



Mid-Decadal Global Land Survey

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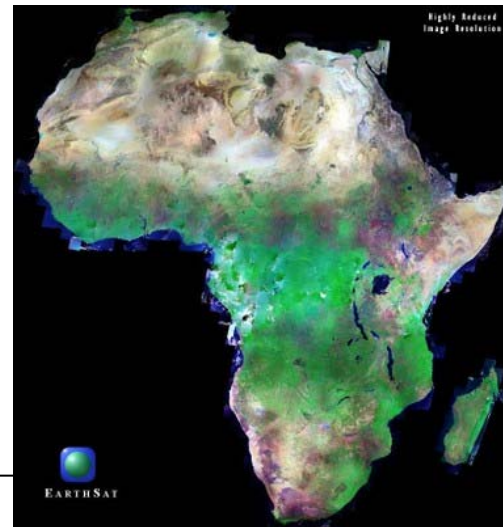
Aerospace Corporation / USGS

April 4, 2007

Mid-Decadal Global Land Survey (MDGLS)

Follow-on to the GeoCover orthorectified global data sets (1975, 1990, and 2000 epochs) centered on 2004-2006

- ◆ Partnership between USGS and NASA, in support of CCSP
- ◆ Support global assessments of land-cover, land-cover change, and ecosystem dynamics (disturbance, vegetation health, etc)
- ◆ Landsat-5 TM and Landsat-7 imagery, with ASTER and EO-1 ALI data as needed



MDGLS Development

Phase 1: identify all candidate scenes and ingest into the USGS archive (USGS lead)

Phase 2: Process selected data into an ortho-rectified dataset compatible with previous surveys (NASA lead)

Phase 3: Analyze data set to quantify trends in land cover and vegetation dynamics (NASA LCLUC)



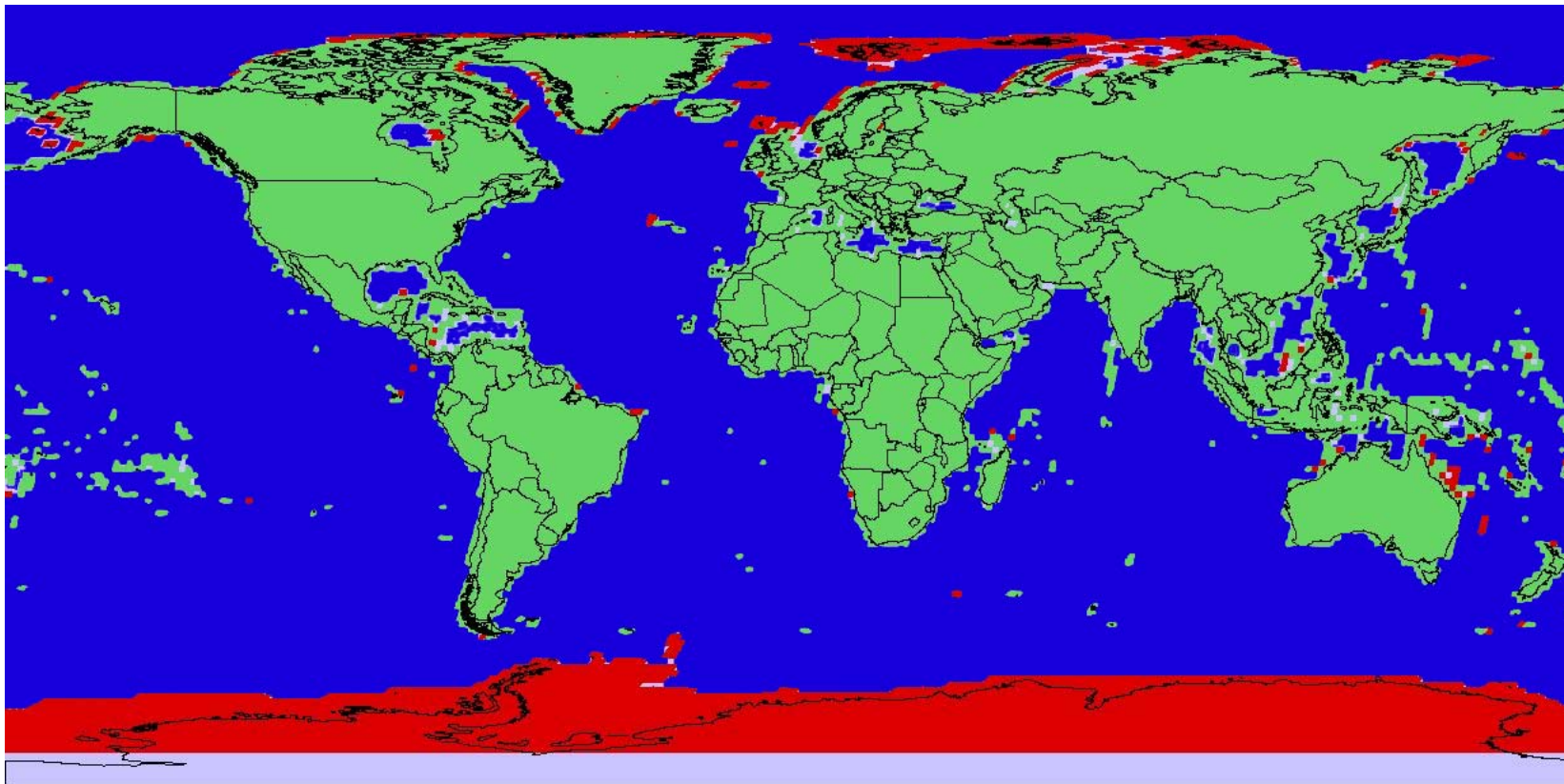
Mid-Decadal Global Land Survey (MDGLS)

Phase I: Identify and Acquire L5 and L7 Data

Phase II: Process MDGLS Data

Phase III: Analyze MDGLS Dataset for Land Cover/
Land Cover Change

Where do we want data?



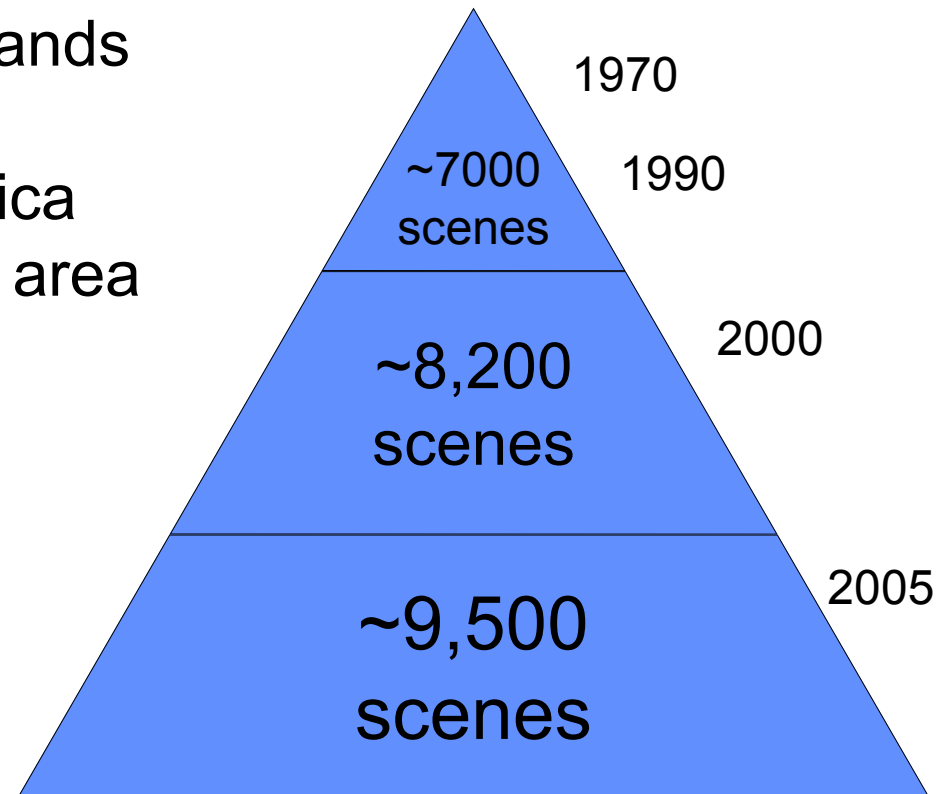
Green = GeoCover 2000 Coverage
Red = New MDGLS Coverage

Coverage

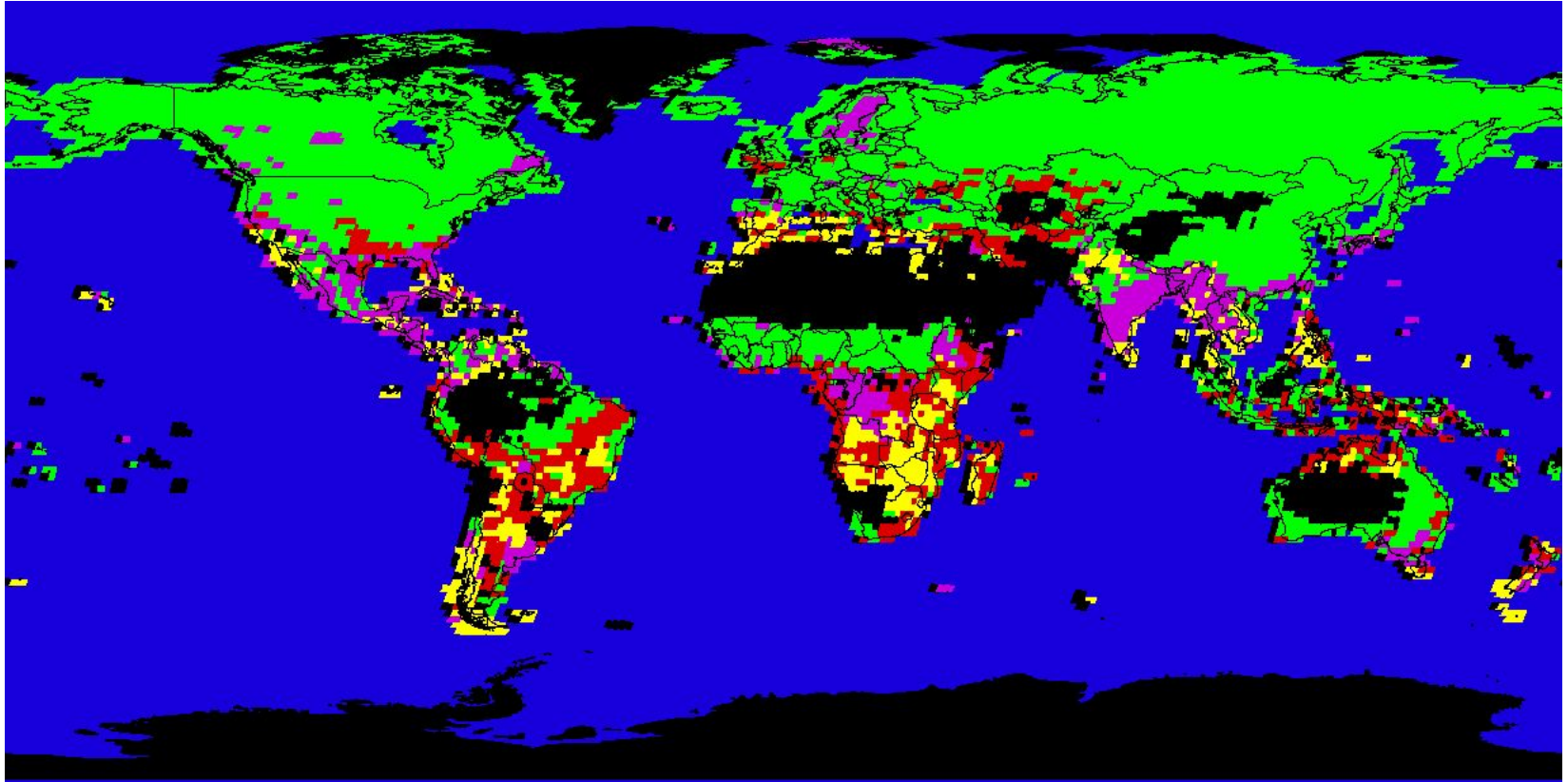
MDGLS Coverage:

- Better accounting of islands and reefs
- Inclusion of the Antarctica
- Full coverage of Arctic area in 'ascending' orbit

IPY ---->

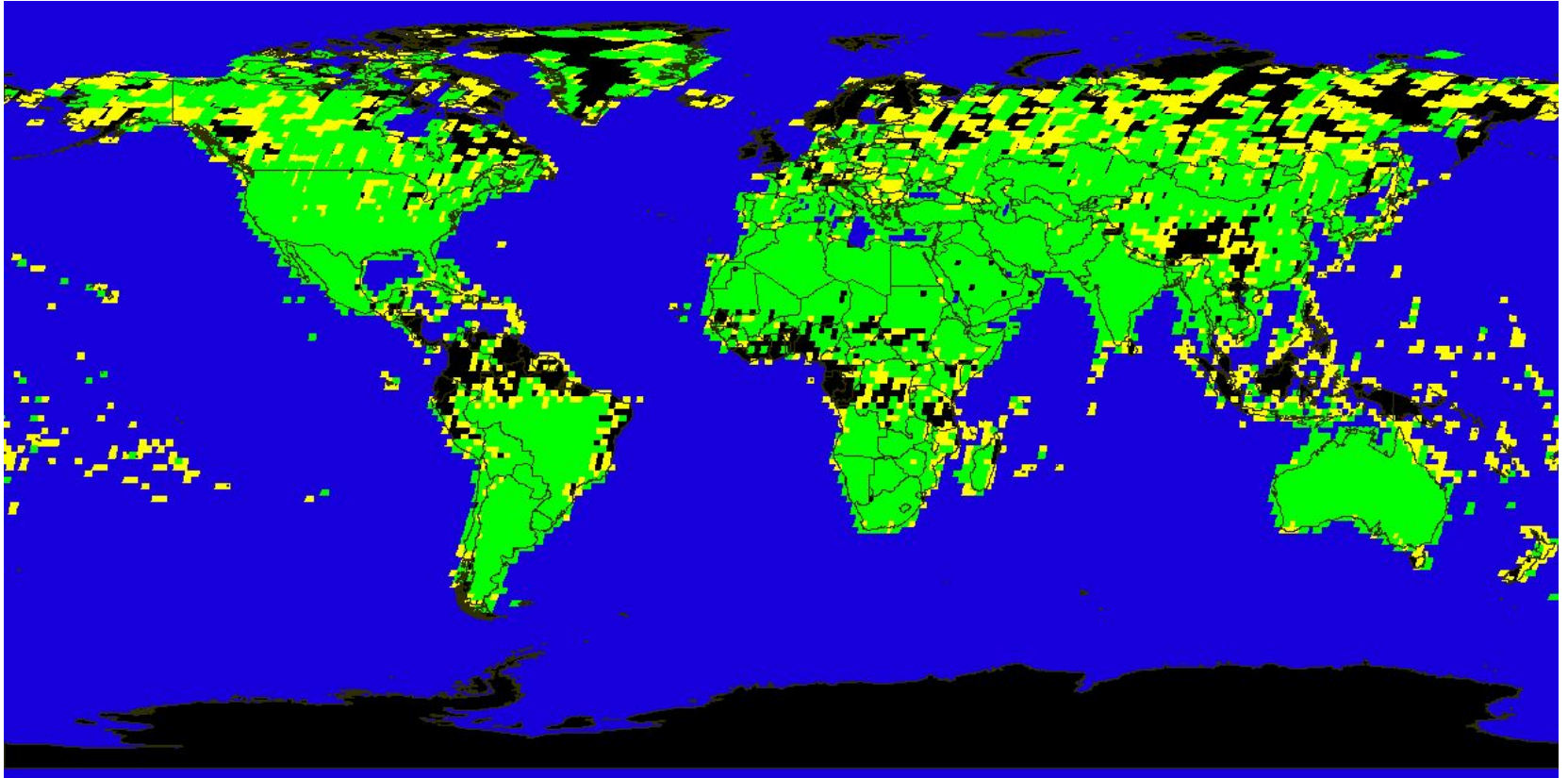


When do we want data?



- Green** = NH Summer (Jun, Jul, Aug, Sep)
- Red** = NH Spring (Apr, May)
- Violet** = NH Fall (Oct, Nov)
- Yellow** = NH Winter (Jan, Feb, Mar, Dec)

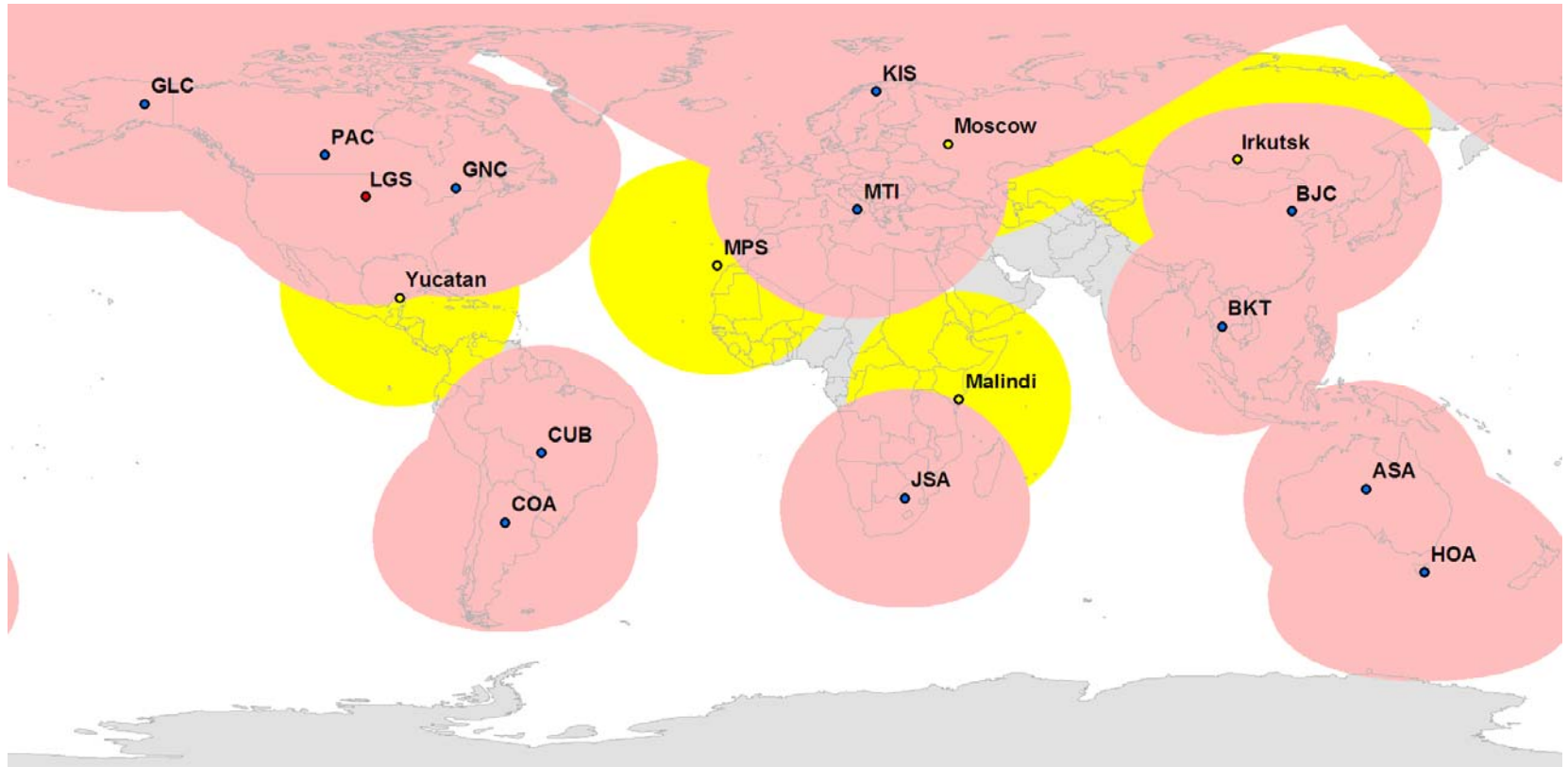
What data are available? Landsat-7



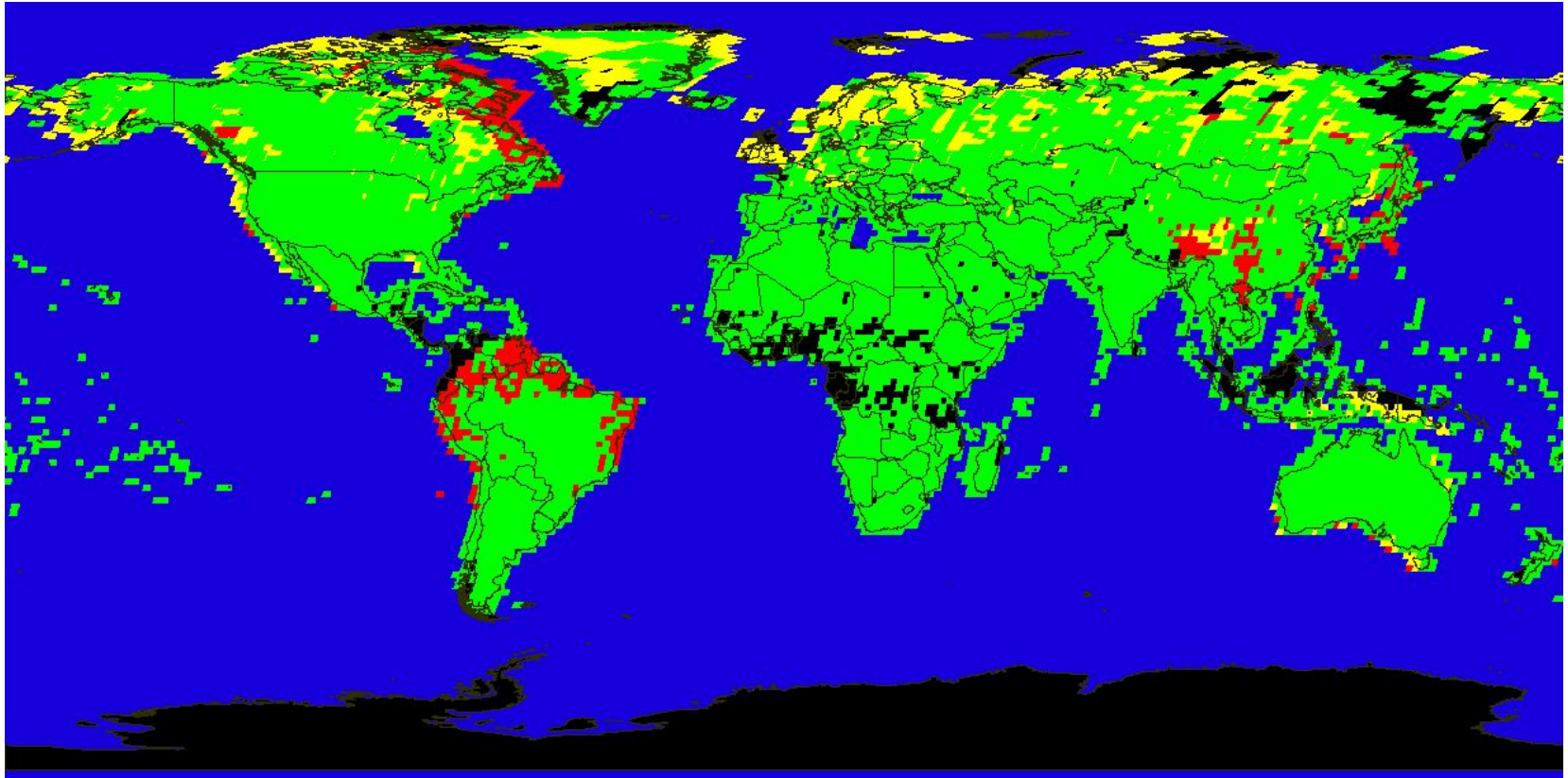
Green = Base \leq 1% CC, Fill \leq 5% CC
Yellow = Base \leq 5% CC, Fill \leq 10% CC

63% of Land Area

What Data Are Available? Landsat-5



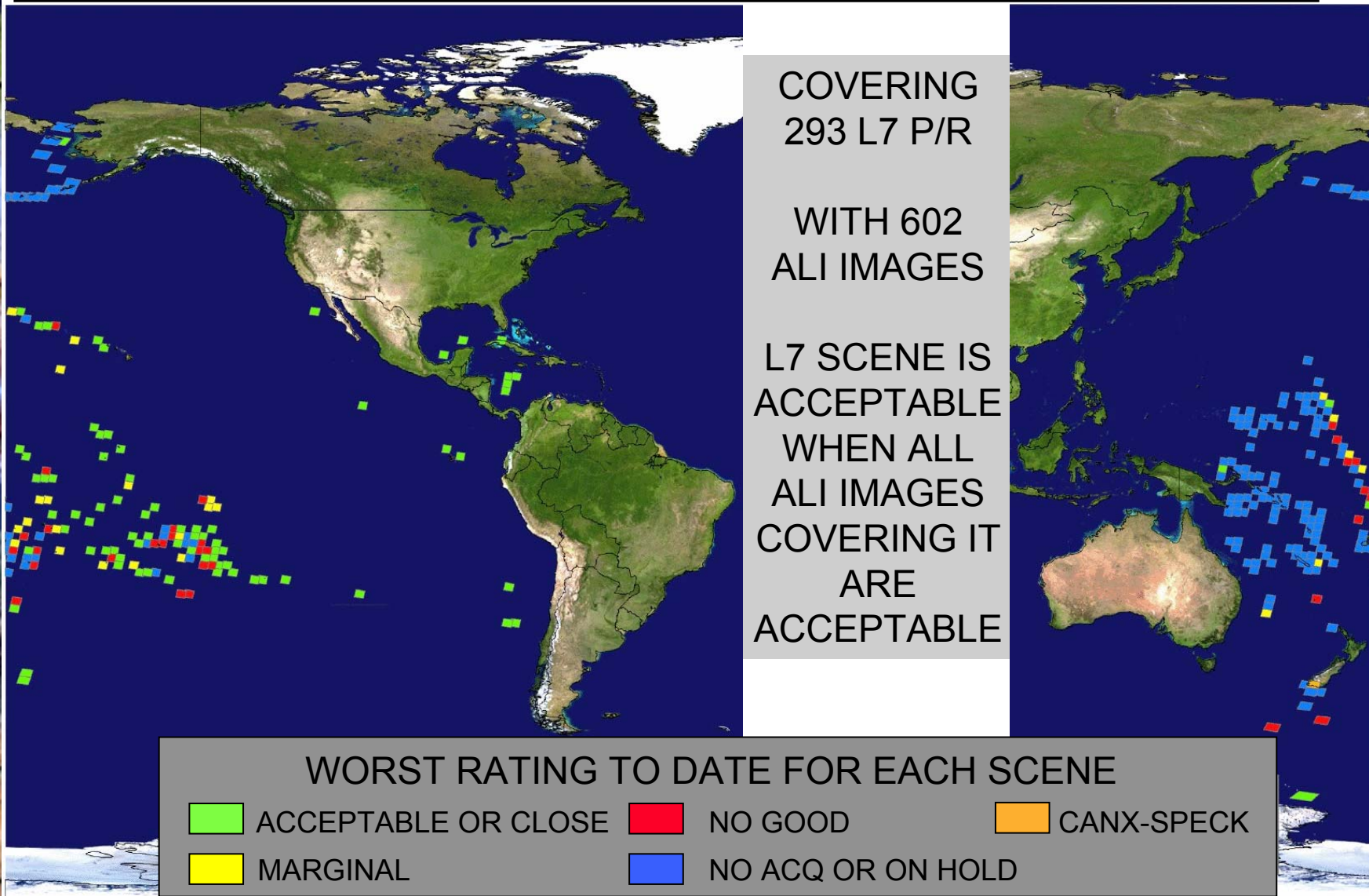
Combined Archived Coverage in EROS Archive



- Green** = ETM+ 5%/10% CC Fill
- Yellow** = TM <10% CC in EROS Archive
- Red** = TM = ??% CC in IC Archives

**>91% of the P/R
Locations Covered**

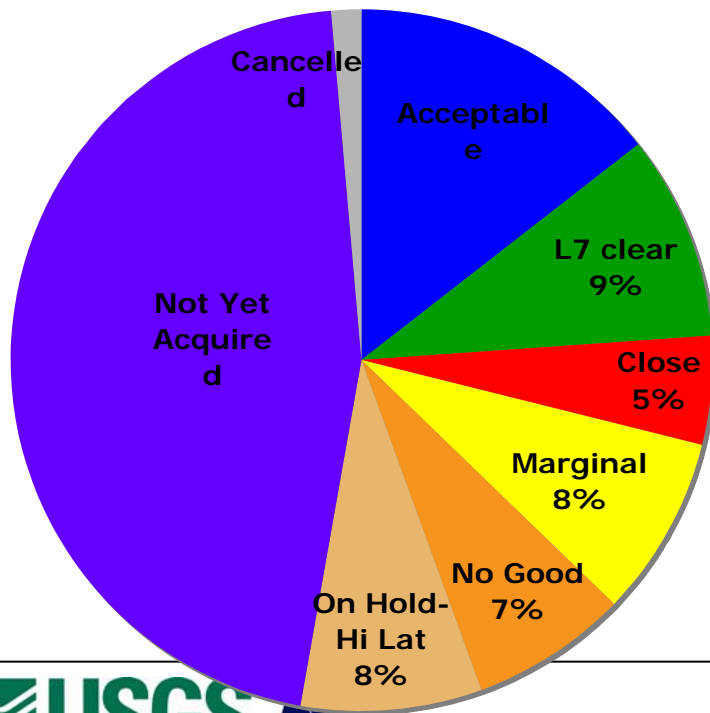
STATUS: EO-1 ALI Campaign for Reefs and Small Islands



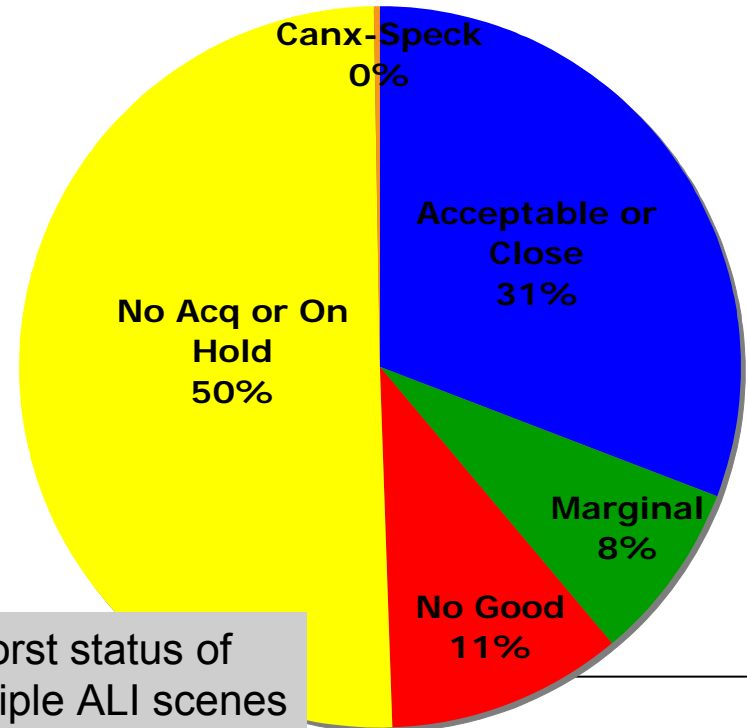
Status of EO-1 island acquisitions

- 293 Landsat-7 path/rows contain islands/reefs being acquired for MDGLS by EO-1 ALI
- 602 ALI scenes to cover the islands and reefs in these scenes
- If island/reef is centered, using L7, otherwise relying on EO-1.

Status of 602 ALI scenes
(as of 30 March 2007)



Status* of 293 L7 path/rows
(as of 30 March 2007)



* Worst status of Multiple ALI scenes Per L7 path/row

Phase 1 Status

- ◆ Developed and implemented an MDGLS acquisition strategy
- ◆ Developed QA management tool and automated scene selection tool
- ◆ Established a network of 6 campaign stations to collect Landsat 5 data
 - 4 have provided data (Kiruna, Moscow, Irkutsk, Maspalomas)
 - 1 is under construction and will begin collections in early 2007 (Chetumal)
 - 1 is in progress (Malindi)
- ◆ Most International Cooperators have agreed to supply image data in support of the MDGLS Project
 - 6 have provided metadata to USGS
 - 6 stations have confirmed Jpeg browse – for easier inspection

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Phase II Tasks

- **Establish MDGLS Product Specifications**
- **Select data source and scenes** (where multiple options are available)
- **Implement automated orthorectification at EROS**
- **Process selected data**
 - Orthorectification
 - Gap-filling (for Landsat-7)
 - Product format
- **Distribute MDGLS data**

Complete dataset available Fall 2008

Sensor Source Selection

Recommendation:

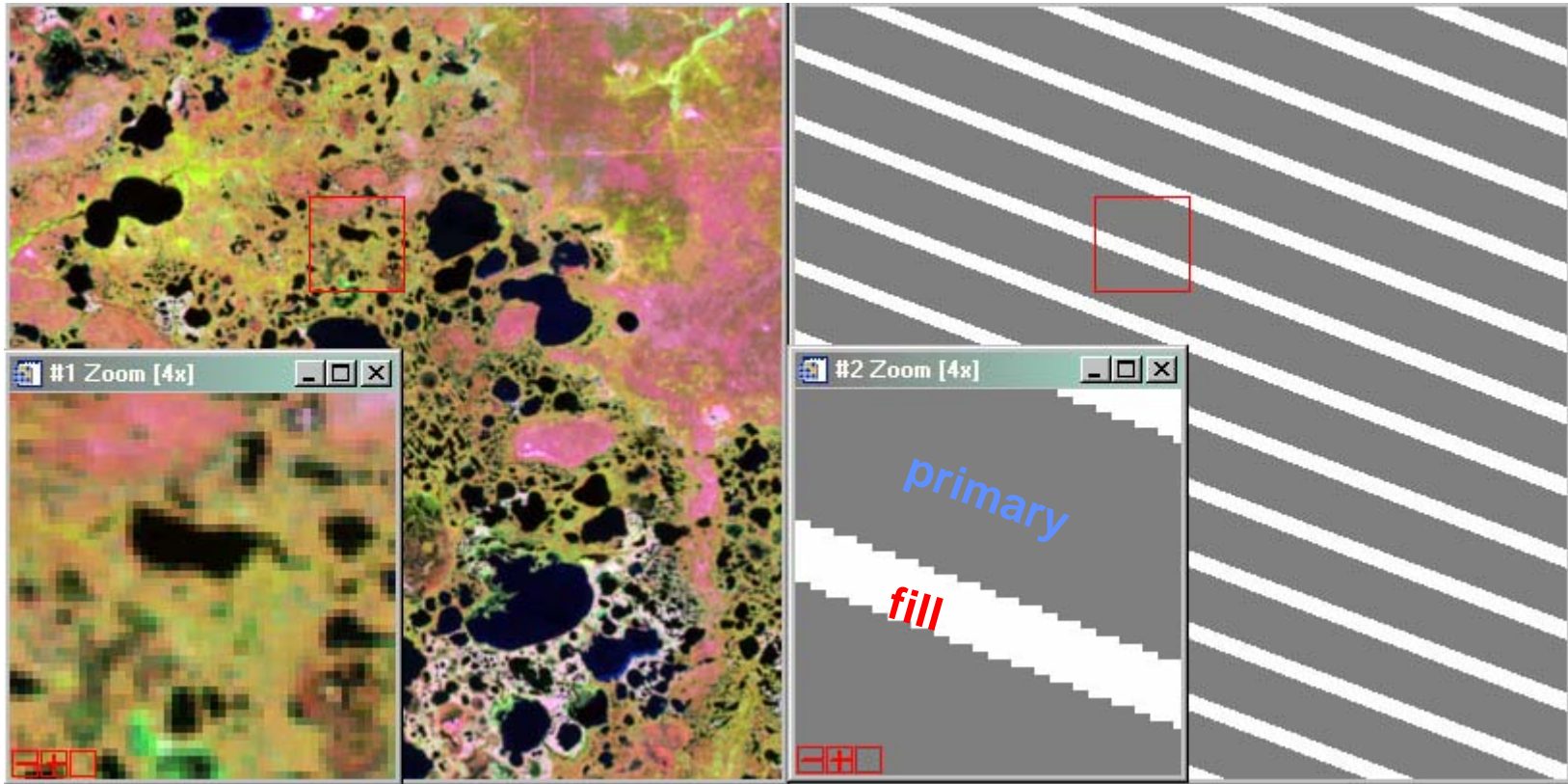
- For cloud-free scenes (<2% CC): lean toward Landsat-7 ETM+
- Cloudier scenes (2-10% CC): lean toward Landsat-5 TM
- Humid Tropics: multiple Landsat acquisitions for compositing
- Gaps: ASTER, ALI, other

Sensor choice must be balanced against acquisition date, overall cloud cover, and acquisition date of 2000 Geocover

- Optimization algorithm developed by ARC to assist selection

Landsat-7 Gap-filling: The Good

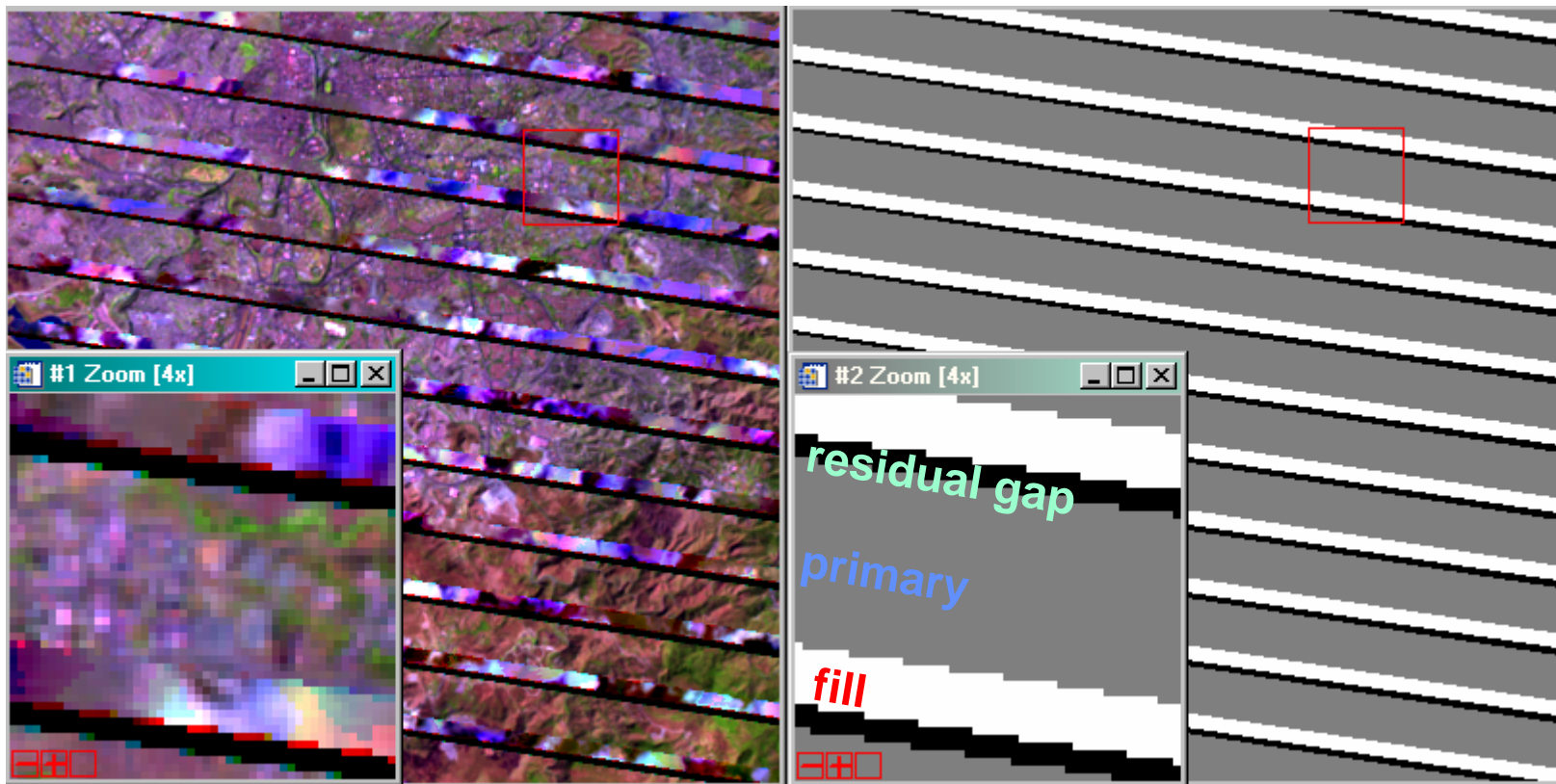
Northern Siberia (p159r15)



EROS Gap-filling works very well in cloud free conditions

Landsat-7 Gap-filling: The Bad and the Ugly

Honduras (p18r50)



Gap-filling with cloudy scenes can introduce radiometric artifacts; small residual gaps are possible

MDGLS Orthorectification

Need to reprocess previous GeoCover datasets in high-relief areas to maintain continuity with MDGLS

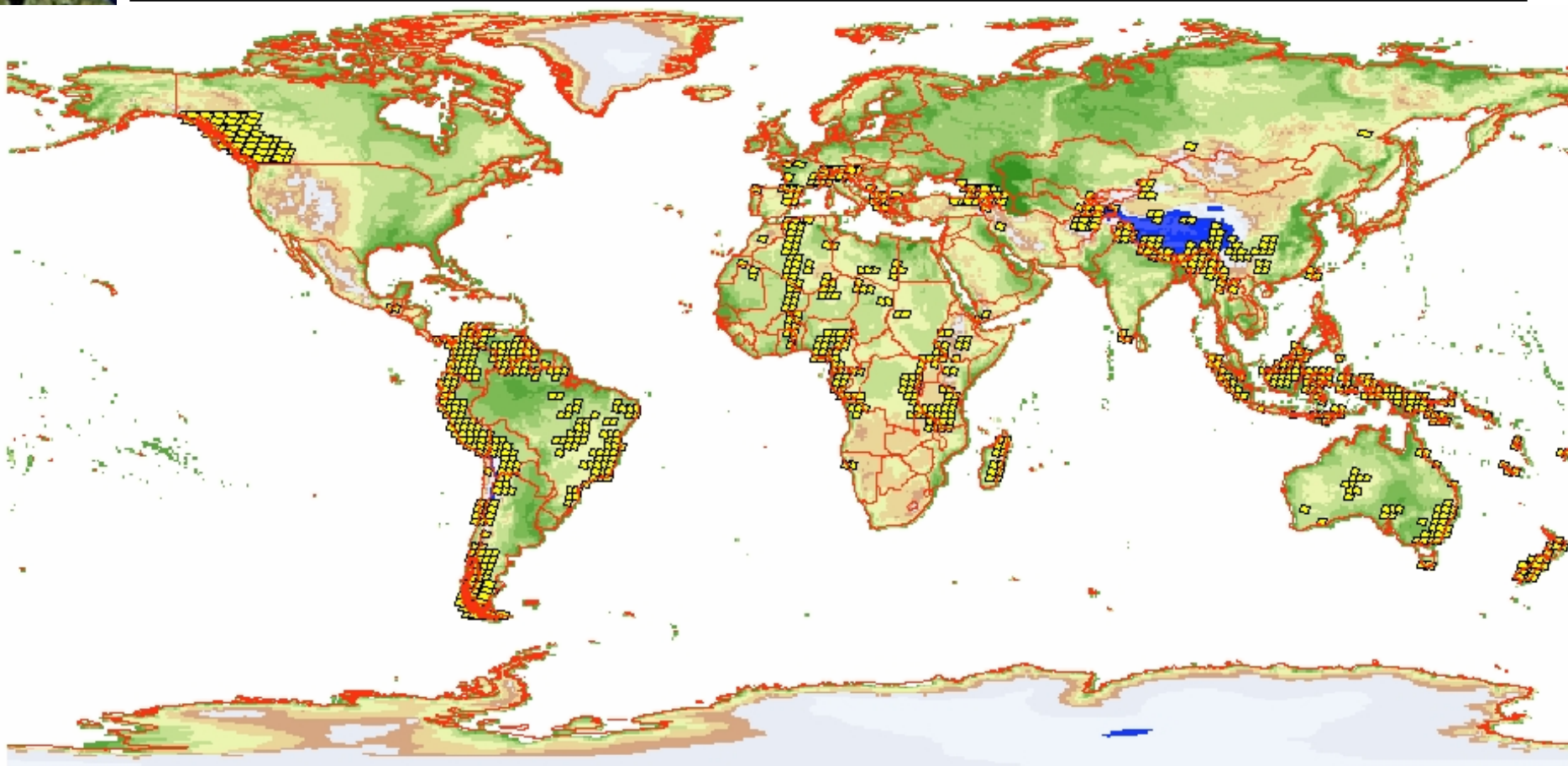
- model absolute error due to Geocover DEM choice
- reprocess locations with significant errors using SRTM

Use 2000 GeoCover chips as geodetic control, SRTM DEM for terrain correction

- L7 automated 1Gt processing available May 2007
- L5 automated 1Gt processing available Spring 2008

Geodetic accuracy relative to 2000 Geocover of 30m RMSE (or better). Maximum absolute geodetic error of 100m.

Geocover Reprocessing Requirements



Identify: scenes with $>0.5\%$ of pixels with error $> 15\text{m}$
scenes with any pixel $>100\text{m}$ error
~ 841 scenes require reprocessing

MDGLS Product Specification

- UTM / WGS-84 projection
- 14.25 / 28.5/ 57 meter resolution
- Cubic Convolution resampling (1 step)
- GeoTiff format
- Orthorectified, Gap-filled
- 30m RMSE relative to 2000 Geocover (reprocessed)

Data Processing and Distribution

Processing responsibility TBD

- EROS capability available May 2007
- USGS RFI for commercial participation

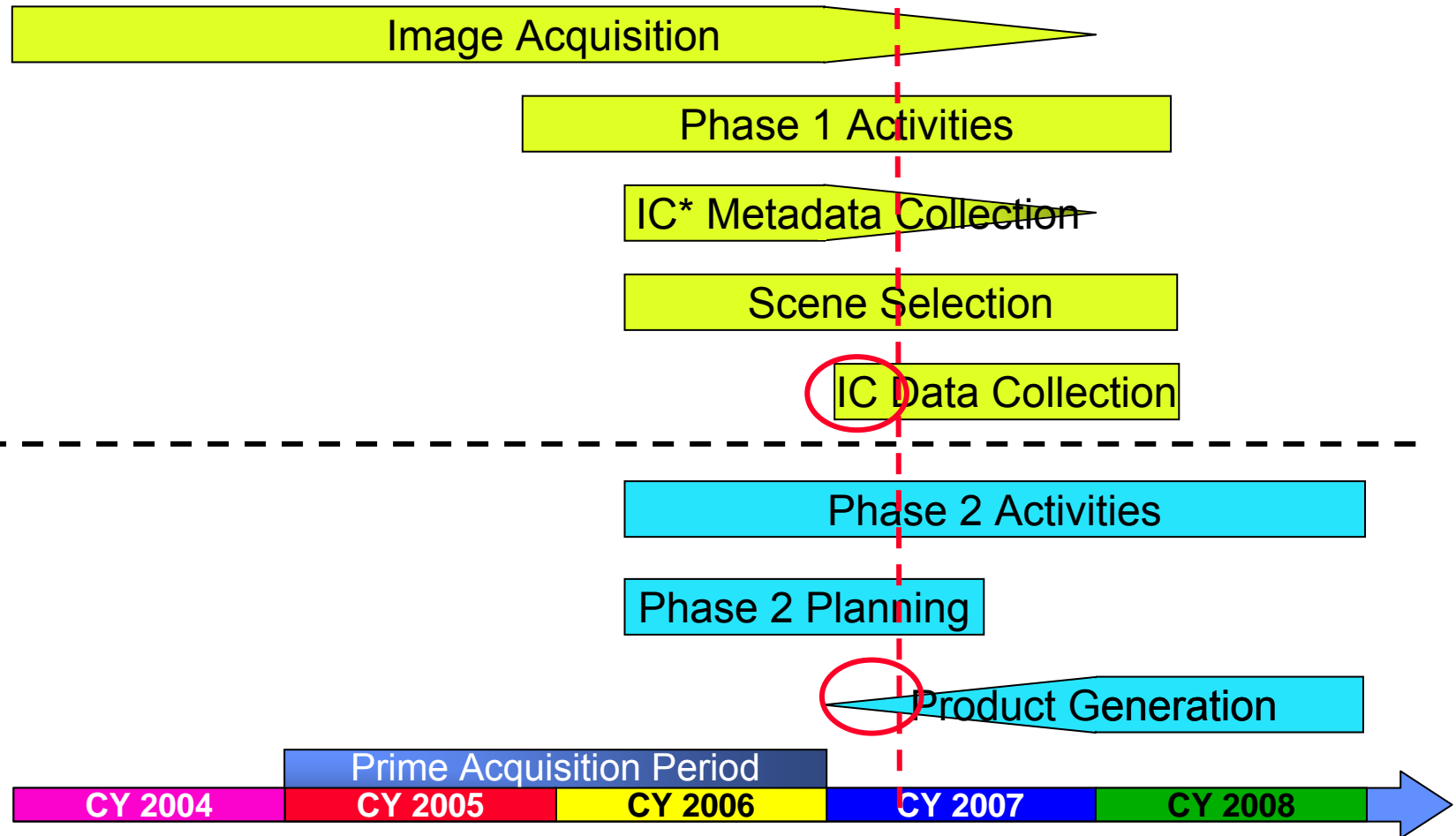
Process North America first (complete by CY07)

CY08: Process rest of globe

Release products as completed

FTP distribution of individual MDGLS scenes at no cost, with limited provision for bulk distribution of entire dataset (e.g. via hard disk transfer).

MDGLS Schedule



*IC = International Cooperator

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Land Cover Change Earth Science Data Record

Routine monitoring of global land cover conditions on 1-5 year time scales has been a documented science priority:

- US Climate Change Science Program (CCSP)
- NASA Earth Science Research Strategy
- CEOS GOFCC/GOLD Program
- Global Land Program (GLP)

The MDGLS dataset offers a “pilot” opportunity to assess global rates of land cover change for 2000-2005

Community Recommendations

Meeting on Phase III Strategy – Feb 27-28, Annapolis

MDGLS critically important for LC Science and Assessments

Highest priority for global estimates of land cover change

- forest cover change, disturbance
- irrigated agriculture extent
- global standing water
- arctic hydrology (bogs, permafrost)
- urbanization
- focus on products that meet societal needs

Distributed implementation ok, but harmonization essential

Open archive would advance science utility of MDGLS

Community Recommendations (2)

FAO LCCS (Land Cover Classification Scheme) is appropriate for MDGLS, with some modification

- reduce emphasis on land use
- need comparable effort for land cover change products

Validation needs to be integrated into Phase III from the start

- work with GOFC Validation Team and CEOS CVWG
- validation of land cover change a new topic




Phase III activities represent a pathfinder for 2010 assessment, and annual assessments in LDCM era

Phase 3 Funding Prospects

- **The NASA LCLUC call opens opportunity for proposals to develop LCLUC products from both GEOCOVER & MDGLS**
 - ◆ Expect 3-4 selected projects, 300-400K/yr
 - ◆ Anticipated starts in Mar'08
- **Next year an additional call to complement what's needed based on the 2007 selections**

MDGLS Web Site

<http://mdgls.umd.edu>

Mid-Decadal Global Land Survey				
Home	Background	Status	Documents	Links
<p>The Mid-Decadal Global Land Survey (MDGLS) is a partnership between the U.S. Geological Survey (USGS) and the National Aeronautics and Space Administration (NASA), in support of the U.S. Climate Change Science Program (CCSP) and the NASA Land-cover Land-use Change (LCLUC) Program.</p> <p>Characterizing trends in land cover and land use remains a key goal for Earth science. The MDGLS is assembling a global dataset of 30-meter resolution satellite imagery to support measurement of Earth's land cover and rates of land cover change during the first decade of the 21st century.</p> <p>The MDGLS builds on the existing Geocover data sets developed for the 1970's, 1990, and 2000. Some 9500 Landsat images from the period 2004-2007 will be acquired, processed, and made available to the public via FTP download. Given the failure of the Landsat-7 ETM+ Scan Line Corrector in 2003, a combination of Landsat-7 gap-filled data and Landsat-5 data from U.S. and international ground stations will be used in the project. Additional imagery from ASTER and EO-1 ALI imagers will be included to augment the Landsat coverage. Processing will begin in early 2007 and orthorectified products will be made available for download throughout the project. The complete dataset is expected to be completed in late 2008.</p> <p>We are interested in your feedback. Questions or comments may be directed to: mdglsinfo@XXXXXX</p>			