



# CDR DEVELOPMENT PROJECT

## A Terrestrial Surface Climate Data Record for Global Change Studies

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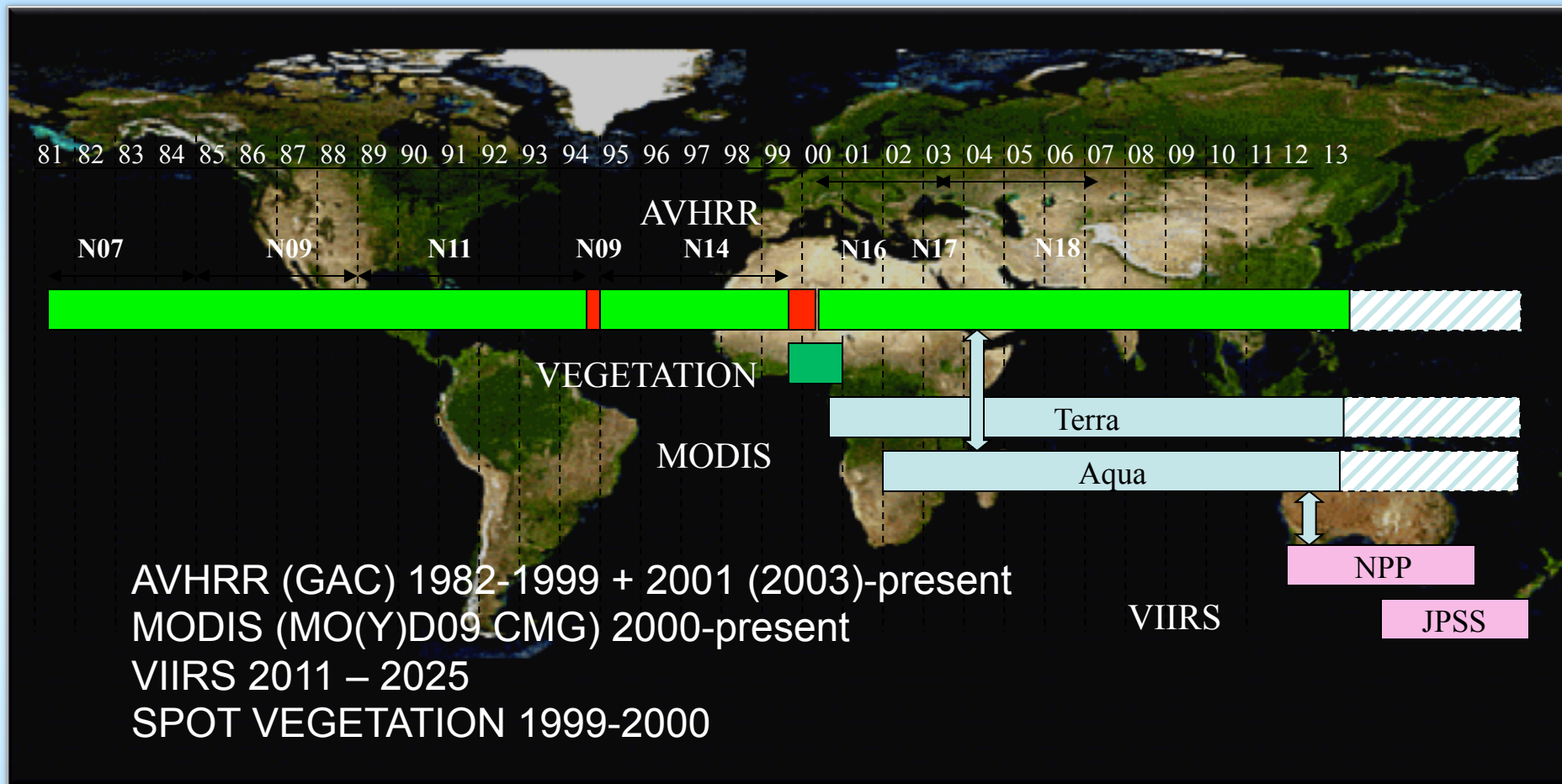
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# Outline

- Project Description
- Production and QA Approach
- Applications
- Schedule & Issues

# Project Description

**Land Climate Data Record:** Multi instrument/Multi sensor Science  
Quality Data Records used to quantify trends and changes



*Emphasis on data consistency – characterization  
rather than degrading/smoothing the data*

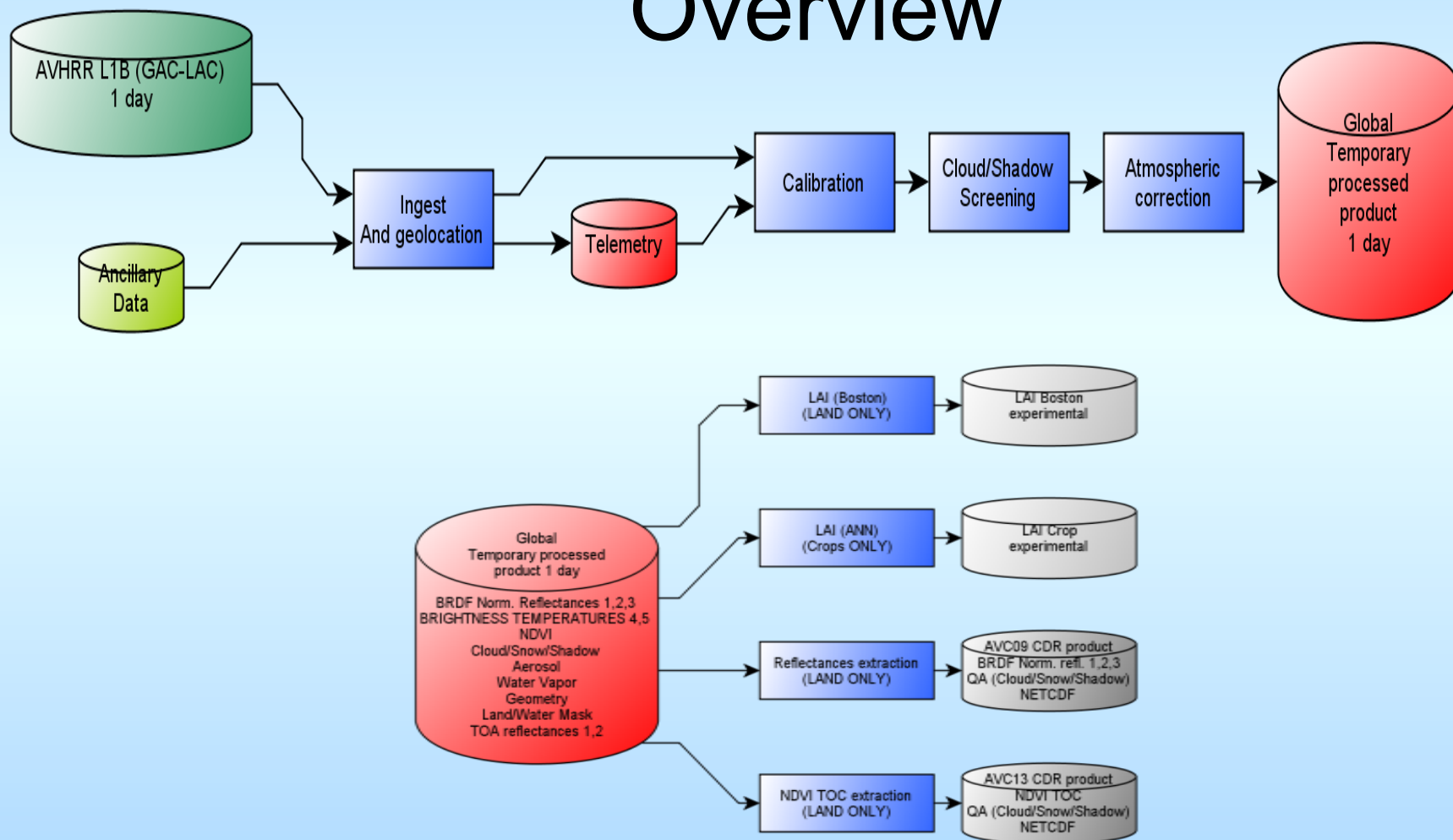
# Project Description

CDR(s)	Period of Record and Temporal Resolution	Spatial Resolution & Projection Used (if applicable)	Update Frequency	Data file distinction criteria	Inputs	Uncertainty Estimates (in percent or error)	Collateral Products (unofficial or unvalidated & produced alongside)
Surface reflectance (Red,NIR)  NDVI	1981-present daily	Linear Latitude Longitude (0.05deg)	daily	One file for each day and each CDR: Surface reflectance, NDVI	AVHRR GAC data	Reflectance (Red 0.02; NIR 0.03) NDVI (0.07)  3x3 average Reflectance (Red 0.01; NIR 0.015) NDVI (0.03)	LAI/FPAR



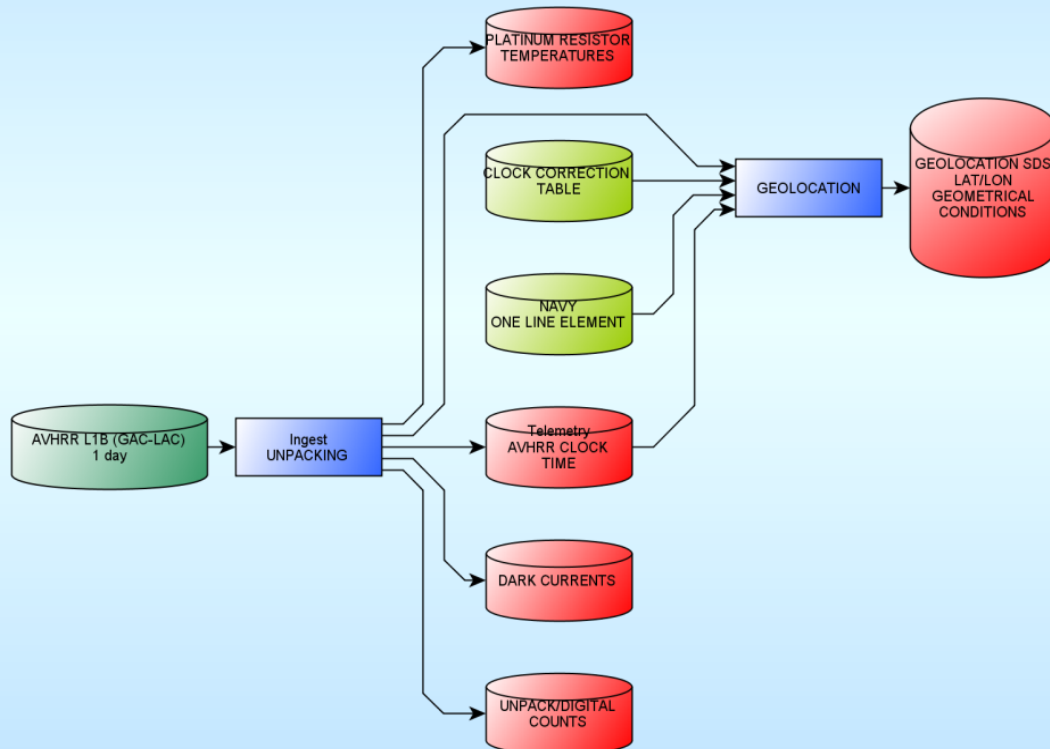
# Production Approach

## Overview

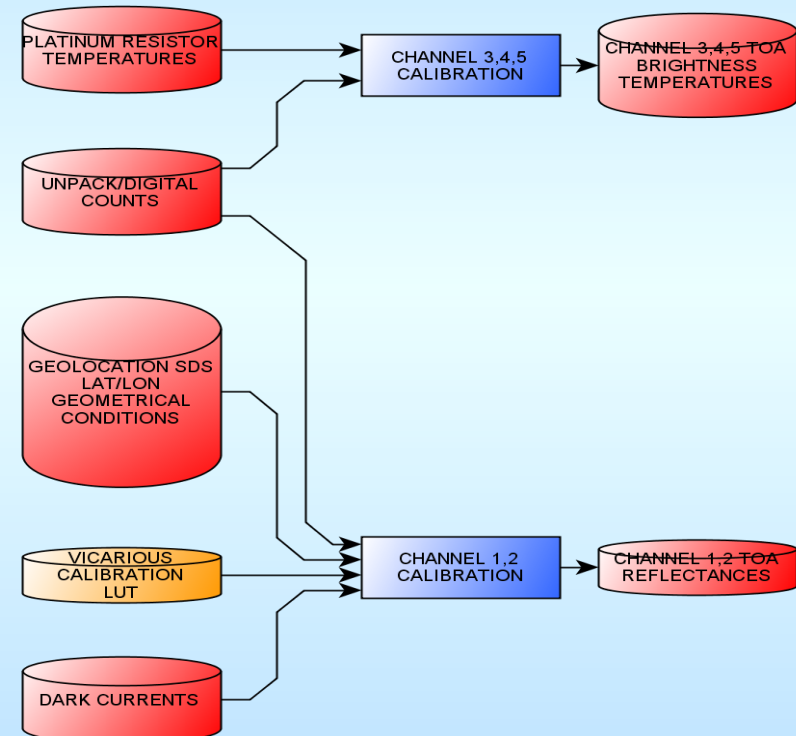


# Production details

## Geolocation



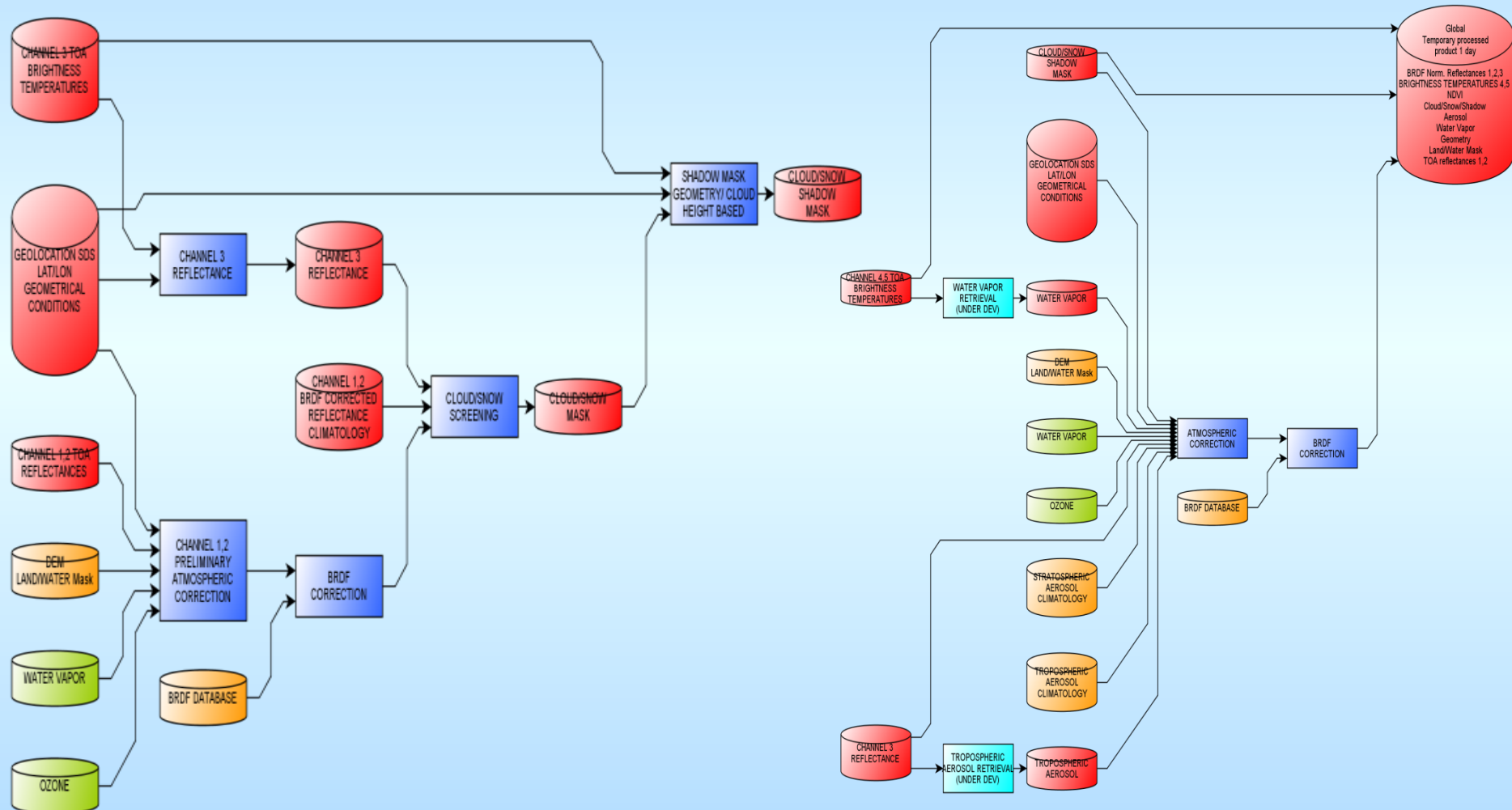
## Calibration



# Production details (cont.)

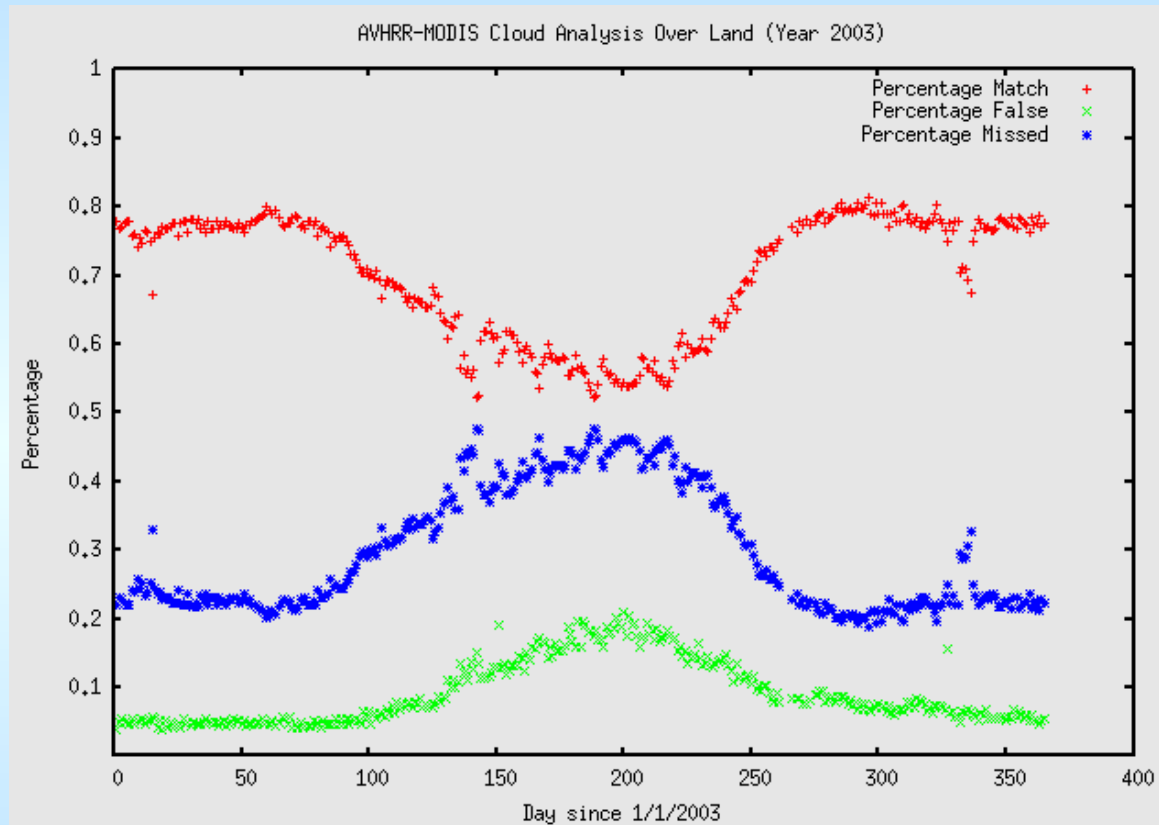
## Cloud/Shadow screening

## Atmospheric/BRDF correction



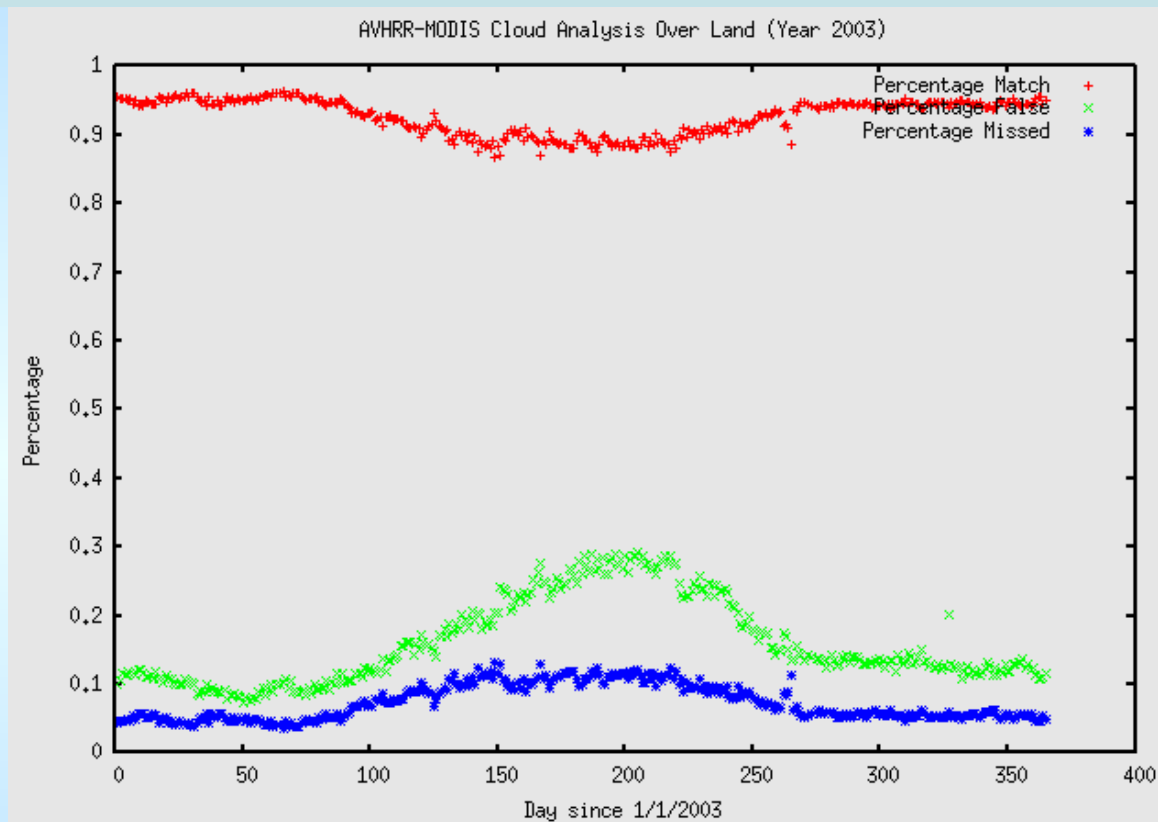
# Validation & Quality Assurance

# Assessing CLAVR using MODIS shows the need of an improved cloud mask



Evaluation of the global performance of the CLAVR Algorithm reported as percentage. Overall CLAVR identified only 2/3 of the cloud flagged by MODIS (red points), and labeled about 1/3 of the observation flagged as clear by MODIS as cloudy (blue points).

# New improved cloud mask for AVHRR

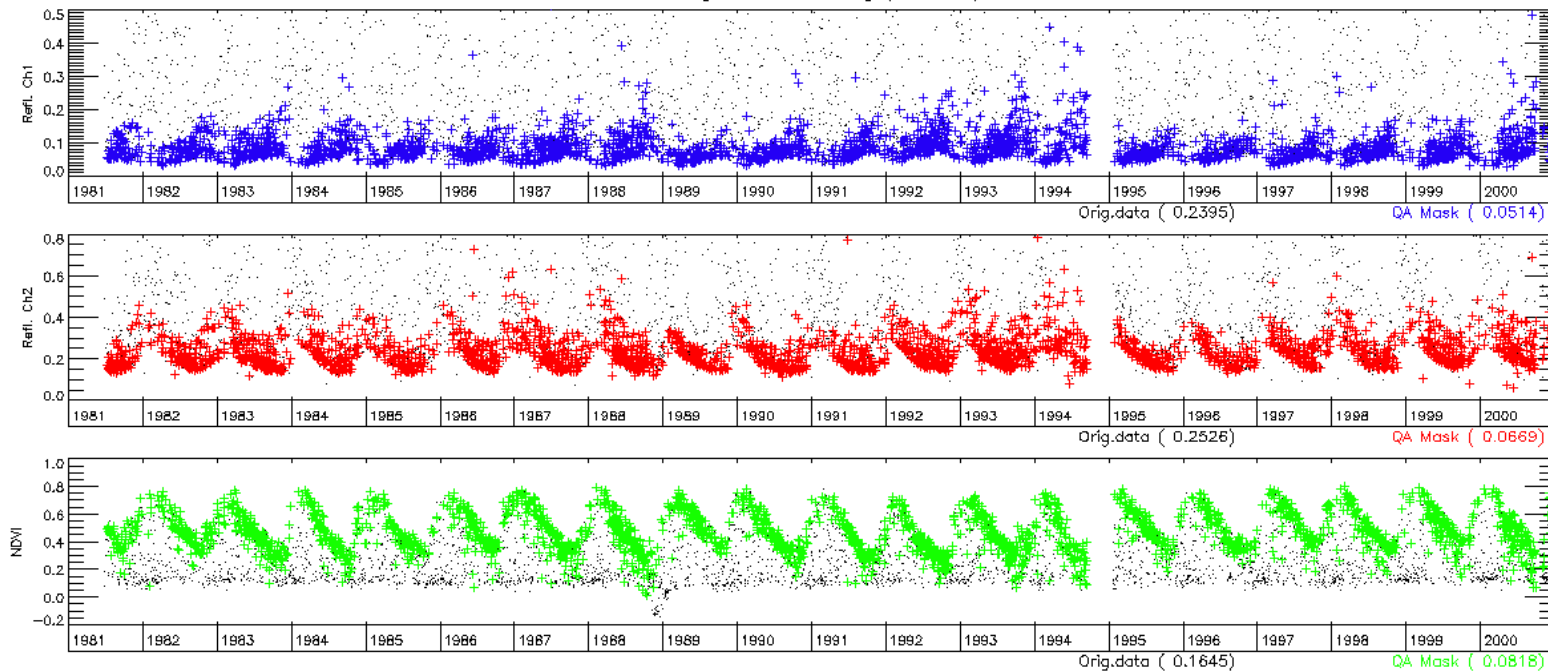


Evaluation of the global performance of the LTDR v3 cloud mask Algorithm reported as percentage.



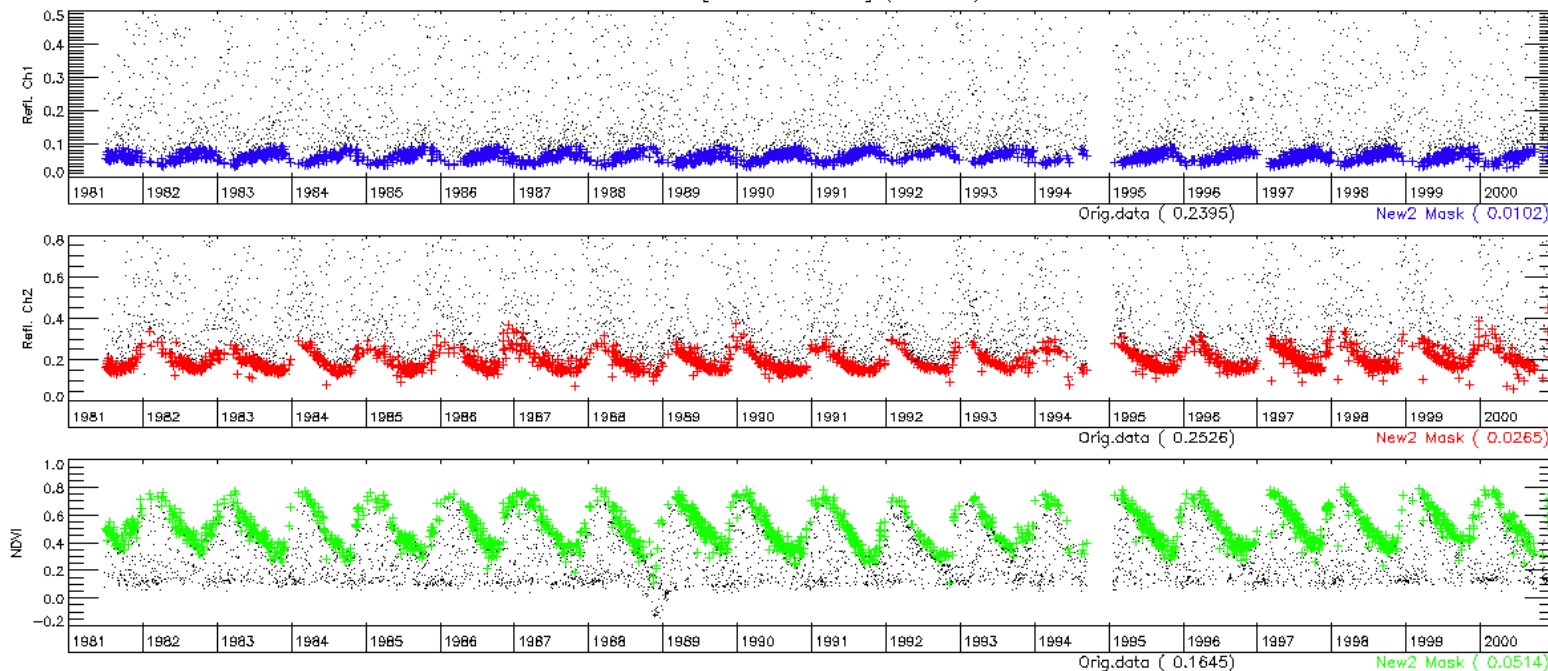
# AVHRR Time series CLAVR mask

DB04 [22.88S, 43.67E] ( 42.07%)

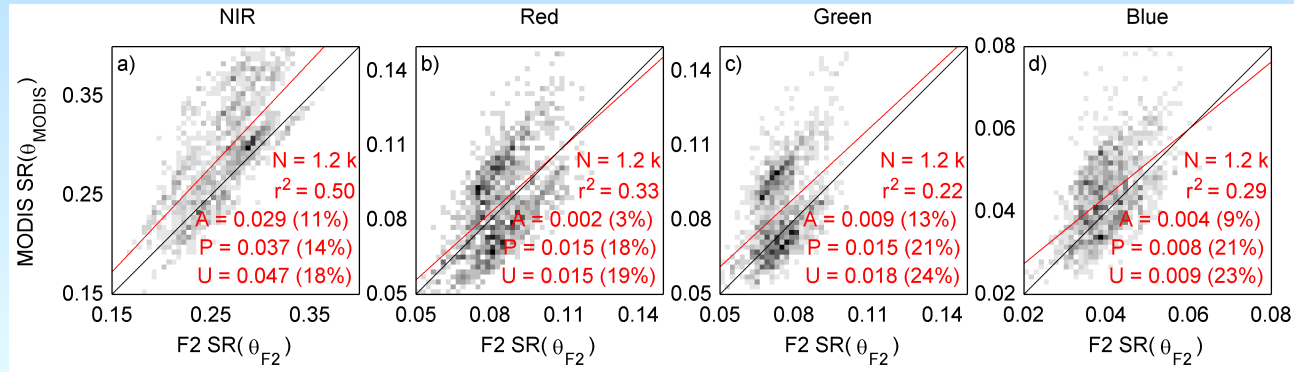


# AVHRR Time series LTDR cloud mask

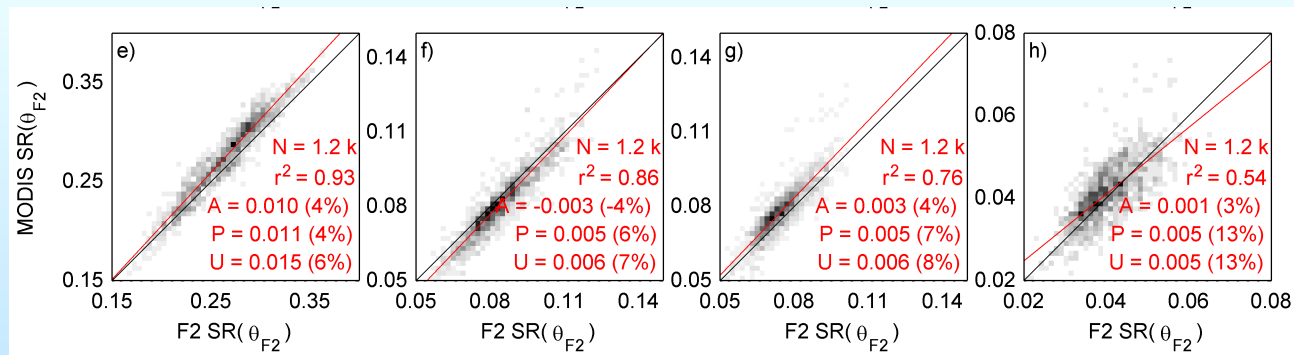
DB04 [22.88S, 43.67E] ( 27.35%)



# Cross-comparison of MODIS SR with product derived using independent approach 1/2



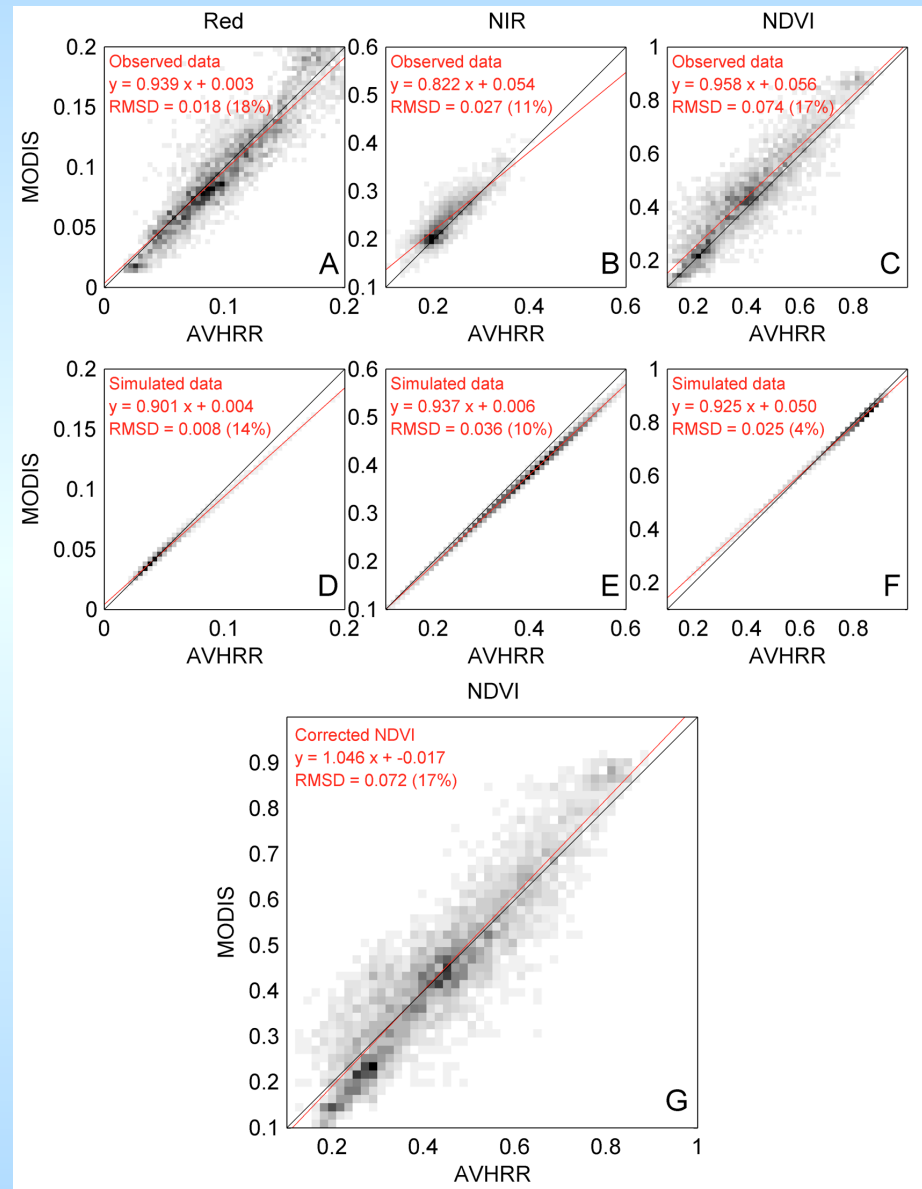
Comparison of aggregated FORMOSAT-2 reflectance and MODIS reflectance. No BRDF correction. Density function from light grey (minimum) to black (maximum); white = no data.



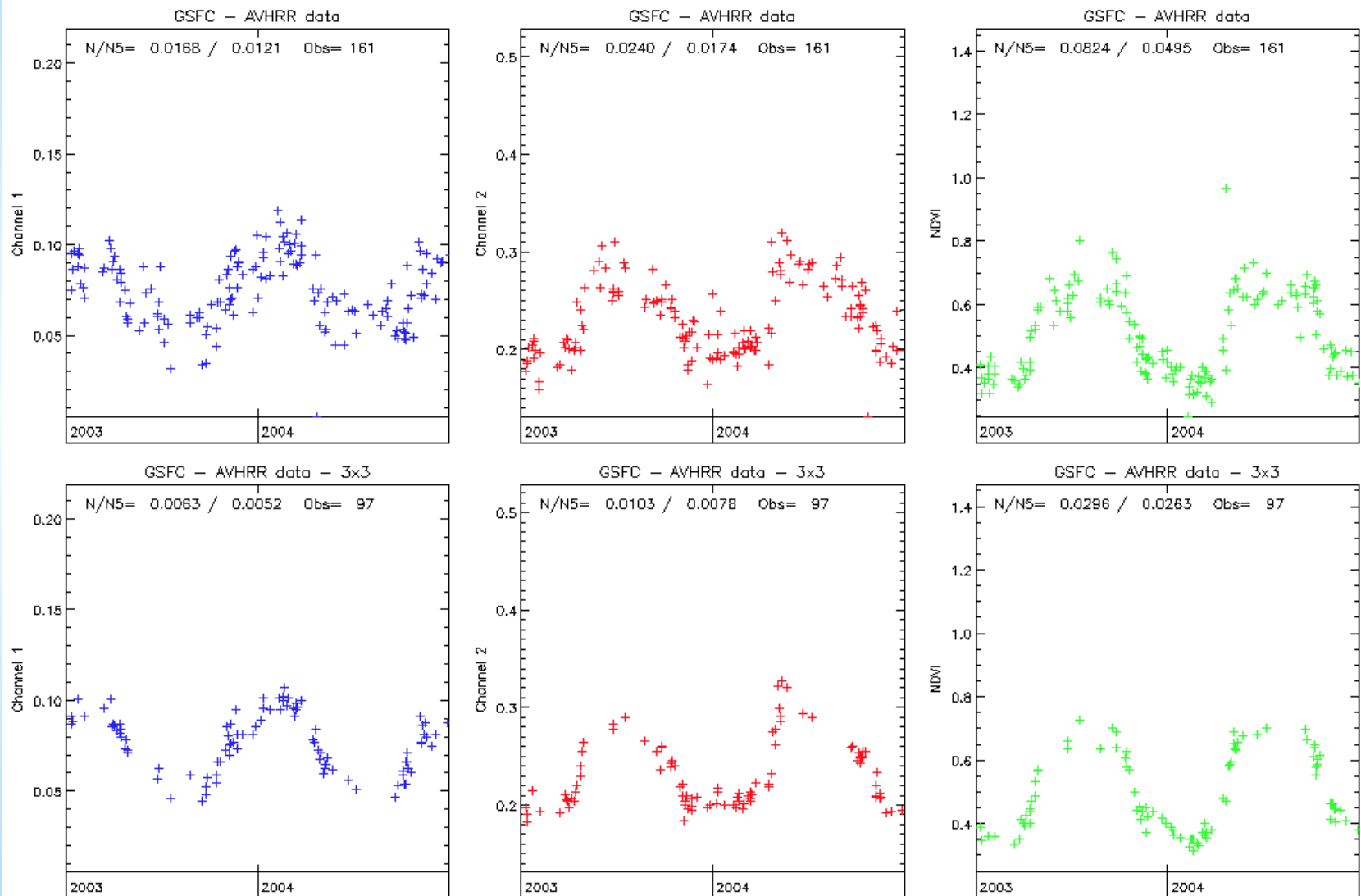
Comparison of aggregated FORMOSAT-2 reflectance and BRDF corrected MODIS reflectance. Corrections were performed with Vermote al. (2009) method using for each day of acquisition, the angular configuration of FORMOSAT-2 data.

# Using Direct comparison with MODIS Aqua for validation

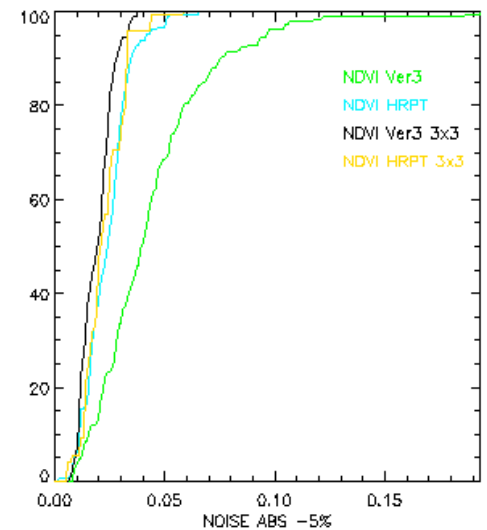
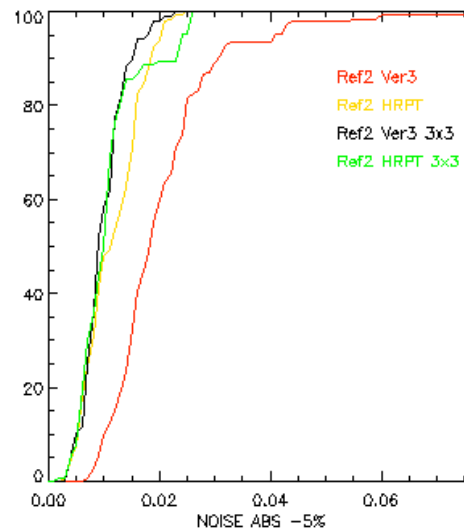
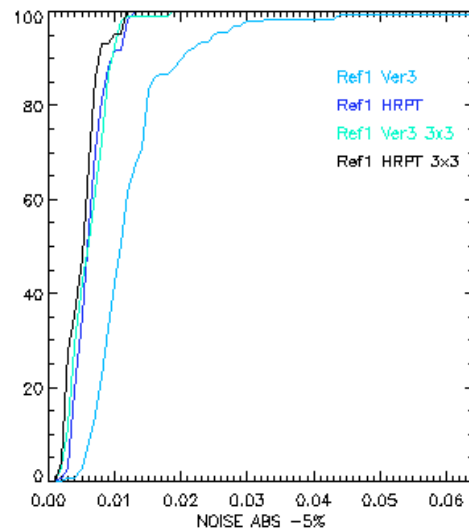
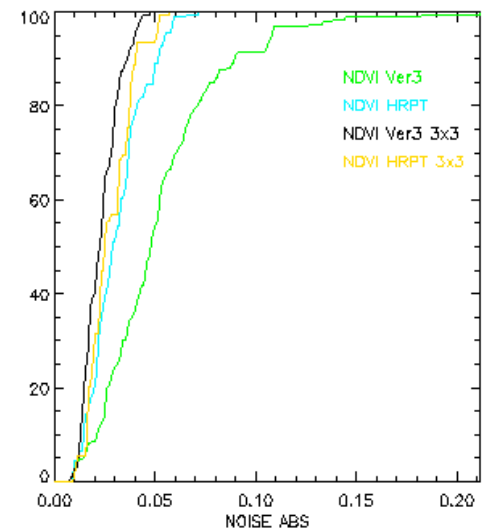
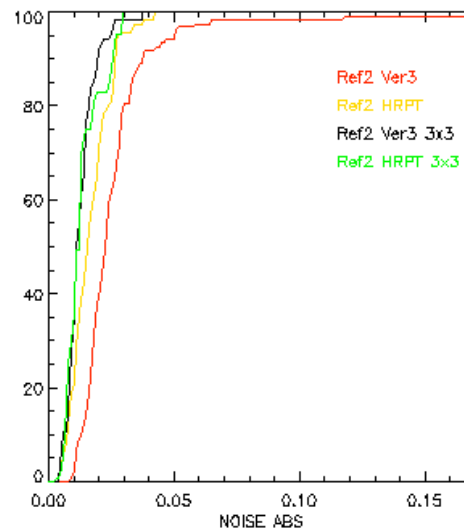
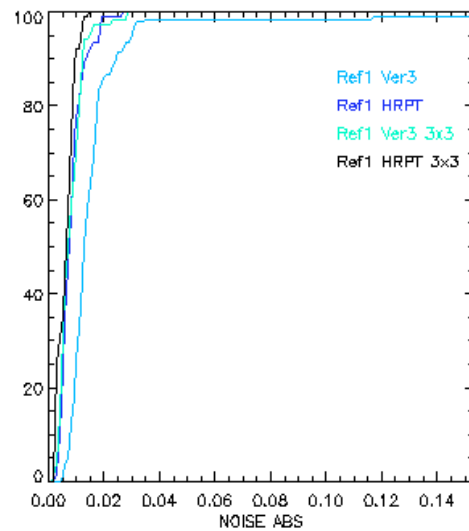
Comparison of MODIS Aqua and NOAA16 AVHRR data, A (Red) ,B (NIR) ,C (NDVI) are observed over AERONET sites for 2003-2004, D (Red), E(NIR), F(NDVI) are simulated using a vegetation model that account for spectral difference between MODIS and AVHRR bands. G shows over the AERONET sites MODIS NDVI versus corrected AVHRR NDVI computed from spectrally adjusted AVHRR surface reflectance.



# Analysis of the AVHRR reflectance and NDVI time series reveal an issue with GAC sampling



# Analysis of the GAC artifact over AERONET SITES





# Operational Quality Assurance

The screenshot shows the NASA Land Long Time Data Record (LTDR) Quality Assessment web page. At the top, the NASA logo and "GODDARD SPACE FLIGHT CENTER" are on the left, and a link to the "NASA Homepage" is on the right. The main title "Land Long Time Data Record" is in orange, followed by "Quality Assessment" in a large, bold, orange font over a satellite image background. A left sidebar contains links: "LTDR Products", "LTDR File Specification", "Calibration", "Global Browse", "Time Series", "Known Product Issues", "QA Tools", "Science Team Member", "QA Personnel", "FAQ", and "Feedback". The main content area has a heading "Welcome to the Land Long Time Data Record Quality Assessment Web Page" and a paragraph explaining the objective of LTDR QA: to evaluate and document the scientific quality of global LTDRs (Long Term Data Records) made from remotely sensed data acquired using AVHRR, MODIS, and VIIRS. It states that LTDRs are currently produced as single global data records for each science parameter at a coarse resolution of 0.05 deg, and any discrepancies or QA-related issues are posted as known issues on the Known Issues web page. The footer includes the "FIRST GOV" logo, a link to the "Privacy Policy and Important Notices", the NASA logo, and contact information for the Web Master (Min Zheng), NASA Official (Ed Masuoka), and a link to the LTDR QA Home Page. It also notes the last update date as May 3, 2006.

NASA GODDARD SPACE FLIGHT CENTER [+ NASA Homepage](#)

## Land Long Time Data Record

### Quality Assessment

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

[Global Browse](#)  
[Time Series](#)  
[Known Product Issues](#)  
[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). 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 the QA process are posted as known issues on the Known Issues web page at this site. These issues are updated as the new version of data records are produced using improved algorithm.

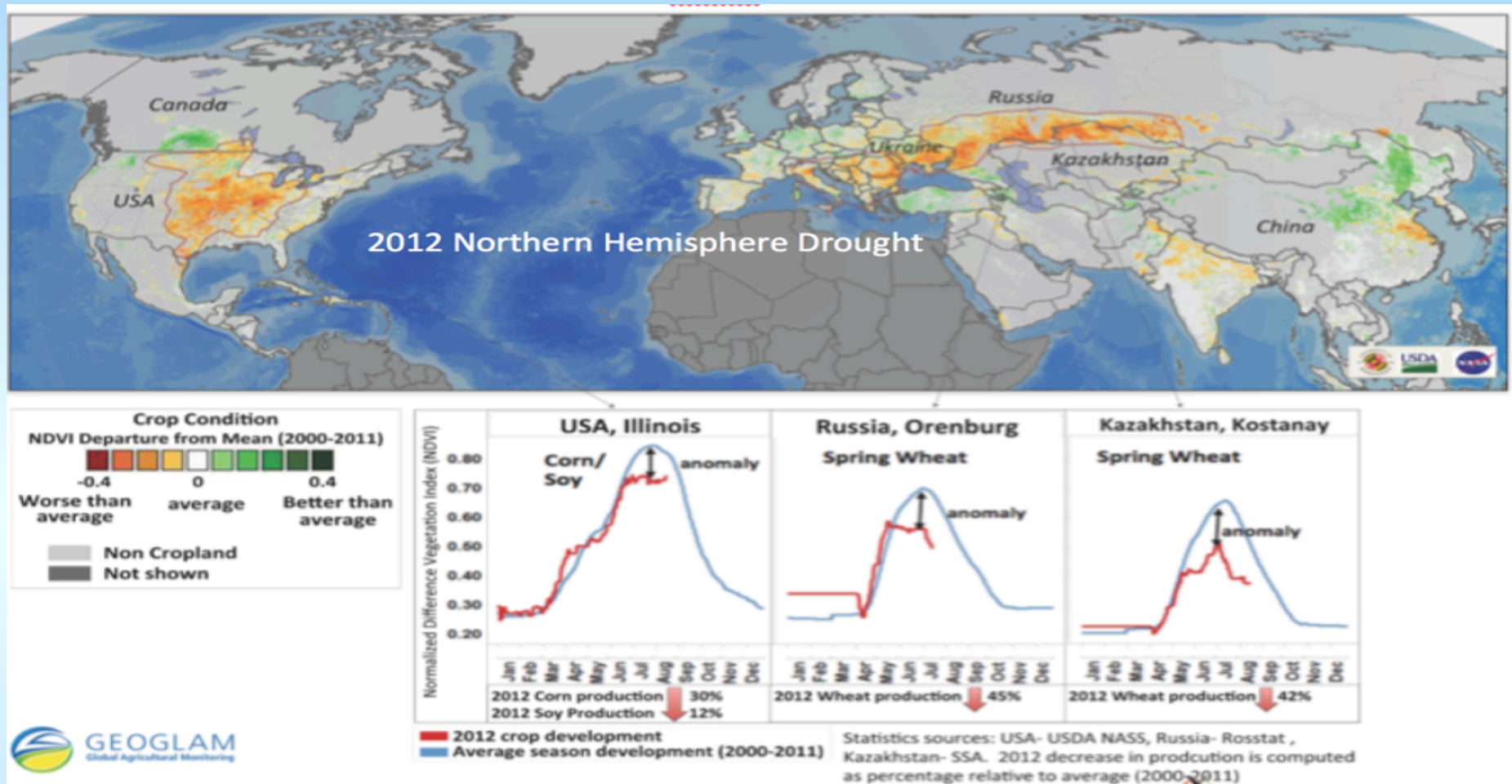
**FIRST GOV**  
Your First Click to the U.S. Government

[+ Privacy Policy and Important Notices](#)

NASA

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

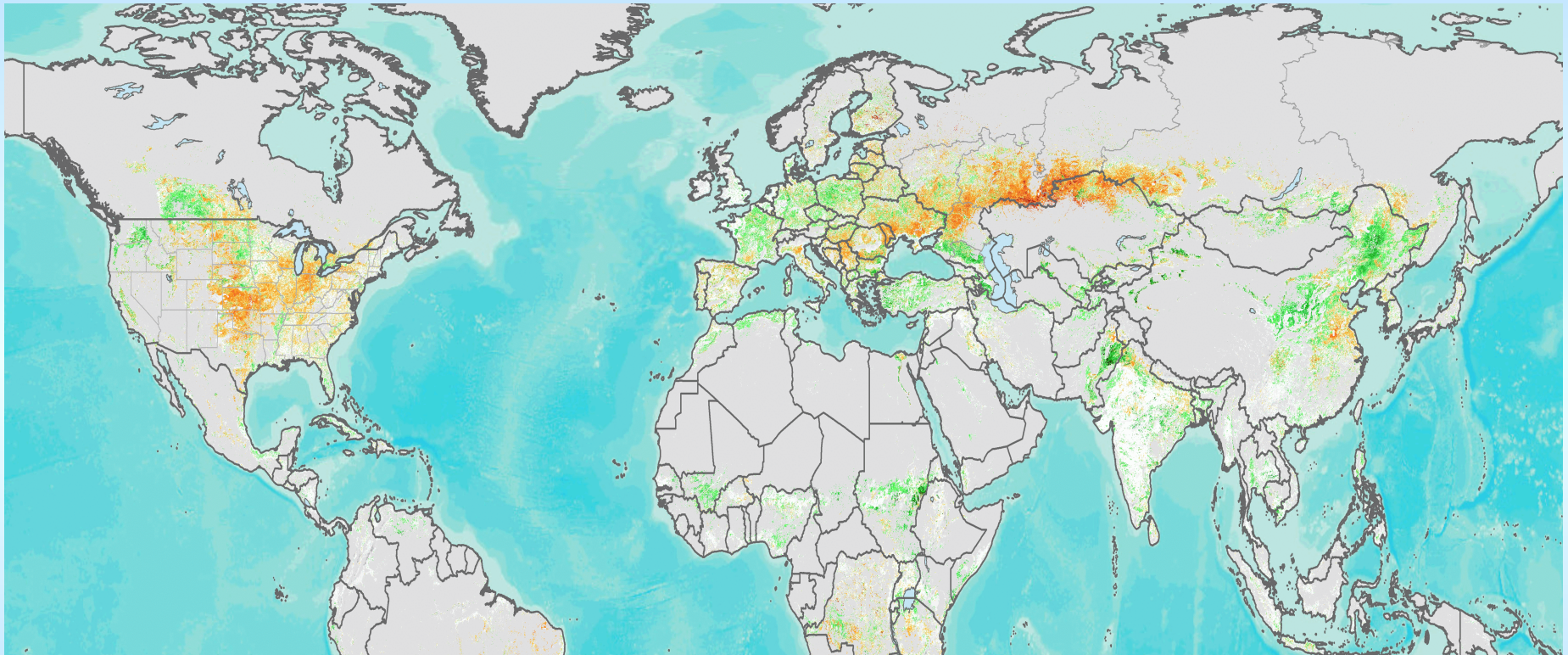
# MODIS NDVI Anomaly July 30<sup>th</sup> 2012



Assessment of the impact of the 2012 Northern Hemisphere Drought from the MODIS Climate Modeling Grid daily NDVI data. The anomaly image shows the cropland NDVI departure from the average (2000-2011) on **July 30<sup>th</sup> 2012**, highlighting hotspots of crops under stress during the 2012 droughts that affected the United States and the Black Sea region. The time-series curves below compare the daily development of croplands in 2012 (red) to average (2000-2011) in 3 important crop growing regions: Illinois, USA; Orenburg Oblast, Russia; Kostanay Oblast, Kazakhstan. The crop development through the season depicted by NDVI shows consistent negative anomalies with regard to a ten year average, with highest discrepancies during the crops peak development period. In 2012 crops in the US, southern Europe and the Black Sea region suffered from prolonged high temperatures and lack of moisture, which resulted in significantly reduced production. This information was available one month prior to harvest and several months before the release of official statistics.



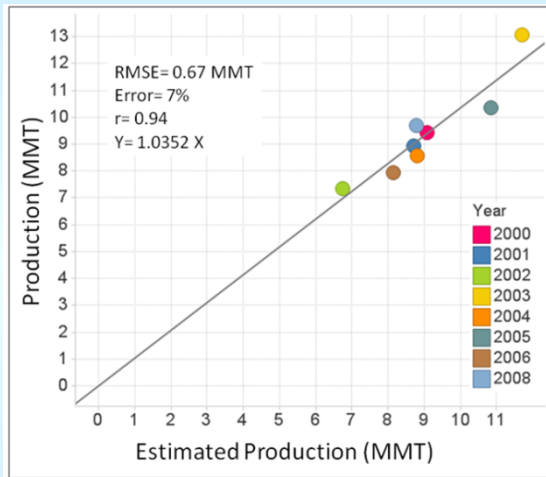
# Prototype VIIRS NDVI Anomaly, July 30<sup>th</sup> 2012



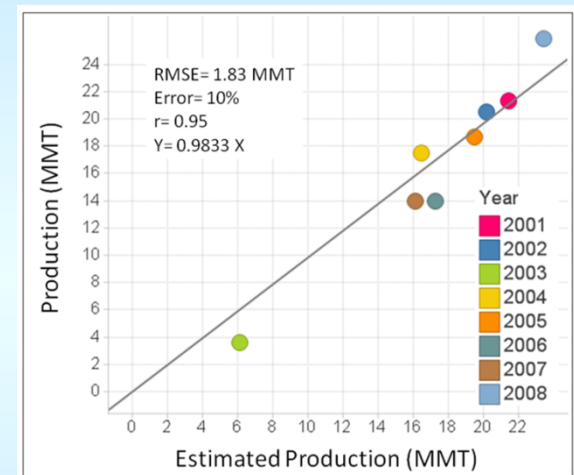
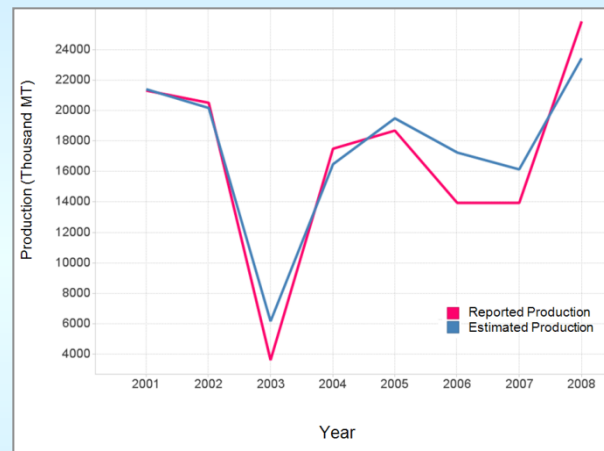
A VIIRS NDVI anomaly (prototype) image computed for the same date (July, 30<sup>th</sup> 2012) as the MODIS NDVI anomaly shown in the previous slide, generated from data produced at the GSFC Land PEATE.

# Application to Agriculture: Yield/ Production prediction

## Kansas: Wheat



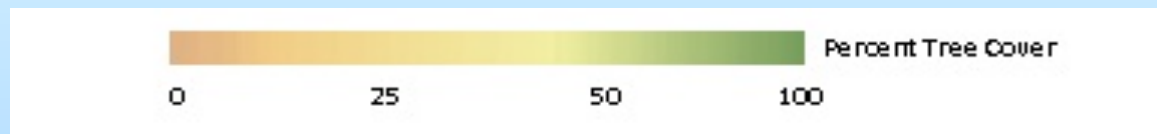
## Ukraine: Wheat



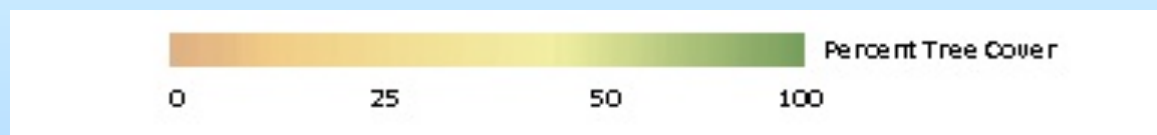
Becker-Reshef, I., E. Vermote, M. Lindeman, and C. Justice (2010a), A generalized regression-based model for forecasting winter wheat yields in Kansas and Ukraine using MODIS data, *Remote Sensing of Environment*, 114(6), 1312-1323.



funded MEASURES-2013 proposal entitled "Vegetation Continuous Fields ESDR for the AVHRR and MODIS Records: 1981 - Present", PI: Robert Sohlberg (UMD).

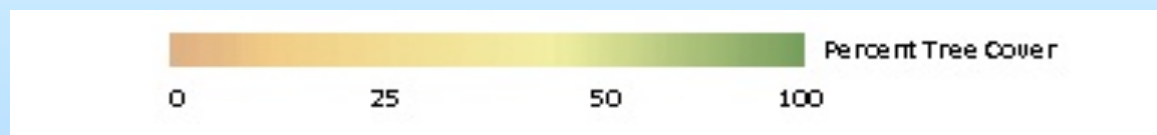


**Percent tree cover, Amazon Basin, 1990--Land LTDR AVHRR data**



**Percent tree cover, Amazon Basin, 2000—MODIS CMG data**





**Percent tree cover, Amazon Basin, 2010--MODIS CMG data**

# Schedule

- Accomplishments over past year and project status
  - CDR samples delivered / compliant with NETCDF4 format
  - CDR code delivered compliant with NCDC requirement
  - Maturity matrix (first version) delivered
  - Flow diagrams delivered
  - C-ATBD first draft delivered.
  
- Milestones (with dates) to finish development & testing.
  - CDR dataset (1981- 31July 2013) : December 30<sup>th</sup> 2013
  - QA results : December 30<sup>th</sup> 2013
  - Daily update to CDR (7-10 latency) : April 1 2014
  - LAI dataset: June 1 2014
  - Fpar dataset: June 1 214
  - Lai/Fpar daily update (7-10 days latency): June 2 2014