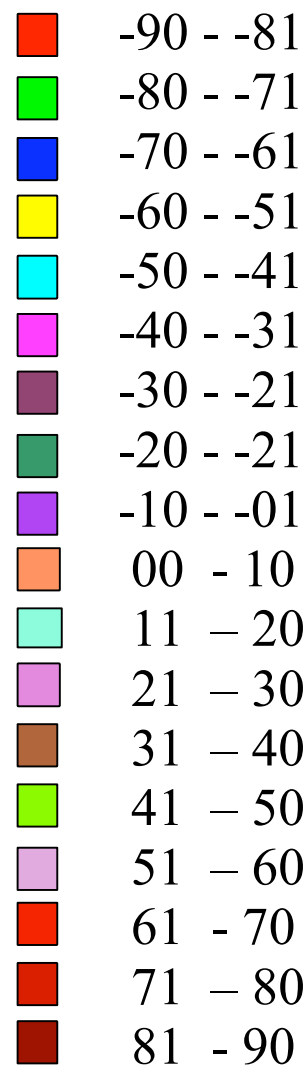
Spatial Comparison of Viewing Geometry 1999193

VZEN in LTDR and SCAN Angle in PAL



LTDR

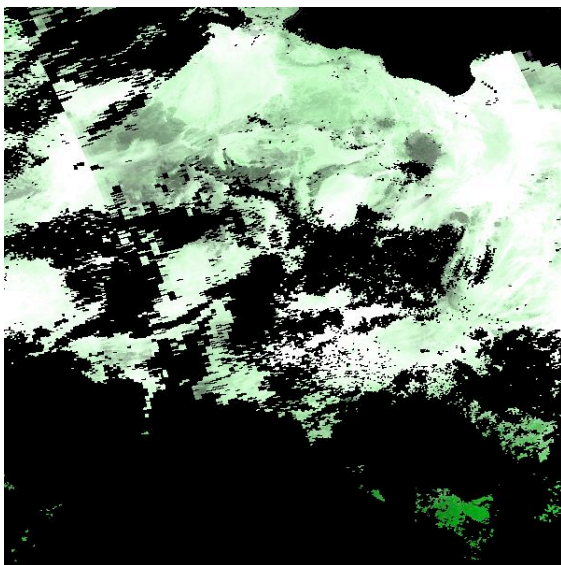
PAL



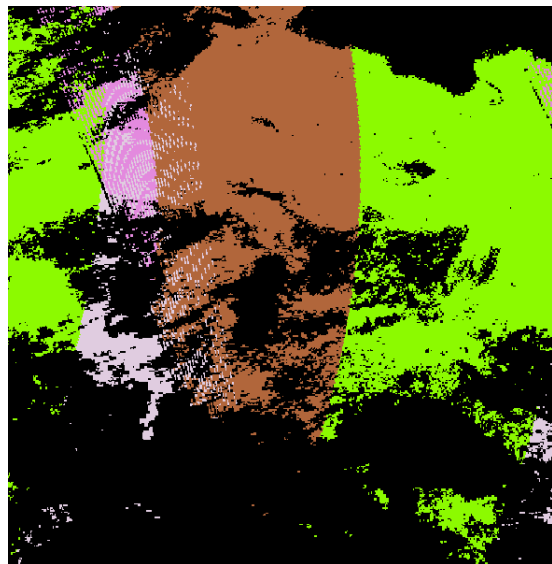
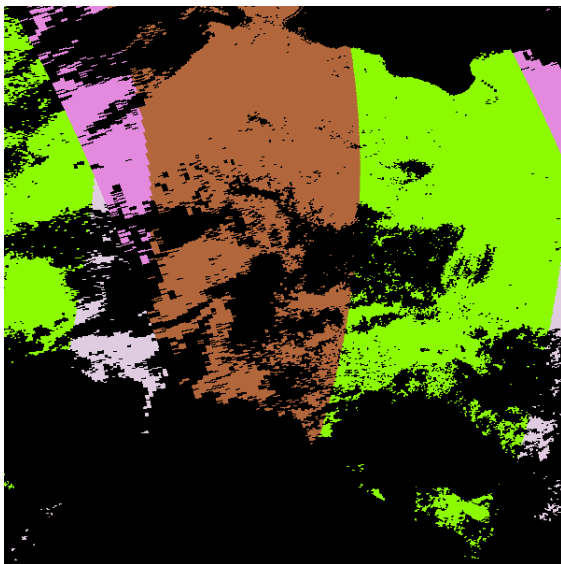
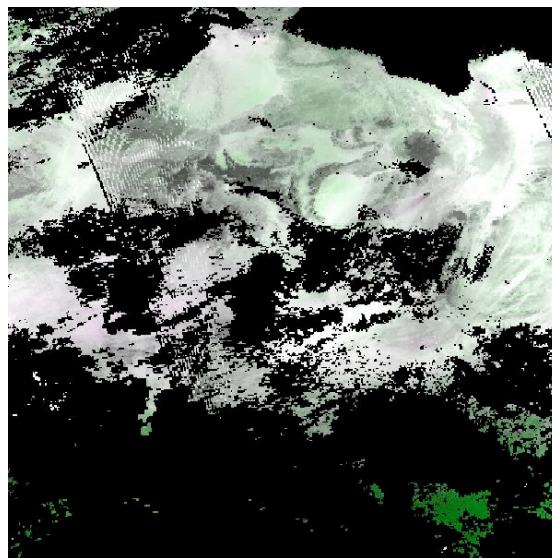
Spatial Comparison of Viewing Geometry - 1999193

SZEN Angle in LTDR and PAL

LTDR



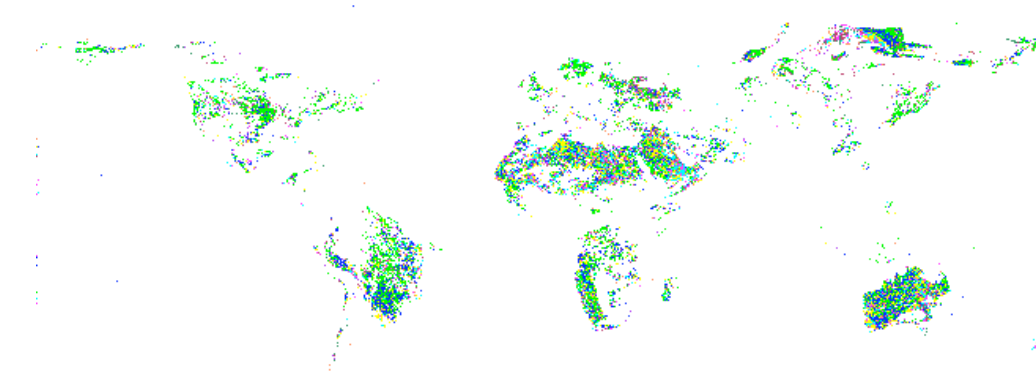
PAL



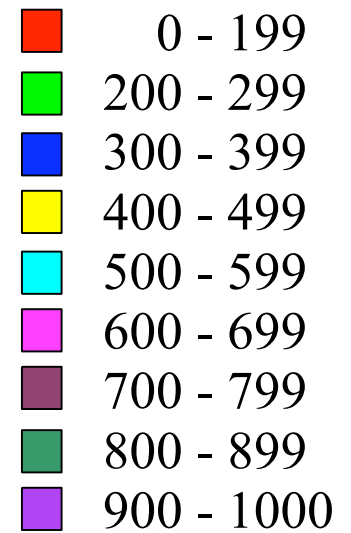
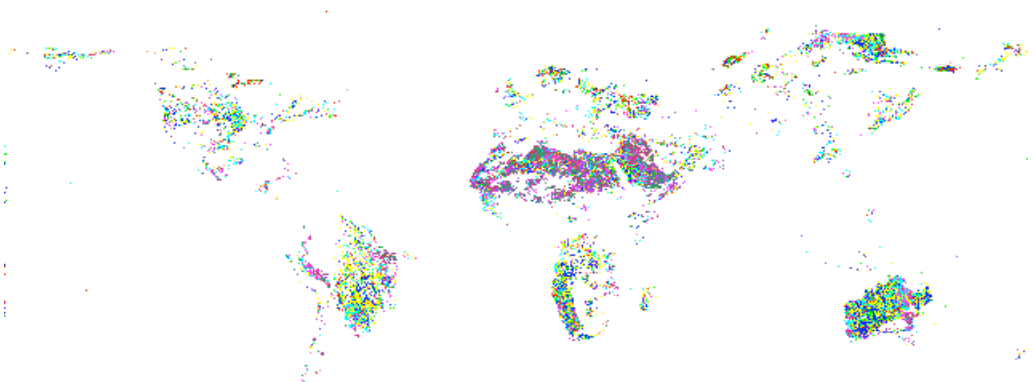
Spatial Comparison

Pixel-wise difference 1999-1993

CH1



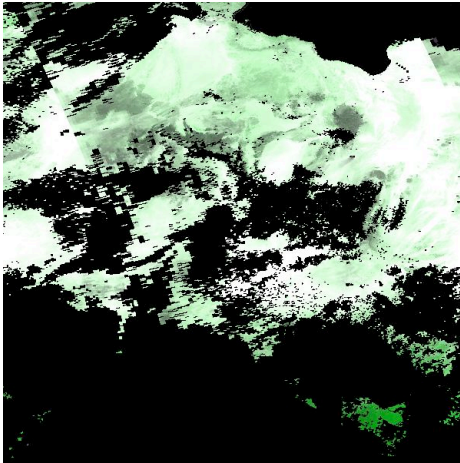
CH2



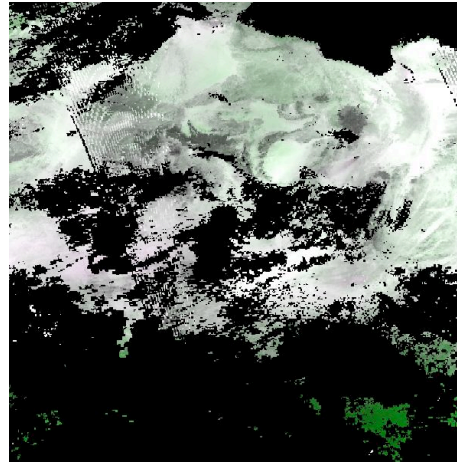
Spatial Comparison

Pixel-wise difference 1999-1993

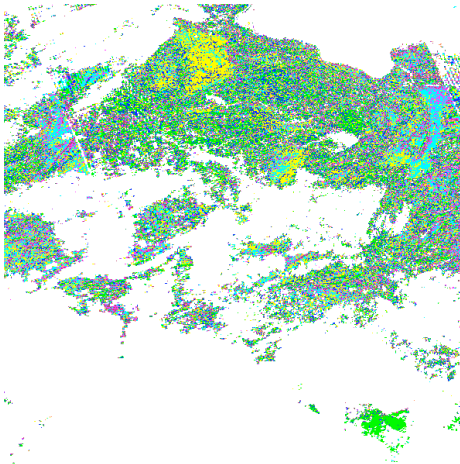
LTDR



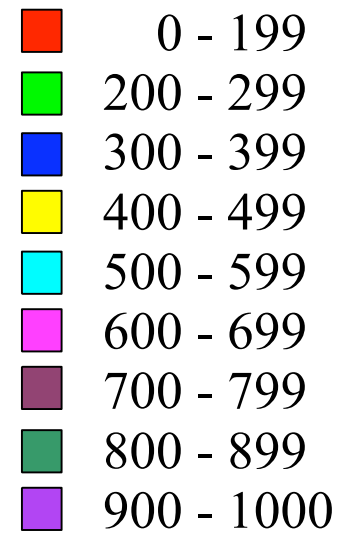
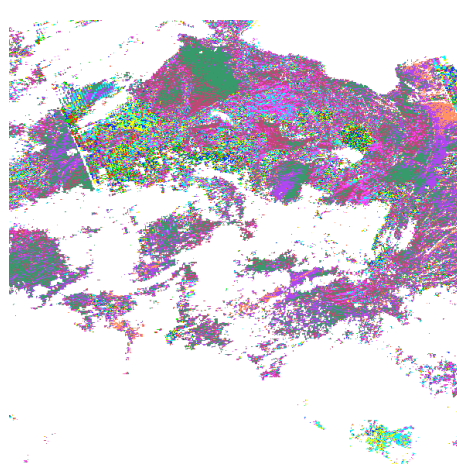
PAL



CH1



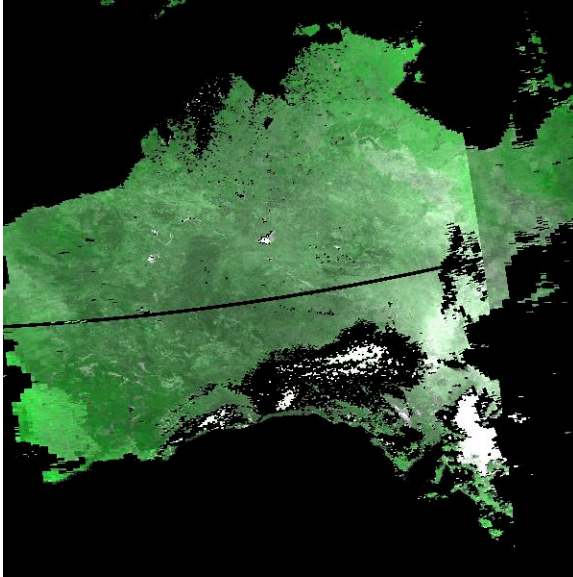
CH2



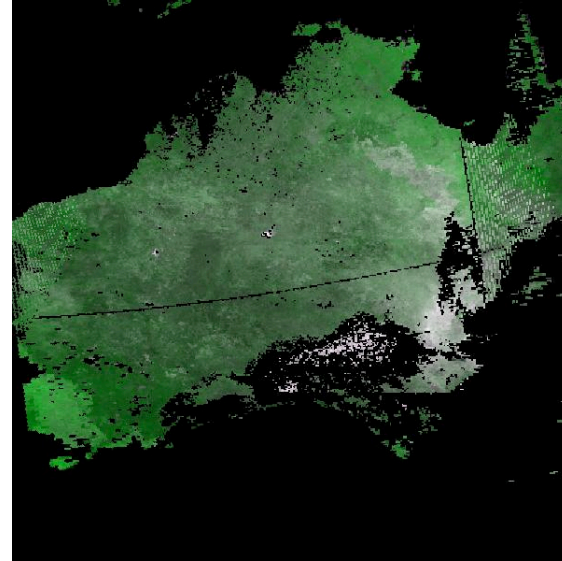
Spatial Comparison

Scatter Plot: X Axis – LTDR, Y-Axis - PAL

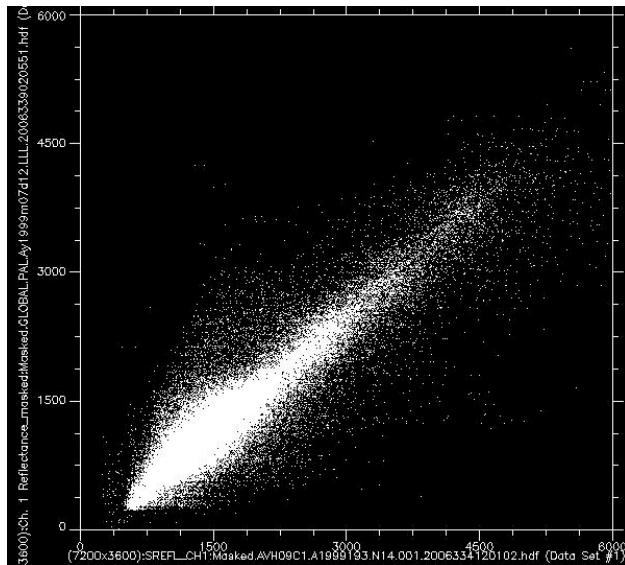
LTDR



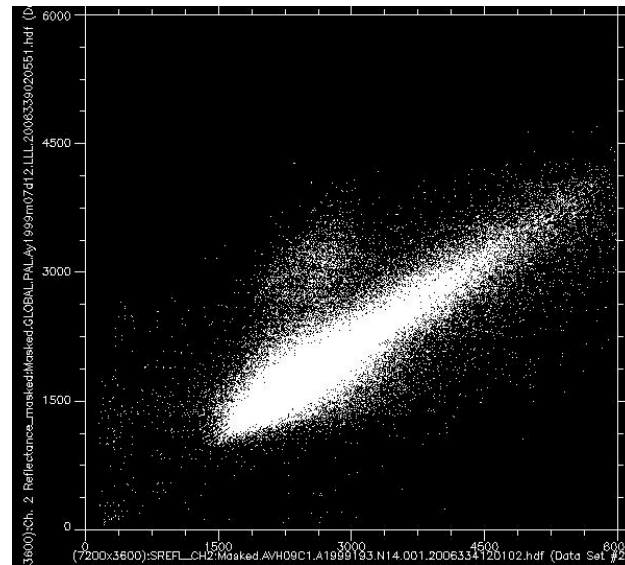
PAL



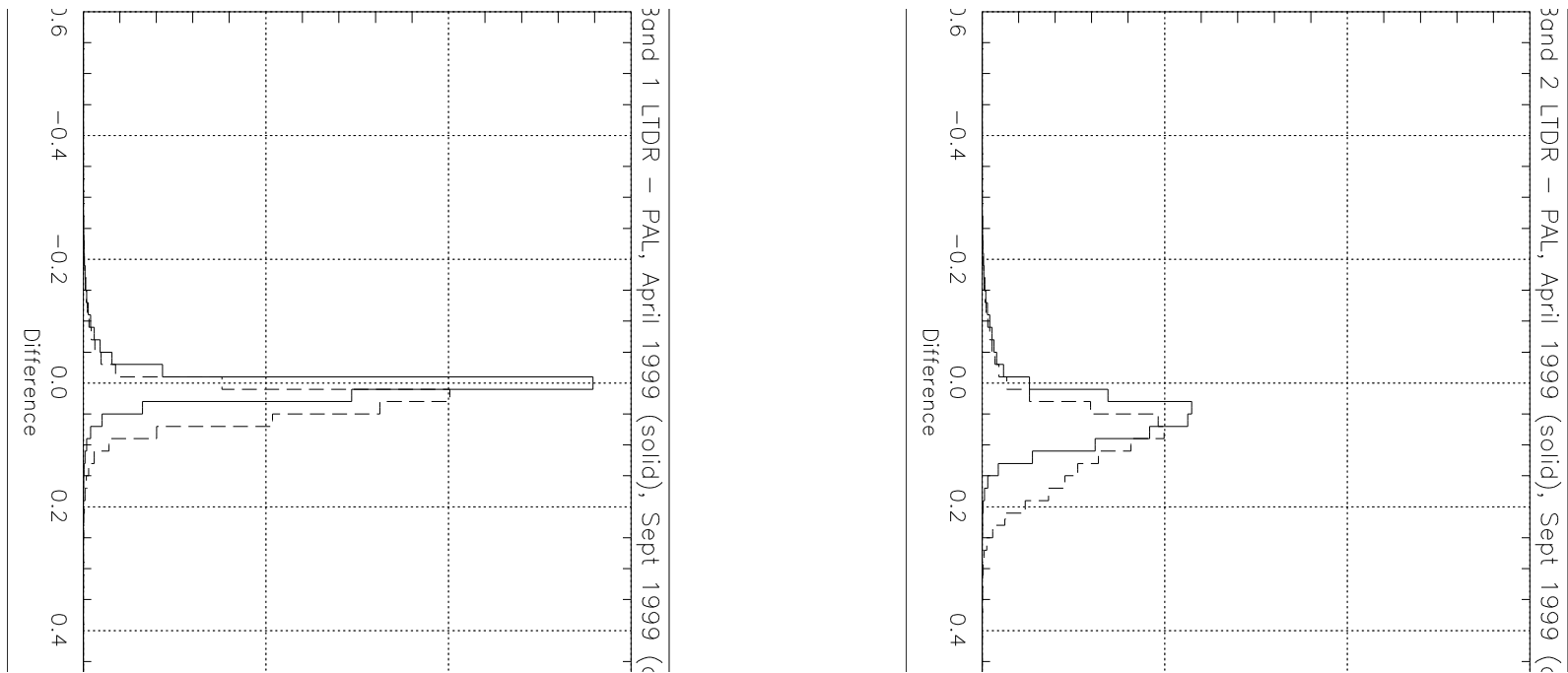
CH1



CH2



Histogram of difference in retrieved reflectance (LTDR – PAL)



Temporal Comparison

- Time Series of daily summary statistics (mean and standard deviation) are computed for each data sets from the LTDR and PAL daily product.
- Only filtered observations are used in the computation of statistics.
- Same set of observations from PAL and LTDR are used.
- Time series statistics are computed for
 - Aeronet sites (50km x 50km)
 - Biomes at MODIS golden tiles (1200km x 1200km)
 - Biomes (global).
- Complete results are available at http://ltdr.nascom.nasa.gov/cgi-bin/QA_WWW/sciTest.cgi (Click on “NOAA-14 Time Series” in the displayed table.
- Time Series plots are available for ch1 and ch2 reflectance and NDVI. Number of observations used in the statistics computation are also plotted.

Temporal Comparison

File Edit View Go Bookmarks Tools Window Help

Back Forward Search Print

Home Bookmarks SGL... WebMail Contact People Yellow Pages Download Find Sites Channels

Time Series for NOAA-14 Test

A time series of summary statistics derived from all the LTDR products at a number of fixed globally distributed locations is maintained and monitored by the LTDR QA personnel in order to enable synoptic quality assessment via the internet. Time series statistics are extracted at all [aeronet sites](#) and also nine MODIS L and [Golden Tiles](#). Product time series are important because they capture algorithm sensitivity to surface (e.g. vegetation phenology), atmosphere (e.g. aerosol loading) and remote sensing (e.g. sun-surface-sensor geometry) conditions that change temporally, and because they allow changes in the instrument characteristics and calibration to be examined. Please select the year and an aeronet site (listed in alphabetical order) or tile and biome combination).

First: ☒ Aeronet ☐ Golden Tile

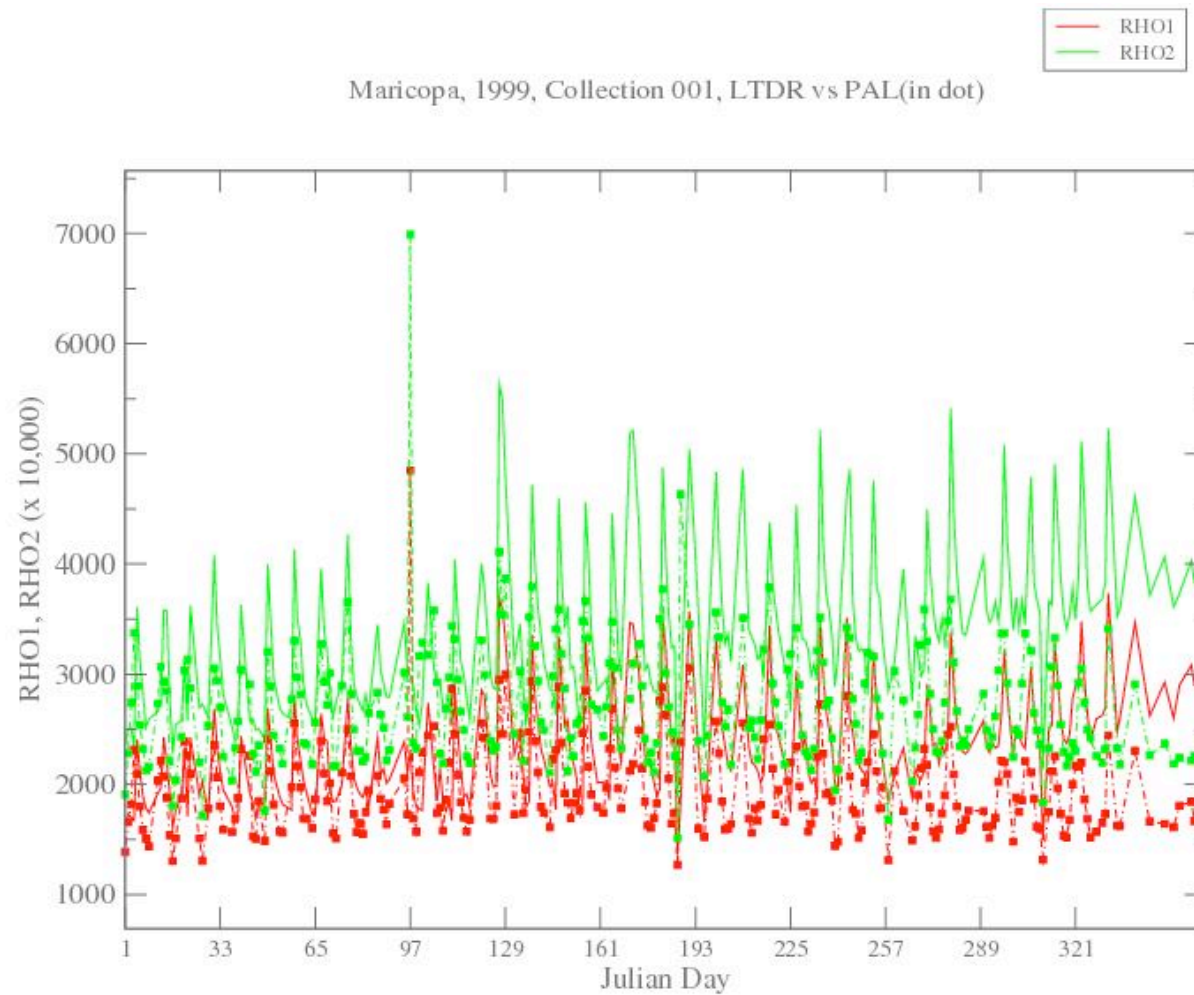
Year: 1992 1993 1994 1995 1996 1997 1998 1999 2000 all

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

Tiles: h09v05 (Southwestern U.S.) h11v03 (Northwestern Canada) h11v08 (Northern Amazon) h11v11 (Northern Chile) h17v07 (Sahel) h20v11 (Southern Africa) h24v04 (Northwestern China) h26v04 (Northeastern China) h30v11 (Central Australia) Global

Biomes: biome_0 (Water) biome_1 (Grasses/Cereal) biome_2 (Shrubs) biome_3 (Broadleaf Crops) biome_4 (Savannah) biome_5 (Broadleaf Forest) biome_6 (Needleleaf Forest) biome_7 (Unvegetated) biome_8 (Urban)

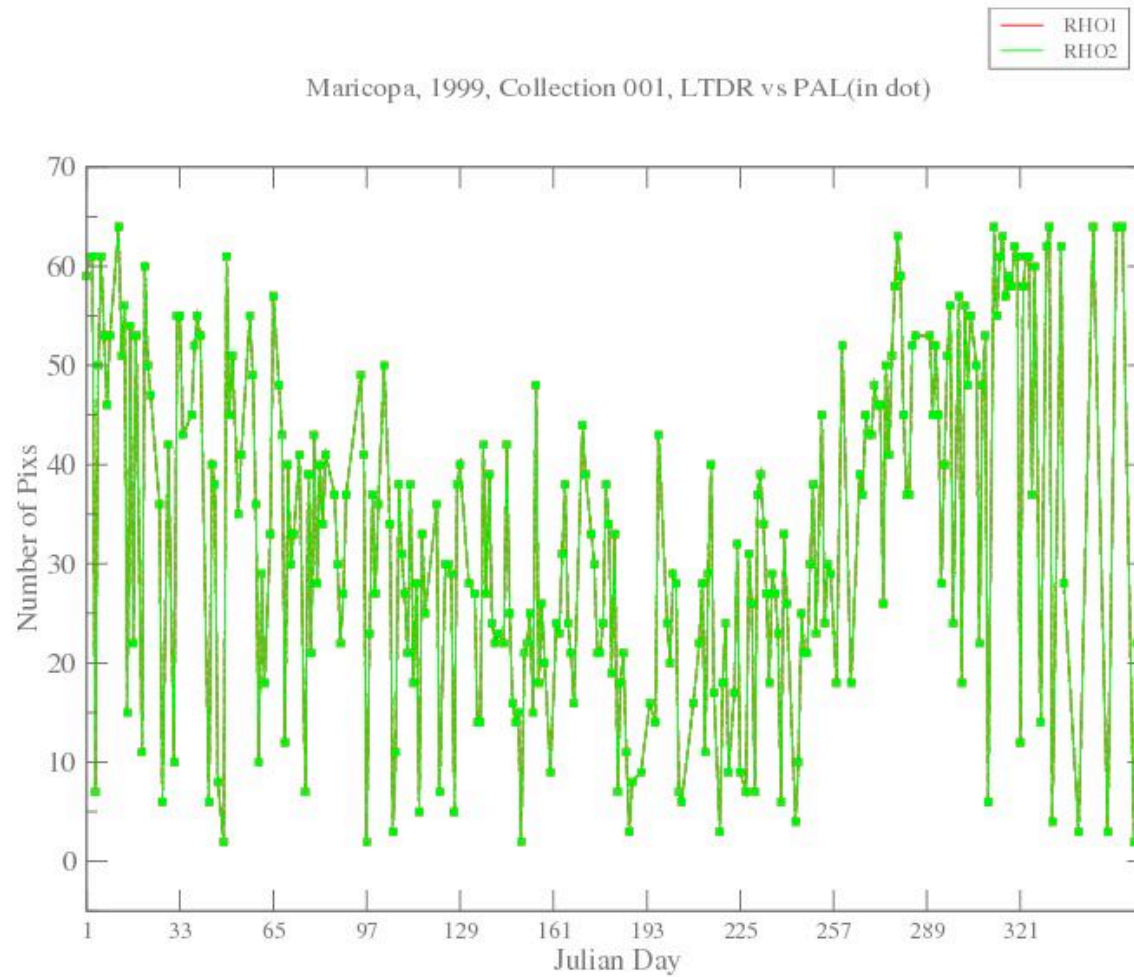
Temporal Comparison



Wed Dec 6 15:03:33 2006

Maricopa Year 1999

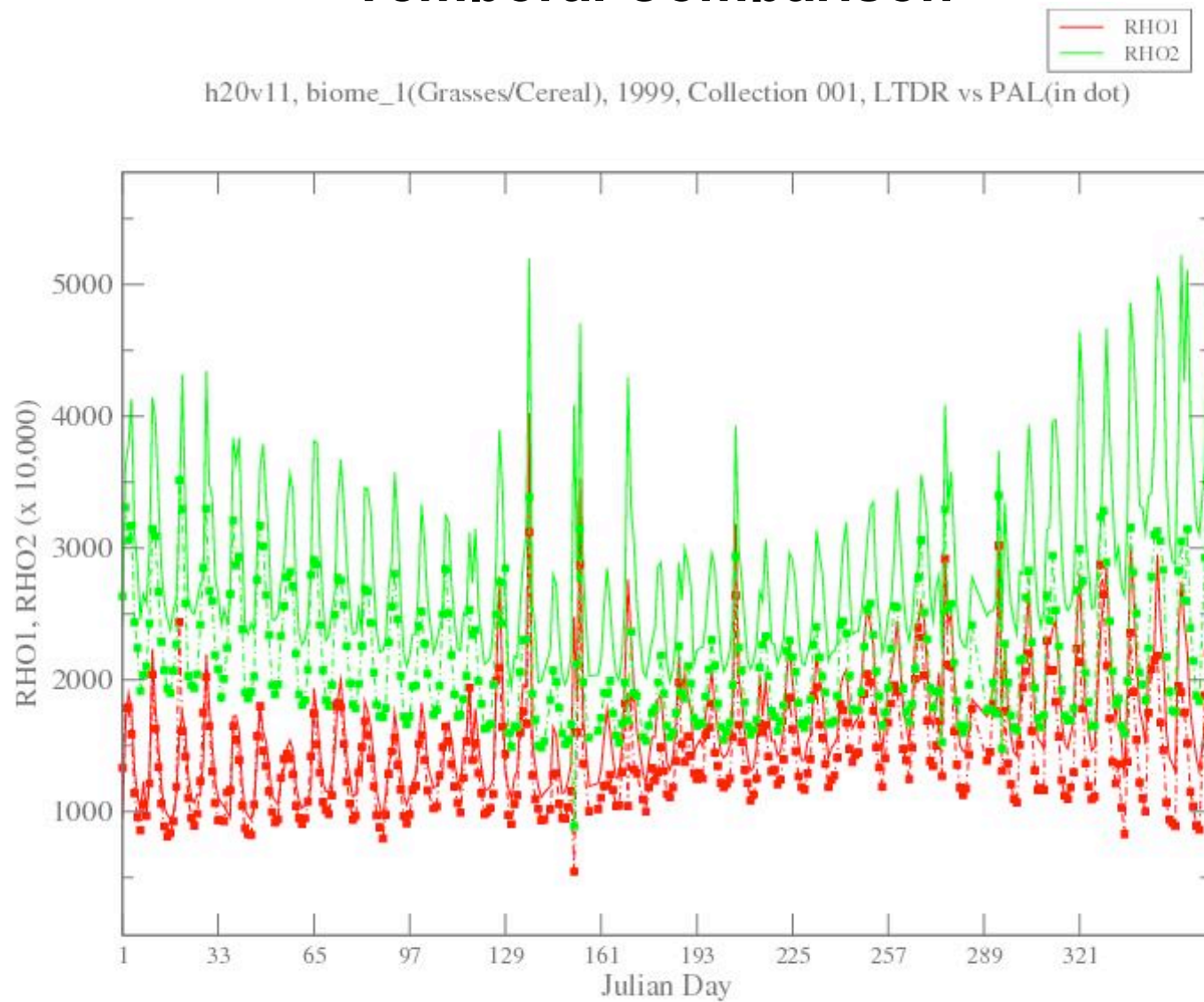
Temporal Comparison



Wed Dec 6 15:15:29 2006

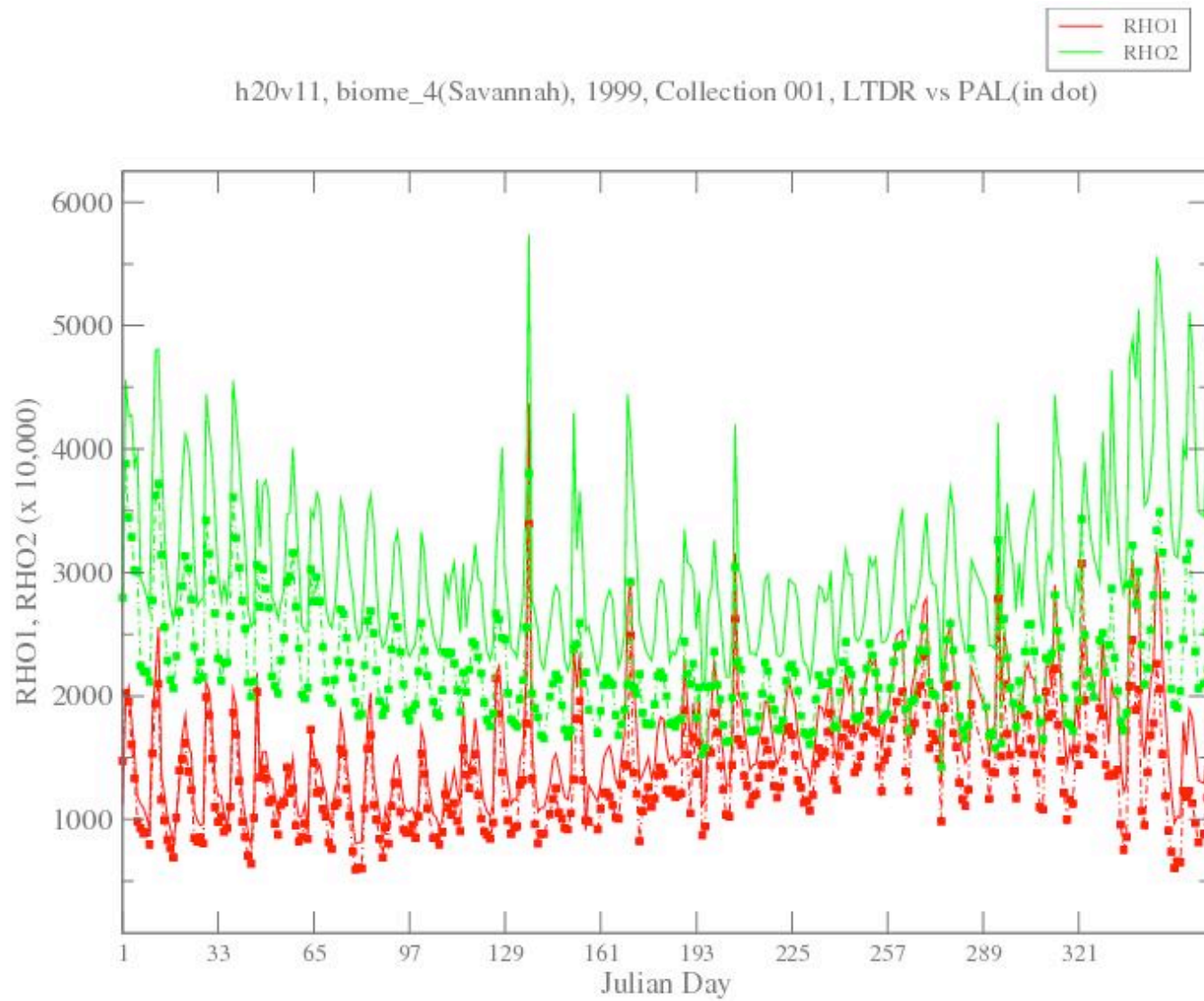
Maricopa Year 1999

Temporal Comparison



Wed Dec 6 11:01:57 2006

Temporal Comparison



Wed Dec 6 11:02:00 2006

Conclusion

- Higher values of surface reflectance retrieved in LTDR for both ch1 and ch2 compared to PAL – due to water vapor correction in LTDR.
- Visual inspection do not reveal any obvious problem or artifact in LTDR compared to PAL
- Time series plots of PAL and LTDR are comparable except for the consistent magnitude difference seen across all season over all biomes and aeronet sites.