Some Aspects of Land Applications

Chris Justice

UMd

Land Applications Considerations

- **Often terrestrial applications require using data in combination e.g.**
  - MODIS – moderate resolution regional monitoring – daily data – cloud free temporal composites (16 days), multiyear time series, change detection
  - Landsat7 /Aster /EO1 – high resolution regional wall to wall mapping – seasonal cloud free coverage, periodic high resolution local sampling
- **Two pathways**
  - Satellite derived data or products used directly
  - Satellite data/products used as inputs used in models – model outputs used as input
- **NASA Applications Emphasis on Supporting Operational Decisions**
  - Decision making often not a formalized quantitative process
  - Need to understand the Decision Process
  - Most likely that remote sensing will be one of several inputs to resource decisions
  - Often a subjective process – economic/socio-political issues may dominate
- **Need to transition methods and ownership from the research to the operational community**
  - Not an easy process – money is the bottom line
  - Arrangements needed for continued data provision –is NOAA funded to do this?
- **Operational Systems need**
  - Operational commitment from an operational agency / unit
  - Routine Quality Control of the input data – impact of product accuracy on utility
  - Understanding of the impact of instrument performance on product accuracy
  - Data continuity – a problem for experimental satellite systems

G L A M

Global Agriculture Monitoring

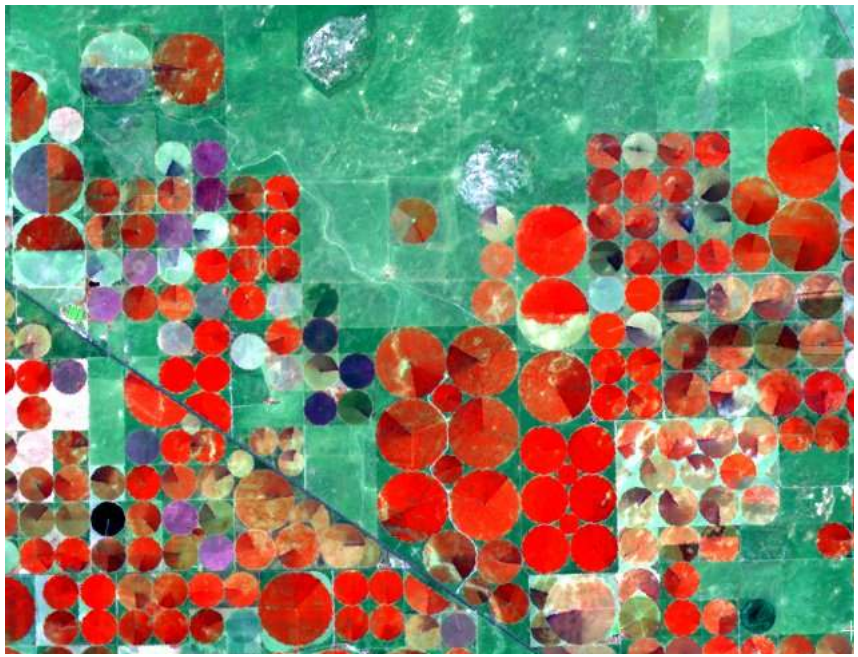
Enhancing the agricultural monitoring and crop production forecasting capabilities of the Foreign Agricultural Service using moderate resolution satellite data

A collaboration between NASA/GSFC, USDA/FAS, SSAI, and UMD Department of Geography

Foreign Agricultural Service PECAD
(Production Estimate & Crop Assessment Division)

FAS PECAD's Mission Statement:

To produce the most objective and accurate assessment of global agricultural production.



- **Generates World Agricultural Production Reports**
- **History-** Remote sensing programs & data archives from 1979
  - **LACIE:** mid-1970's, pioneer remote sensing research by USDA/NASA/NOAA to monitor agriculture production with satellites.
  - **AGRISTARS:** during 1980s, developed automated applications using Landsat, NOAA-AVHRR, and weather data.
  - **GIMMS GSFC** 1990's AVHRR, SPOT Vegn, SeaWiiFS moderate resolution time series
  - **Landsat 5 and 7** now using IRS AWIFS data

USDA

Global Data Sources for Estimating Crop Production

USDA United States Department of Agriculture

Production Estimates and Crop Assessment Division (PECAD)

USDA/FAS/PECAD, USDA South Building,MS-1045, 1400 Independence Ave., SW, Washington DC, 20250

URL:http://www.fas.usda.gov/pecad/

Foreign Agricultural Service

WMO STATION DATA

- Daily station data for rainfall, & min/max temperatures
- Archive from 1979

COARSE-RESOLUTION DATA (Air Force Weather Agency)

METEOSAT

GOES

SSM/I

GRIB (RASTER)

Rainfall images (8-km)

MEDIUM-RESOLUTION SATELLITE DATA

AVHRR/ NOAA

LAC (~4000-6000 images/yr)

GAC (8-km)

SPOT-VEG

(1-km)

TERRA/AQUA MODIS

(250-m)

Data Processed by NASA/GIMMS

- Time-series DBMS
- Approx. same output products
- Monitor vegetation conditions by raster analysis.

PCIWORKS (Image analysis)

AGRMET (GRID CELLS)

- Daily grid cell data (25-51-km) for rainfall, snow, solar radiation, min/max temperatures, potential ET, and actual ET
- Archive from 1981

HIGH-RESOLUTION SATELLITE DATA

SPOT

~500-1000 images/yr

IKONOS

Landsat

~2000 images/yr

Archive Explorer http://151.121.3.218/ for all USDA agencies

RADAR ALTIMETER SATELLLITE

Poseidon

Sept 1992 - Aug 2002

Jason

Sept 2002

Automated lake elevations (176) every 10-days

ECONOMIC INFORMATION

- Attache reports (from USDA/FAS) for area harvested, yield, & production. http://www.fas.usda.gov/scripts/attacherep/

75 offices monitoring 110 countries

- PECAD Agricultural Economists for Grains, Cotton, and Oilseeds
- National production data & news wires
- Regional experts & crop assessment travel

PECAD REGIONAL CROP ASSESSMENT ANALYSTS

12 regional analysts monitoring 100 countries

Automated products on web

Interactive data extraction

PCIWORKS (Image analysis)

- Vegetation classification
- Vegetation stress
- Area planted estimates

GeoCover (Global Landsat LandCover & mosaics DBMS)

CADRE DBMS

AUTOMATED data extracts & JPG images generated from Perl scripts

Crop Explorer http://151.121.3.218/ (Maps & time-series graphs over major crop regions)

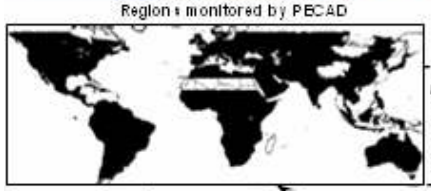
ArcGIS (Images, shape files, & graphs)

Convergence of Evidence Analysis

Production = Yield * Area

http://www.fas.usda.gov/pecad/

Regions monitored by PECAD



INTERACTIVE TOOLS to generate images and time-series graphs for rainfall, temperature, and soil moisture.

CADRE EX-PLOT (Multi-year time series comparisons)

ARCVIEW/CADRE (Multi-year comparisons)

Historical crop area, yield, production, & normals connected to regional weather anomalies.

2-LAYER SOIL MOISTURE MODEL

- Estimates soil moisture daily for grid cells and stations.

BASELINE REFERENCE DATA

- Historical crop production databases
- Administrative boundaries, DCW, etc.
- Average temperature & rainfall spatial data
- Soil texture & water-holding capacity

CROP STRESS (ALARM) MODELS

- Crop hazard algorithm monitors crop stress for corn, wheat, & sorghum.
- Acts as meteorological data filters by providing early warning to adverse weather conditions that affect crop growth.
- Flags regional weather anomalies that exceed temperature and soil moisture thresholds for the particular crop.

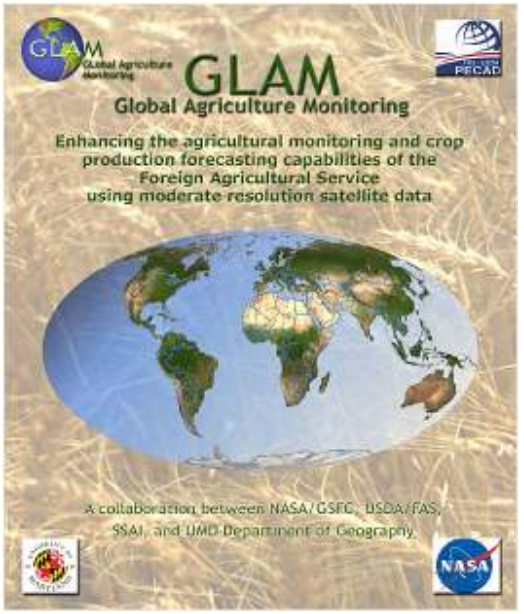
CROP MODELS

- Crop calendars model crop stages for corn, wheat, soybean, sorghum, and barley.
- Crop water production functions estimate relative yield reductions.
- Models include wheat (CERES, AGRISTARS, Maas, & URCROP), corn (AGRISTARS & URCROP), soybean (Sinclair), sorghum (AGRISTARS) & barley (URCROP), DSSAT, etc.

CROP PRODUCTION ESTIMATES

- PSD ONLINE http://www.fas.usda.gov/psd/
- Preliminary production estimates
- "Lockup" with USDA's World Outlook Board
- *USDA official production estimates released on the second week of each month*

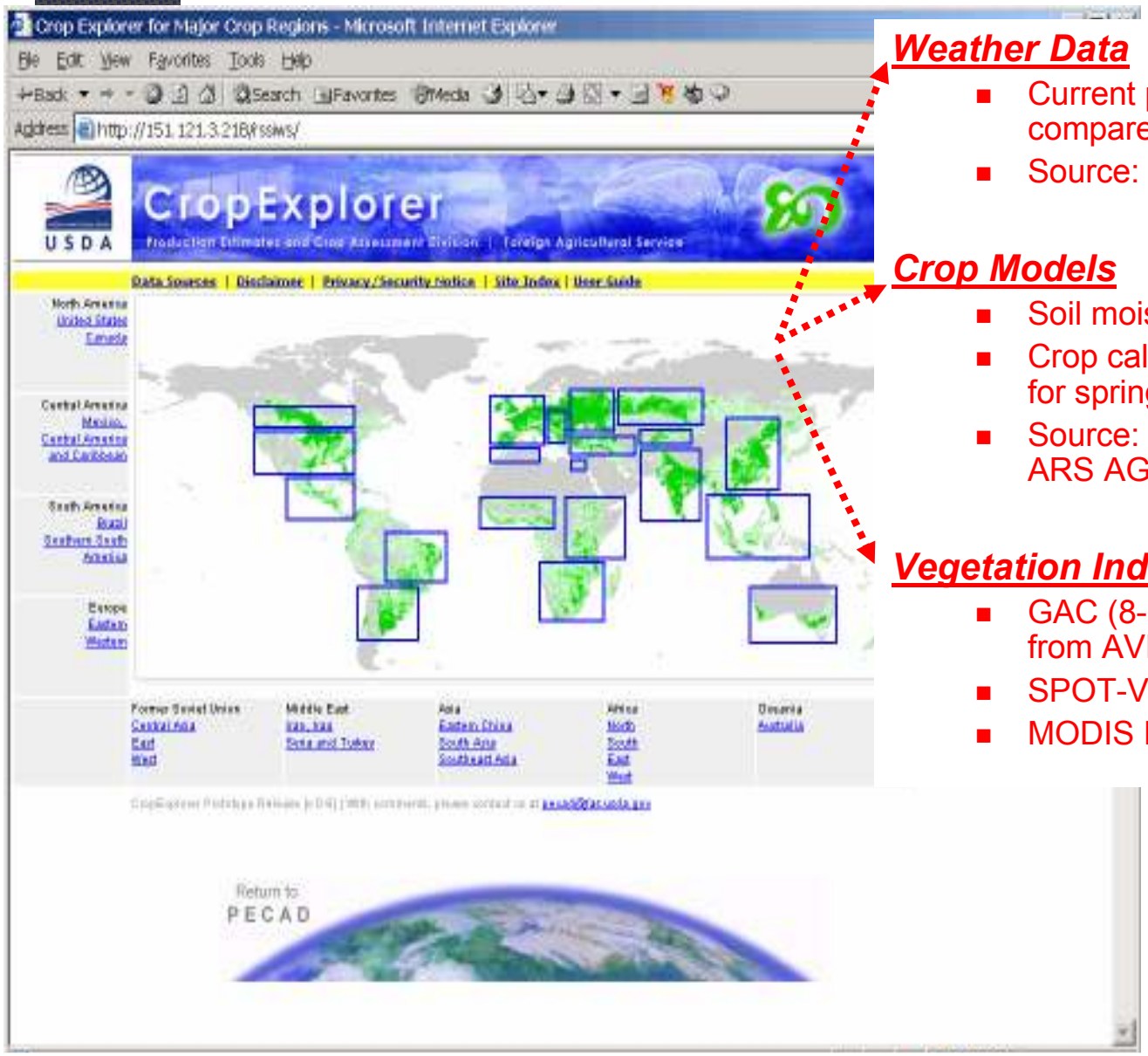
GLobal Agricultural Monitoring (GLAM)



- **Upgrade from AVHRR 8km to MODIS**
  - **Establish Data Continuity**
- **NRT MODIS Rapid Response Data**
  - **Customized products**
- **MODIS Crop Mask / Type Mapping**
- **MODIS/AVHRR Time-series Data Base**
- **Improved GUI for Information Extraction**
- **Develop an Operational FAS Prototype based at GSFC**
- **Prepare for use of NPP VIIRS**

Project website: http://tripwire.geog.umd.edu/usda/index.asp

Crop Explorer = Automated Weather, Crop Models, & Vegetation Analysis Over Major Crop Regions



Weather Data

- Current precipitation & temperature compared to climate normals
- Source: AFWA & WMO

Crop Models

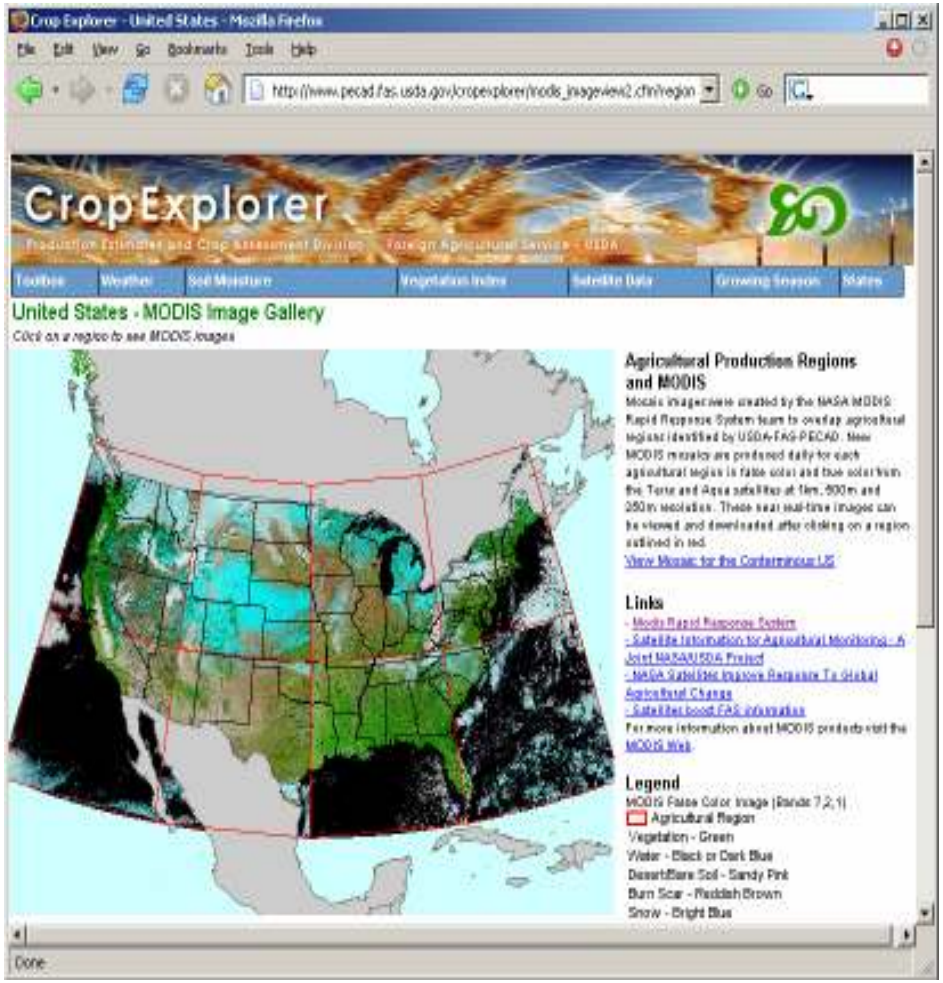
- Soil moisture (two-layer)
- Crop calendars (or stage) for spring wheat, winter wheat, & corn
- Source: Models originally developed by ARS AGRISTARS project (1980s)

Vegetation Indices

- GAC (8-km) and LAC (1-km) from AVHRR-NOAA
- SPOT-VEG (1-km)
- MODIS RR and Time Series

USDA

MODIS RR Web Interface with PECAD Crop Explorer



- **MODIS RR 250m Data fully integrated in PECAD Crop Explorer**
- **RR coverage being expanded to global agricultural areas**
- **RR data used for special event monitoring - flooding, drought**
- **RR product suite being expanded to include VI and 7.2.1 products**

USDA Crop Explorer
(http://www.pecad.fas.usda.gov/cropexplorer)

MODIS Rapid Response
(http://rapidfire.sci .gsfc..nasa.gov

MODIS RR Web Interface with PECAD Crop Explorer

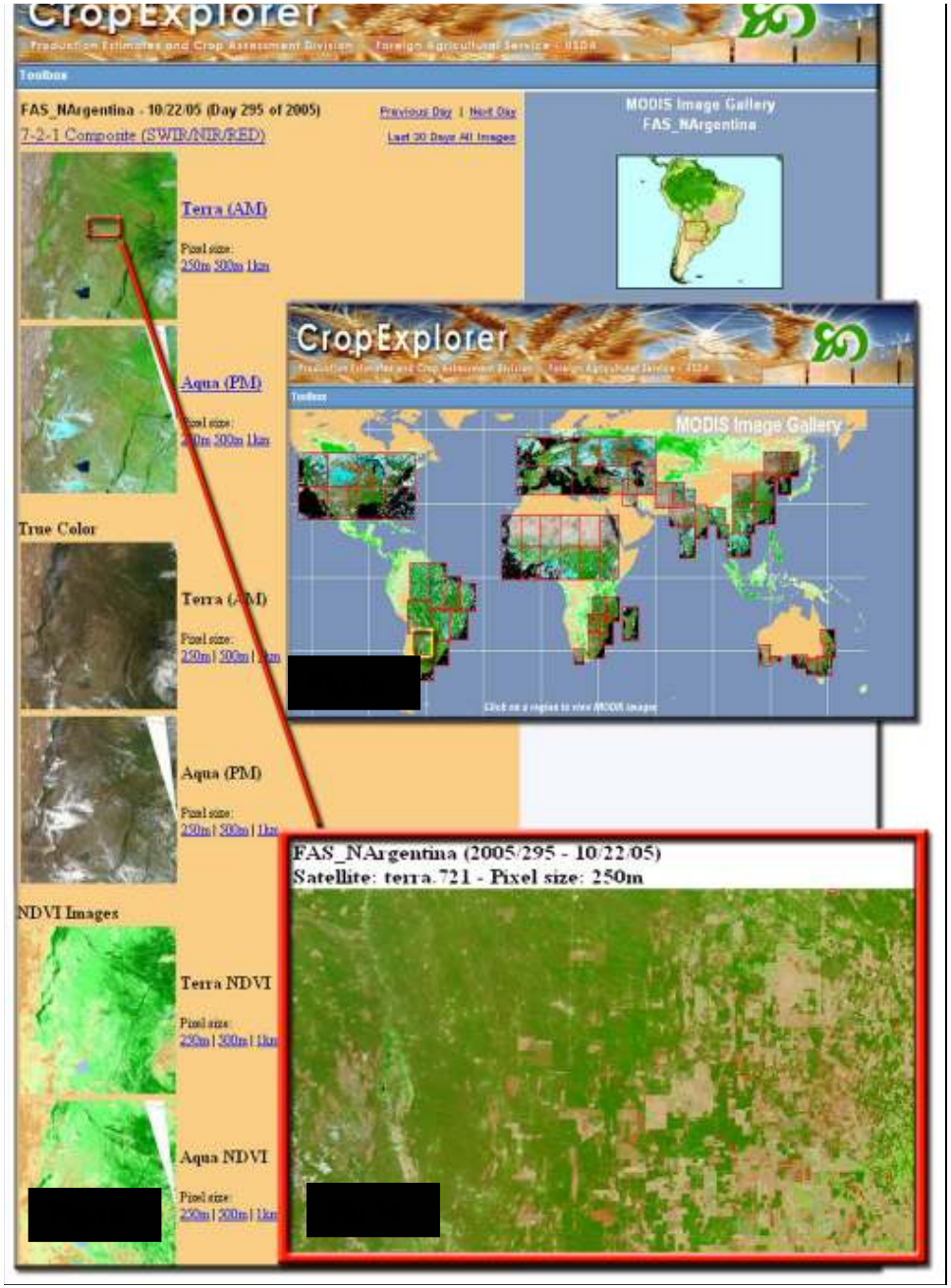


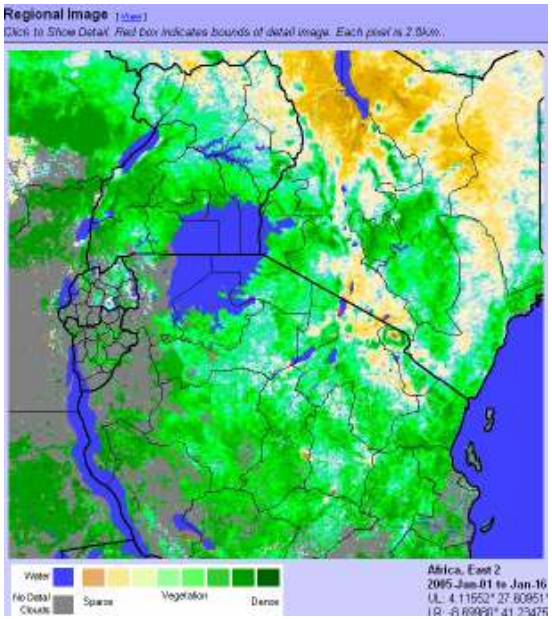
Fig.1a - MODIS RR web interface with PECAD Crop Explorer showing clickable regions for which RR data is available.

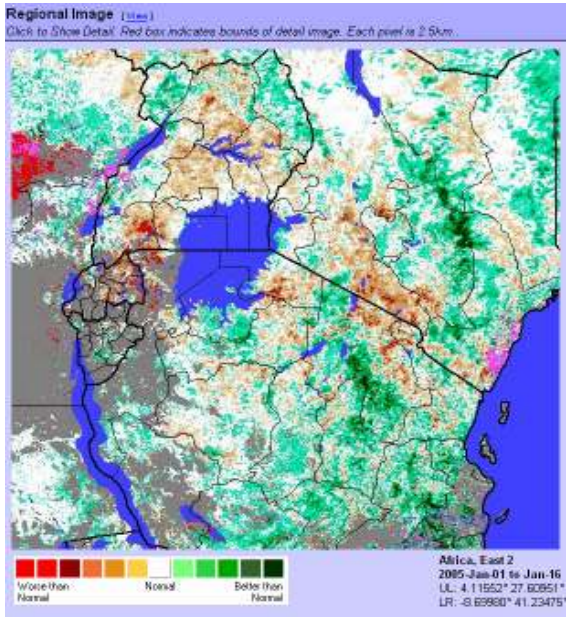
Fig.1b - Example of RR imagery available for NArgentina on October 22nd 2005, including false color and true color composites, and NDVI at 250m, 500m and 1km resolutions. The highlighted red box shows soy croplands in the Chaco region of Argentina.

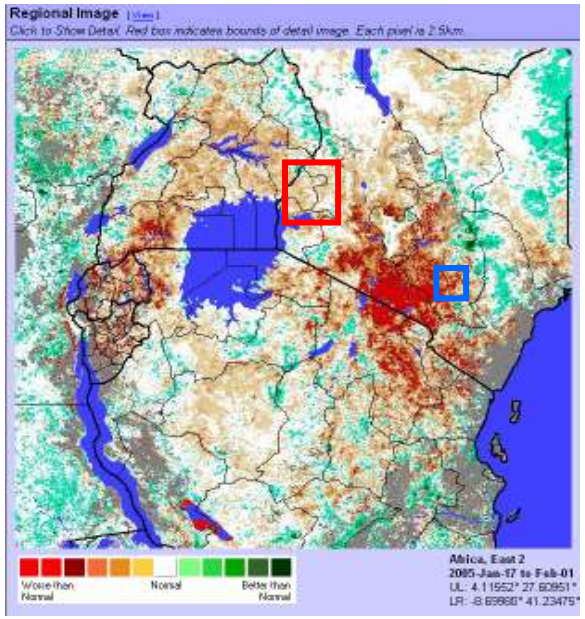
Fig.1c - Highlighted soy croplands at 250m resolution band combination 7-2-1.

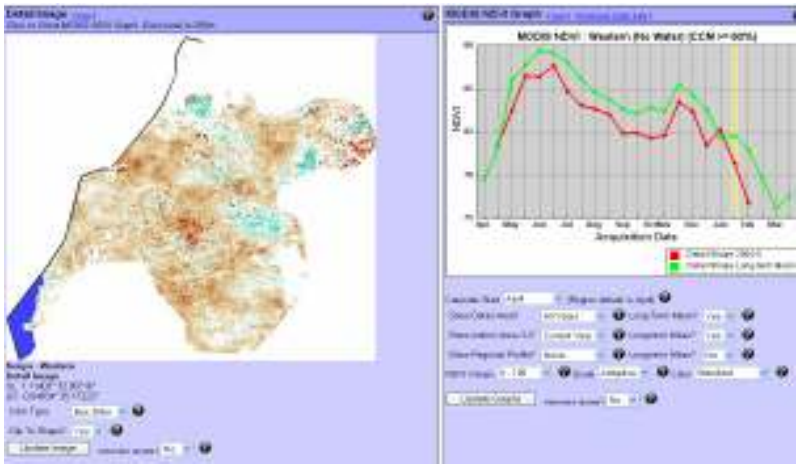
USDA Crop Explorer
(http://www.pecad.fas.usda.gov/cropexplorer)

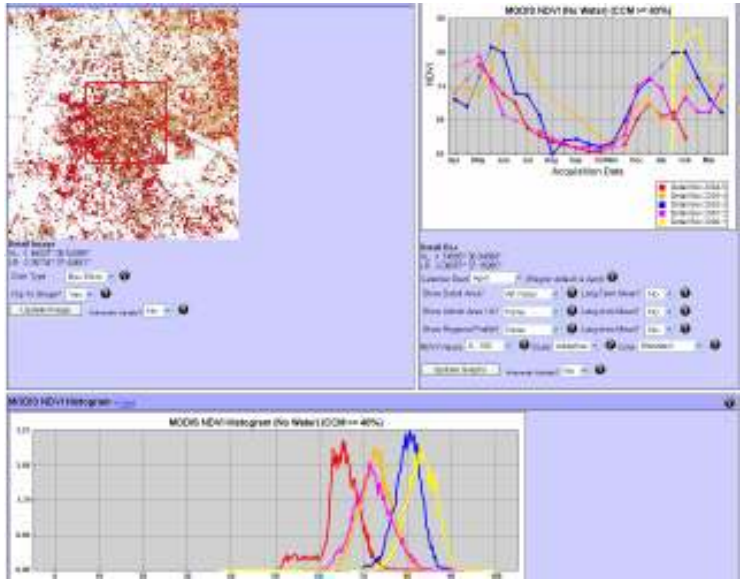
Kenyan Drought depicted by Database GUI









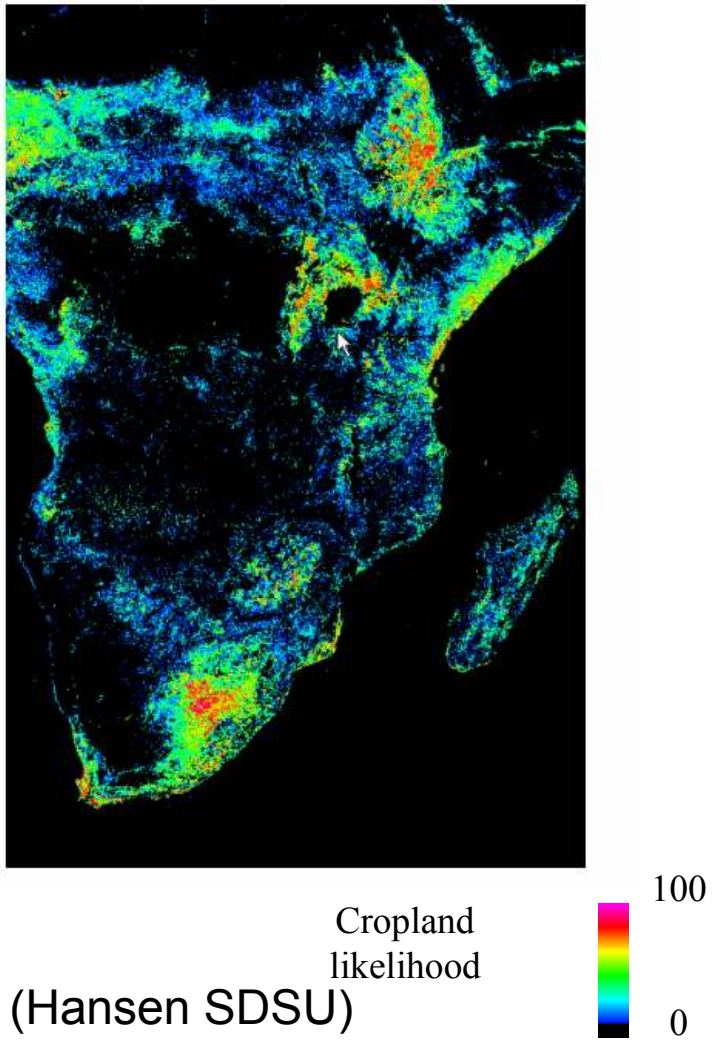


The cereal deficit this season has grown to 300,000 metric tons, which means that up to 2.7 million people will need food aid this season in Kenya

Enhanced cropland products using MODIS

A dynamic continuous cropland mask for use with MODIS time-series web interface

- New experimental crop products
- A continuous crop-likelihood mask using 4 years of MODIS 500m data (2001-2004)
    - Allowing analysts to threshold cropland membership according to their needs and region of interest
    - Currently under evaluation / validation

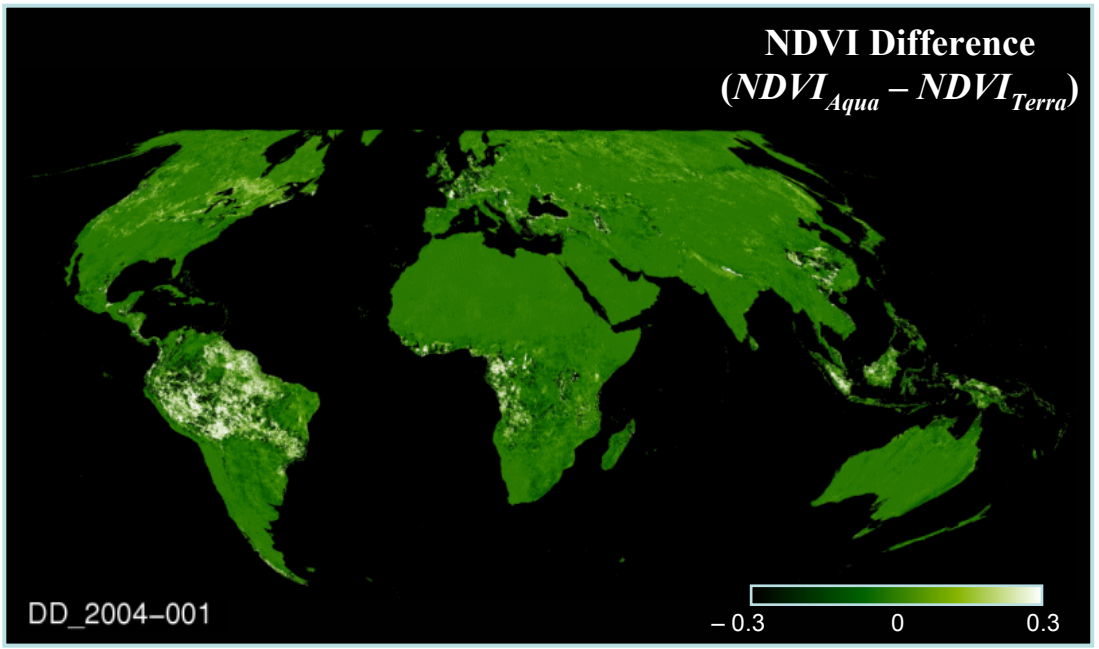


(Hansen SDSU)

Compatibility of Morning vs. Afternoon Overpass Data: MODIS Vegetation Index Products (Terra vs. Aqua)

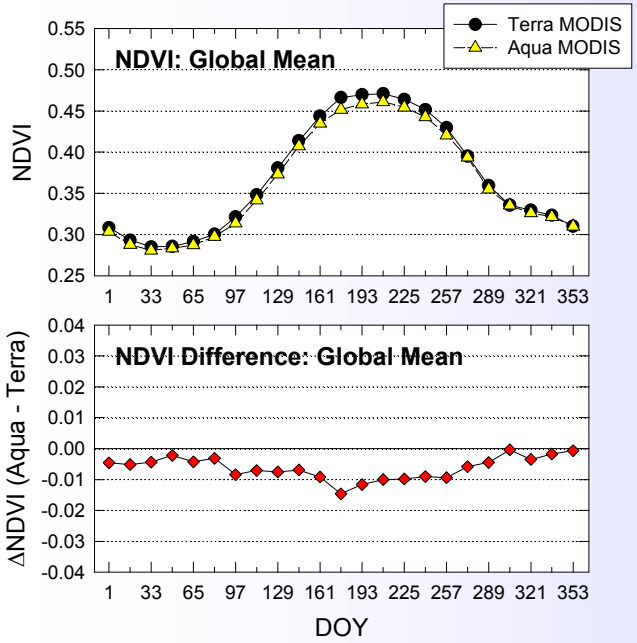
- Long-term observations of global vegetation from multiple satellites require much effort to ensure continuity and compatibility due to differences in sensor/orbital characteristics and product generation algorithms.
- One issue that needs to be addressed is compatibility between morning and afternoon overpass data, e.g.:
  - ✓ NOAA-14 AVHRR : 1:30pm (at launch)
  - ✓ NOAA-16 AVHRR/3 : 2:00pm
  - ✓ NOAA-17 AVHRR/3 : 10:00am
  - ✓ SPOT VEGETATION : 10:00am
  - ✓ Terra MODIS : 10:30am
  - ✓ Aqua MODIS : 1:30pm
- Compatibility of Terra- vs. Aqua-MODIS VI products (NDVI and EVI) were assessed for:
  - ✓ Geographic dependency
  - ✓ Seasonal dependency
  - ✓ Latitudinal dependency
  - ✓ Land cover dependency

Geographic Dependency of NDVI Differences



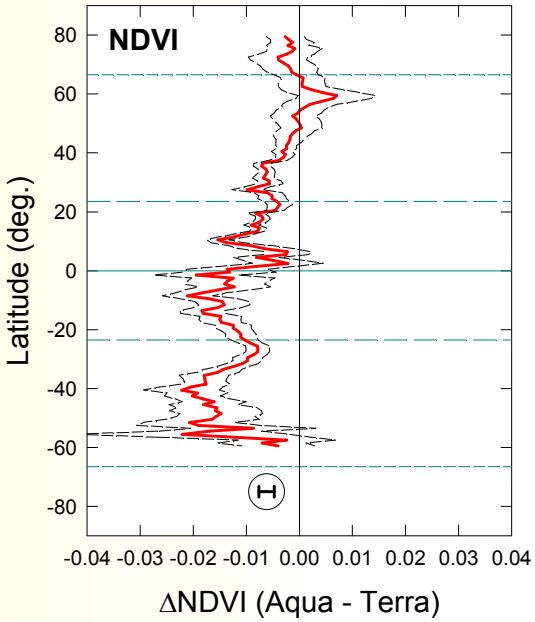
– Discrepancies (differences) in the NDVI can be seen in the tropical, sub-tropical, and high-latitude zones.

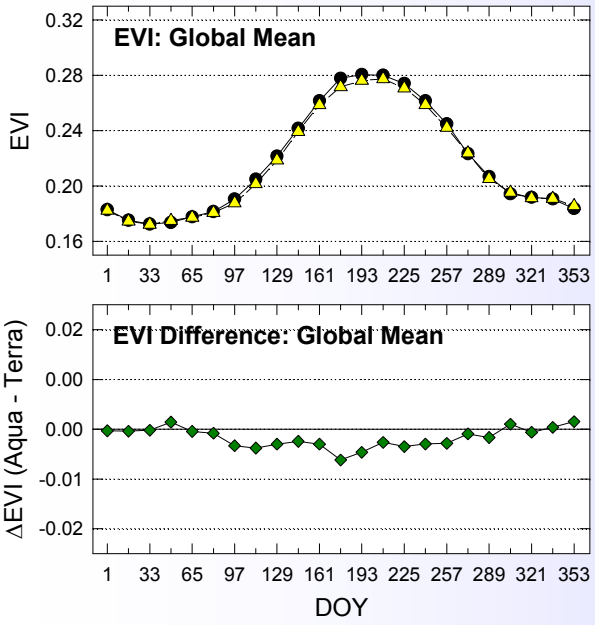
Tomoaki Miura U. Hawaii



Seasonal Dependency

- The NDVI and EVI differences between Aqua- and Terra- MODIS were generally negative (i.e., Aqua MODIS VIs smaller than the Terra counterparts) and larger for larger VI values.
- The overall magnitudes of the differences were:
  - < 0.015 for NDVI
  - < 0.01 for EVI

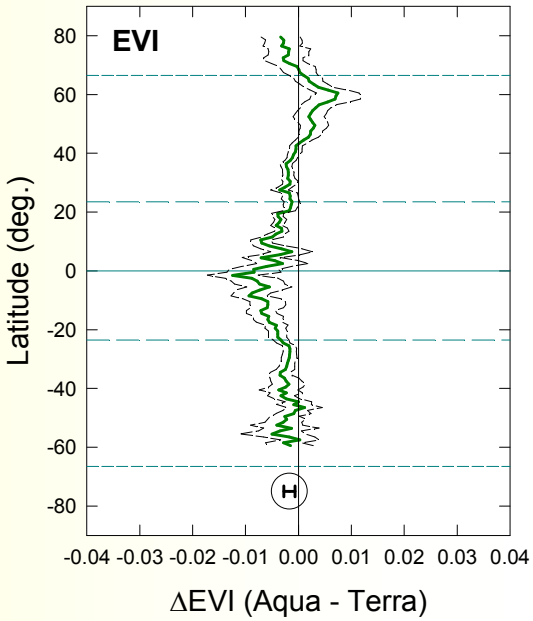




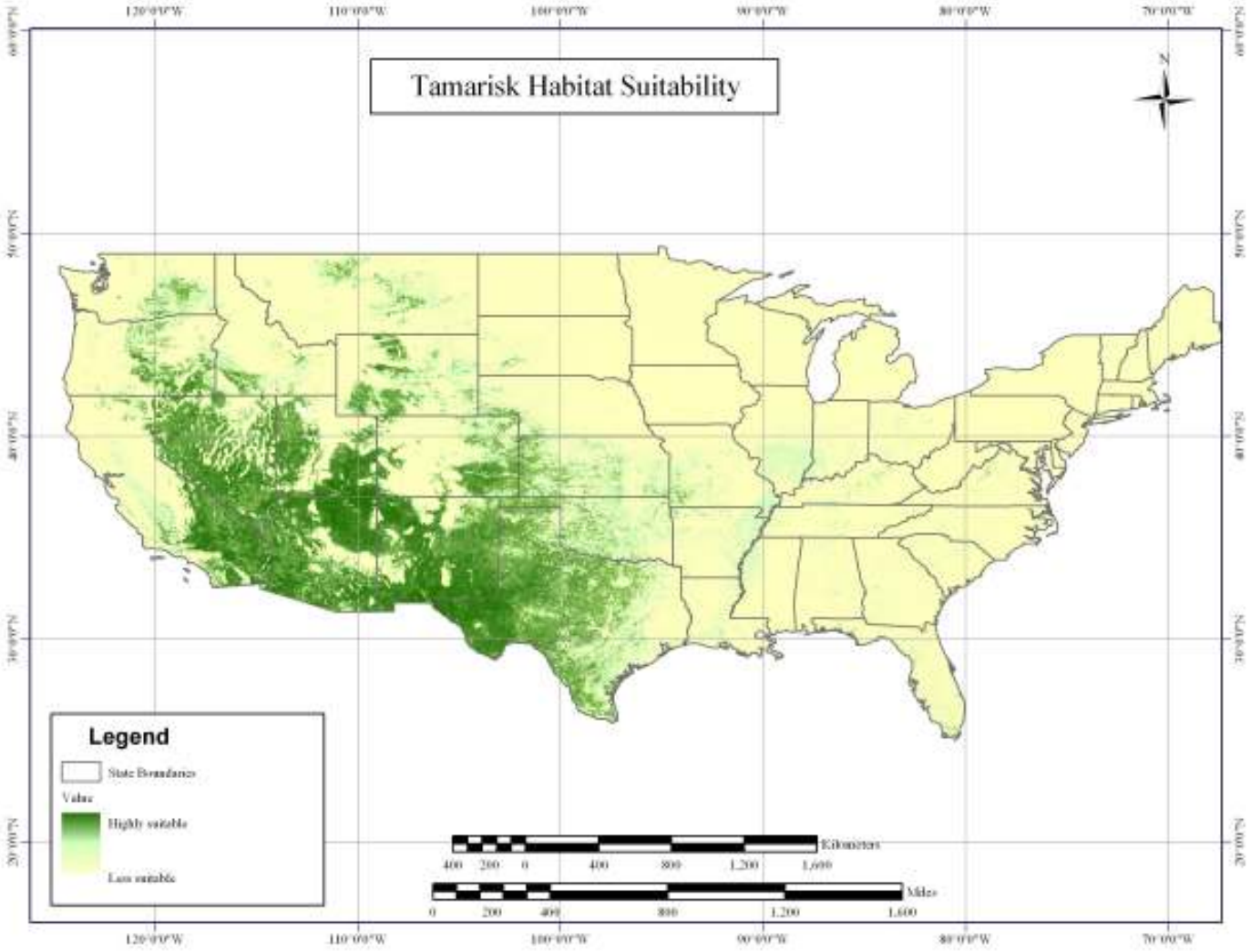
Latitudinal Dependency

- For both the NDVI and EVI, the differences were always negative except for the latitudes around 60° N.
- The overall magnitudes of the differences were:
  - < 0.02 for NDVI
  - < 0.01 for EVI

Tomoaki Miura U. Hawaii



National map of habitat suitable for tamarisk



***Habitat suitability = a function of* MODIS Land Cover *and the* difference in range of EVI and NDVI**

Morisette, J.T., C. S. Jernevich, A. Ullah, W. Cai, J.A. Pedelty, J. Gentle, T.J.Stohlgren, J.L. Schnase, A tamarisk habitat suitability map for the continental US., *Frontiers in Ecology*, February 2006.

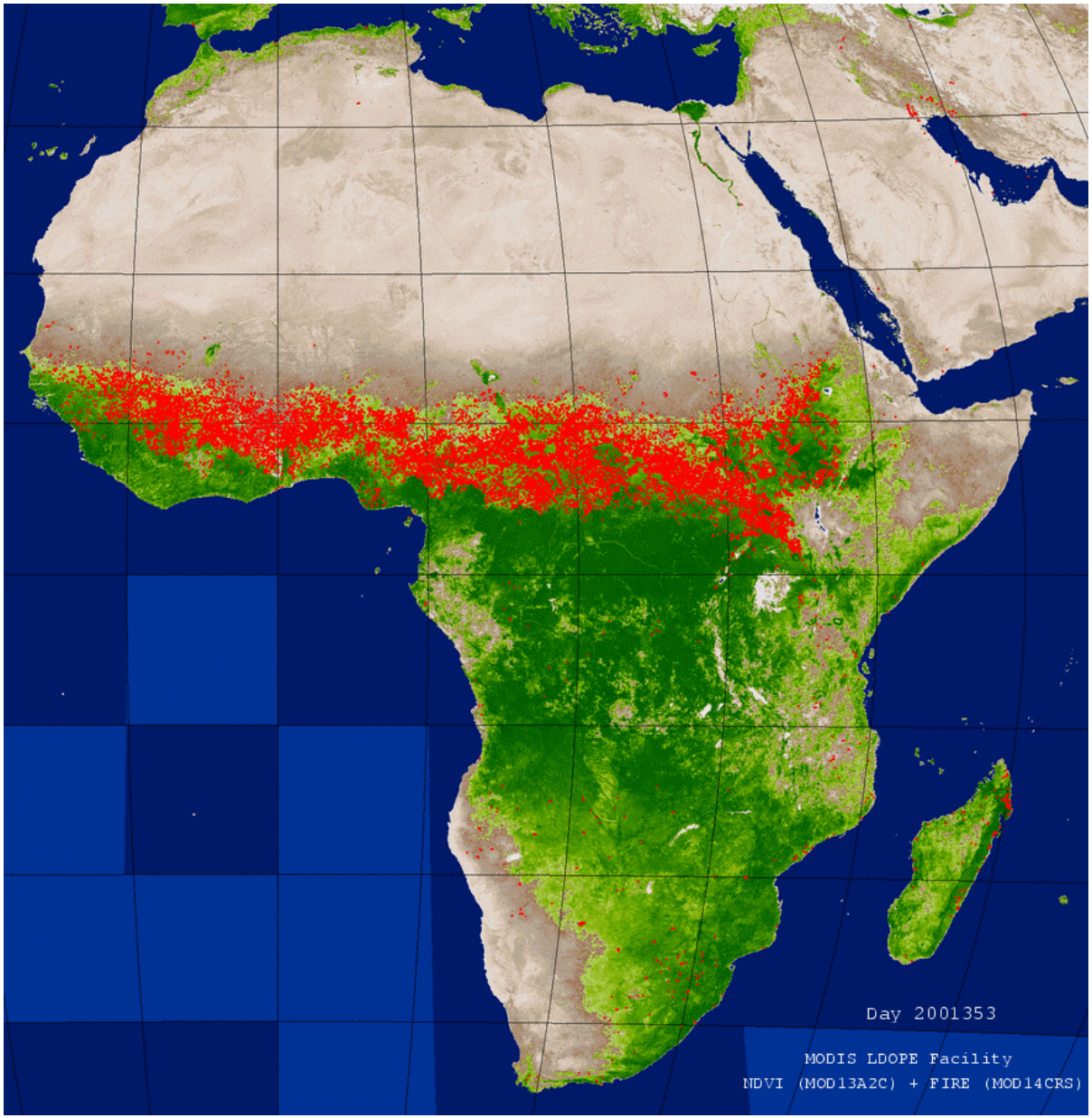
Large-scale monitoring of spatio-temporal fire dynamics

ACTIVE FIRES and VI

2001 animation

1km MODIS active fire detections (red)

superimposed on MODIS 16 day NDVI



Developing a fire early warning system for South Africa

- In South Africa wildfires often make headline news.
- Following a tragic incident in 2001 the Department of Agriculture installed a MODIS Direct Broadcast system at the Satellite Applications Center (SAC) in Pretoria
- SAC asked UMD and NASA to help demonstrate the utility of a fire early warning system to the National Disaster Management Center and Eskom – South African power company

Why Eskom?

ESKOM produces 95% of South Africa's electricity

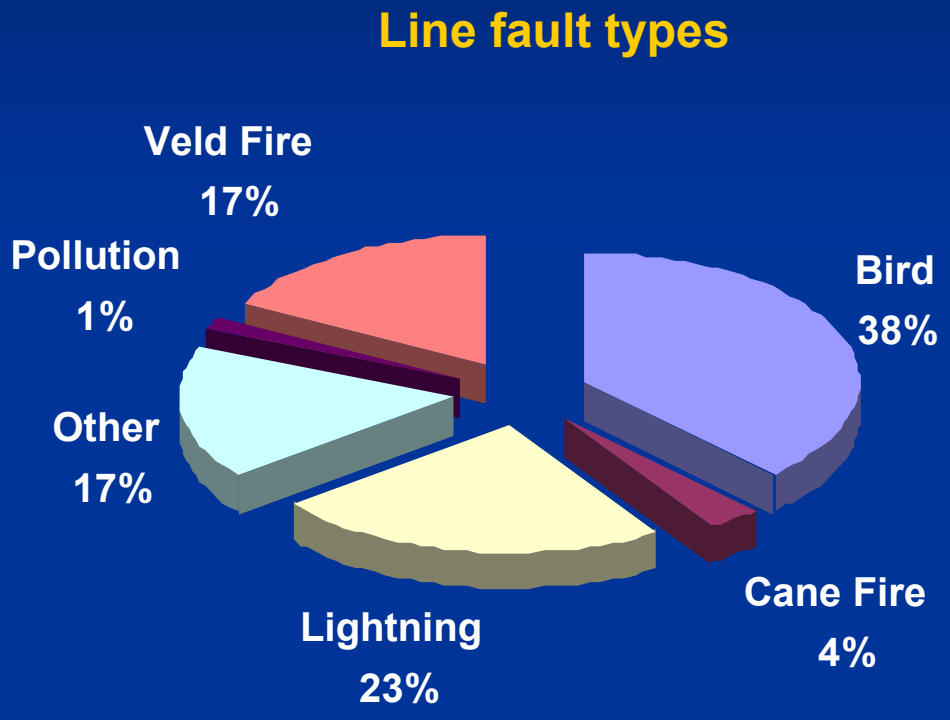
ESKOM transmission network in South Africa

Why ESKOM?

- Each year ESKOM experiences a substantial amount down time on its transmission lines due to 'flashovers' triggered by hot air plasma from intense fires that causes an electrical short

Photo courtesy of R.Evert, Eskom

Integrating Active Fire data into ESKOM's decision support system



Source: ESKOM

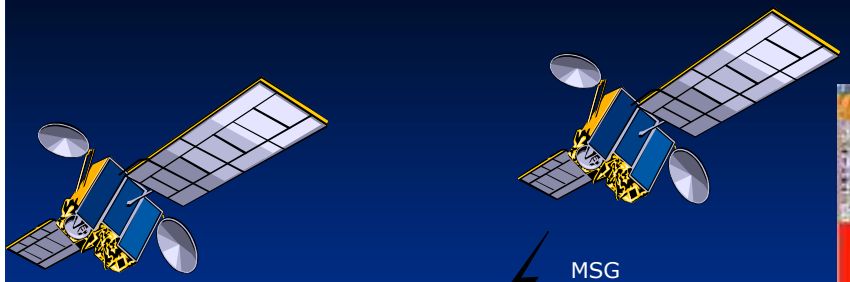
If ESKOM knows when an active fire is approaching the transmission line staff can be deployed to assess the situation

- suppress the fire
- affected lines can be switched out and electricity supply re-routed through the grid

Establishing the Advanced Fire Information System (AFIS)

1. Replicate the MODIS Rapid Response system to enable automated processing of near real-time (40 mins) active fire data and production of MODIS imagery
2. Customize Web Fire Mapper internet mapping tool to allow users to view and query the full database of active fire detections.
3. Develop an SMS / text messaging and email alert system to warn managers of fires within a 2.5km buffer around transmission lines

Overview South Africa's Fire Early Warning System



Terra and Aqua

MSG

Direct Broadcast Receiving Station Satellite Application Centre (SAC) South Africa

Direct Broadcast Receiving Station National Weather Service South Africa

Advanced Fire Information System (AFIS) http://wamis.co.za

Real-time feed

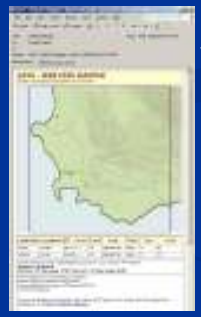
End users

- ESKOM
- Disaster Management Unit
- Weather Service
- Forest Department

Rapid Response System SAC(CSIR) MODIS Fire-Algorithm

Weather Service, South Africa MSG Fire-Algorithm (Philip Frost)

GeoDatabase



E-mail Alerts

Rapid Response System SMS/Text messages

Satellite Applications Center, Pretoria

Active Fire Locations (Text files)

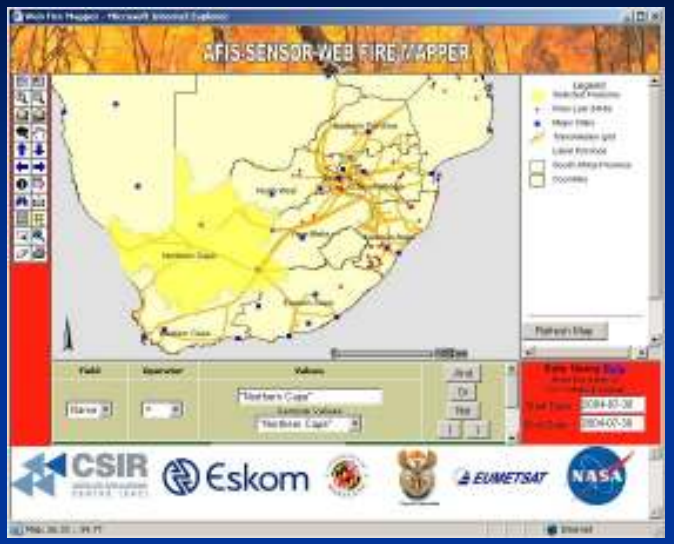
University of Maryland

GeoDatabase

Web Fire Mapper http://maps.geog.umd.edu

Advanced Fire Information System (AFIS):

Web mapping tool that allows users to view and query active information



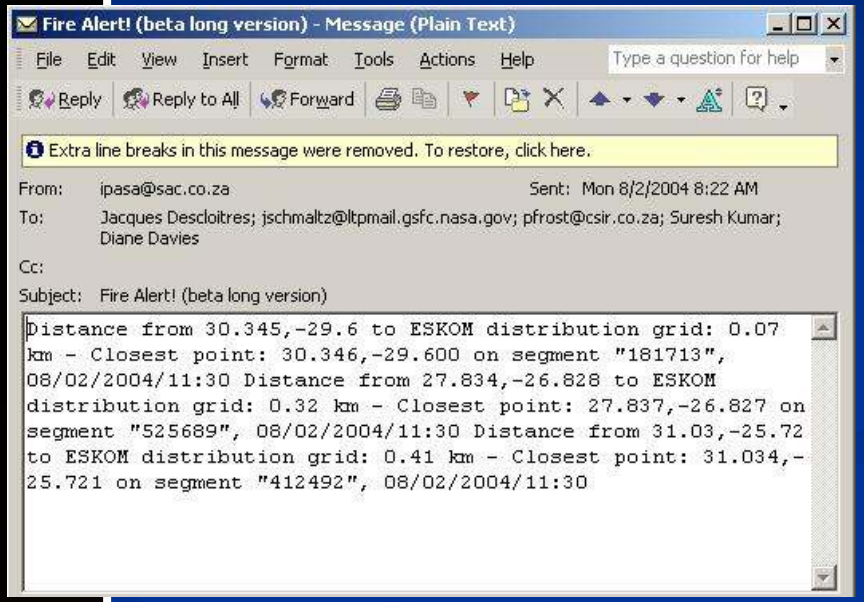
Query

Buffer

Find

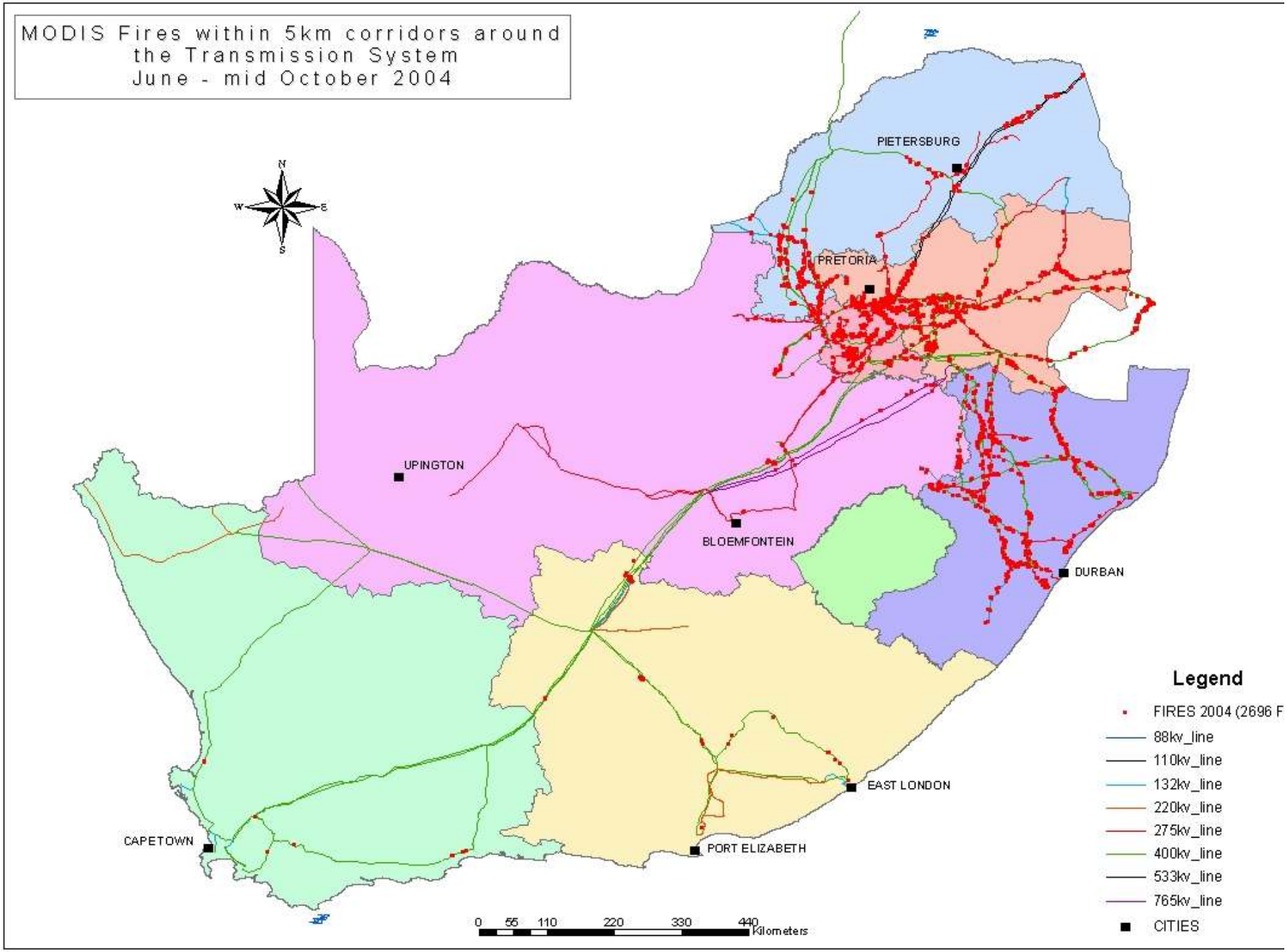
- MODIS Image
- Fire Archive
- Distance Calculator
- Identify layer attributes
- Print maps
- Scale
- Pan and Zoom
- Overview Maps
- Slimed down version for dialup users

Text message service



- Capable of handling both SMS/Text messages and E-mail messages
- Can be sent in near real-time

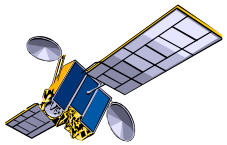
Davies et al. UMD


MODIS Fires within 5km corridors around the Transmission System June - mid October 2004
PIETERSBURG
PRETORIA
UPINGTON
BLOEMFONTEIN
DURBAN
EAST LONDON
PORT ELIZABETH
CAPETOWN
N
W
E
S
0 55 110 220 330 440
Kilometers
Legend
FIRES 2004 (2696 F
88kv_line
110kv_line
132kv_line
220kv_line
275kv_line
400kv_line
533kv_line
765kv_line
CITIES

Results from the 2004 fire season

- ESKOM statistics show a 30% drop in line faults since the introduction of AFIS
- The system was successful in raising awareness and better enabled ESKOM to manage fire events
- The economic benefits to ESKOM will lead to them continuing to fund AFIS - and make the data freely available to other users in the region

FIRMS: Fire Information for Resource Management System



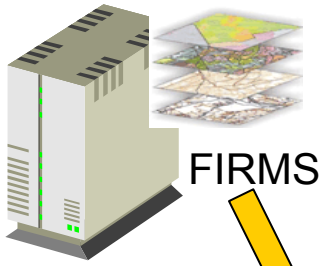
Terra and Aqua

Interactive Web GIS Maps

EDOS

MODIS Rapid Response DAAC

MODAPS



FIRMS

Email Alerts

Cell phone Text messages

Active Fire Locations
Burned Area Product

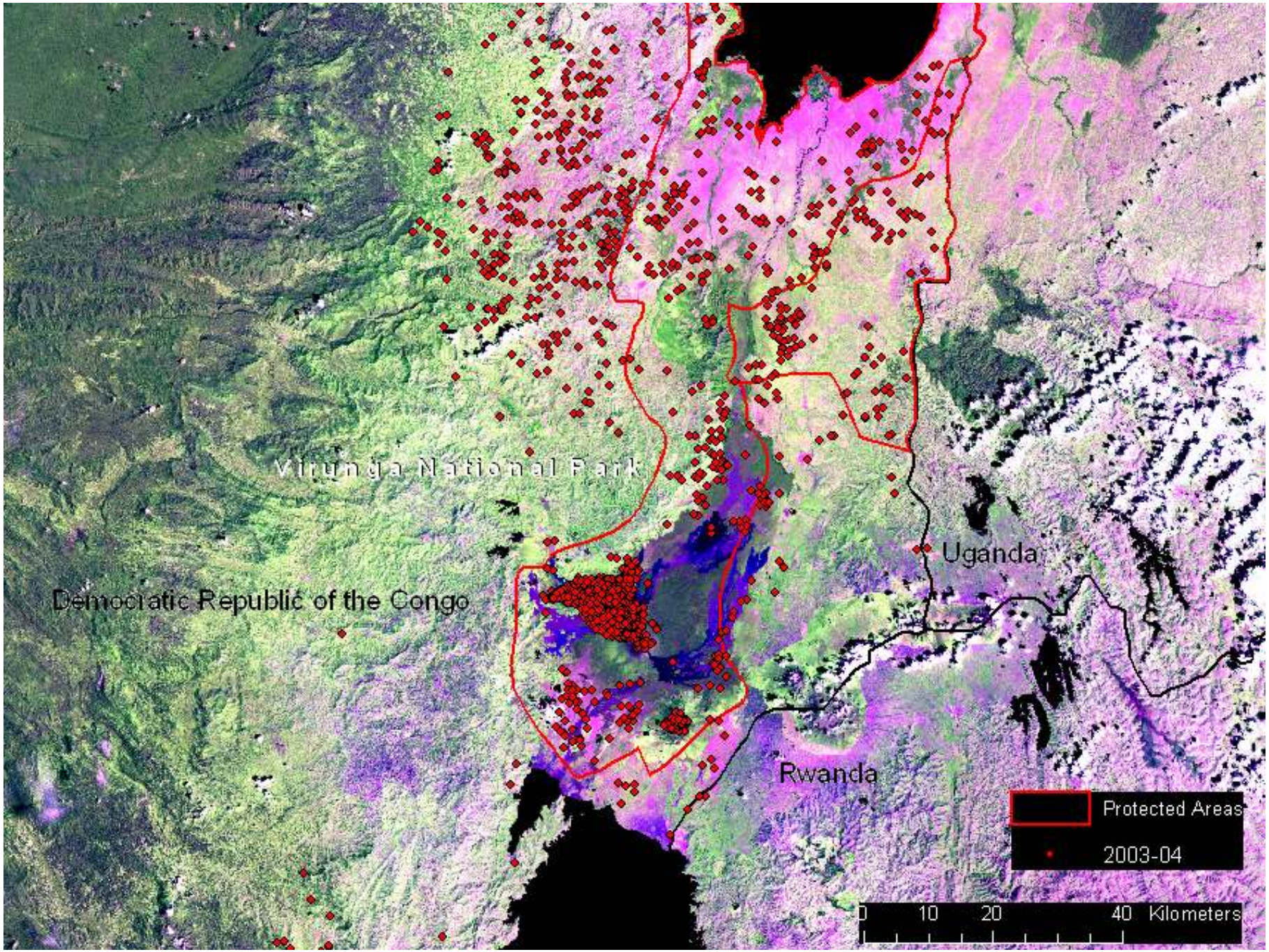
MODIS subset color composite images

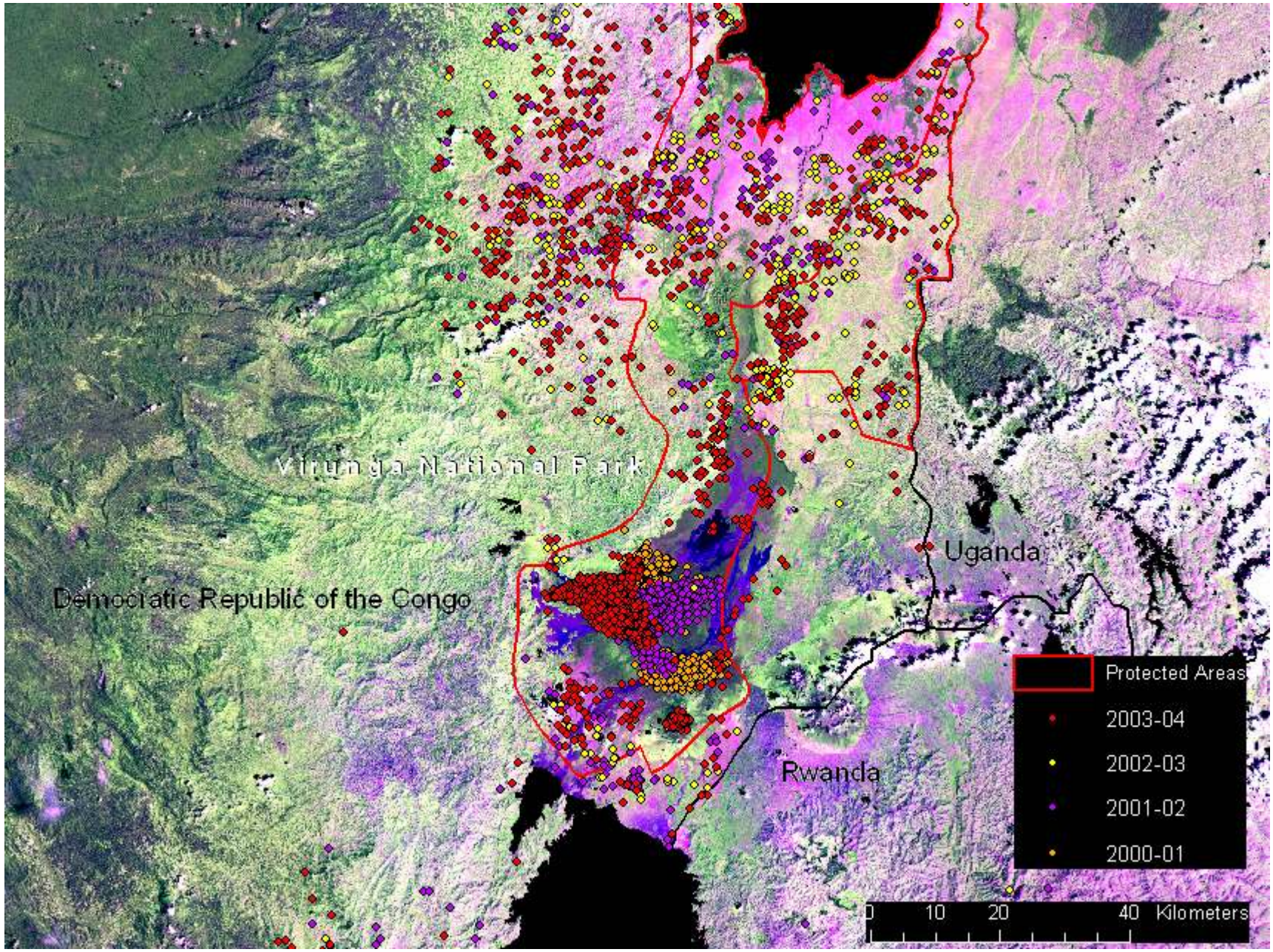
Supporting Protected Area Management

Strategic Fire Management: to control or suppress fires
Establish fire record to help formulate fire policy
Early Warning Disaster Management
Ecological Monitoring
Validating fire risk maps
Prioritization of resources Analyze fire responses & staffing levels
Modeling fire emissions
Identify poaching activity

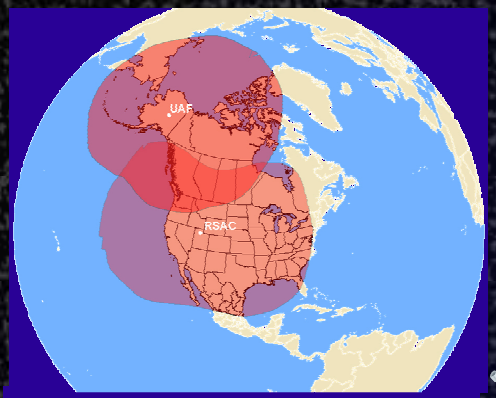
Primary Partners

UNEP, UN FAO

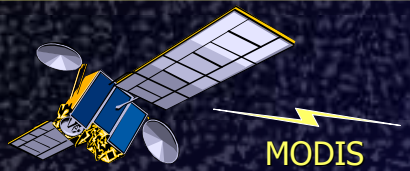

Virunga National Park
Democratic Republic of the Congo
Uganda
Rwanda
Protected Areas
2003-04
0 10 20 40 Kilometers


Virunga National Park
Democratic Republic of the Congo
Uganda
Rwanda
Protected Areas
2003-04
2002-03
2001-02
2000-01
0 10 20 40 Kilometers

USFS Active-Fire Mapping: MODIS

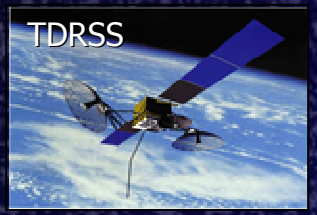


USFS-RSAC/UAF-GINA
Direct Broadcast Coverage



Terra / Aqua

MODIS
Raw Data



MODIS
Raw Data

USFS-RSAC
Direct Readout

UAF-GINA
Direct Readout

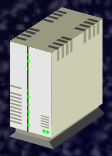
White Sands, NM

RSAC Direct Readout

MODIS L0 Data
(< 1/2 hour)

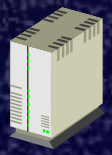
MODIS L0 Data
(< 1/2 hour)

MODIS
L0 Data



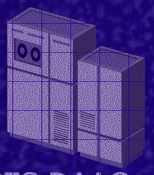
USFS-RSAC
Rapid Response System

Image & Active Fire
Detection Processing



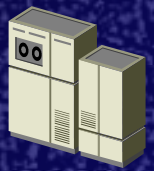
UAF-GINA
Rapid Response System

Image & Active Fire
Detection Processing



GES DAAC
NASA/GSFC

MODIS Land
Product
Distribution @
LP DAAC
(~ 1 Week)



NOAA MODIS
Real Time
Processing System

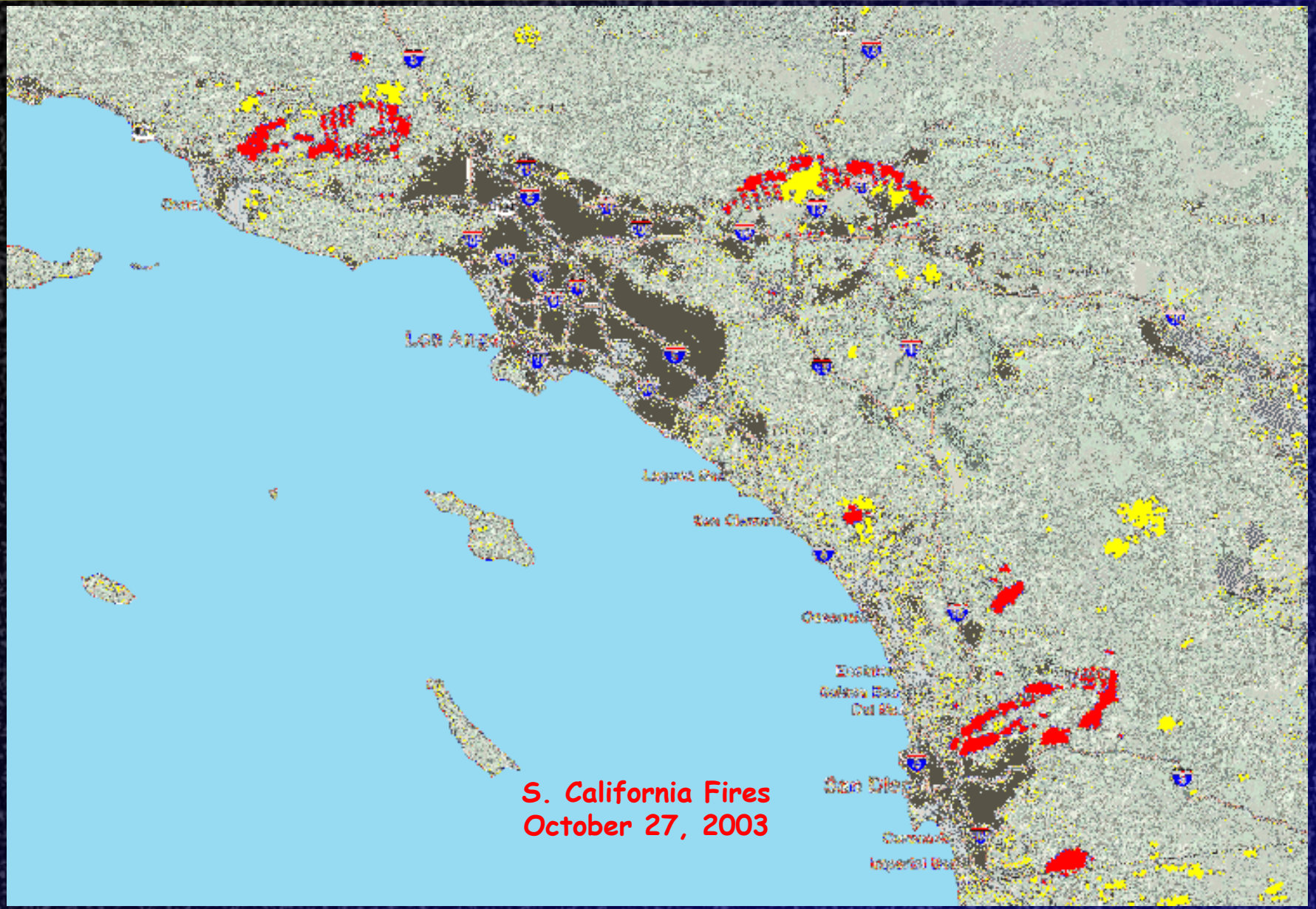
MODIS L0
(~3 hours)

NASA/GSFC
Rapid Response System

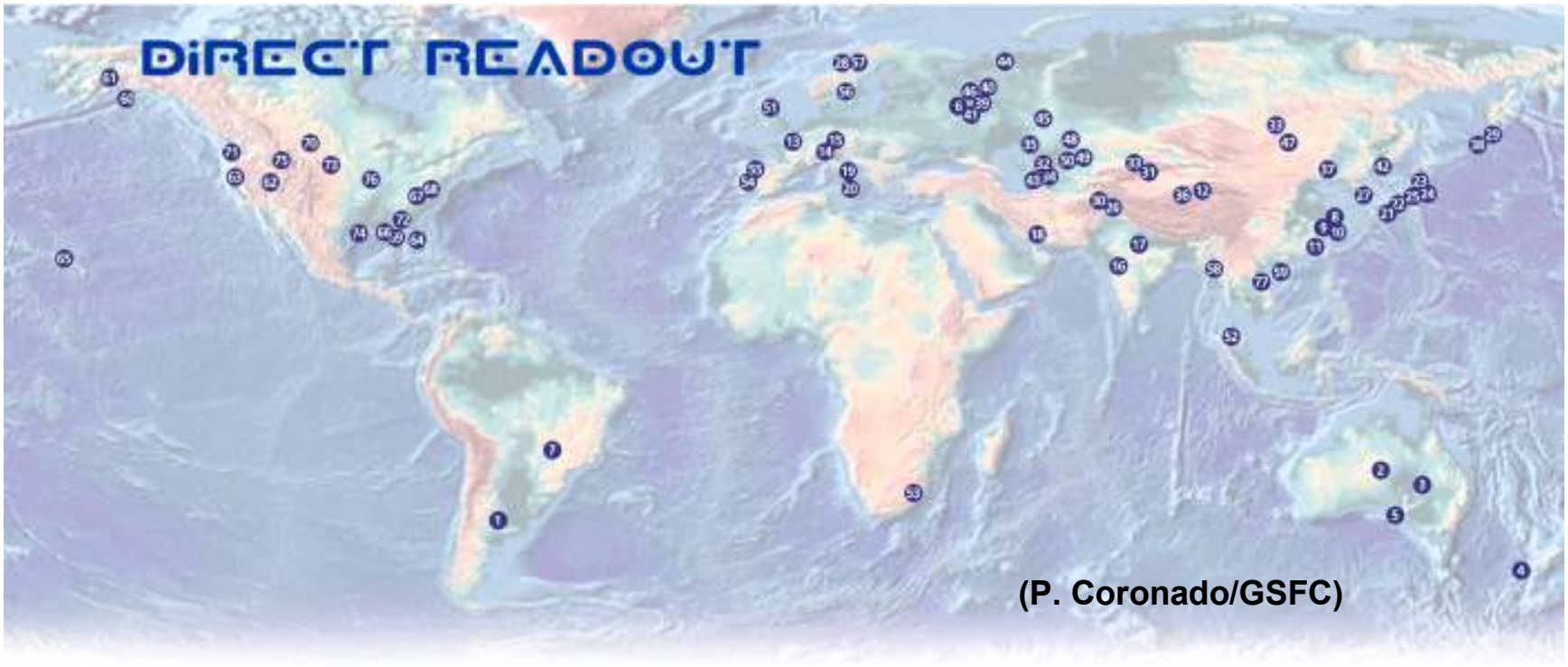
Image & Active Fire
Detection Processing

Bobbe et al RSAC USFS

MODIS Active-Fire Map & Imagery Products



Increasing Number of MODIS Direct Broadcast Sites



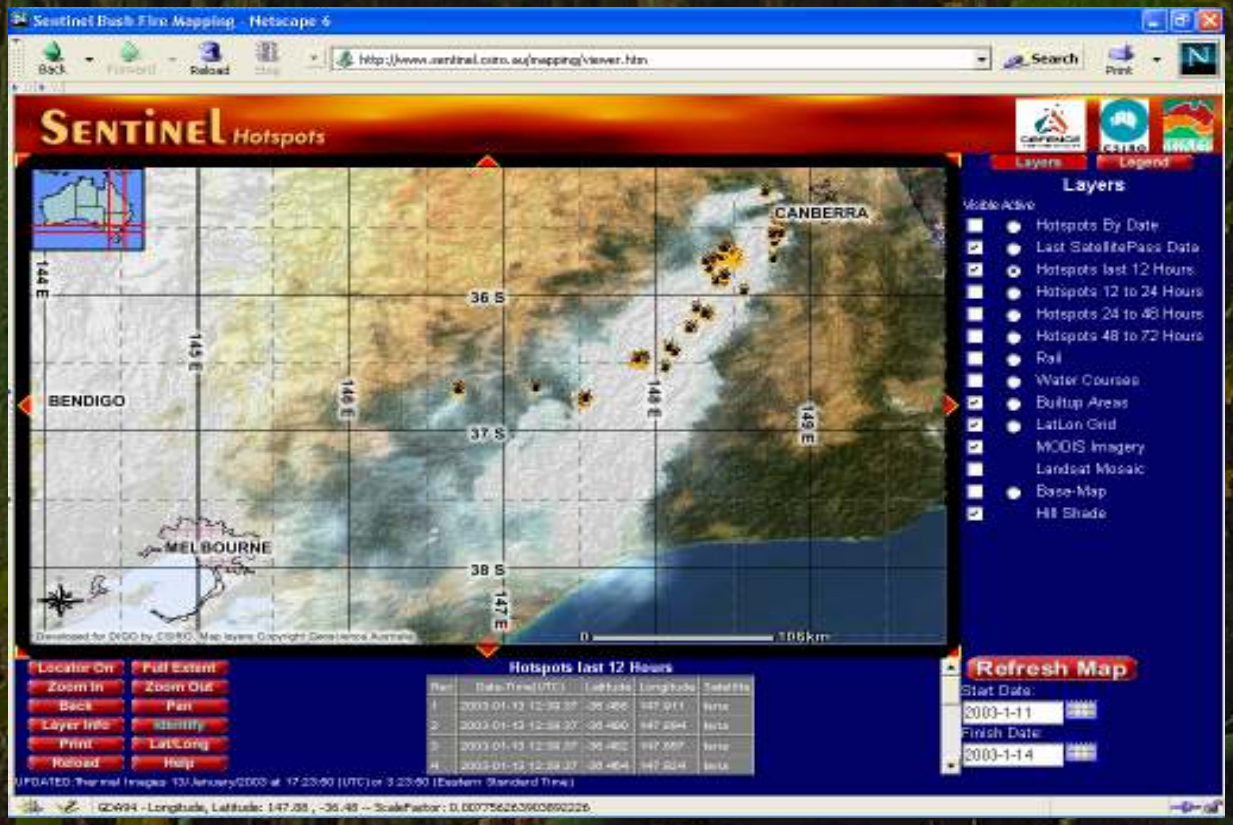
(Freely Available Code for Fire Detection)

- 82 Ingest sites around the world for Terra/Aqua DB downlink
- List is located on the Direct Readout Portal
- Web based MODIS fire servers in Australia, Africa, Brazil, Mexico, Europe, Russia – recent requests for support from India, Mongolia, Malaysia


Queimadas - Vegetation Fires
CPTEC
MONITORAMENTO DE QUEIMADAS POR SATÉLITE
NOAA 12, NOAA 16, TERRA 01, AQUA 01 e GOES 12
DPI
Parâmetros da Pesquisa
Data Inicial (> 01-JUNHO-1998)
Formato aaaa-mm-dd
2003-09-25
Data Final
2003-09-26
Pais
BRASIL
Estado Brasileiro
TO
Satelite
TODOS
Vegetação
Clique em "Ver Focos"
Gráficos e Histogramas
Tipo: Politico
Histograma
Procurar Município
Nome
Estado Brasileiro
Todos
Ordenar
Alfabeticamente
Procurar
Limpar
Ajuda (clique aqui...)
Focos nas Unidades de Conservação (clique aqui)...
Ver Focos
Recompor
Imagens Satélite
Mapas Temáticos
Tamanho da Tela
Mosaico Landsat 1990/Politico
N15:00:00 O30:00:00
San Jose
Caracas
Georgetown
Cayenne
Bogota
Boa Vista
Macapa
Quito
Belem
Sao Luis
Manaus
Fortaleza
Natal
Recife
Maceio
Porto Velho
Lima
Salvador
Cuiaba
Brasilia
La Paz
Belo Horizonte
Campo Grande
Rio De Janeiro
Sao Paulo
Assuncao
Curitiba
Florianopolis
S30:00:00 O90:00:00
Nesta tela existem 201 de um total de 201 focos no periodo de 2003-09-25 a 2003-09-26 no estado de TO
Tabela de Atributos
Selecione forma de saída
WEB
BASED
Distribution
AVHRR
MODIS
GOES
TERRA
AQUA
Iniciar
Eudora - [In]
4 Internet Explorer
Microsoft PowerPoint ...
PT
11:27

Distributed MODIS Ground Stations

http://sentinel.ga.gov.au/acres/sentinel/index.shtml

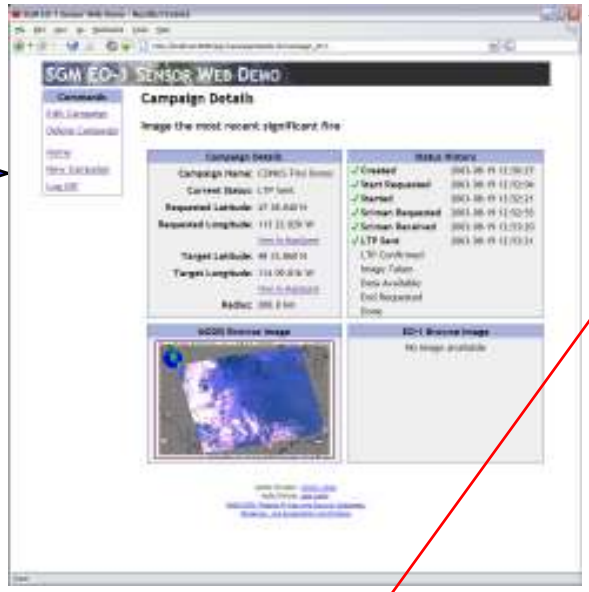


After 3 years, we have begun transfer of the Sentinel Hotspots demonstrator system [www.sentinel.csiro.au] from our CSIRO systems to those in a 24/7 operational agency, Geoscience Australia.

SensorWeb Demonstration Scenario

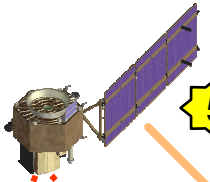
- National Priority Wildfires 8-22-03

1 Large wild fires tracked by National Interagency Fire Center (NIFC)



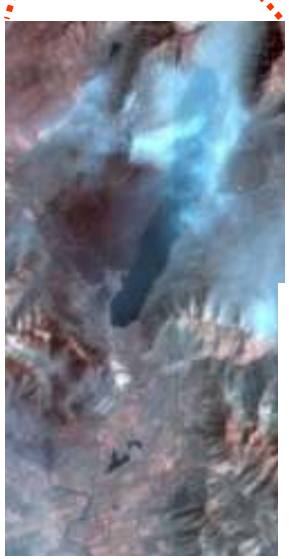
3 After ascertaining that the Robert fire is at lat 48.564 long –114.163, EO-1 is tasked to take closer high resolution look

4 SGM causes MOPSS, CMS, CASPER (ground version) to task EO-1 via command load



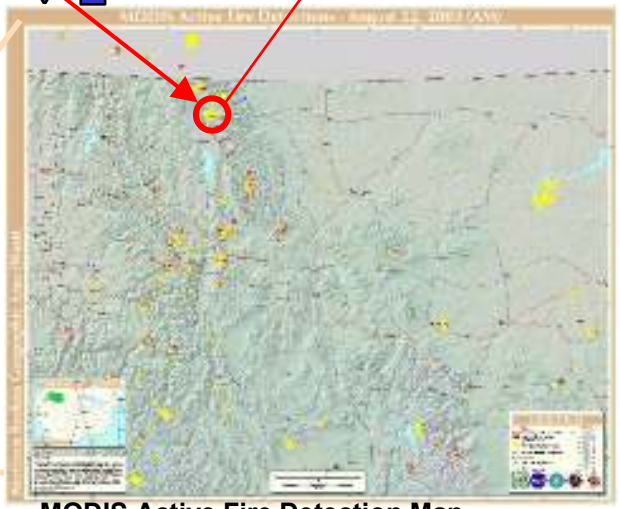
5 and causes EO-1 to downlink the image to EROS Data Center (EDC) at Sioux Falls

6 EDC performs L0 and L1 processing and FTP's image to Natural Hazards investigators at UMD.

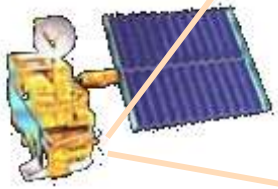


7 UMD team transforms image into ERDAS format and FTP's file to USFS/Salt Lake City where burn extent product is derived. Result is sent to BAER team at Robert Fire.

2 SGM correlates selected wildfire (25 Robert) to exact present location using data from Rapid Fire workstation in MODIS Instrument Center which is updated every 5 minutes



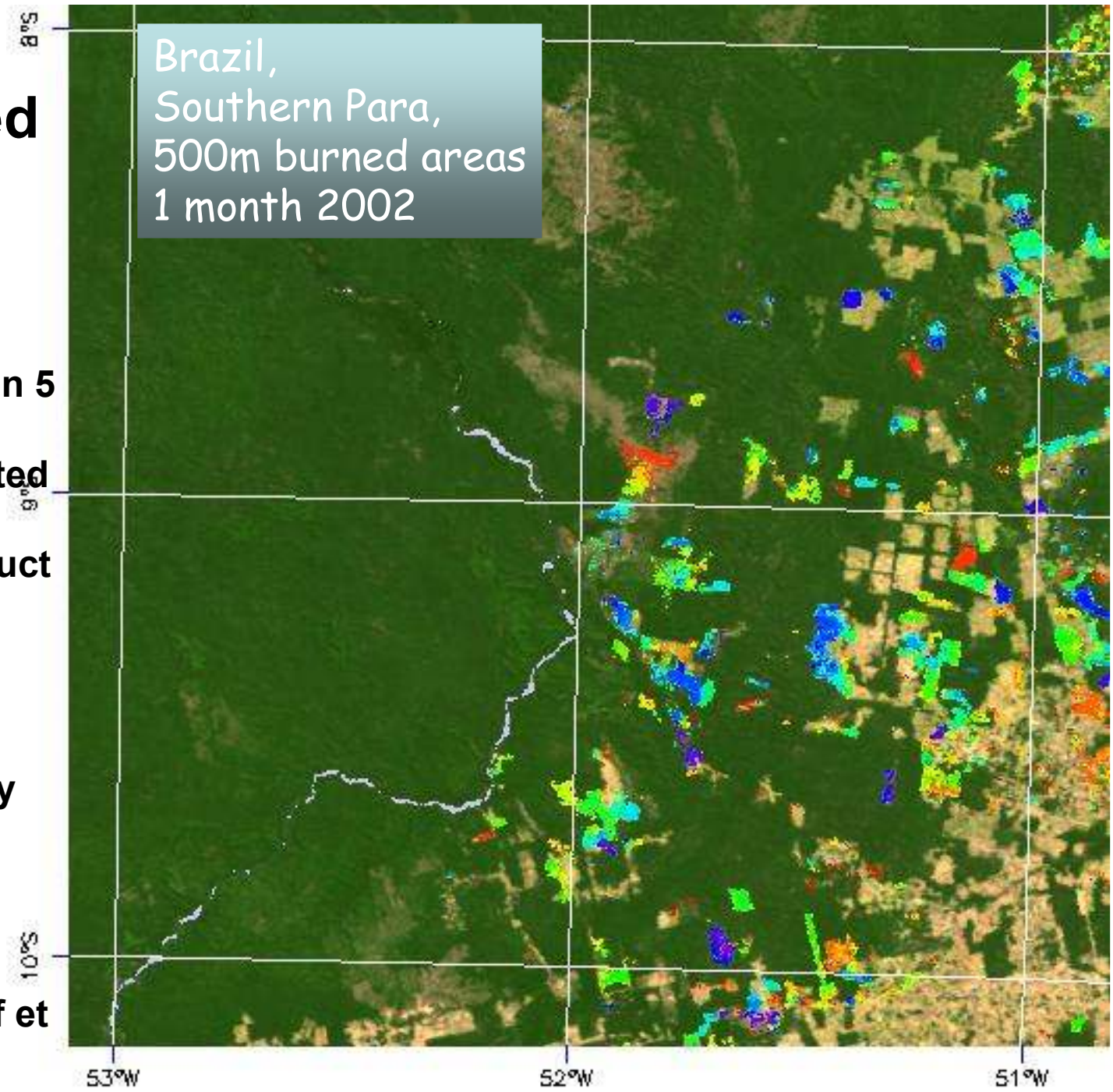
MODIS Active Fire Detection Map



MODIS Instrument on Terra or Aqua

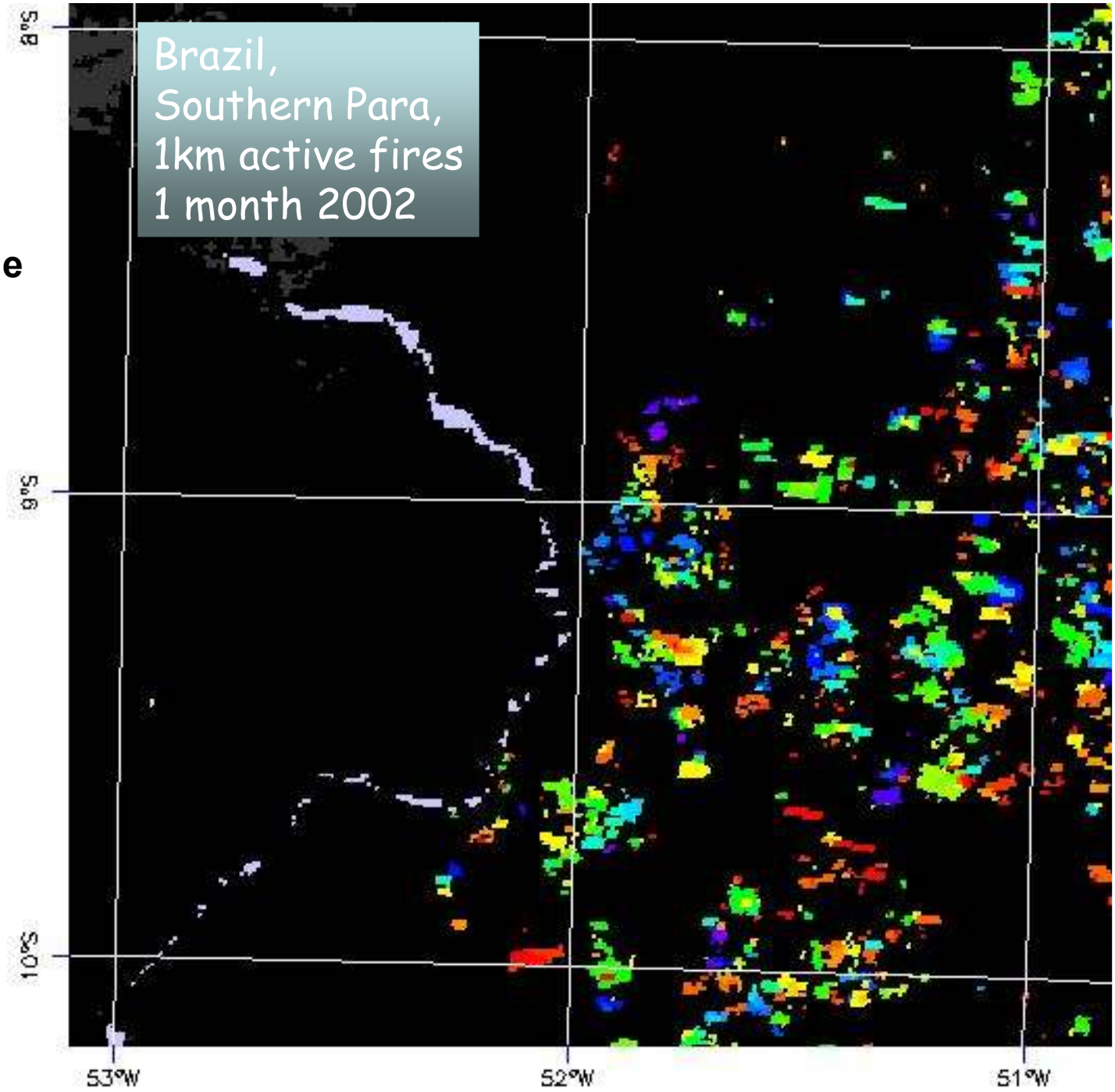
MODIS Burned Area Product

- **Will run in Collection 5**
- **Currently being tested**
- **Monthly 500m product**
- **Validated in Africa, Australia**
- **Validation underway in Brazil, Russia, US**
- **DB Version of the BA Product under development (Schaaf et al)**

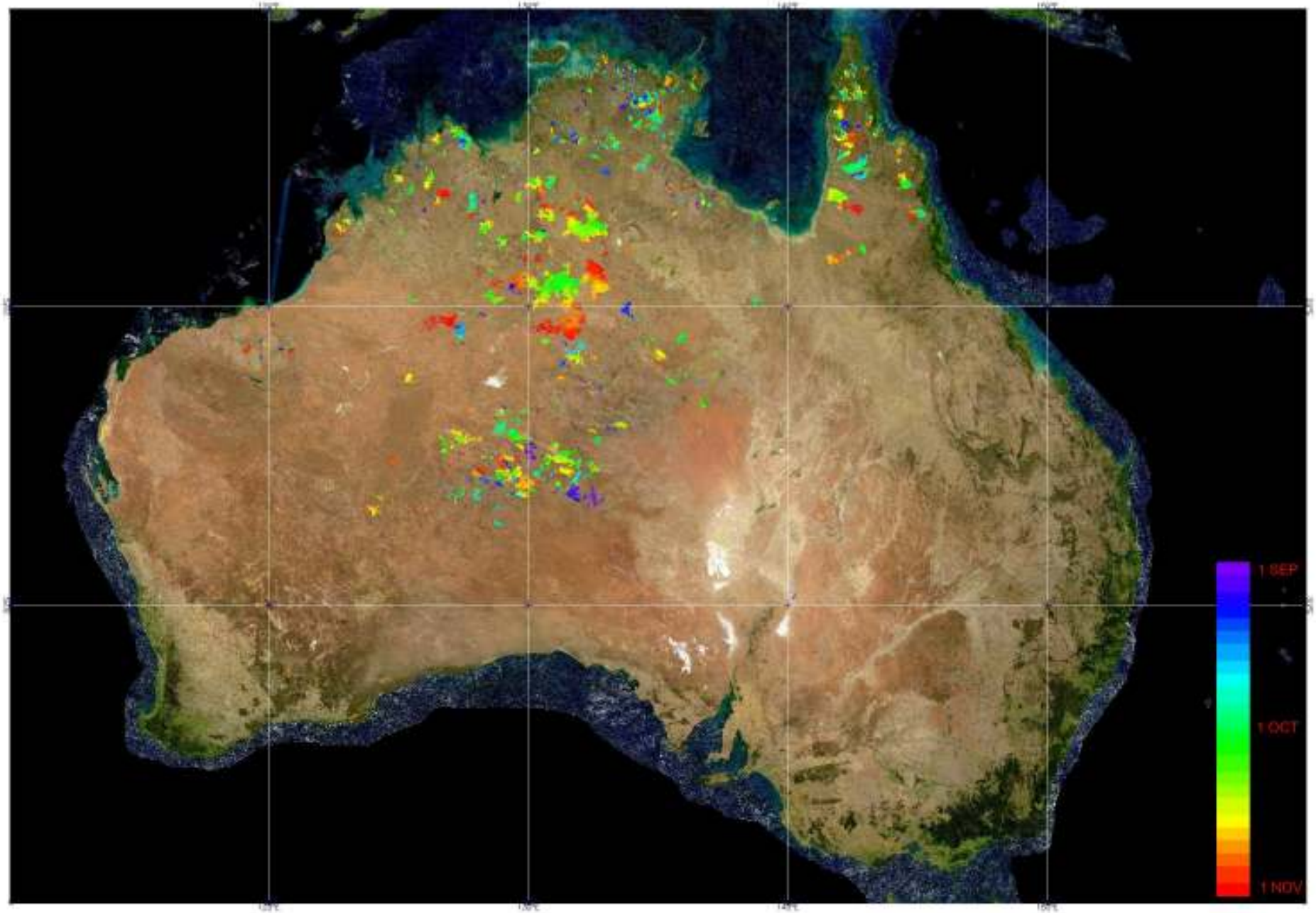


Roy UMD

Comparison Of MODIS Active Fires With burned Area product for the Same period.



2 months of MODIS burned areas: SEPT-OCT 2002



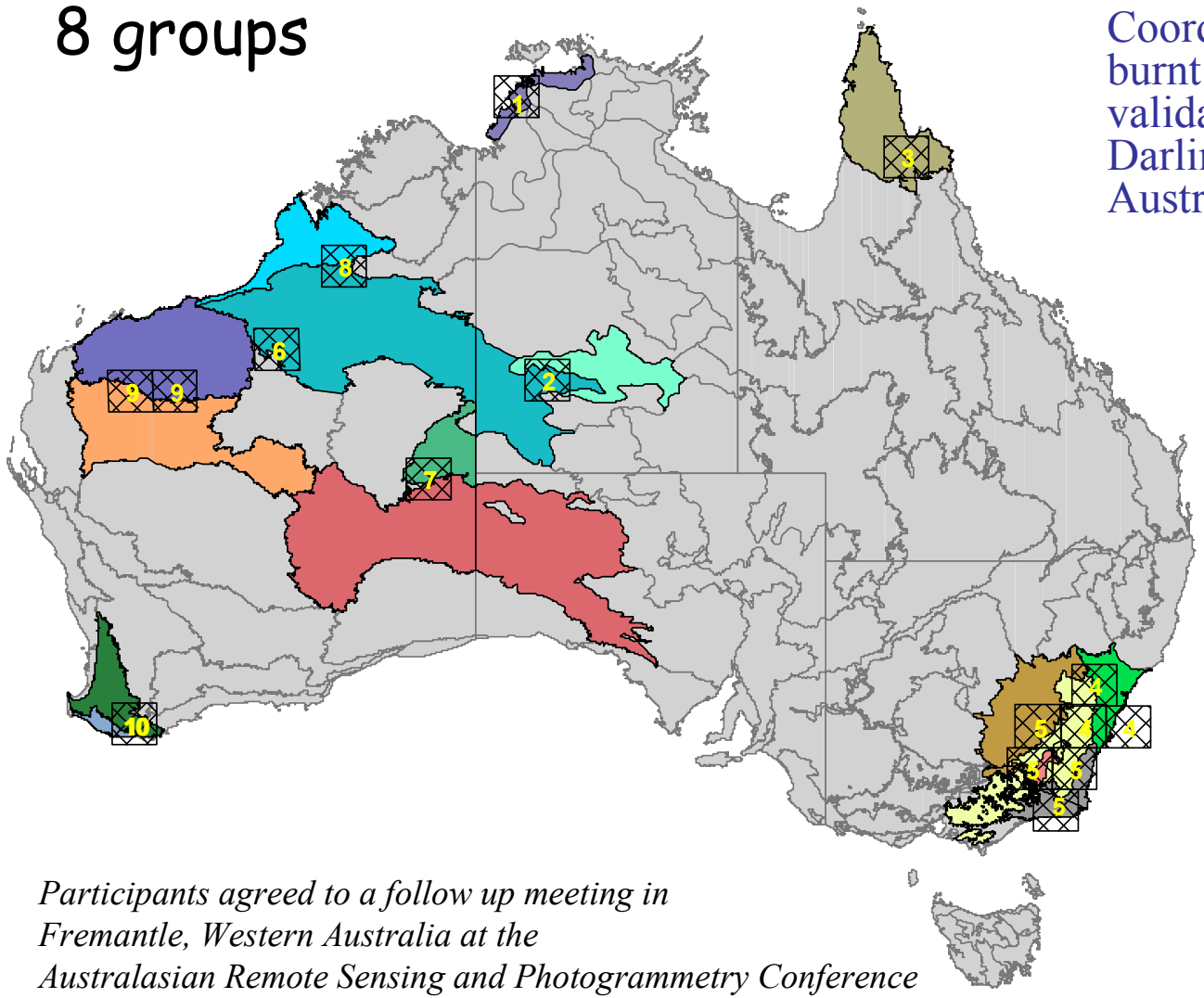
Rov. Boschetti UMD

Surface reflectance mosaic: E.Vermote

2002 Australian Landsat ETM+ validation scenes

8 groups

Coordinated at Australian burnt area mapping and validation workshop, Darling Harbour, Syndey, Australia, October 7th 2003.



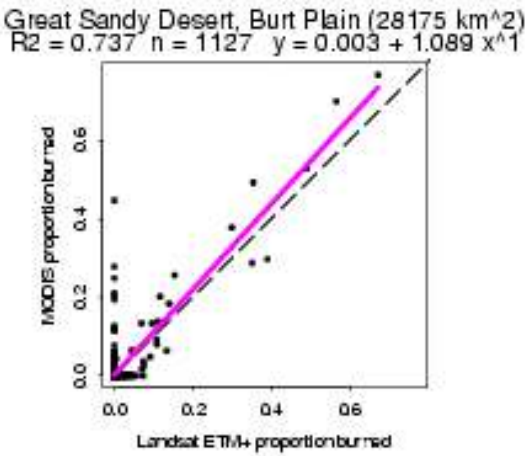
Landsat Images

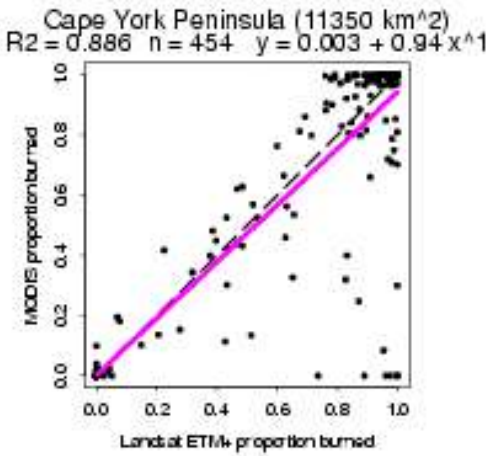
MODIS/IBRA Validation Sites

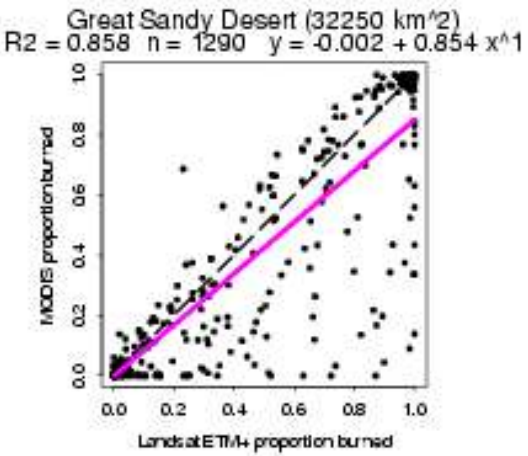
- Australian Alps
- Burt Plain
- Cape York Peninsula
- Central Ranges
- Dampierland
- Darwin Coastal
- Gascoyne
- Great Sandy Desert
- Great Victoria Desert
- Jarrah Forest
- NSW South Western Slopes
- Pilbara
- South East Corner
- South Eastern Highlands
- Sydney Basin
- Warren
- IBRA 5.1 Regions

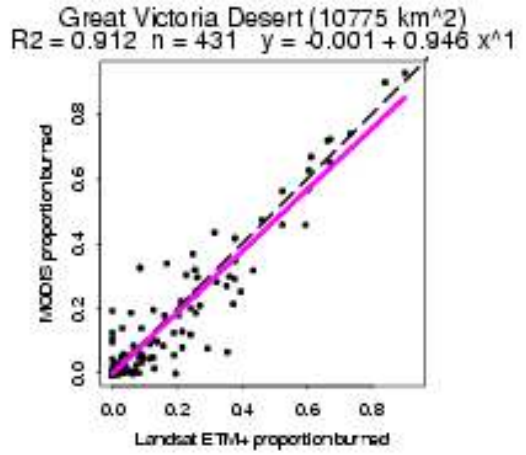
Participants agreed to a follow up meeting in Fremantle, Western Australia at the Australasian Remote Sensing and Photogrammetry Conference 18th – 22nd October 2004

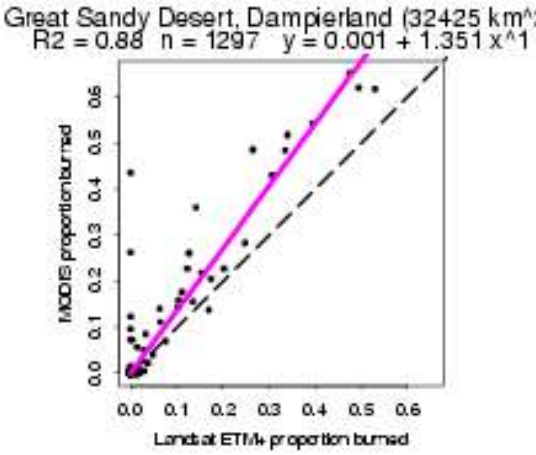
Belinda Heath

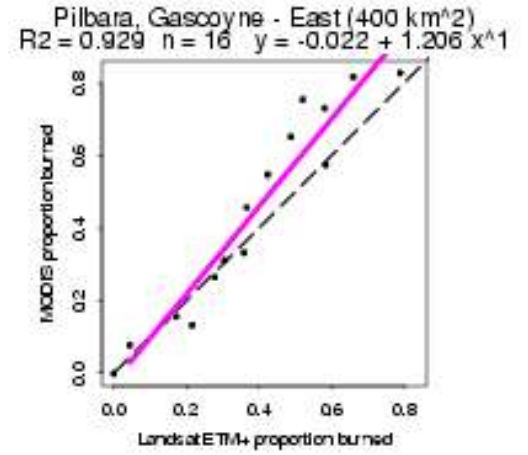


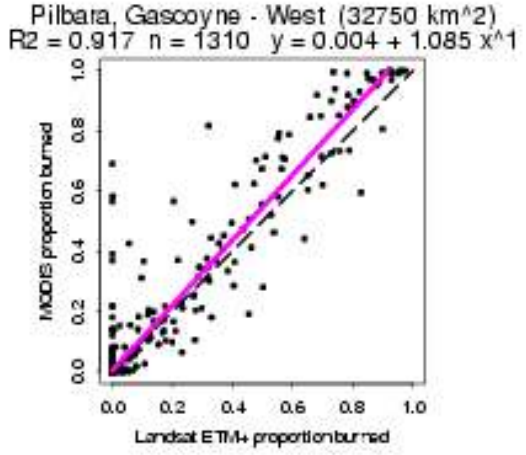


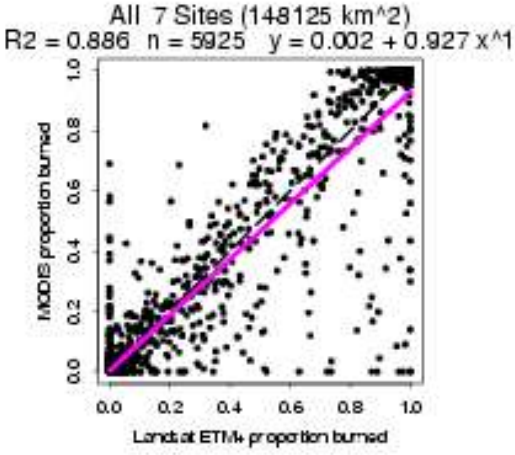












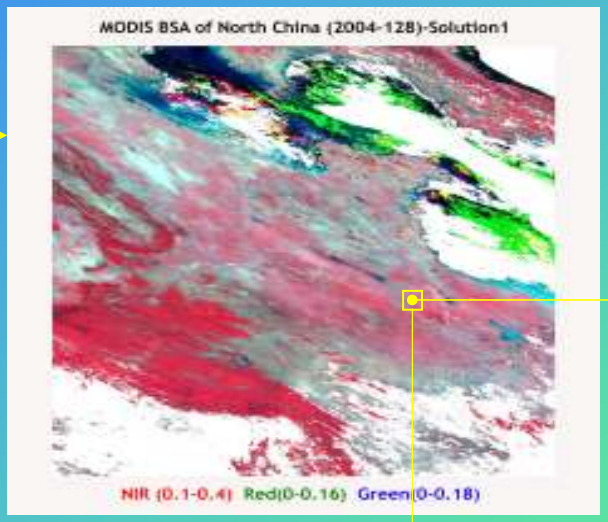
Landsat Validation of MODIS Burned Area

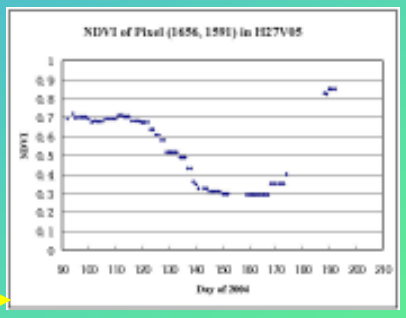
Roy, Allan et al.

Daily Phenology from BRDF/Albedo

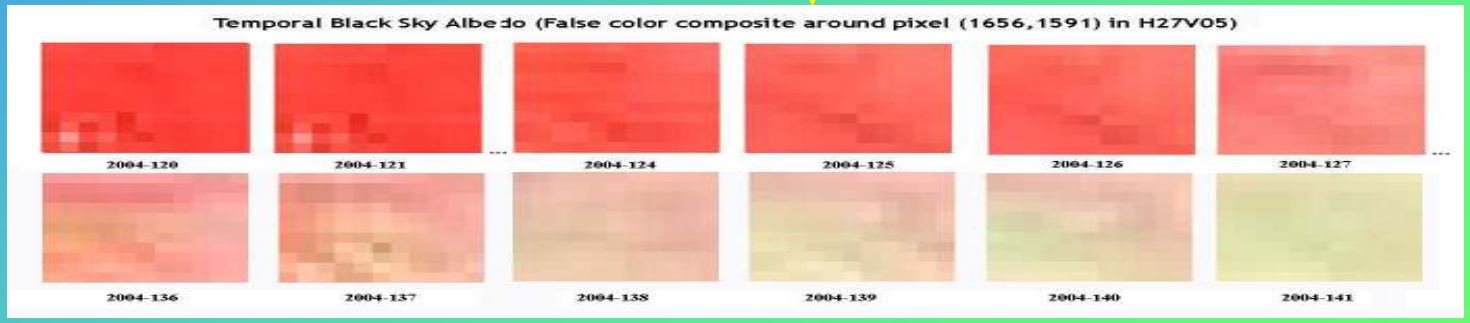
- **MODIS BRDF information is in demand at Direct Broadcast sites to capture phenology on a daily basis**

Agricultural region in China





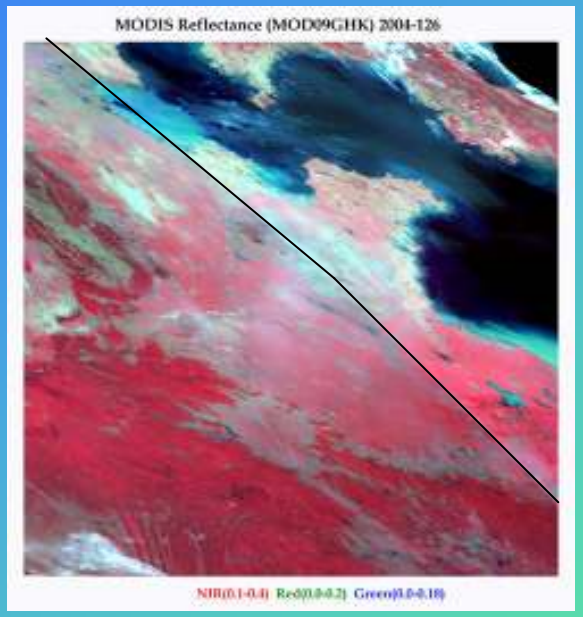
Daily change in NDVI during the harvest season



Daily change in Black Sky Albedo during the harvest season, produced using a daily rolling database BRDF/Albedo algorithm

BRDF Removes Angular Effects

- **MODIS BRDF information is in demand at Direct Broadcast sites to remove angular effects**



Left: MOD09GHK. Angular effect is severe between two swaths (North China Plain)

Right: Nadir BRDF-Adjusted Reflectance (NBAR). Angular effect is clearly removed

Operational Deforestation Detection in Brazilian Legal Amazon with MODIS

(**DETER** - **DE**tecção em **TE**mpo **R**eal do Desmatamento na Amazônia Legal)

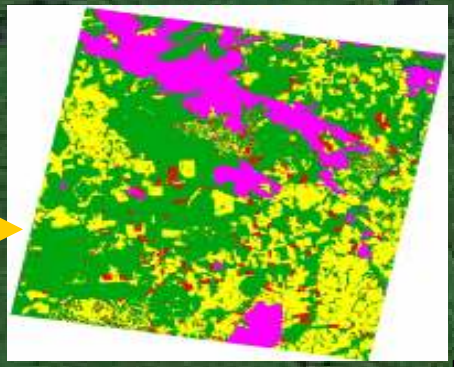
www.obt.inpe.br/deter

- **Reference: deforestation map available from the Landsat derived deforestation product (PRODES) for the previous year**
- **Monthly detection of changes in forested areas without cloud cover**
- **Rapid production and dissemination of the results using the internet**
- **Daily acquisitions and free availability key for operational real-time monitoring**
- **Not a substitute for higher resolution, Landsat-like observations but allows rapid assessment**

INPE
MINISTÉRIO DA CIÊNCIA E TECNOLOGIA
INSTITUTO NACIONAL DE PESQUISAS ESPACIAIS

DETER

PRODES Project



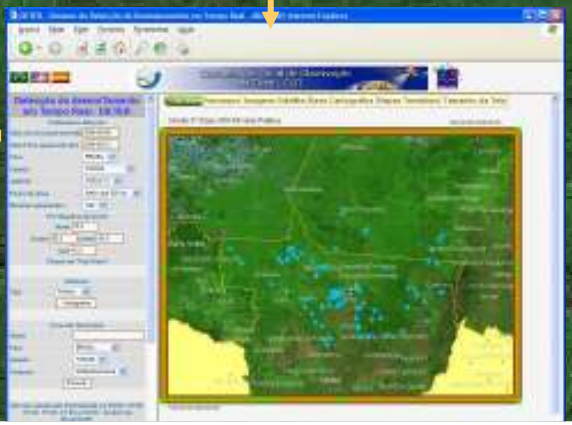
Deforestation Database for the previous years

MODIS image from NASA

Ground Station Cuiabá / MT (In the future)

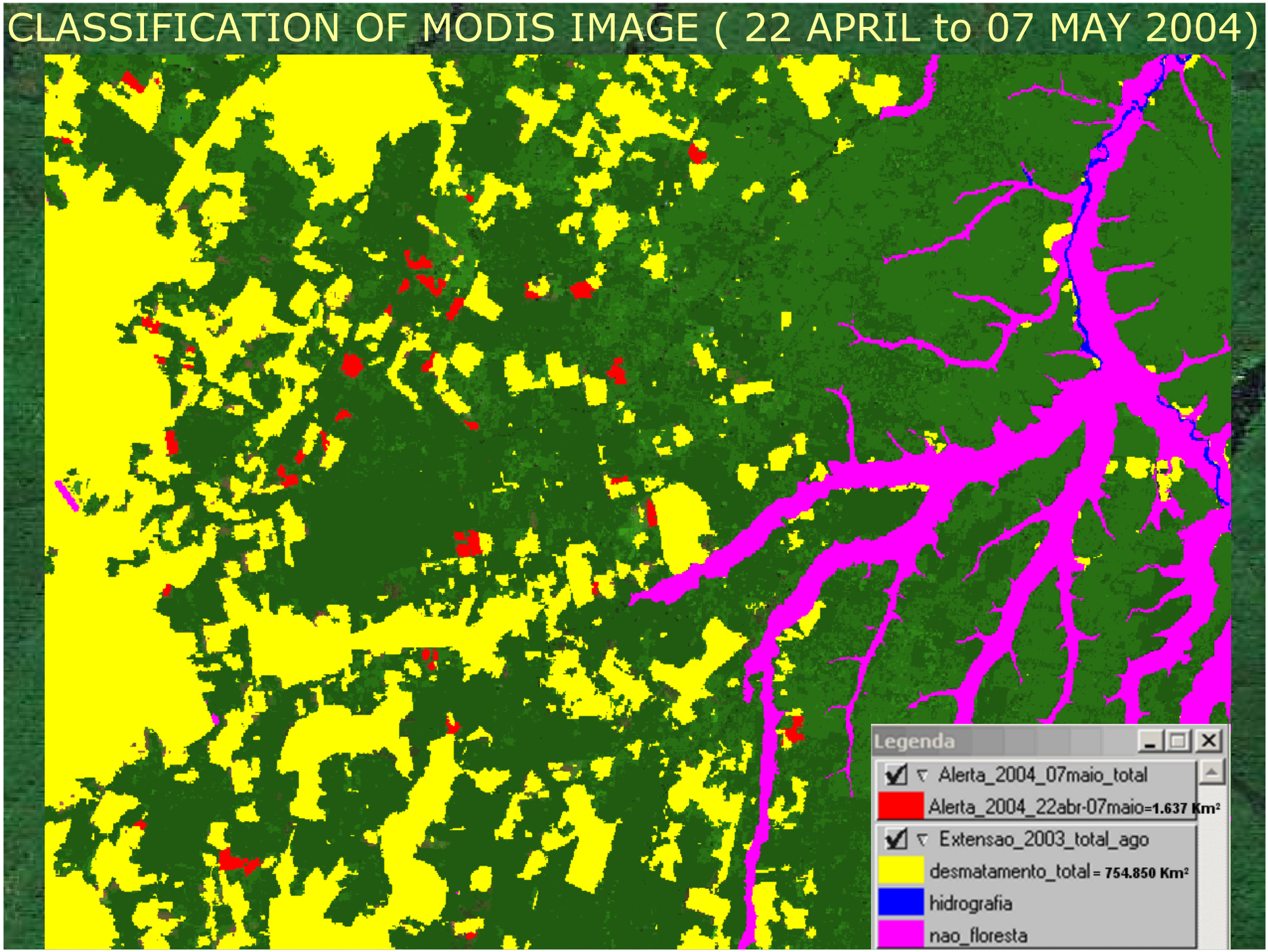
Processing data in S.J. Campos: SPRING – detection of new deforestation areas

Products in the Internet

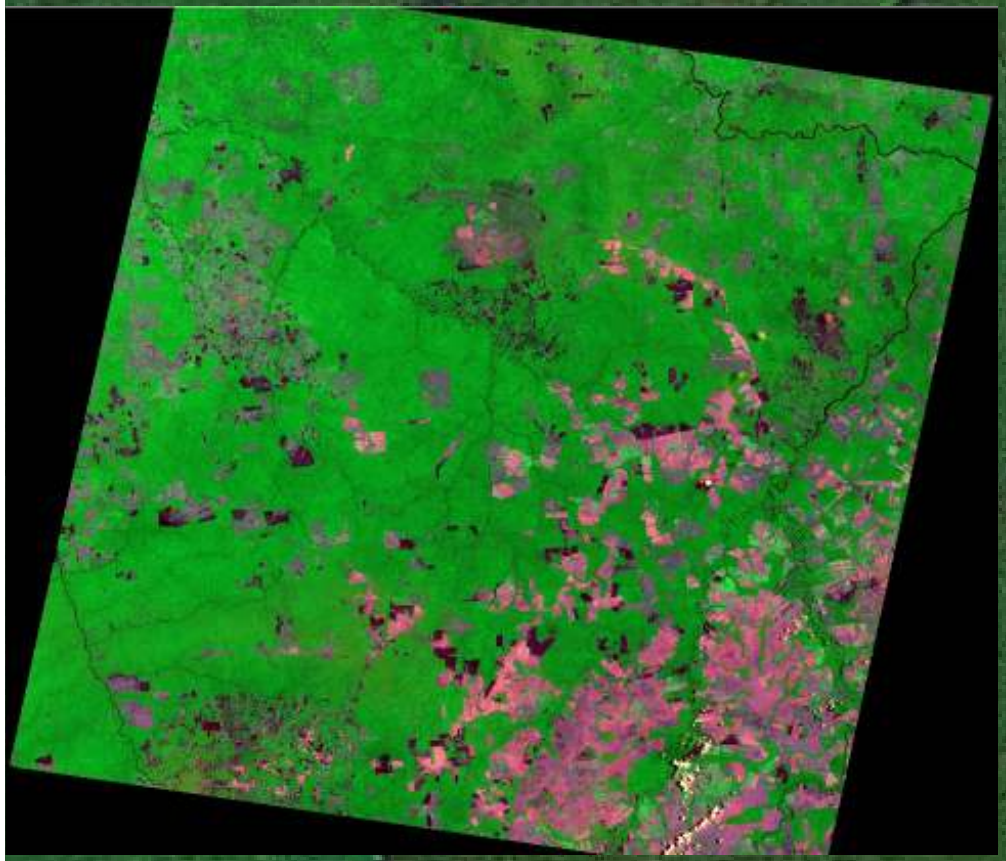


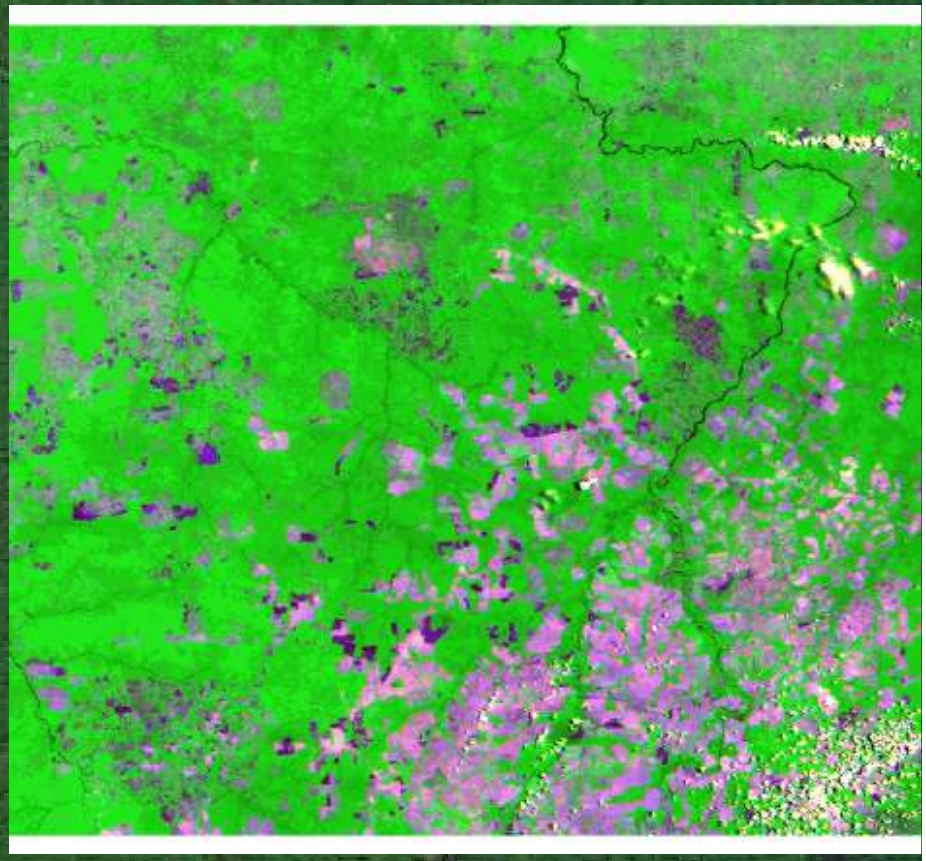
Fiscalization: IBAMA and other Institutions

CLASSIFICATION OF MODIS IMAGE (22 APRIL to 07 MAY 2004)

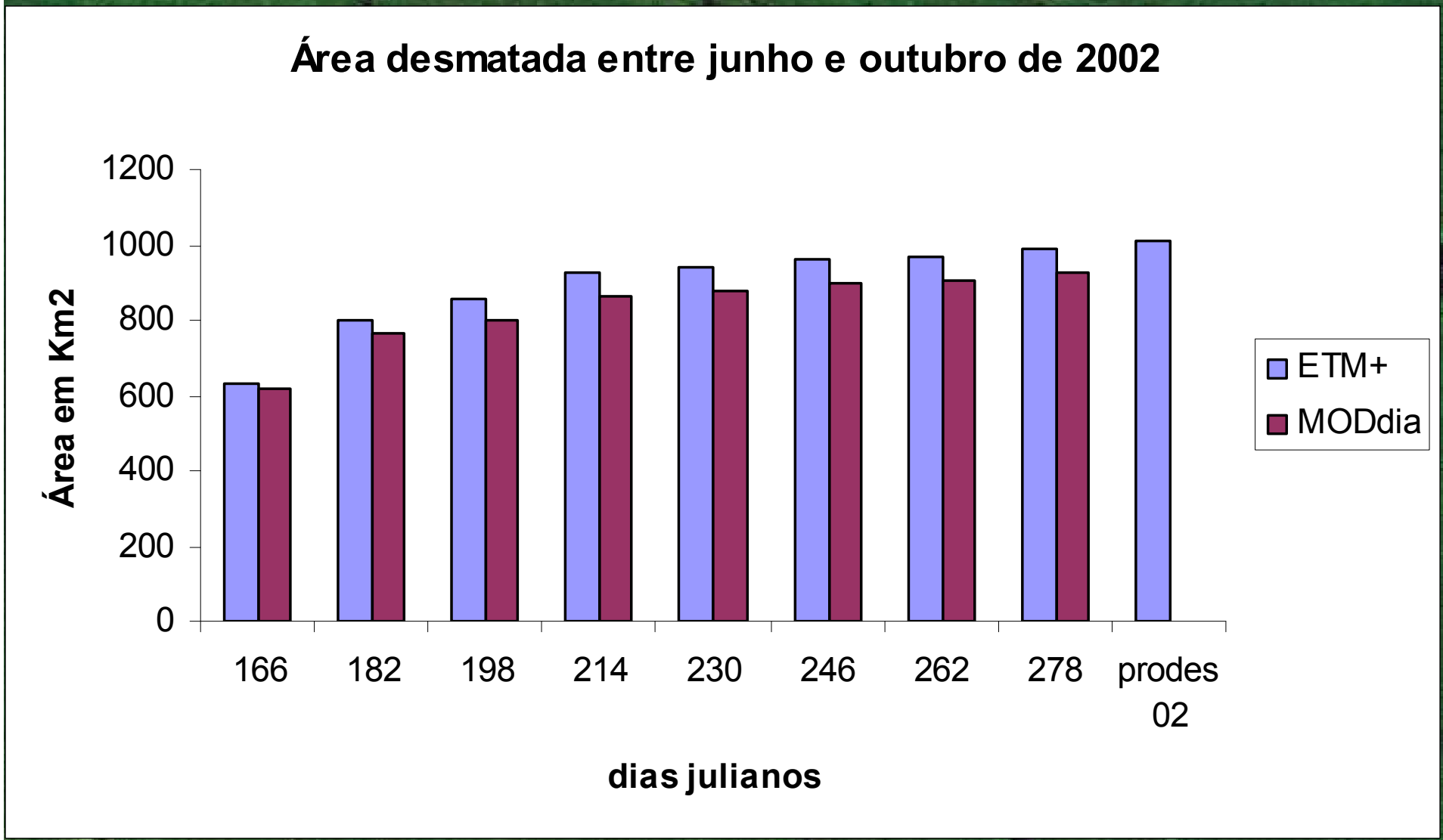


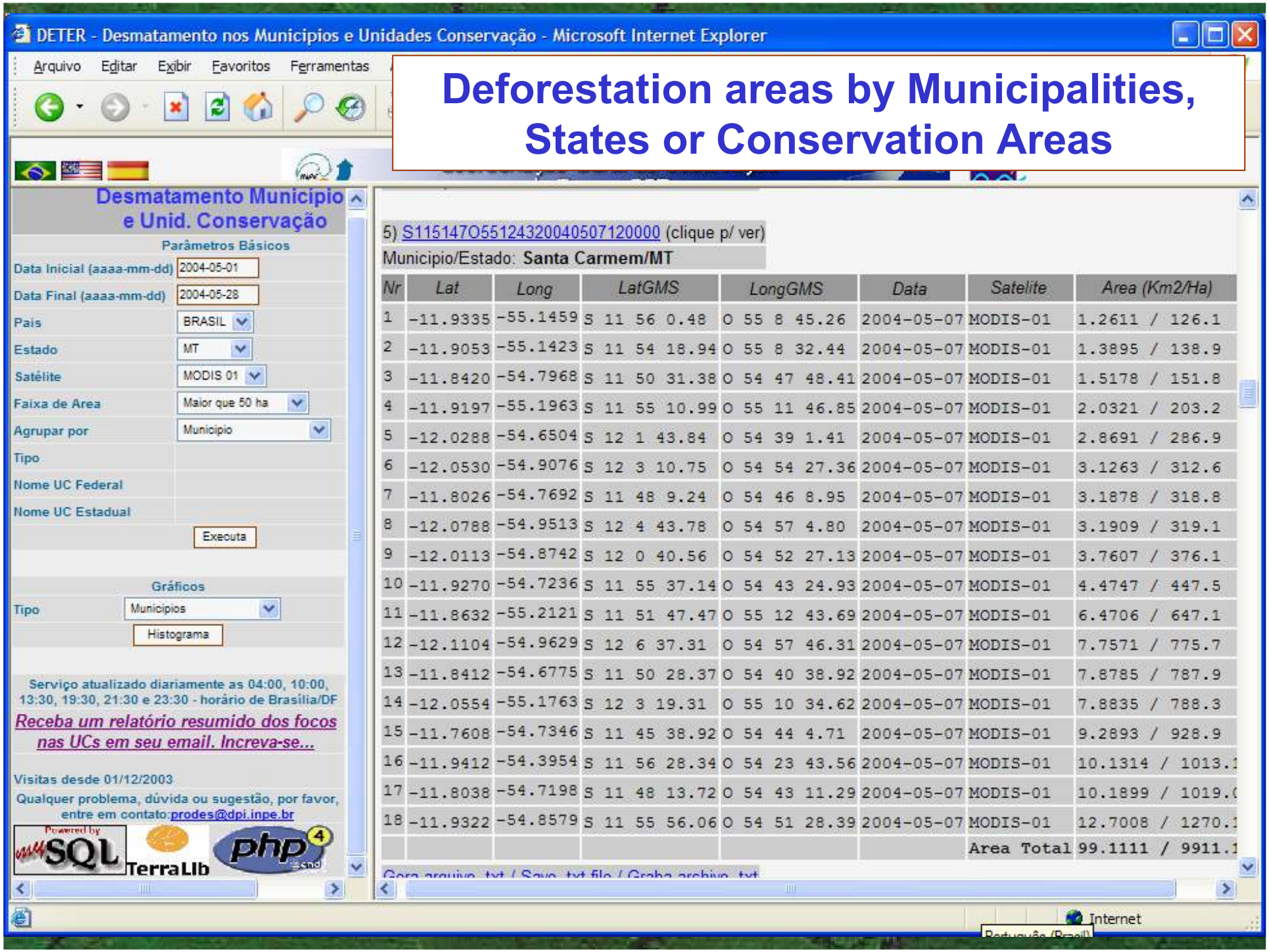
LANDSAT ETM+ - TERRA MODIS 2002 / 278

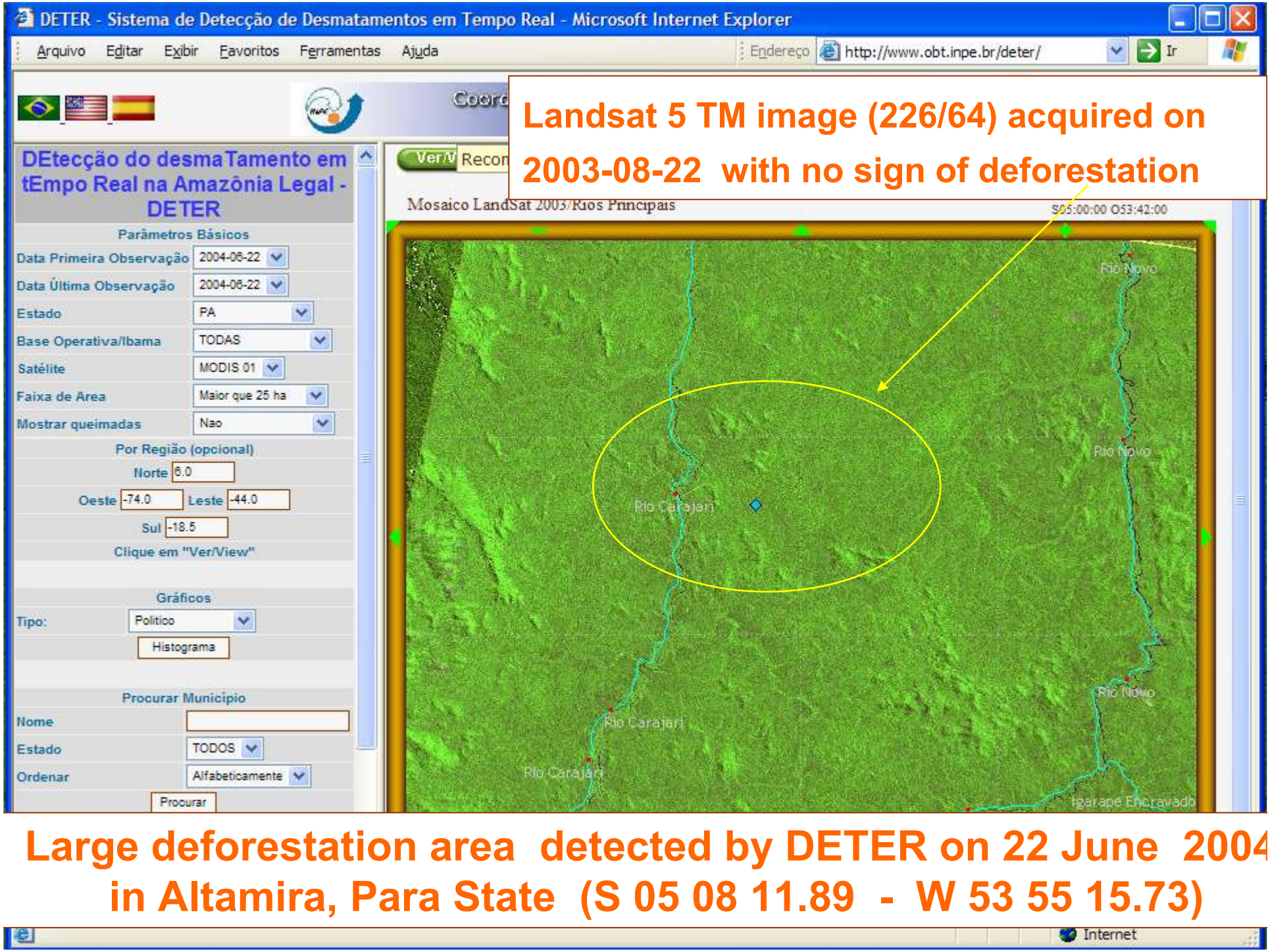




LANDSAT ETM+ - MAPPED AREAS (KM^2)

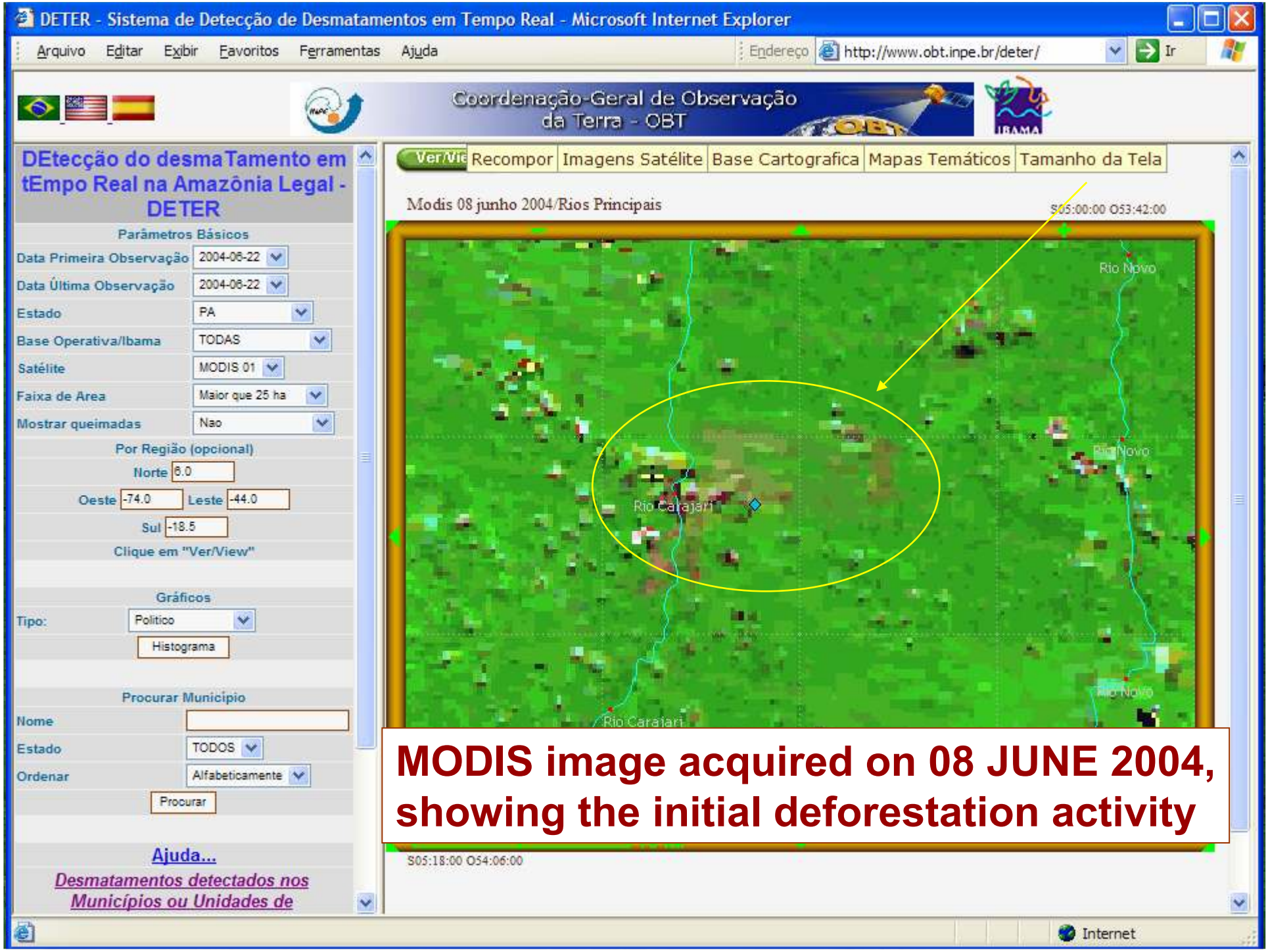



DETER - Desmatamento nos Municipios e Unidades Conservação - Microsoft Internet Explorer
Arquivo Editar Exibir Favoritos Ferramentas
Deforestation areas by Municipalities, States or Conservation Areas
Desmatamento Municipio e Unid. Conservação
Parâmetros Básicos
Data Inicial (aaaa-mm-dd) 2004-05-01
Data Final (aaaa-mm-dd) 2004-05-28
Pais BRASIL
Estado MT
Satélite MODIS 01
Faixa de Area Maior que 50 ha
Agrupar por Municipio
Tipo
Nome UC Federal
Nome UC Estadual
Executa
Gráficos
Tipo Municipios
Histograma
Serviço atualizado diariamente as 04:00, 10:00, 13:30, 19:30, 21:30 e 23:30 - horário de Brasília/DF
Receba um relatório resumido dos focos nas UCs em seu email. Increva-se...
Visitas desde 01/12/2003
Qualquer problema, dúvida ou sugestão, por favor, entre em contato:prodes@dpi.inpe.br
Powered by MySQL
TerraLib
php 4
5) S115147O55124320040507120000 (clique p/ ver)
Municipio/Estado: Santa Carmem/MT
Nr Lat Long LatGMS LongGMS Data Satelite Area (Km2/Ha)
1 -11.9335 -55.1459 S 11 56 0.48 O 55 8 45.26 2004-05-07 MODIS-01 1.2611 / 126.1
2 -11.9053 -55.1423 S 11 54 18.94 O 55 8 32.44 2004-05-07 MODIS-01 1.3895 / 138.9
3 -11.8420 -54.7968 S 11 50 31.38 O 54 47 48.41 2004-05-07 MODIS-01 1.5178 / 151.8
4 -11.9197 -55.1963 S 11 55 10.99 O 55 11 46.85 2004-05-07 MODIS-01 2.0321 / 203.2
5 -12.0288 -54.6504 S 12 1 43.84 O 54 39 1.41 2004-05-07 MODIS-01 2.8691 / 286.9
6 -12.0530 -54.9076 S 12 3 10.75 O 54 54 27.36 2004-05-07 MODIS-01 3.1263 / 312.6
7 -11.8026 -54.7692 S 11 48 9.24 O 54 46 8.95 2004-05-07 MODIS-01 3.1878 / 318.8
8 -12.0788 -54.9513 S 12 4 43.78 O 54 57 4.80 2004-05-07 MODIS-01 3.1909 / 319.1
9 -12.0113 -54.8742 S 12 0 40.56 O 54 52 27.13 2004-05-07 MODIS-01 3.7607 / 376.1
10 -11.9270 -54.7236 S 11 55 37.14 O 54 43 24.93 2004-05-07 MODIS-01 4.4747 / 447.5
11 -11.8632 -55.2121 S 11 51 47.47 O 55 12 43.69 2004-05-07 MODIS-01 6.4706 / 647.1
12 -12.1104 -54.9629 S 12 6 37.31 O 54 57 46.31 2004-05-07 MODIS-01 7.7571 / 775.7
13 -11.8412 -54.6775 S 11 50 28.37 O 54 40 38.92 2004-05-07 MODIS-01 7.8785 / 787.9
14 -12.0554 -55.1763 S 12 3 19.31 O 55 10 34.62 2004-05-07 MODIS-01 7.8835 / 788.3
15 -11.7608 -54.7346 S 11 45 38.92 O 54 44 4.71 2004-05-07 MODIS-01 9.2893 / 928.9
16 -11.9412 -54.3954 S 11 56 28.34 O 54 23 43.56 2004-05-07 MODIS-01 10.1314 / 1013.1
17 -11.8038 -54.7198 S 11 48 13.72 O 54 43 11.29 2004-05-07 MODIS-01 10.1899 / 1019.0
18 -11.9322 -54.8579 S 11 55 56.06 O 54 51 28.39 2004-05-07 MODIS-01 12.7008 / 1270.1
Area Total 99.1111 / 9911.1
Internet

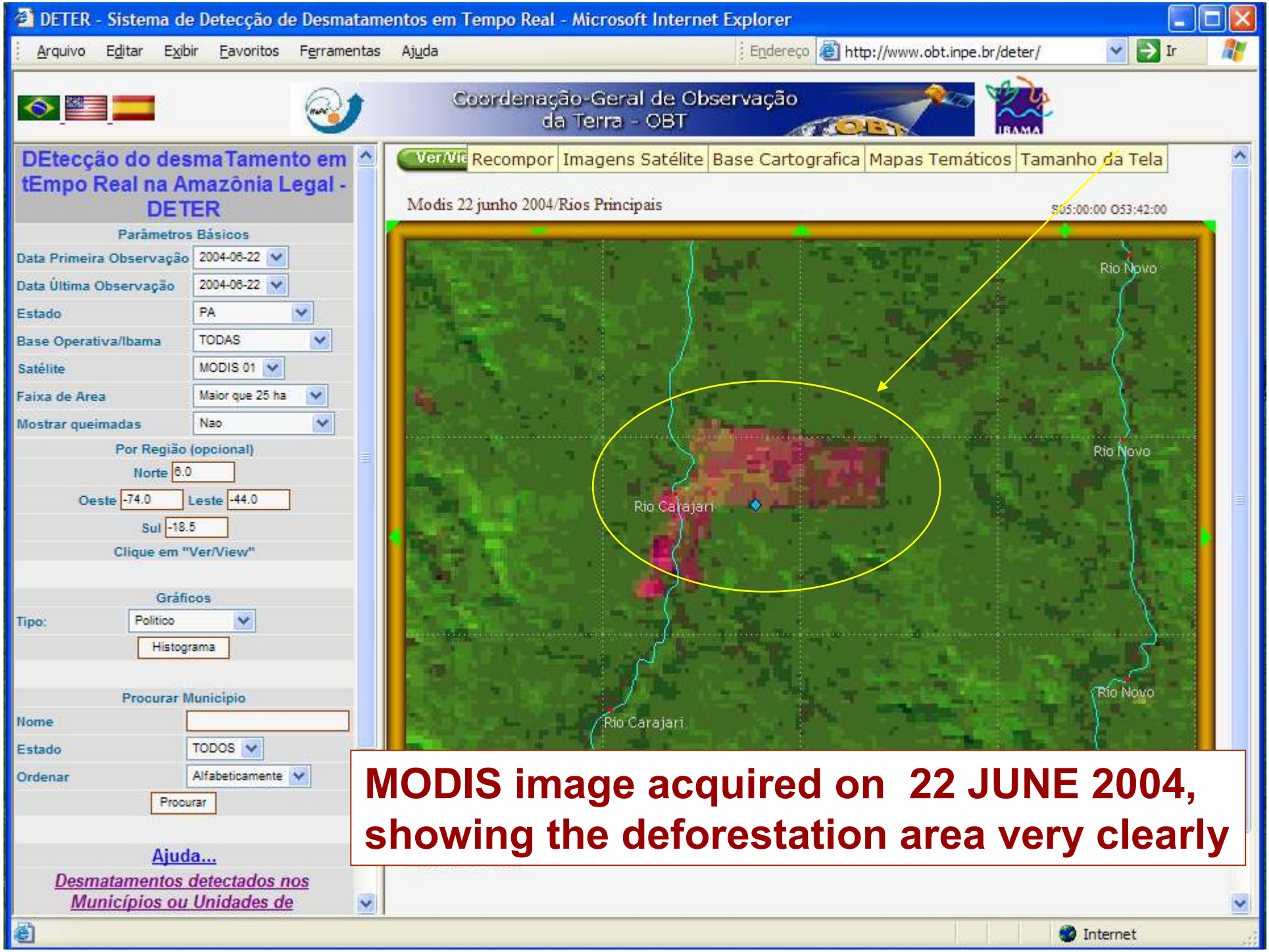


Landsat 5 TM image (226/64) acquired on 2003-08-22 with no sign of deforestation

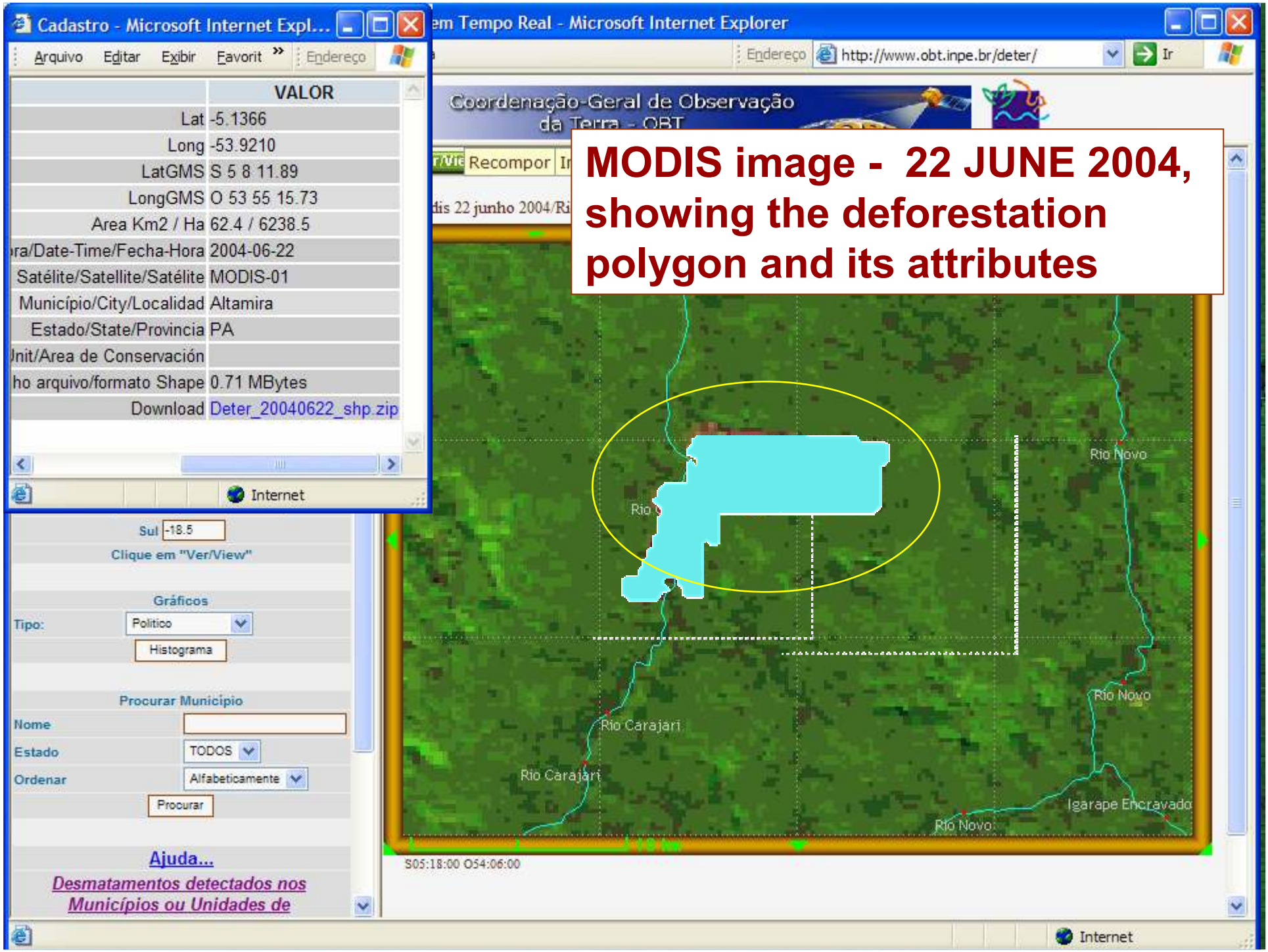
Large deforestation area detected by DETER on 22 June 2004 in Altamira, Para State (S 05 08 11.89 - W 53 55 15.73)

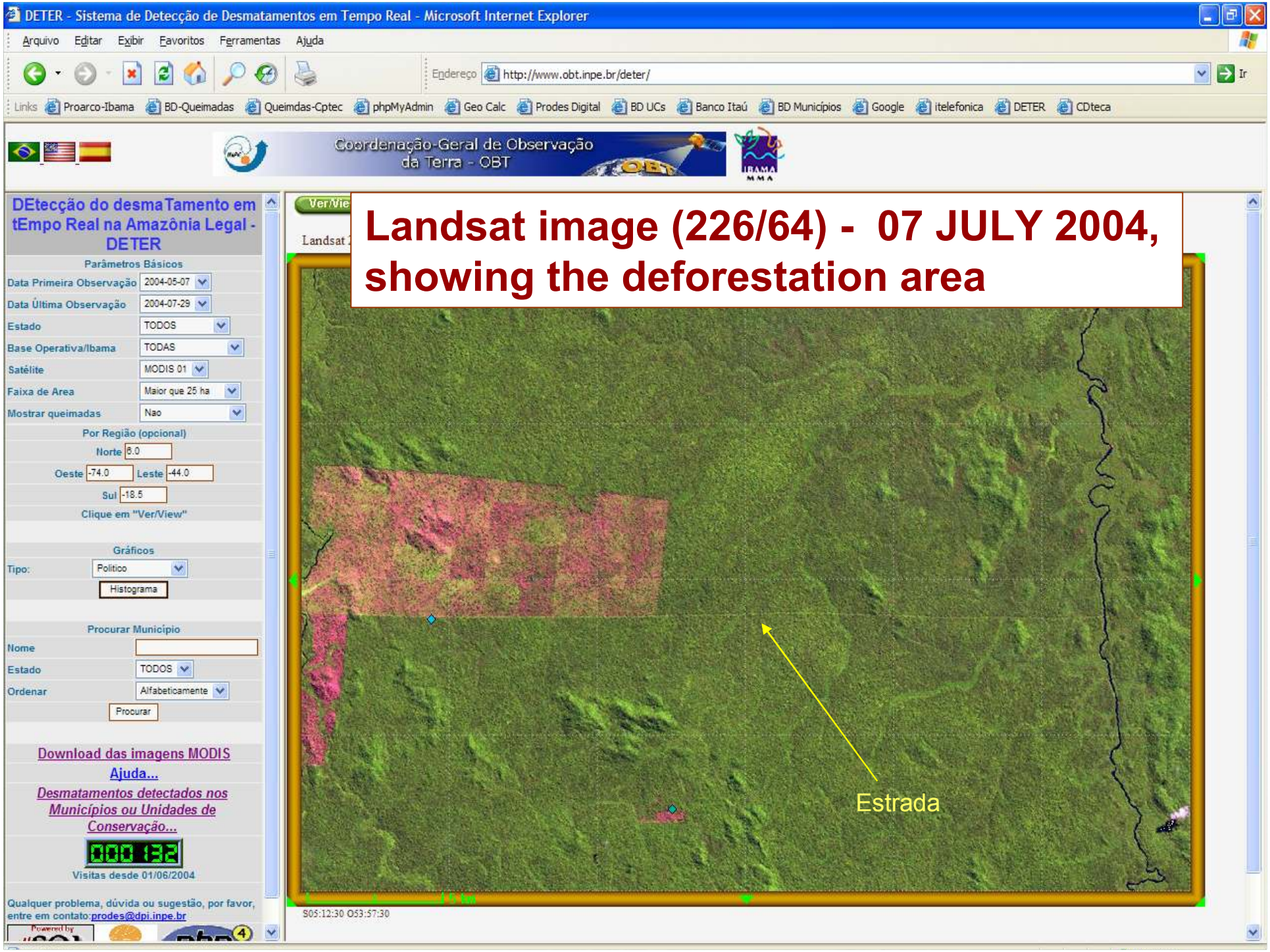


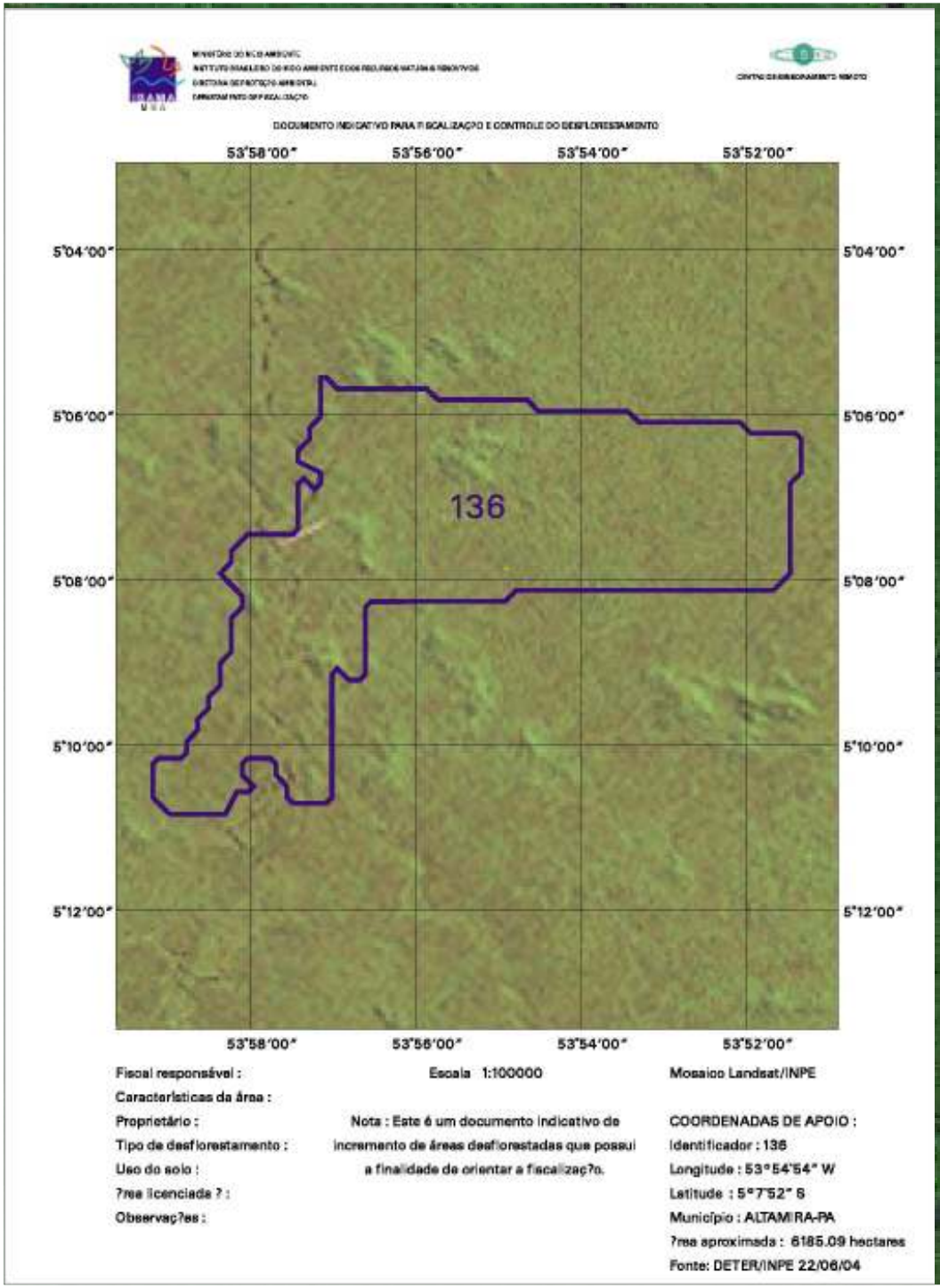
MODIS image acquired on 08 JUNE 2004, showing the initial deforestation activity



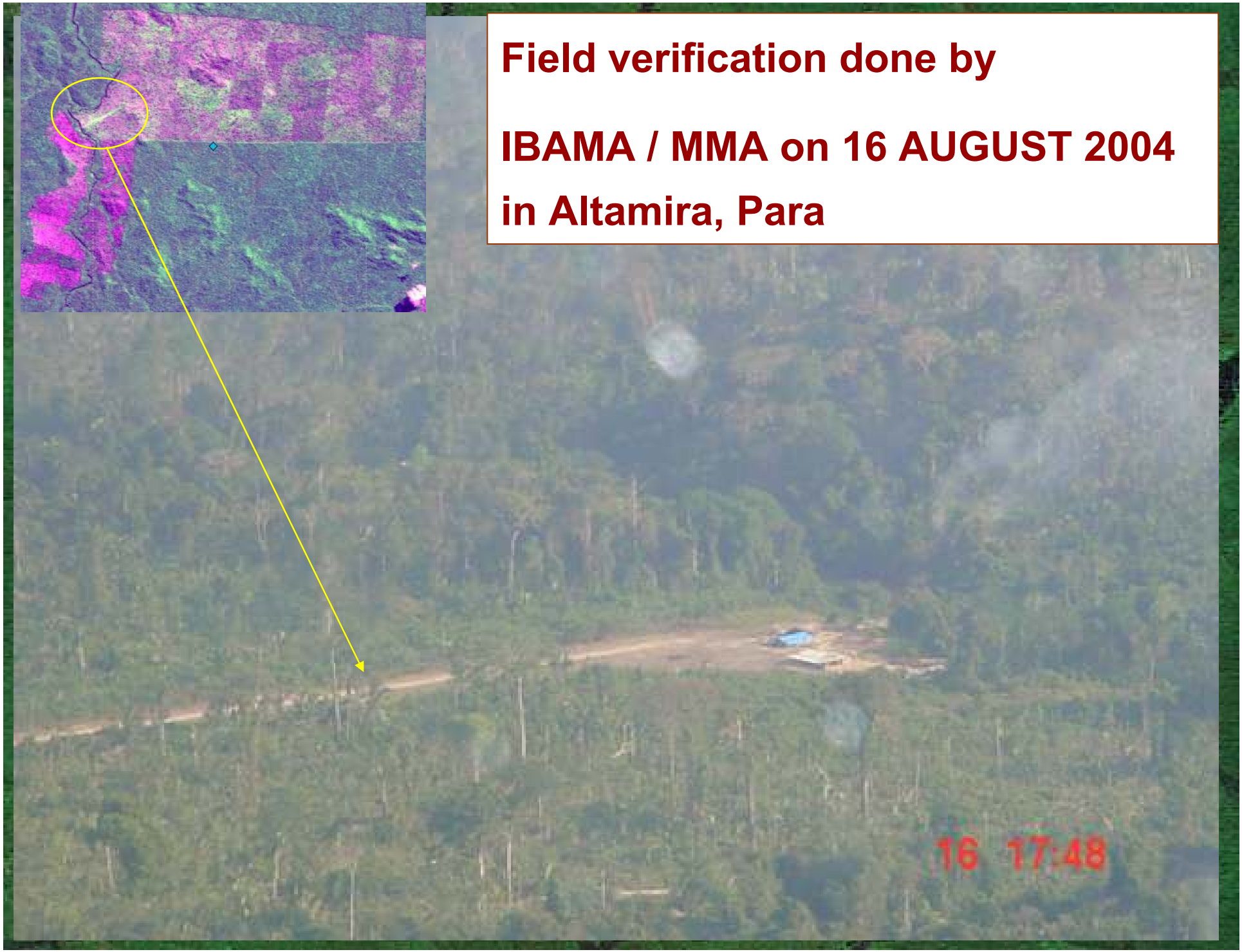
MODIS image acquired on 22 JUNE 2004, showing the deforestation area very clearly


Cadastro - Microsoft Internet Expl...
Arquivo Editar Exibir Favorit
Endereço
VALOR
Lat -5.1366
Long -53.9210
LatGMS S 5 8 11.89
LongGMS O 53 55 15.73
Area Km2 / Ha 62.4 / 6238.5
ra/Date-Time/Fecha-Hora 2004-06-22
Satélite/Satellite/Satélite MODIS-01
Município/City/Localidad Altamira
Estado/State/Provincia PA
Unit/Area de Conservación
ho arquivo/formato Shape 0.71 MBytes
Download Deter_20040622_shp.zip
Internet
em Tempo Real - Microsoft Internet Explorer
Endereço http://www.obt.inpe.br/deter/
Ir
Coordenação-Geral de Observação da Terra - OBT
Recompor
dis 22 junho 2004/Ri
MODIS image - 22 JUNE 2004, showing the deforestation polygon and its attributes
Rio Novo
Rio Carajari
Rio Carajari
Igarape Encravado
Rio Novo
Rio Novo
S05:18:00 O54:06:00
Sul -18.5
Clique em "Ver/View"
Gráficos
Tipo: Politico
Histograma
Procurar Município
Nome
Estado TODOS
Ordenar Alfabeticamente
Procurar
Ajuda...
Desmatamentos detectados nos Municípios ou Unidades de
Internet


DETER - Sistema de Detecção de Desmatamentos em Tempo Real - Microsoft Internet Explorer
Arquivo Editar Exibir Favoritos Ferramentas Ajuda
Endereço http://www.obt.inpe.br/deter/
Coordenação-Geral de Observação da Terra - OBT
DEtecção do desmaTamento em tEmpo Real na Amazônia Legal - DETER
Parâmetros Básicos
Data Primeira Observação 2004-05-07
Data Última Observação 2004-07-29
Estado TODOS
Base Operativa/Ibama TODAS
Satélite MODIS 01
Faixa de Area Maior que 25 ha
Mostrar queimadas Nao
Por Região (opcional)
Norte 6.0
Oeste -74.0 Leste -44.0
Sul -18.5
Clique em "Ver/View"
Gráficos
Tipo: Politico
Histograma
Procurar Município
Nome
Estado TODOS
Ordenar Alfabeticamente
Procurar
Download das imagens MODIS
Ajuda...
Desmatamentos detectados nos Municípios ou Unidades de Conservação...
000132
Visitas desde 01/06/2004
Qualquer problema, dúvida ou sugestão, por favor, entre em contato:prodes@dpi.inpe.br
Landsat image (226/64) - 07 JULY 2004, showing the deforestation area
Estrada
S05:12:30 O53:57:30

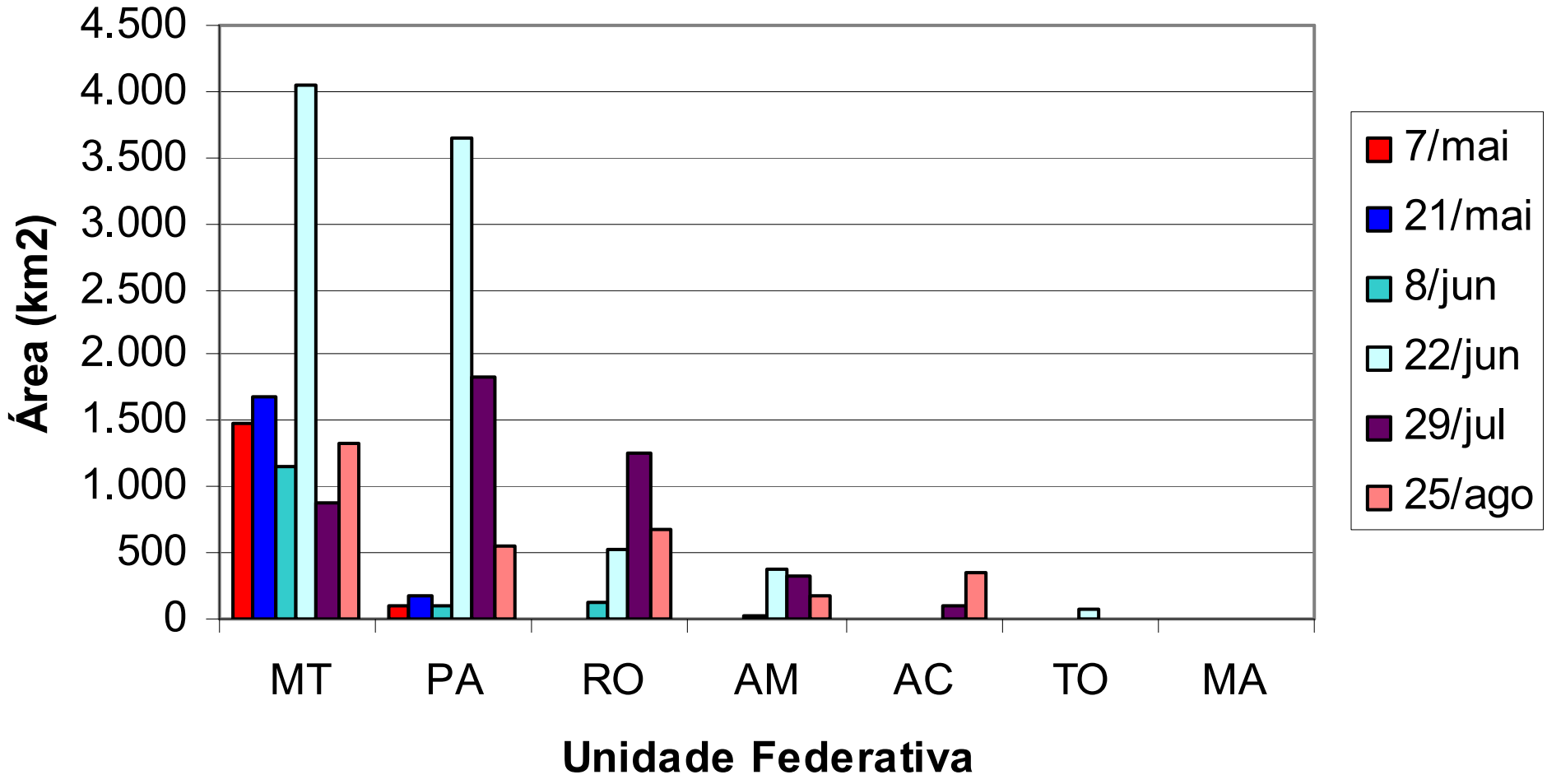


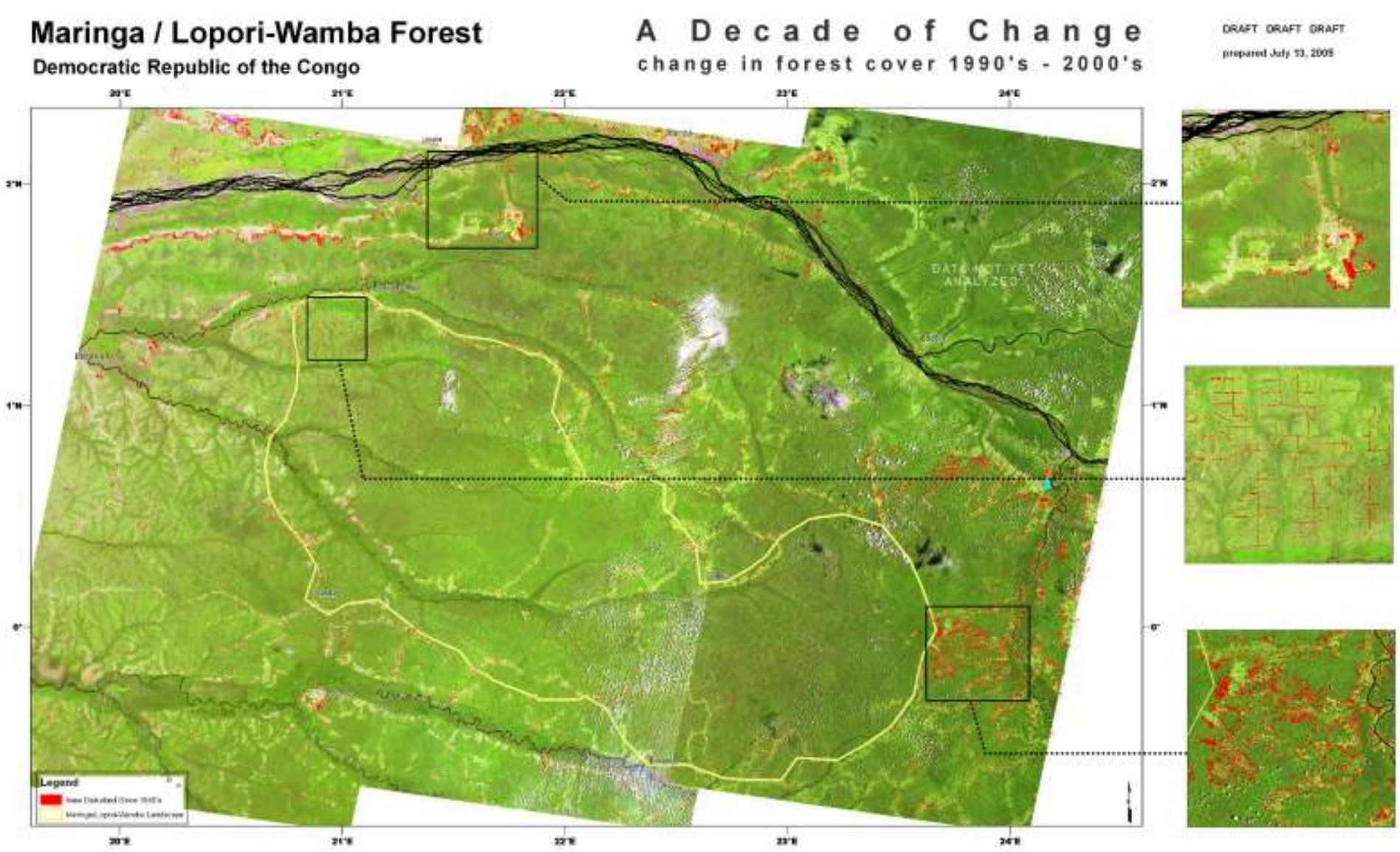
"Document Indicative for Fiscalization and Control of Deforestation", written by IBAMA/MMA based on DETER information


Field verification done by
IBAMA / MMA on 16 AUGUST 2004
in Altamira, Para
16 17:48


16 17:49

Dinâmica do Desmatamento por Unidade Federativa (Agosto/2003-Agosto/2004)





USAID
Central Africa
Regional Project
For the Environment (CARPE)

LANDSAT Change Products

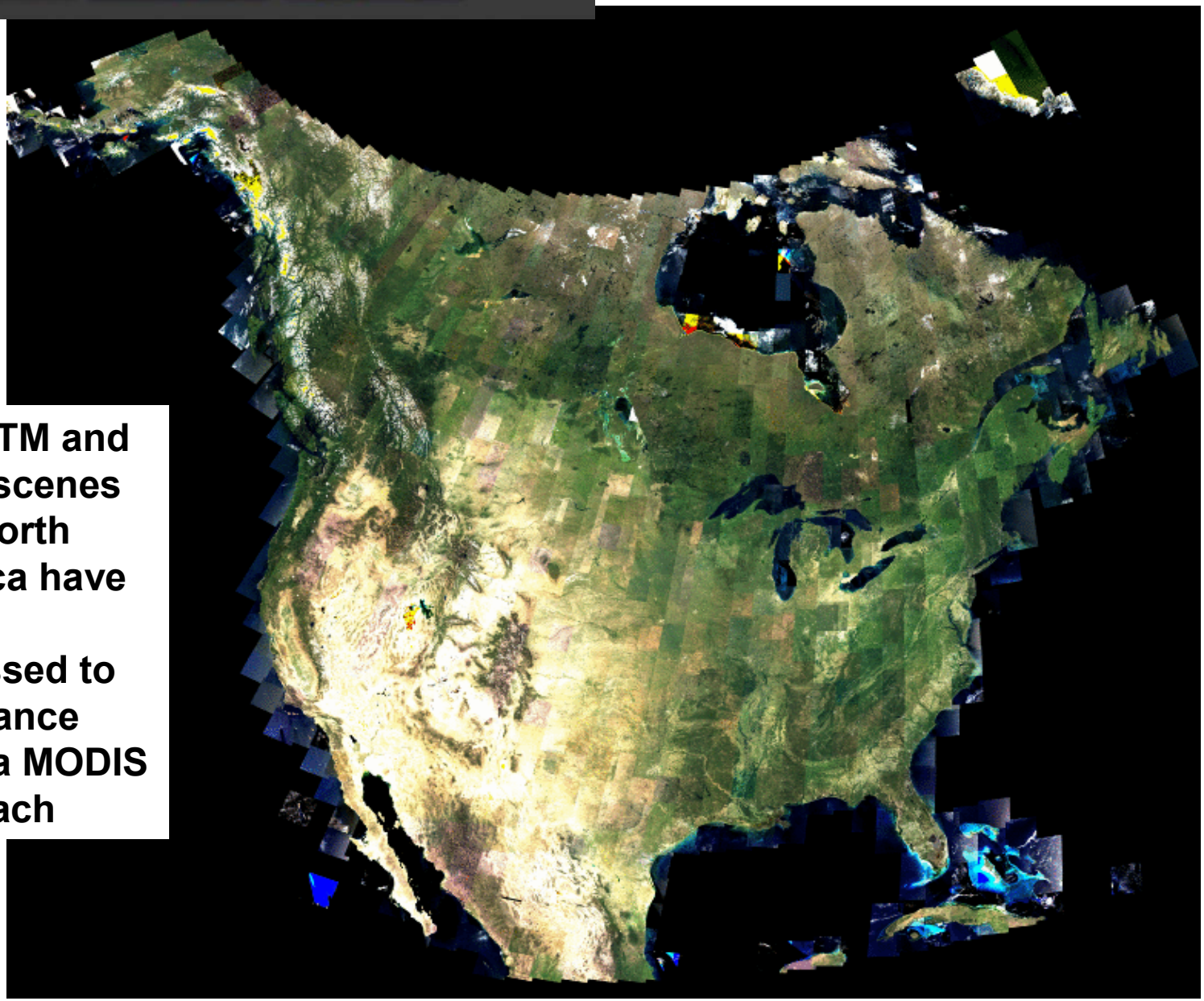
Source: M. Hansen SDSU

Landsat Applications

- Landsat has made the single largest contribution to land applications of remote sensing
- Within the Landsat Progra - the NASA Geocover Global Data sets 1990 – 2000 were a major contribution – enabling regional scale analyses using large numbers of scenes
- Future applications will include a more synergistic use of moderate and high resolution data
- Need to advance Landsat class observations commensurate with the MODIS class observations
  - Atmospheric Correction, Data Normalization
  - Regional mosaics and derived products
- Prototyping for processing and distribution underway
  - REASONS, ACCESS
- Current SLC problem with Landsat 7 2003 has created a data gap for applications user
- For applications users there is a need for an equivalent data set to Geocover for the mid decade 2004-2007

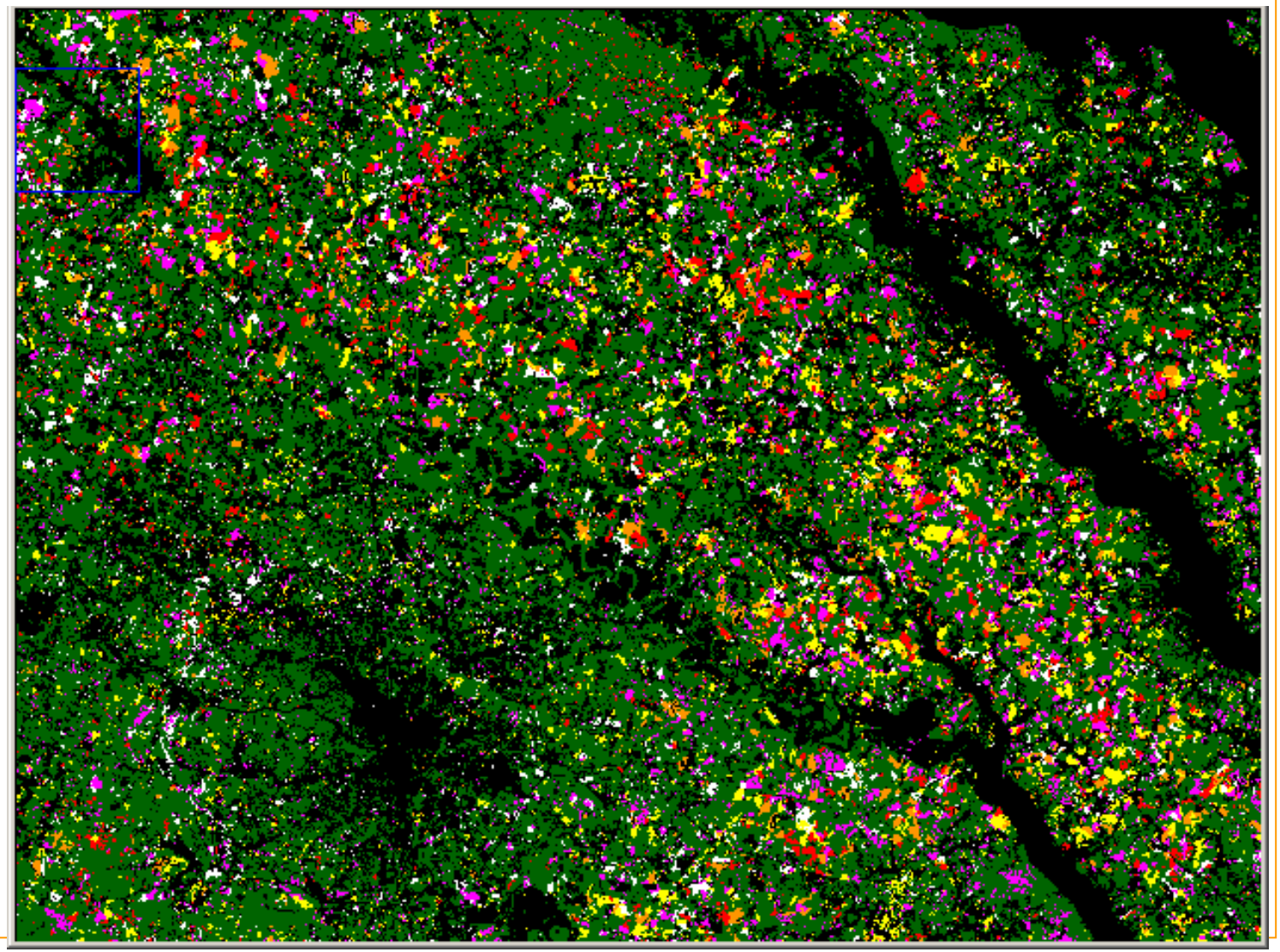
Landsat Ecosystem Disturbance Adaptive Processing System

Landsat Surface Reflectance



~2200 TM and ETM+ scenes over North America have been processed to reflectance using a MODIS Approach

Landsat Disturbance History Example: Virginia

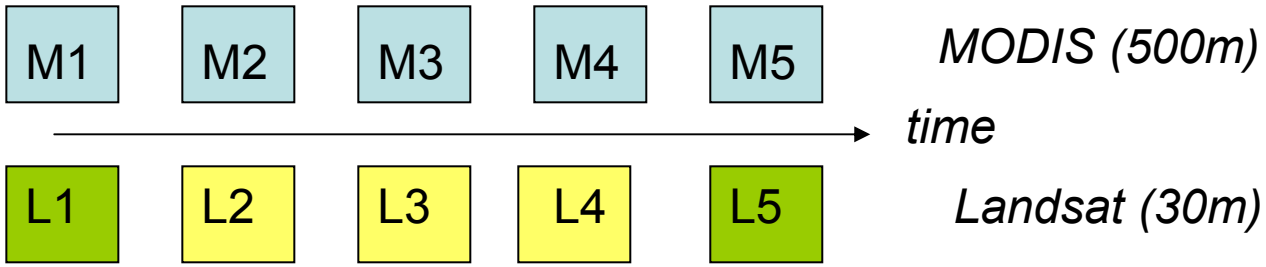


DATA BLENDER PROJECT

"Daily" Landsat Surface Reflectance

- Objectives:

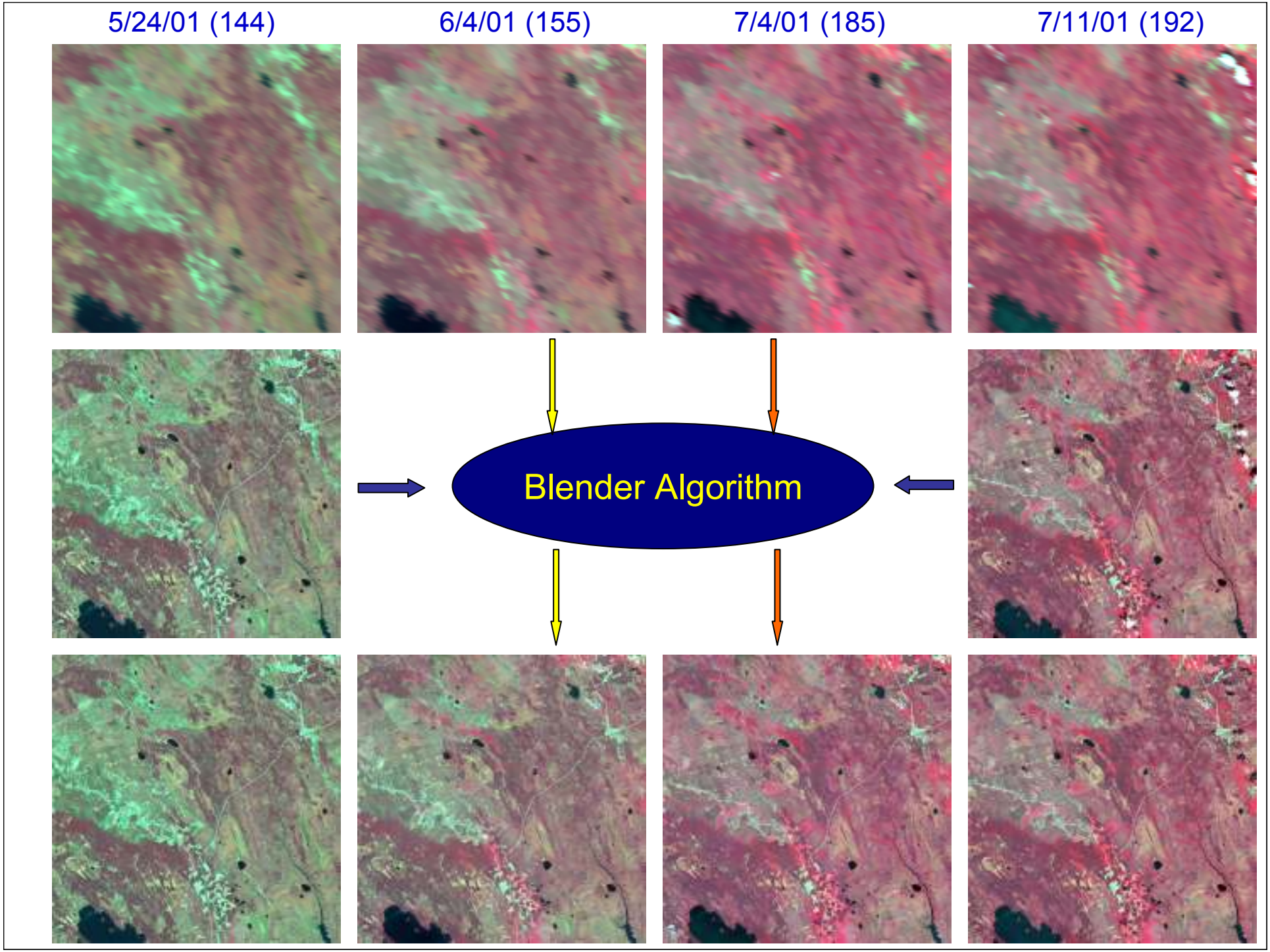
  blend high-frequency temporal information from MODIS and high spatial resolution information from Landsat to produce "daily" Landsat-like surface reflectance



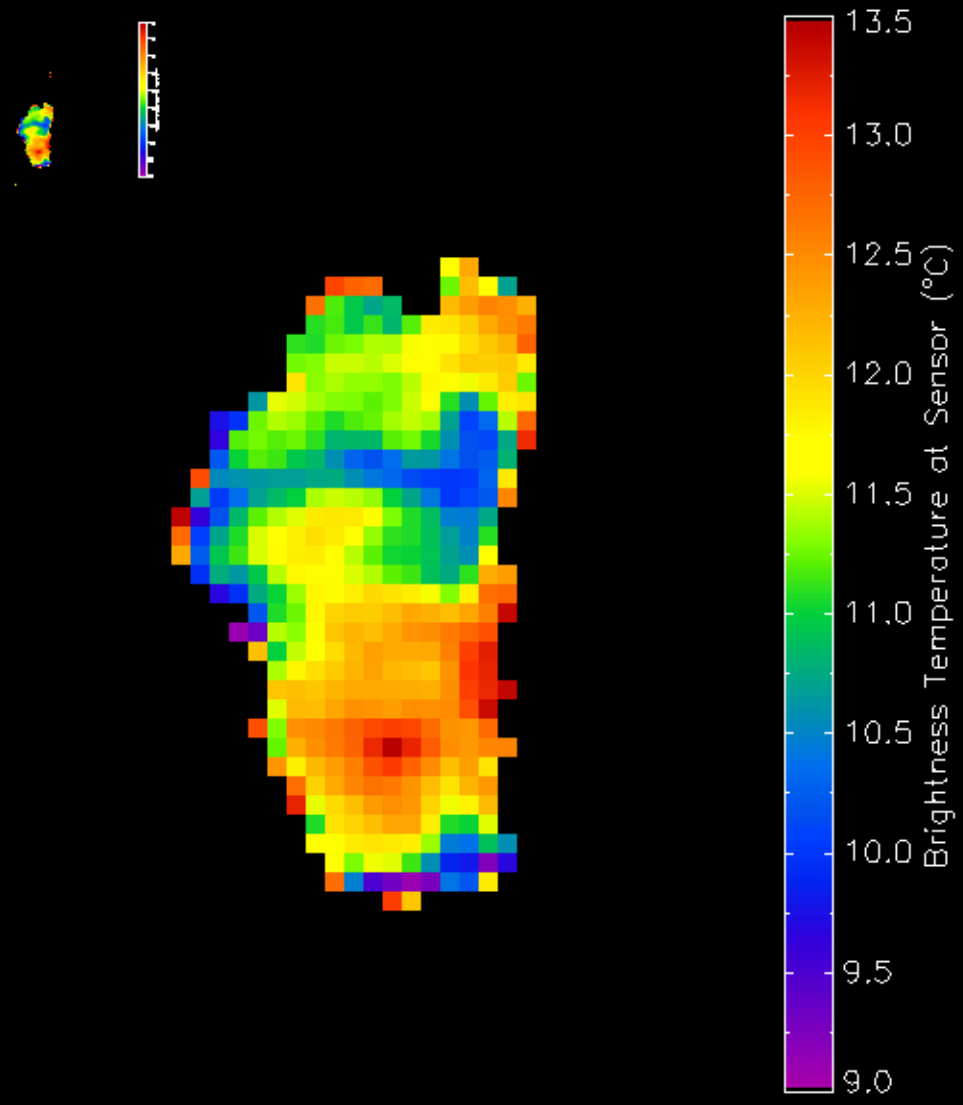
- Input:
  - MODIS surface reflectance $M(x_i,y_j,t_k)$ at t_k
  - Landsat surface reflectance $L(x_i,y_j,t_k)$ at t_k
  - MODIS surface reflectance $M(x_i,y_j,t_0)$ at t_0
- Predict:

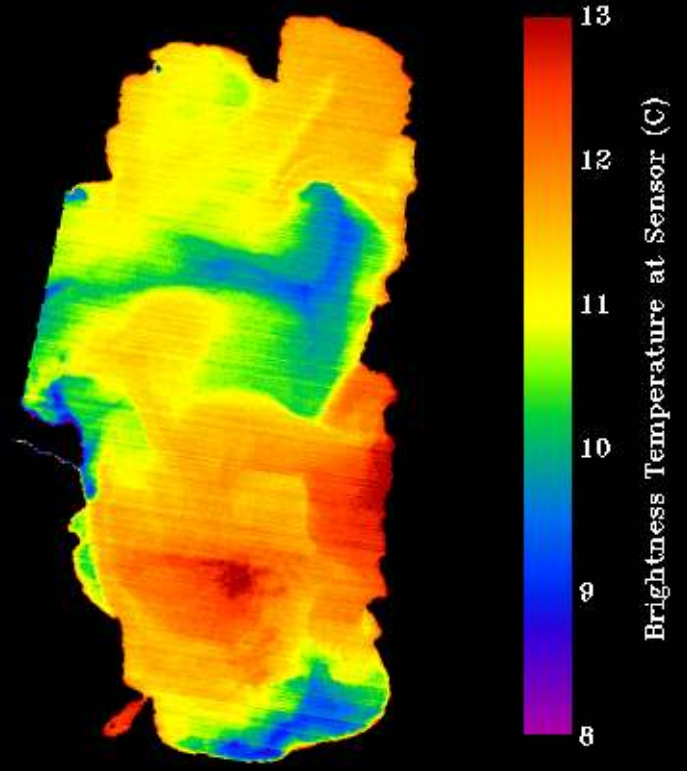
  Landsat surface reflectance $L(x_i,y_j,t_0)$ at t_0

Masek et al. GSFC


5/24/01 (144)
6/4/01 (155)
7/4/01 (185)
7/11/01 (192)
Blender Algorithm

Detecting upwellings (cold water plumes) with MODIS and ASTER





MODIS 6/03/2001

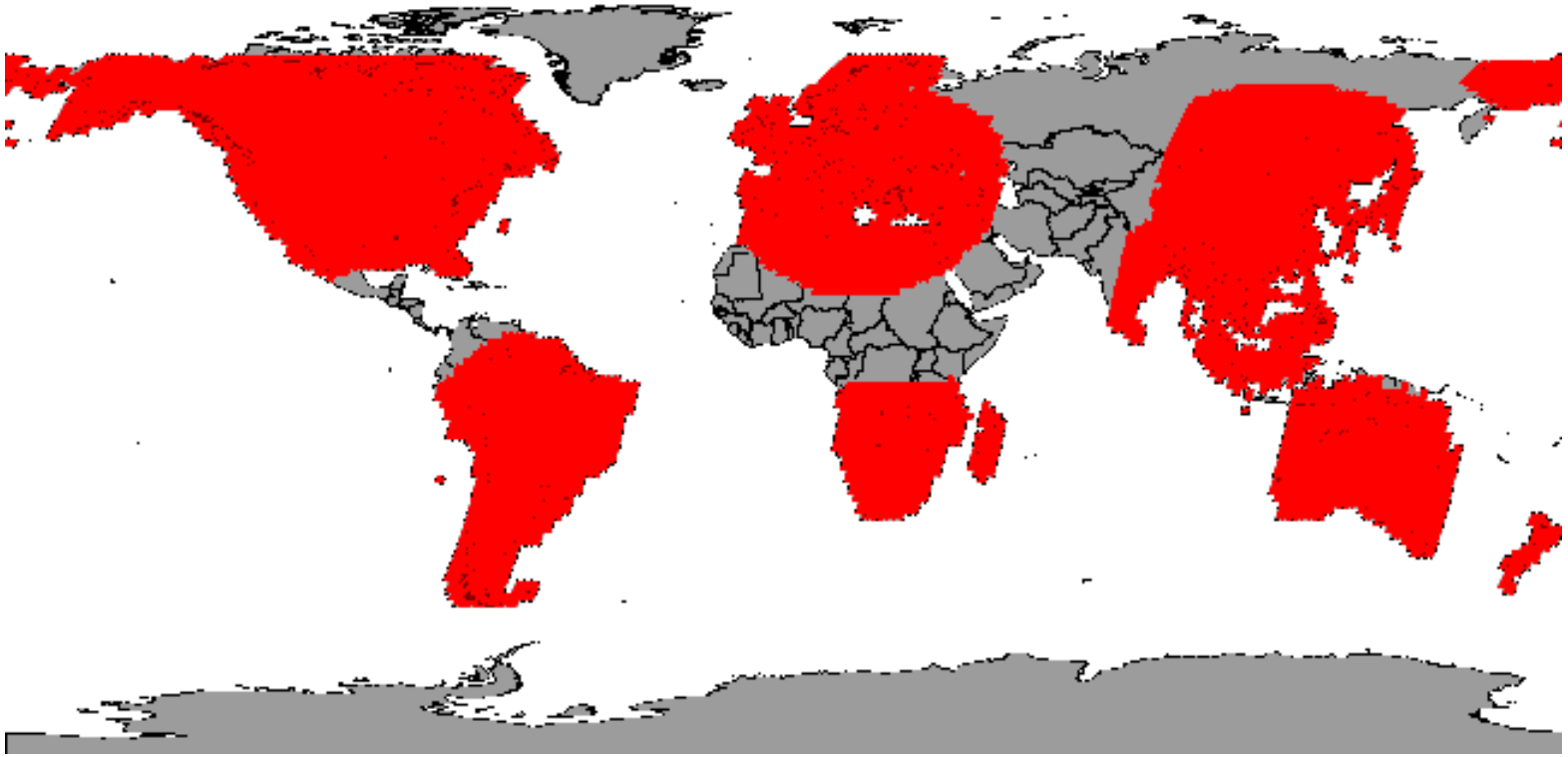
ASTER 6/03/2001

Mid-Decadal Global Land Survey Initiative

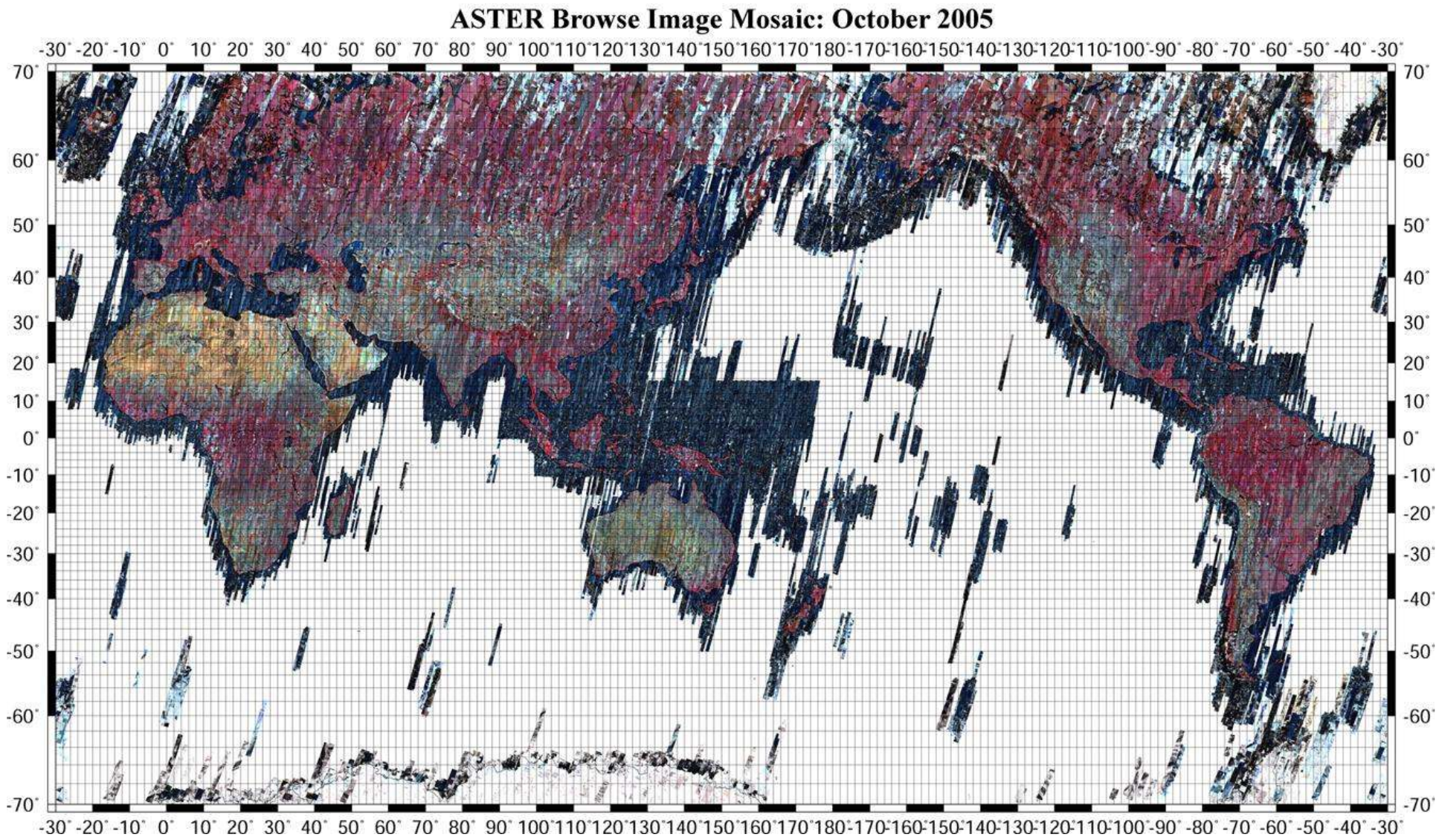
- Extend the global cloud free data sets for 1990-2000 with a mid–decadal data set 2004-2007
  - Total number of WRS land scenes: 13334 scenes covering approximately 210M km²
- Landsat 7 SLC problem - will necessitate data from multiple sources – NASA Assets with possibility of supplementing the data set with foreign data sources
- Cooperation between NASA / USGS – USGS to lead the implementation
- Project Stages
  - Project Specification and Design – completing
  - Data Acquisition - starting
  - Data Integration, Processing and Dissemination (need specification and funding)

MDGS Coverage with Landsat 5:

- **Map displays both US and International Cooperator (IC) stations**



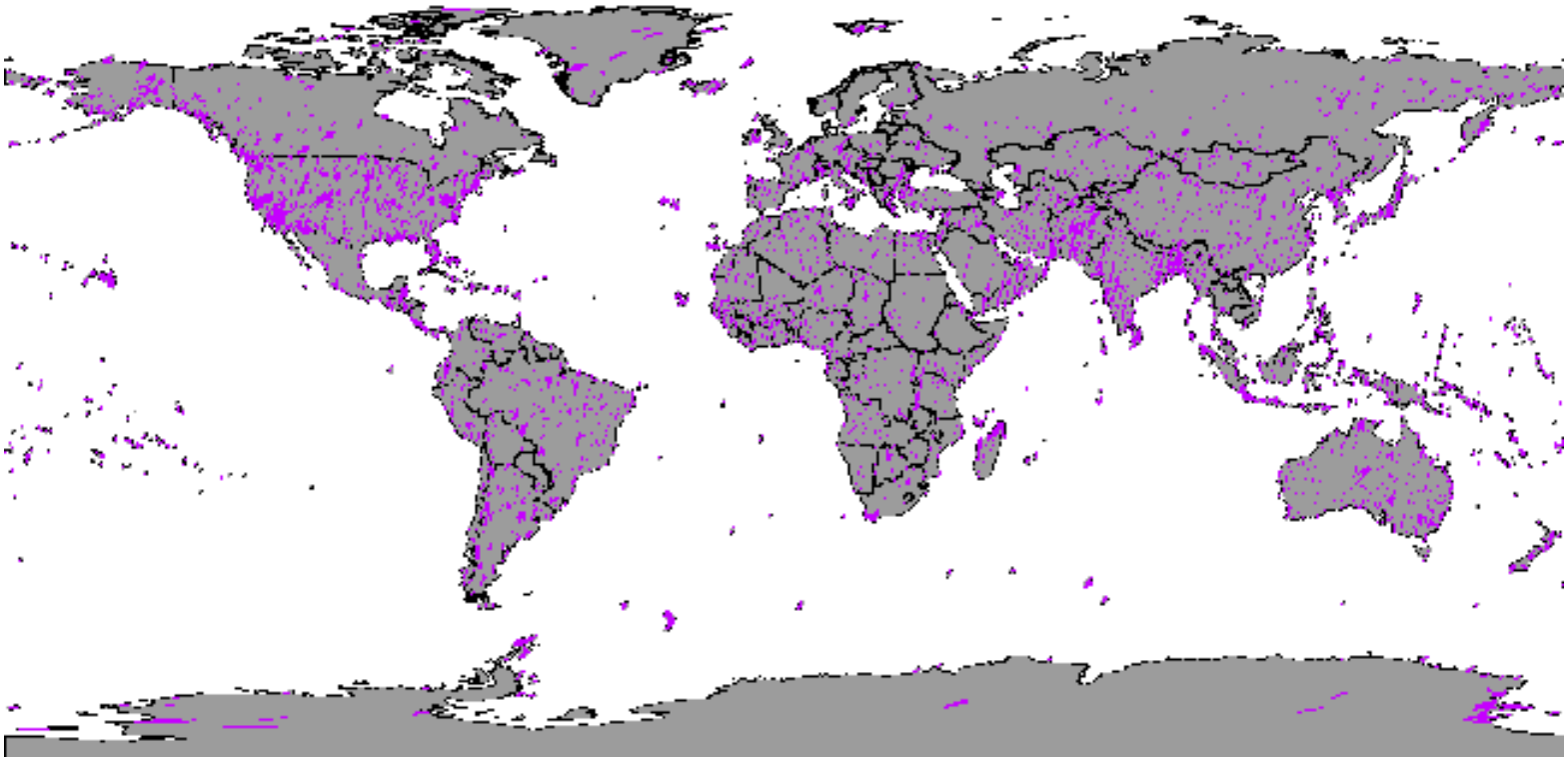
- **This map represents a best-case scenario for L5 data meeting the Mid-decadal Global Survey (MDGS) to date.**
  - Assumes that, over the three-year survey epoch, the IC stations will have acquired at least one acceptable scene over each P/R



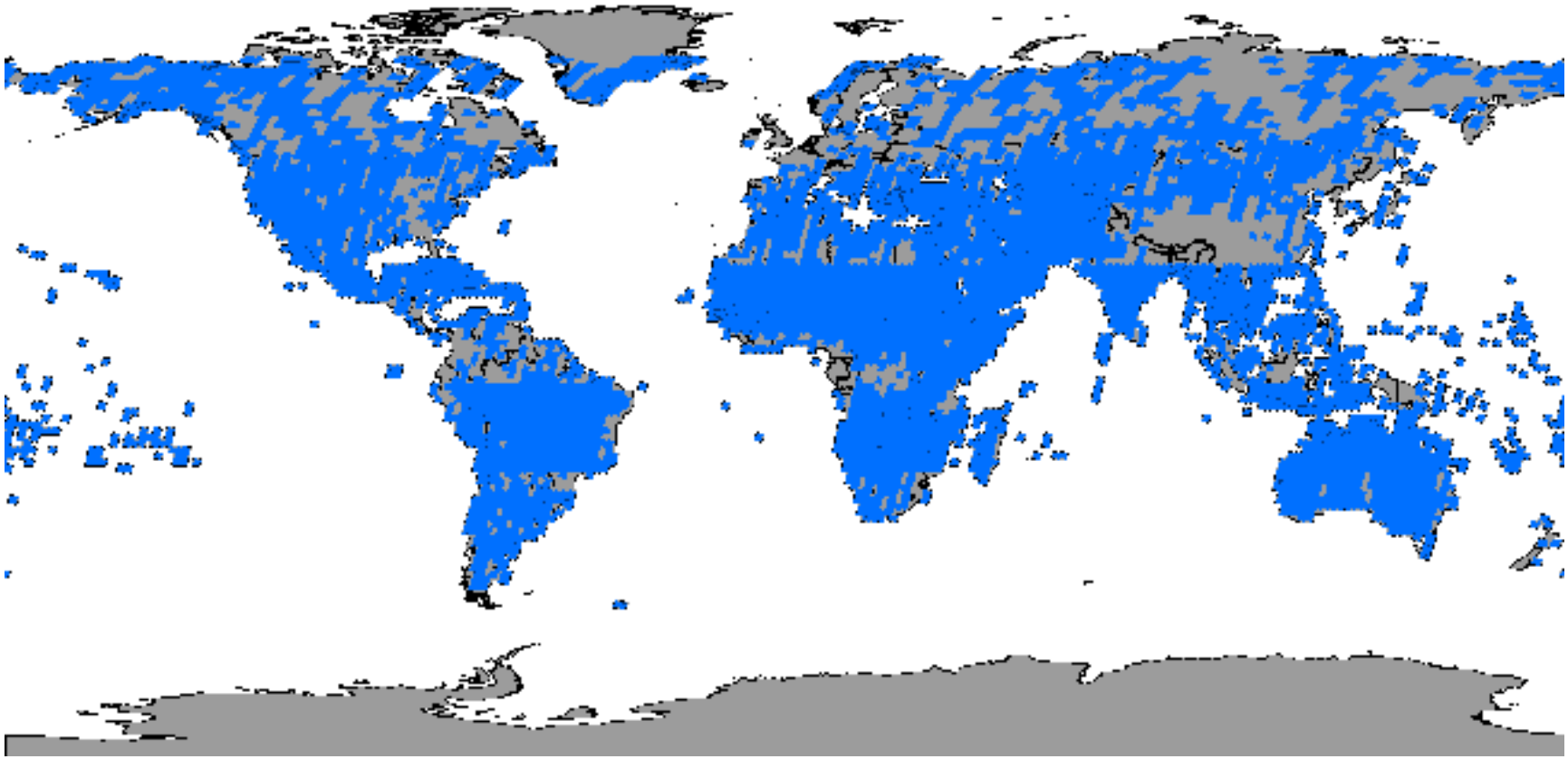
ASTER has produced 2 cloud-free global datasets

EO-1 Coverage

- **EO-1 acquisitions over islands and reefs provide some additional coverage**



L7 Global Coverage meeting MDGS Criteria



- **Primary scene with <10%CC, filler with <20%CC, >95% coverage**
  - Primary scene accounts for 78% of image area

International Cooperation on Landsat Class Observations

- International community strong supporters of Landsat – recognize NASA's long standing contribution
- GOFC/GOLD has raised international awareness concerning the current widening Landsat data gap
- At the Nov 05 LGSWG Meeting a good response from foreign ground stations Landsat 5 to help with data provision
- Interest from other instrument providers to help fill data gaps – India, China/Brazil, Argentina
- High resolution data a major topic at the last CEOS meeting
- A real opportunity to initiate international data coordination in the framework of GEOSS but will need working
  - CEOS Cal/Val WG poised to help

International Land Observations: Mechanisms for Coordination

- GOFC/GOLD
  - Requirements and coordination
    - land cover and land use change
    - fire observations
  - Part of the emerging IGOL
- CEOS CVWG LPV
  - Emphasis on cross instrument calibration and validation coordination

IGOS-P had not considered the observational needs relating to many aspects of the land

- Sustainable economic development,
- Natural resources management,
- Conservation and biodiversity
- Ecosystems Functioning Services
- Multilateral environmental agreements, mandatory reporting

Stakeholders

Environmental Assessments (Global, regional, sectoral)

- Early Warning Systems
- Sustainable agriculture, forestry and fisheries
- International Environmental Conventions
- Decision-makers at National Level
- Evolving Scientific Requirements (IGBP, WCRP, IHDP).
- Scientific focus on coupled human environmental systems

Determining the Requirements

- Food Security And Sustainable Development
- Sustainable Forestry
- Early Warning Systems
- Biodiversity And Conservation
- Ecosystem Services
- Land Degradation
- Fire And Related Hazards (Including Air Quality)
- Climate
- Real Time Response Systems

Proceeding by a series of IGOL workshops – inputs to GEOSS

Biodiversity - Nov 05

Food Security and Agricultural Monitoring Needs - March 06

Global Earth Observation System of Systems (GEOSS)

- An opportunity for coordinated international observations for decision support and societal benefit
- Heavy emphasis on land applications
- NASA is already making significant international contributions
  - Can we build on these activities?
  - Make these contributions to a GEOSS
  - Respond to GEOSS work packages

Land Applications

- **MODIS is contributing significantly to Land Applications**
- **International issues are increasingly of National Importance**
  - **Tremendous uptake of MODIS and enhancement by the international community – we can benefit from their expertise and involvement**
  - **Real opportunities for NASA to contribute to GEOSS**
  - **For GEOSS we will need to move beyond National Agencies**
- **Combination of moderate and high resolution data extremely powerful – we should continue to play to our strengths**
  - **Phenological monitoring is only possible with high temporal resolution and has shown to be critical for vegetation monitoring and land process models**
  - **The Landsat data gap is critical for Land Applications**
  - **The Applications Program should be a partner in the Mid Decadal Data Set initiative**

Land Applications

- **How does the Applications Program influence the NASA mission priorities?**
  - **What are the Applications measurement requirements e.g. Landsat Data Continuity Mission**
  - **What is the relationship between the Applications Program and the Land Measurement Teams**
- **Until we have an operational agency responsible for Land satellite missions and observations (“No L in NOAA”) - NASA will need to continue to strengthen use and uptake satellite data by land applications partners**