



Landsat Project Status

Landsat Science Team Meeting

June 2009

Presented By:

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Landsat Project Manager, U.S. Geological Survey/EROS

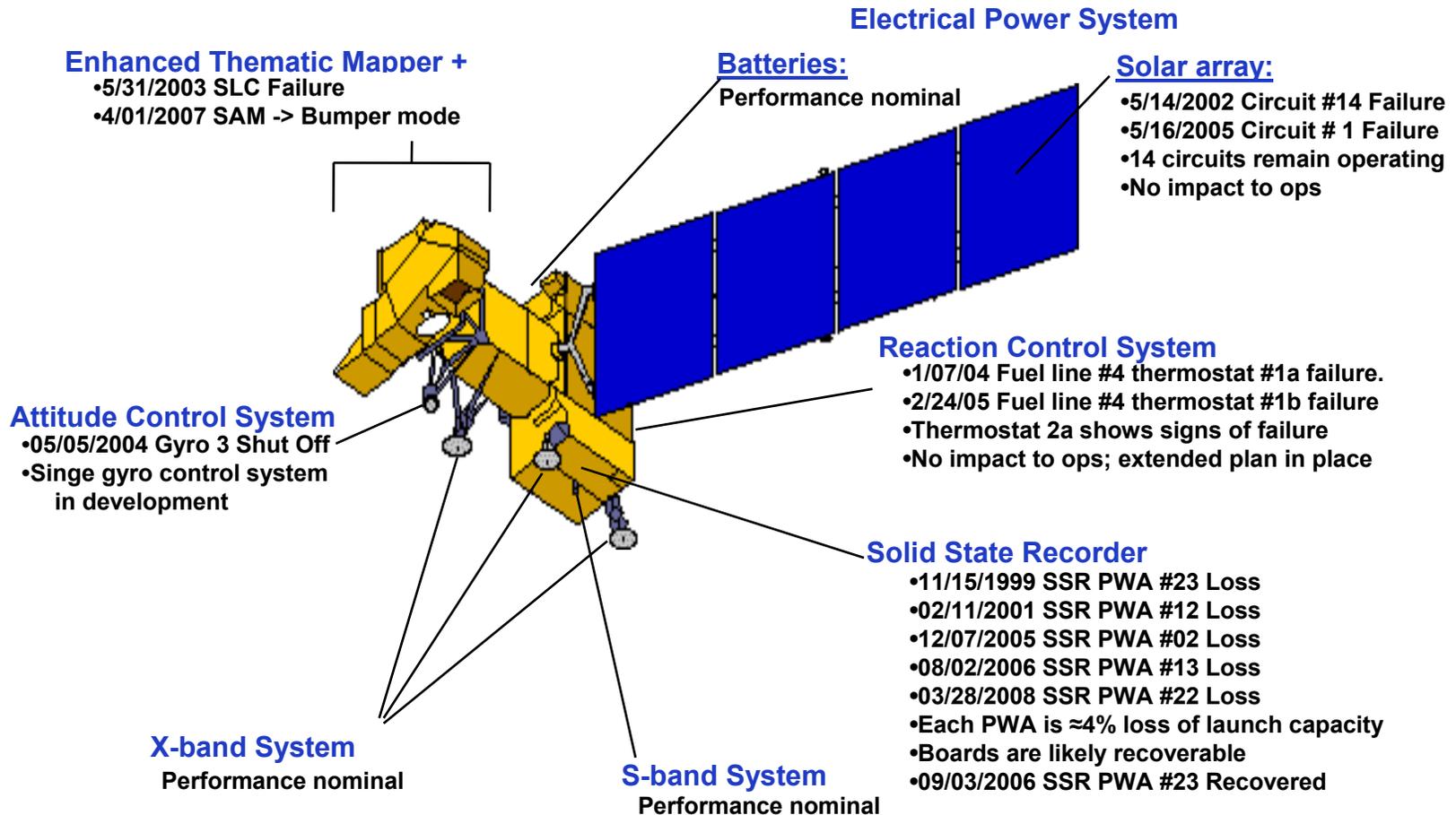
kkline@usgs.gov, (605) 594-2585

U.S. Department of the Interior

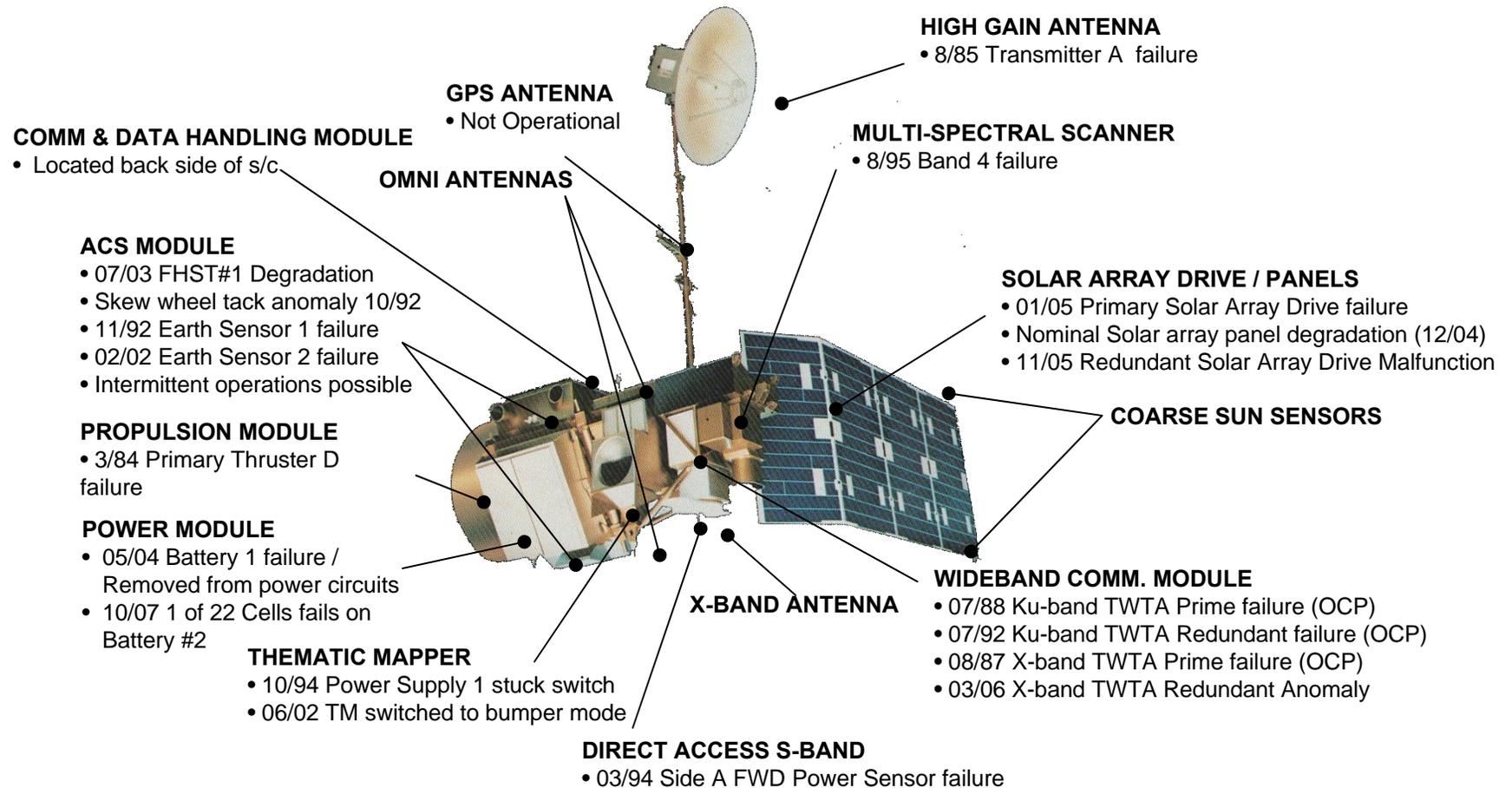
U.S. Geological Survey

Satellite Segment

Landsat 7 Flight Segment



Landsat 5 Flight Segment



Space Segment - Landsat 5 Status

- **Battery Issues**

- ◆ Power balance – Both batteries are behaving as expected and are being managed to maximize coverage
- ◆ Expanded TM Operations – S. Hemisphere extended to 50° from last year's 49°. (N.H. at pre-anomaly 15°)
 - Well over 2207 additional scenes captured this year so far
 - The previous extension to 68° was reduced to accommodate N.H. GLS 2010 campaign

- **Traveling Wave Tube Amplifier (TWTA) – X-band downlink**

- ◆ The helix current is operating at an all-time high current, but no “trips”
- ◆ This is the historical season for elevated current; a trend down beginning

Space Segment - Landsat 5 Status

- **Attitude**

- ◆ Continue to work on better gyro calibration and updates to improve spacecraft attitude
- ◆ Team has completed testing of an updated star catalog. It is now used in operations and is being monitored. While it is hard to classify the new catalog as 'better', the content should be less-prone to 'near neighbor' issues.

- **Outgassing**

- ◆ Requested by calibration/validation team due to reduced gain of the instrument
- ◆ Historically, outgassing is performed in conjunction with a Delta-I
- ◆ Power issues prevented outgassing with the Delta-I
- ◆ Completed successfully Jan 27-28, 2009

Ground Segment

U.S. Landsat Archive Overview

(Marketable Scenes through May 11, 2009)

- **ETM+: Landsat 7**
 - ◆ 922,274 scenes
 - ◆ 428 TB RCC
 - ◆ 428 L0Ra Data
 - ◆ Archive grows by 260 GB Daily
- **TM: Landsat 4 & Landsat 5**
 - ◆ 792,407 scenes
 - ◆ 198 TB of L0Ra Data
 - ◆ Archive Grows by 40 GB Daily
- **MSS: Landsat 1 through 5**
 - ◆ 652,163 scenes
 - ◆ 20 TB of Data



Ground Segment Activities

- **Processing**

- ◆ MSS Processing in NLAPS

- Ceased manual precision processing

- ◆ If L1T is not created automatically, scene is switched to L1G processing
- ◆ Approximately 22% automatically process to L1T (stats through June 10, 2009)

- Completed Proof of Concept activities and began Prototype efforts for MSS processing in LPGS

- ◆ FTP Disk Clean up performed twice in May

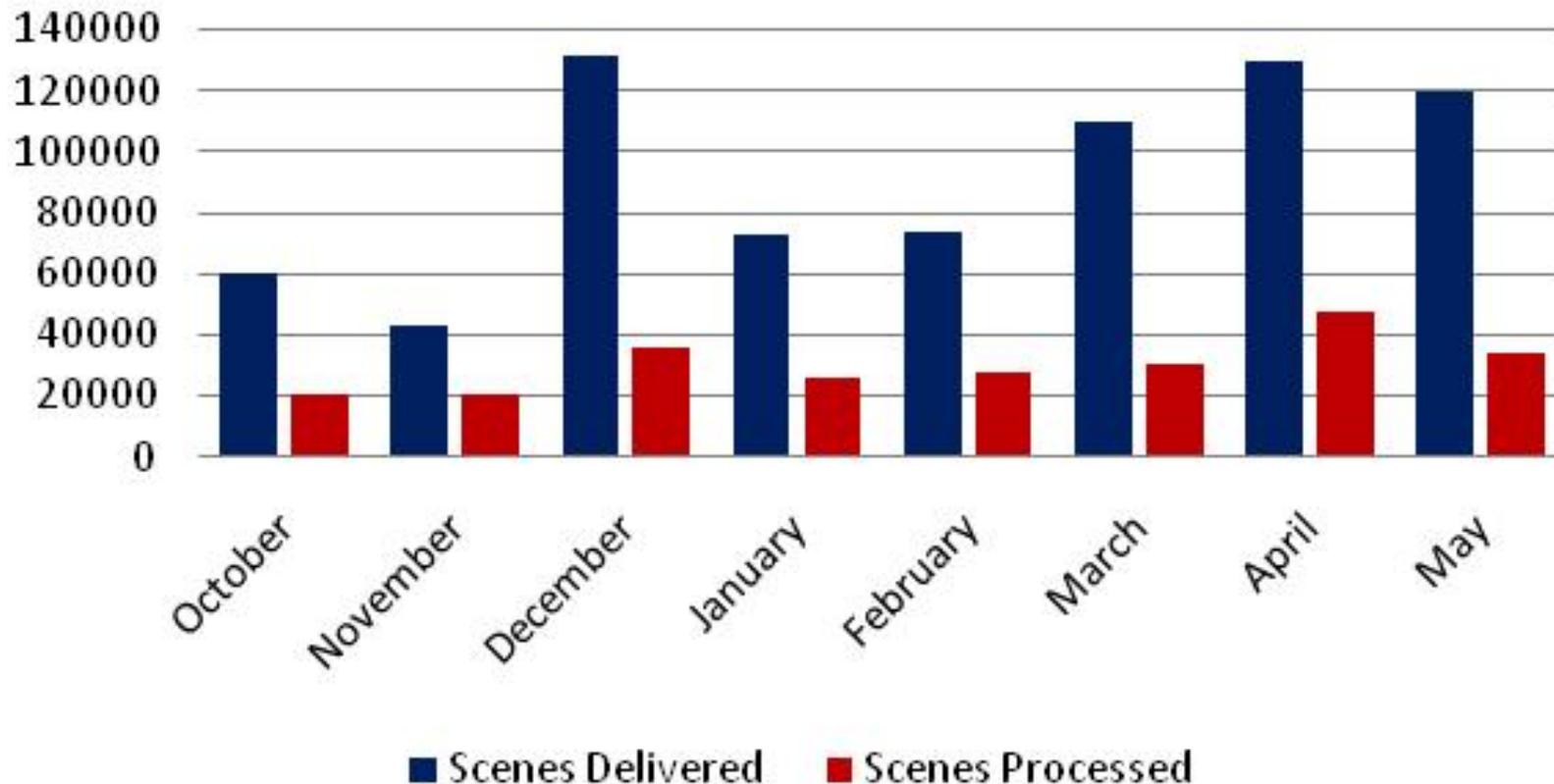
- 5/5/2009 – 22,512 ETM+ scenes removed (~4.8TB)
- 5/27/2009 – 32,723 ETM+ scenes removed (~7.5TB)

- ◆ Processed in May: 34,017 (Ave: 1097/day)

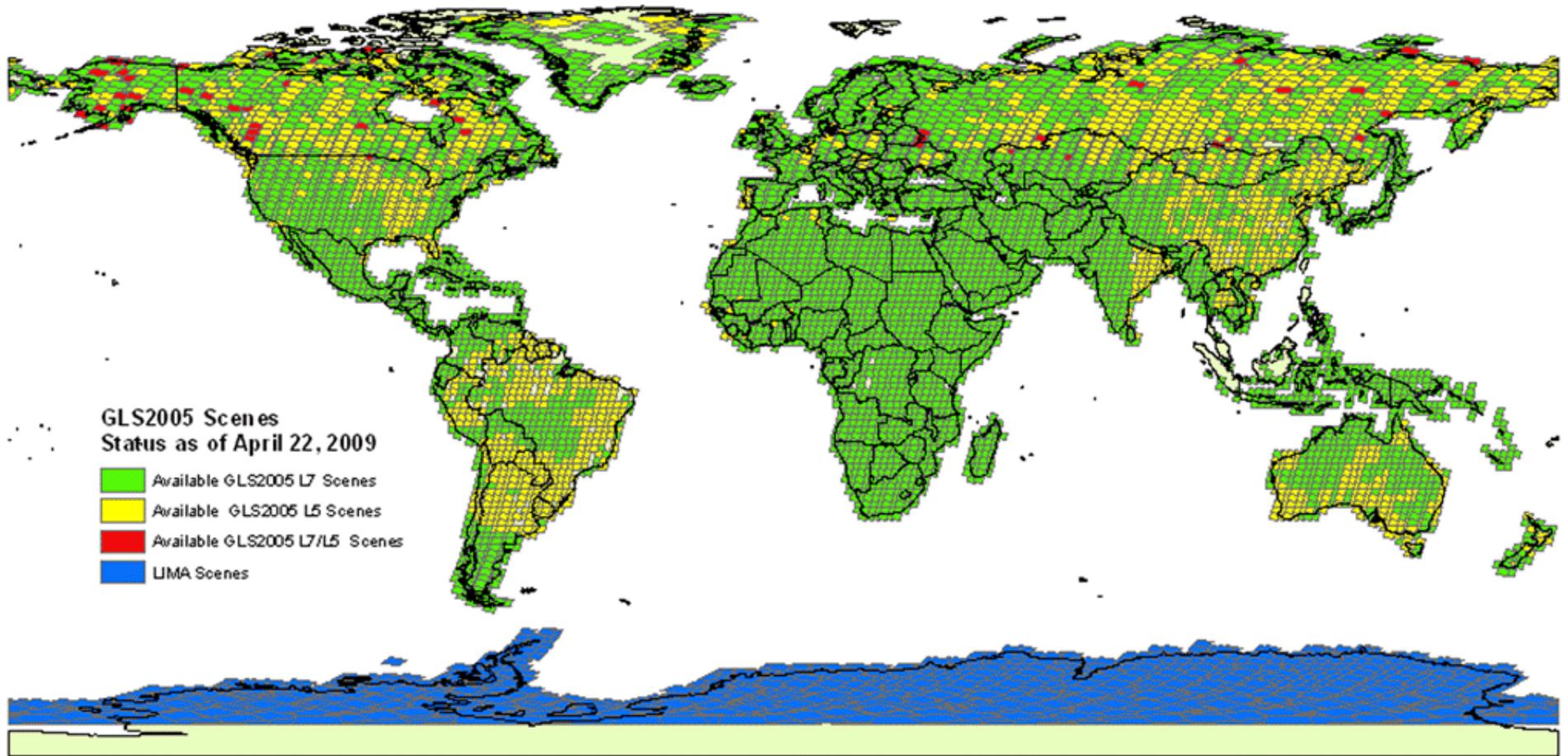
- ◆ Downloads in May: 119,311 (Ave: 3849/day)

Monthly Downloads/Processing

Landsat Web-enabled Monthly Statistics



GLS2005 Status



Remaining Issues with Web-enabling

- **Landsat 4 TM transition from NLAPS to LPGS – Complete**
- **Bulk Server bottleneck and loading issues**
 - ◆ Modifications to bulk server significantly helped loading problem
 - ◆ Bottleneck at the near-line tape archive still an issue
- **FTP space for processed products**
 - ◆ Current disk holds approx. 10% total archive
 - ◆ Over 50,000 ETM+ scenes were removed to make room for newer data and on-demand requests from the archive

Remaining Issues with Web-enabling

- **Processed Product (L1T) Metadata**

- ◆ Infrastructure for processed product metadata not currently in place (on project priority list)
- ◆ Purpose
 - Users currently do not know if a product is processed to L1G or L1T
 - Users have no knowledge of when the product was processed or with what Calibration Parameter File
 - Possible other useful information needed prior to product download

- **Small number of product issues reported**

- ◆ L1G processed versus L1T
- ◆ Georegistration issues
- ◆ Please continue to report any issues you find!

Remaining Issues with Web-enabling

- **MSS Processing**

- ◆ Manual processing of L1T MSS products on the NLAPS system caused large backlog and several month delay in product processing
- ◆ LST input beneficial in making decision to move to L1G processing (for now)
- ◆ Transition of MSS processing to more automated approach on LPGS in work

Tiger Team Conclusions

- **Recommended Technical Approach -- See the grease board**
 - ◆ MSS to LPGS
- **Technical Feasibility**
 - ◆ Schedule is P->A->X ; risk reduction, lessons learned; Concurrent Development Activities
 - ◆ Risks: ingest, missing ephemeris / attitude data
 - ◆ Pros:
 - Significant reuse of existing institutional software components and production system
 - New processing elements may improve LPGS processing e.g. 4/5 TM
 - ◆ Hierarchical matching technique
 - ◆ Verification approach
 - ◆ Trending approach
 - Opportunities for product improvement through radiometric and geometric characterization and calibration

Tiger Team Conclusions

- **High-level Estimate**

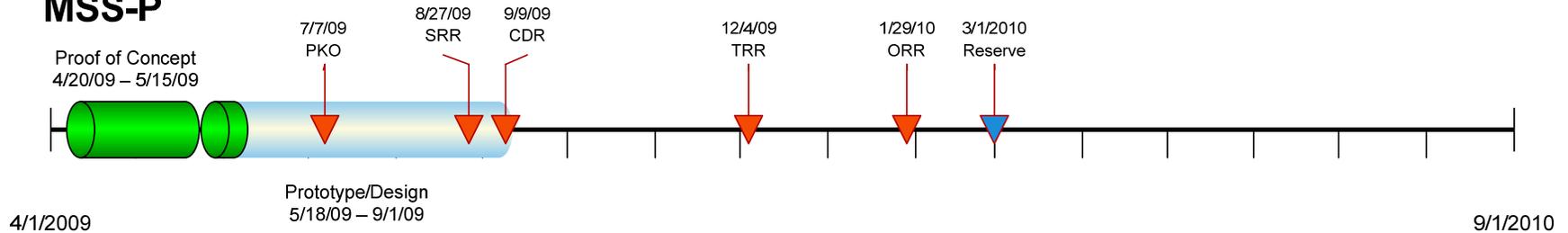
- ◆ Open action for the project
- ◆ Risk: Available skills and level of effort, ensuring continuity of science R&D

- **Other Methods Considered**

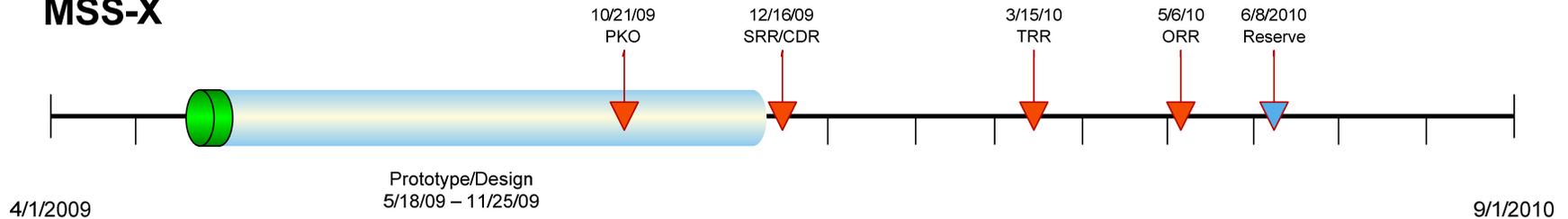
- ◆ Proprietary software approaches continue to provide challenges for variant data types (ingest is still an issue)
- ◆ Would still need to verify proprietary packages
- ◆ NLAPS Modifications - Would require sole source contract, would provide an institutionally opaque system with limited opportunities for processing algorithm modifications and update of calibration, geolocation and science algorithm knowledge
- ◆ Operating commercial system and LPGS is costly for the operational project

Status on MSS Schedule (as of 6/5/2009)

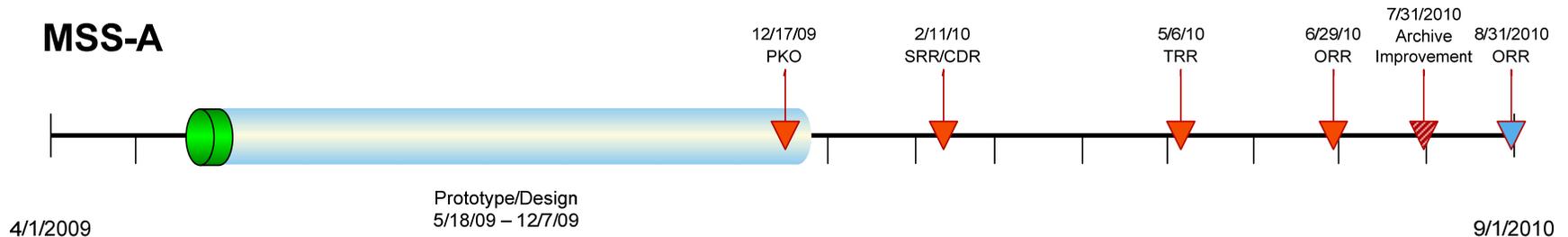
MSS-P



MSS-X



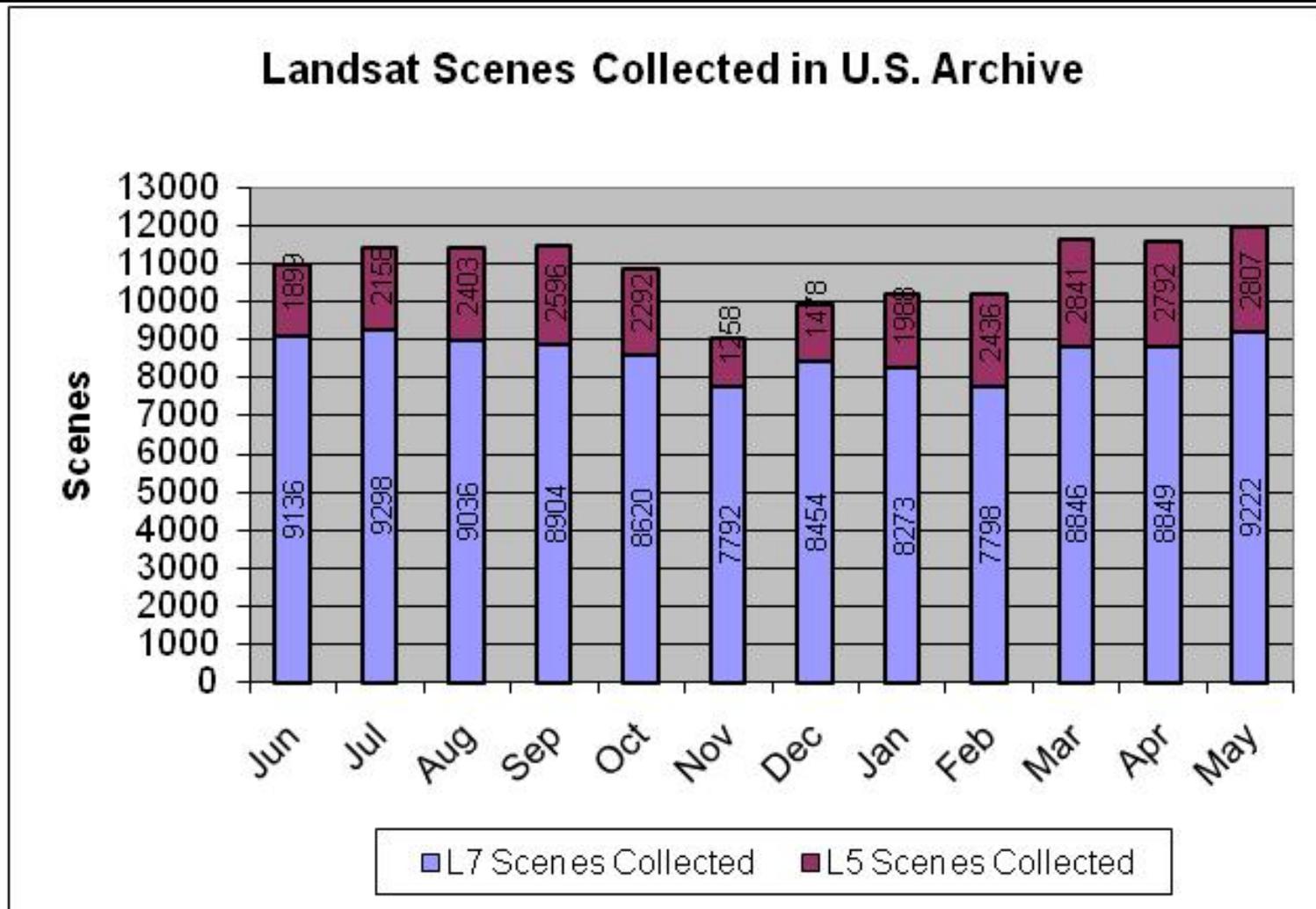
MSS-A



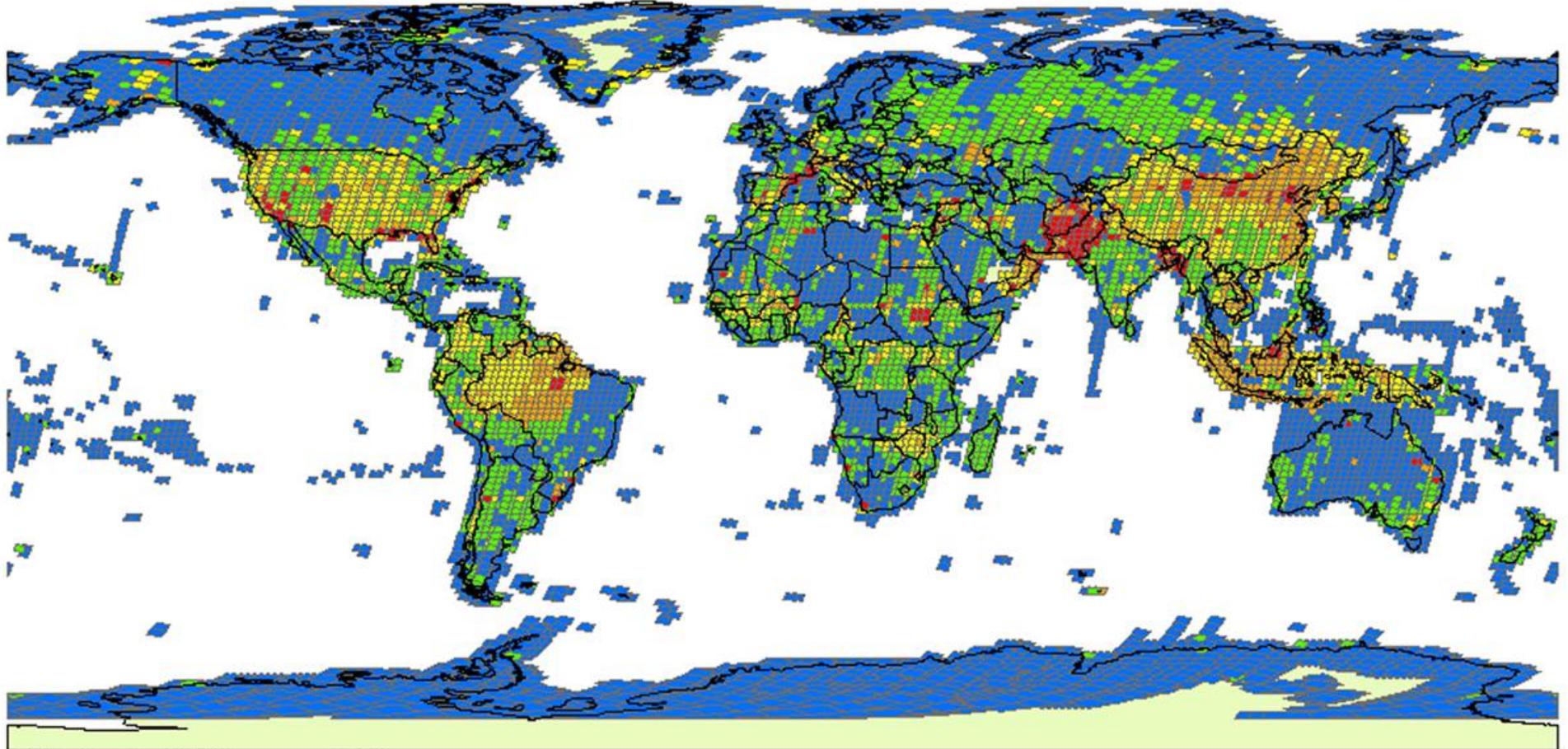
Potential Future Discussion

- **Migration of current standard product to LDCM baseline product (Top of Atmosphere?)**
 - ◆ Discussion topics
 - Impacts to current users not using a TOA product
 - Communication to users (how, when – how much time prior to switch)
 - Operational impacts:
 - ◆ Schedule for changes
 - ◆ Coordinating any other product changes at the same time
 - ◆ Issues with execution of product changes

Landsat Data Acquired by Month



Scenes Processed (ETM+)

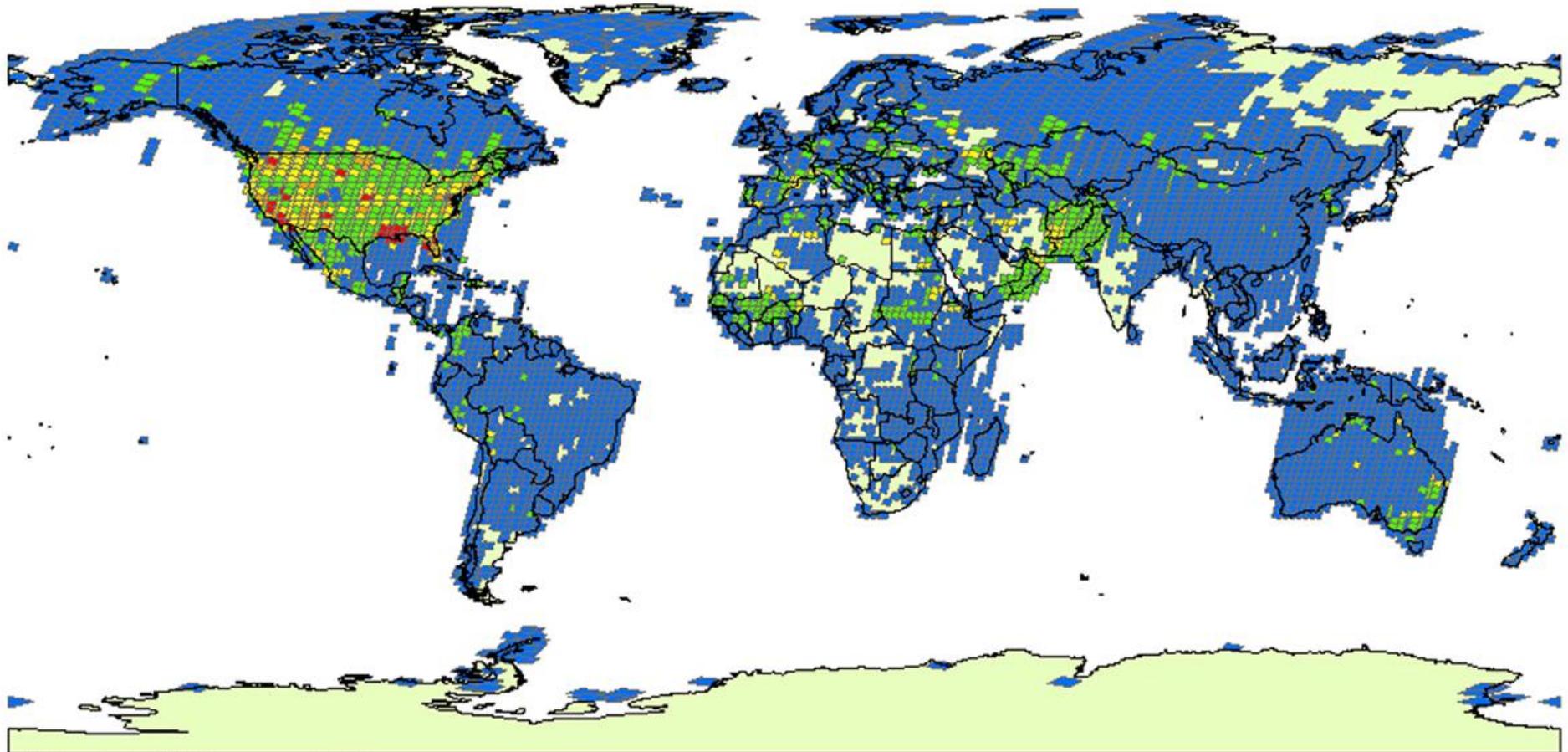


ETM+ Standard L1T Scenes on FTP Server
Status through May 31, 2009
176,297 Total Scenes
11,869 Unique Locations

1 - 10 11 - 27 28 - 51 52 - 85 86 - 197



Scenes Processed (TM)



TM Standard L1T Scenes on FTP Server

Status through May 31, 2009

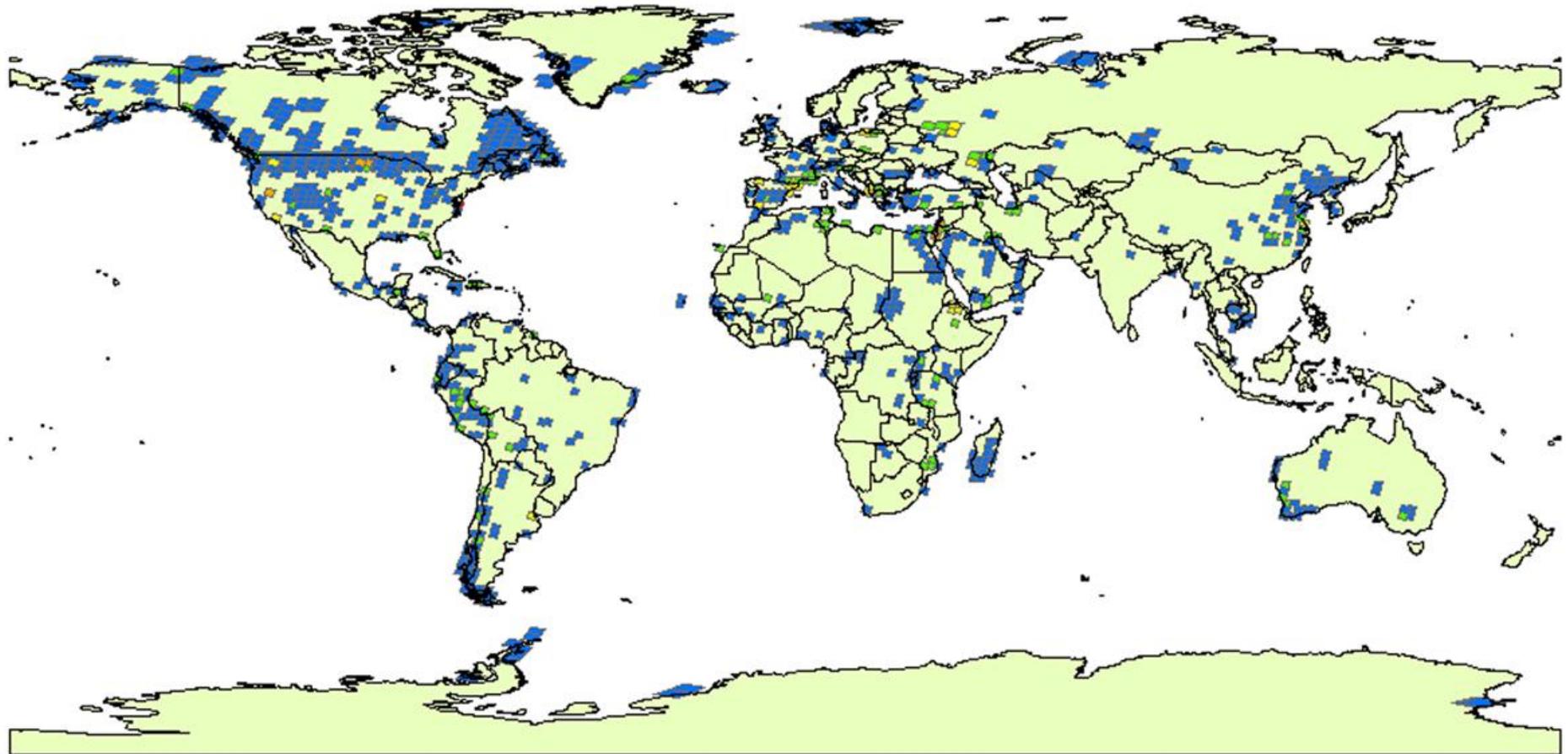
86,701 Total Scenes

6,811 Unique Locations

1 - 17 18 - 50 51 - 109 110 - 225 226 - 497



Scenes Processed (MSS – WRS2)

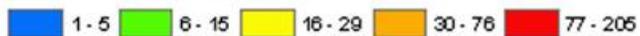


L4-5 MSS Standard L1T Scenes on FTP Server

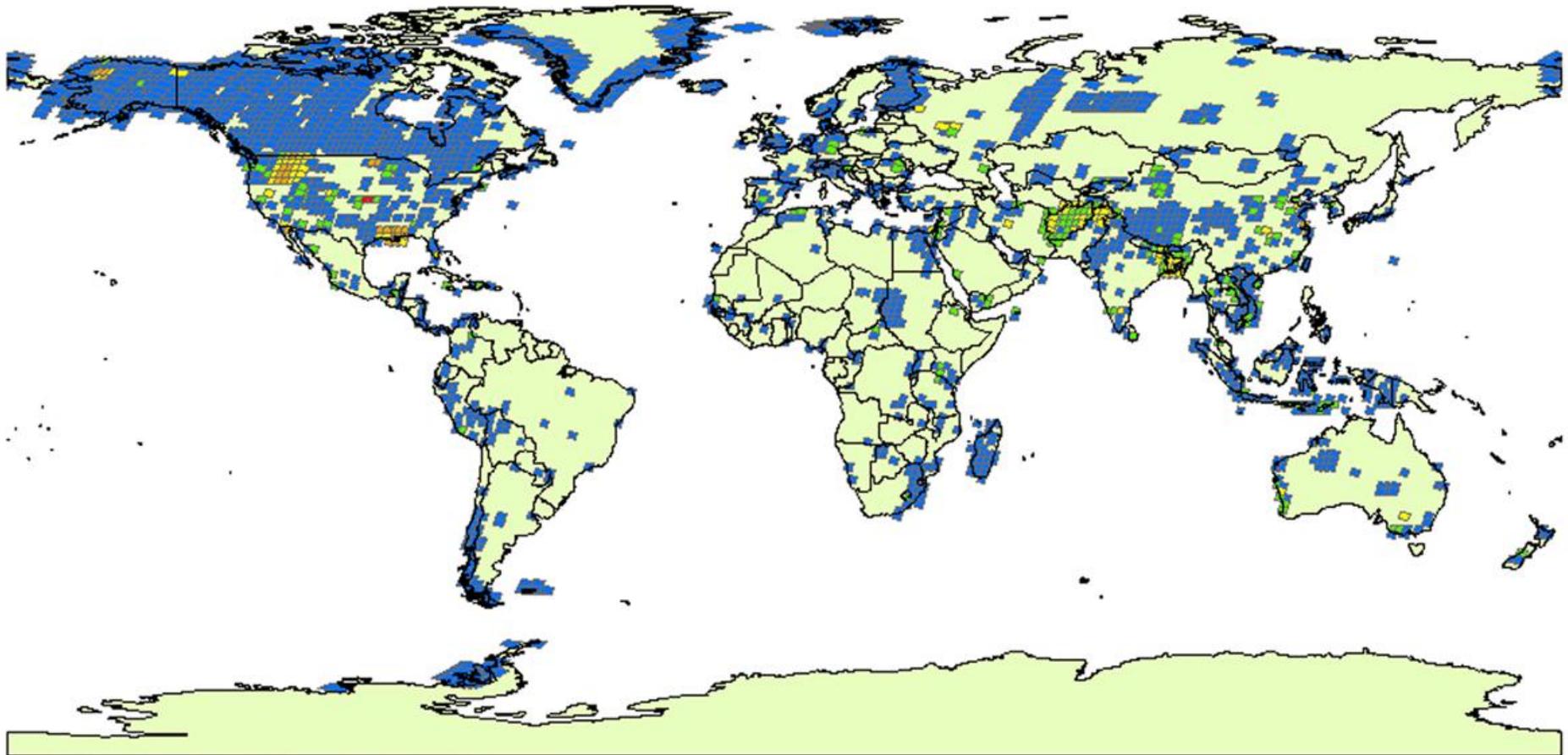
Status through May 31, 2009

3,168 Total Scenes

896 Unique Locations



Scenes Processed (MSS – WRS1)



L1-3 MSS Standard L1T Scenes on FTP Server

Status through May 31, 2009

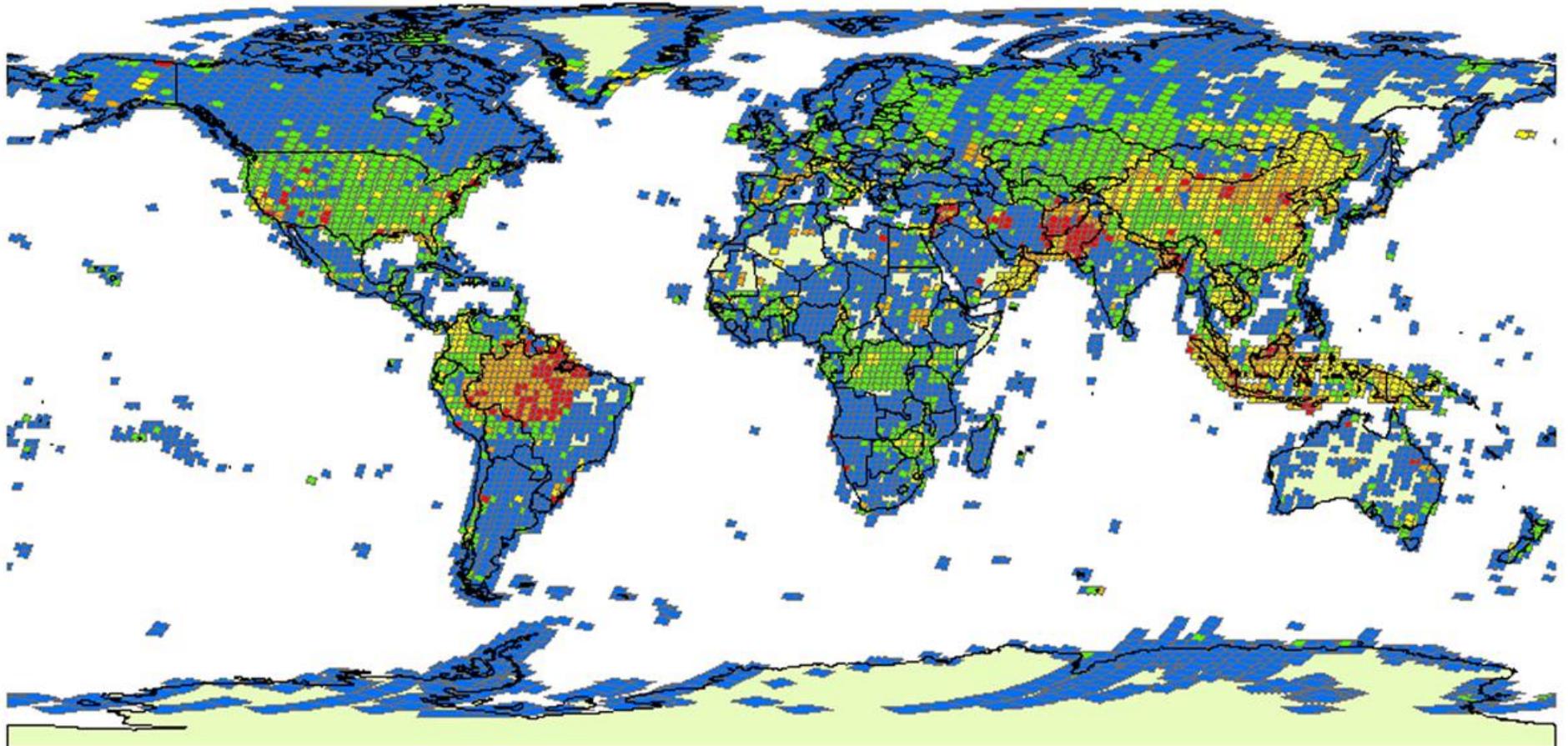
9,241 Total Scenes

2,047 Unique Locations

1 - 6 7 - 19 20 - 44 45 - 91 92 - 208



On-Demand Requests (ETM+)

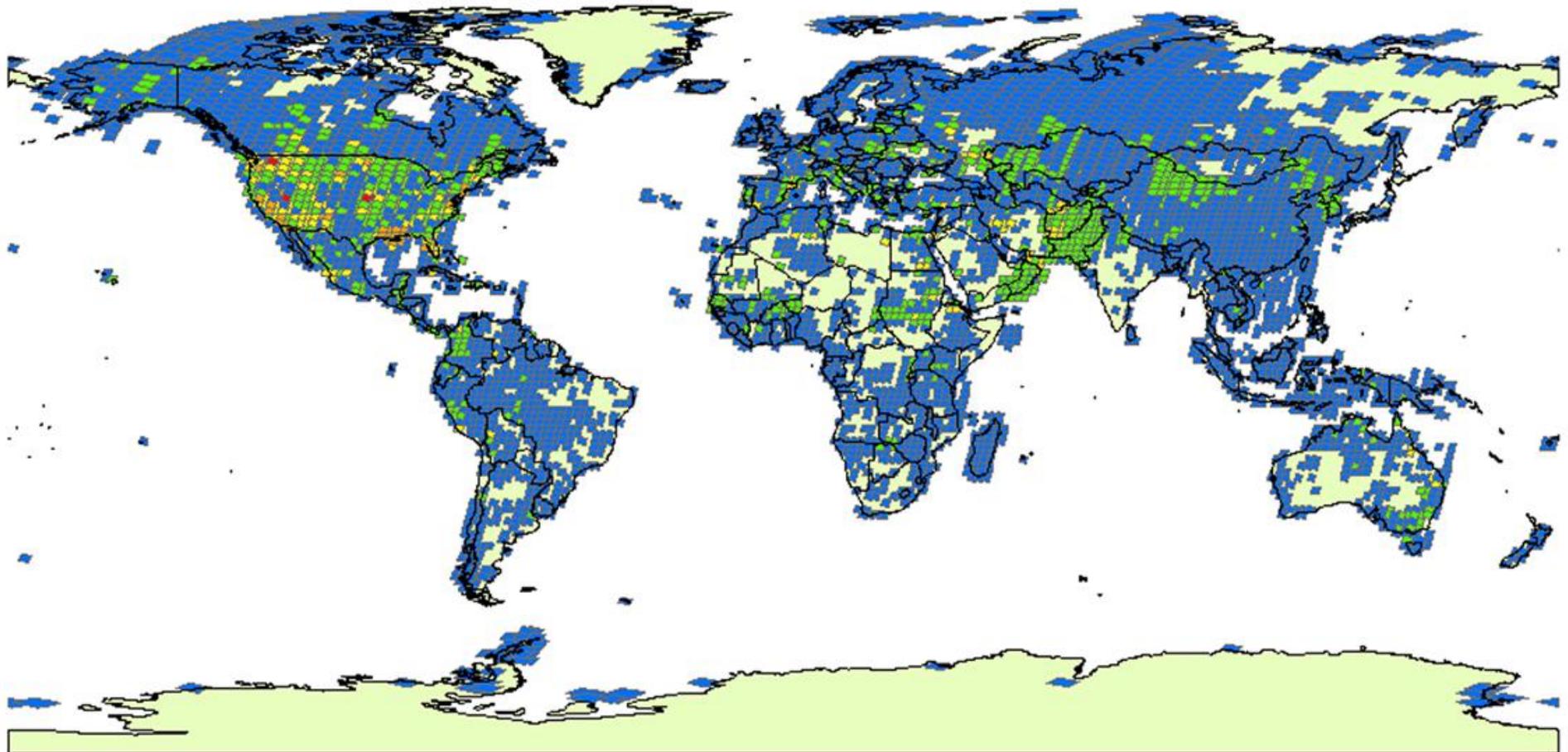


ETM+ On-Demand Orders
Status through May 31, 2009
148,839 Total Scenes
8,661 Unique Locations

1 - 11 12 - 32 33 - 60 61 - 91 92 - 205



On-Demand Requests (TM)



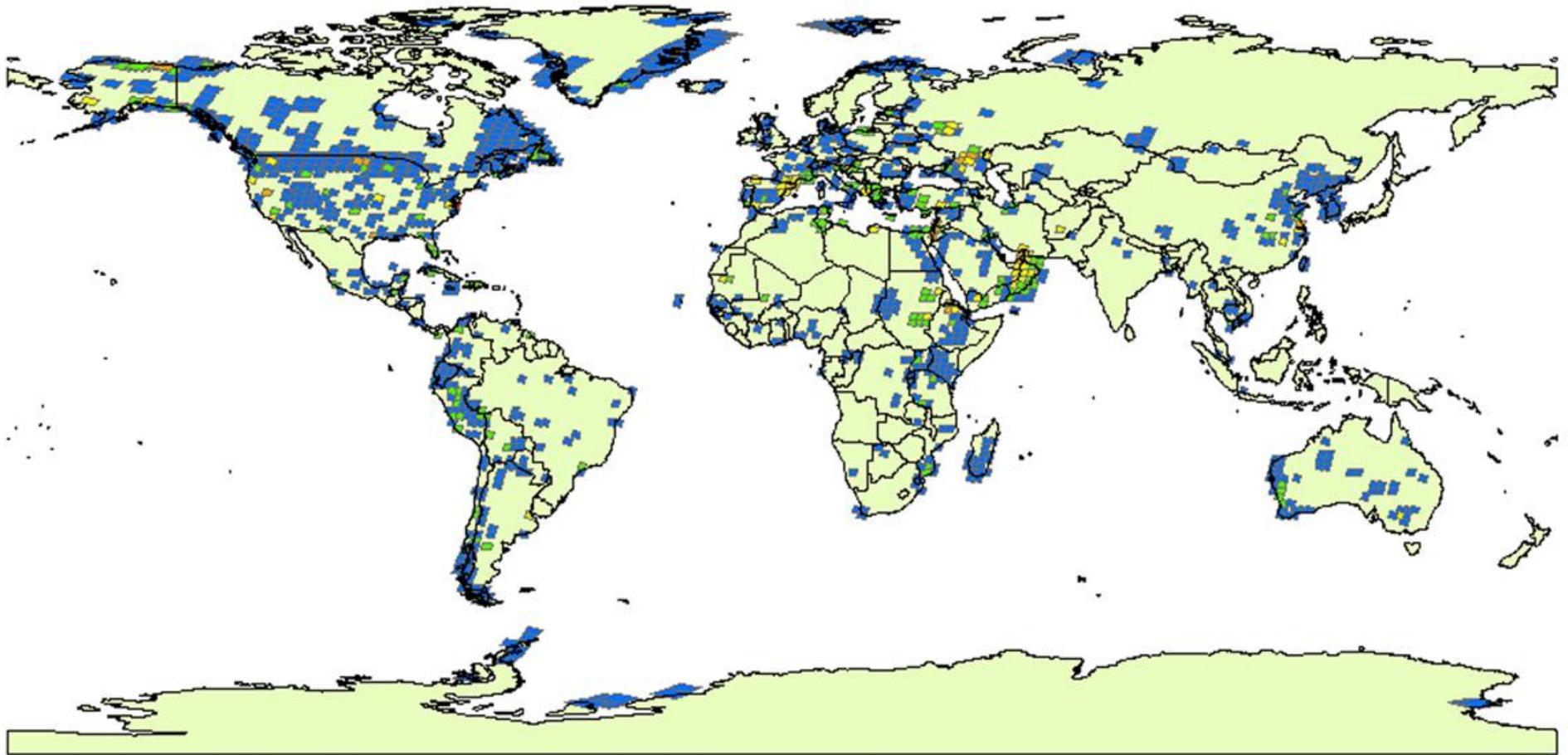
TM On-Demand Orders
Status through May 31, 2009
81,458 Total Scenes
5,924 Unique Locations

1 - 18 19 - 62 63 - 177 178 - 384 385 - 735



Landsat Project Status– Landsat Science Team
June 2009

On-Demand Requests (MSS – WRS2)

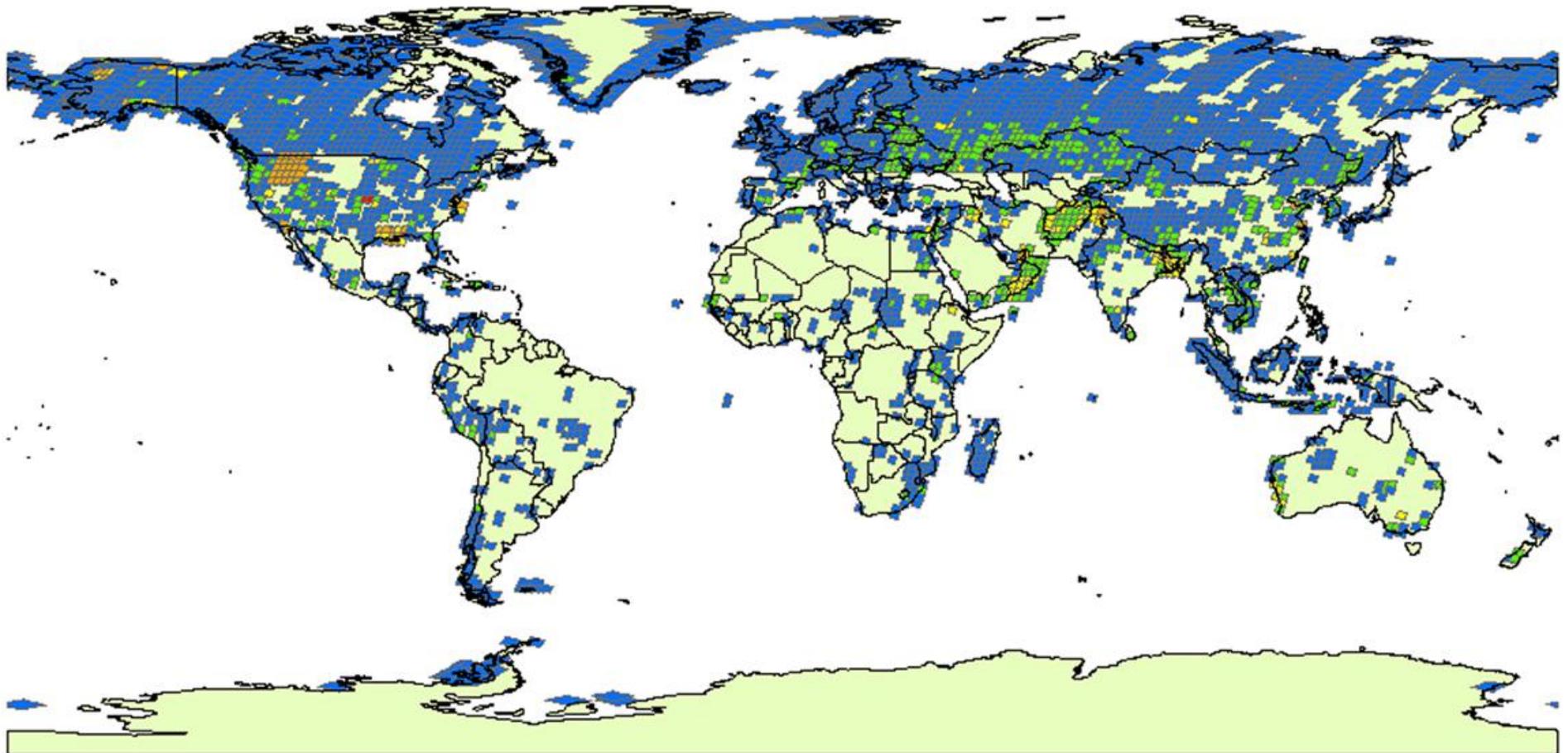


L4-5 MSS On-Demand Orders
Status through May 31, 2009
6,497 Total Scenes
1,239 Unique Locations

1 - 6 7 - 18 19 - 38 39 - 121 122 - 212



On-Demand Requests (MSS – WRS1)

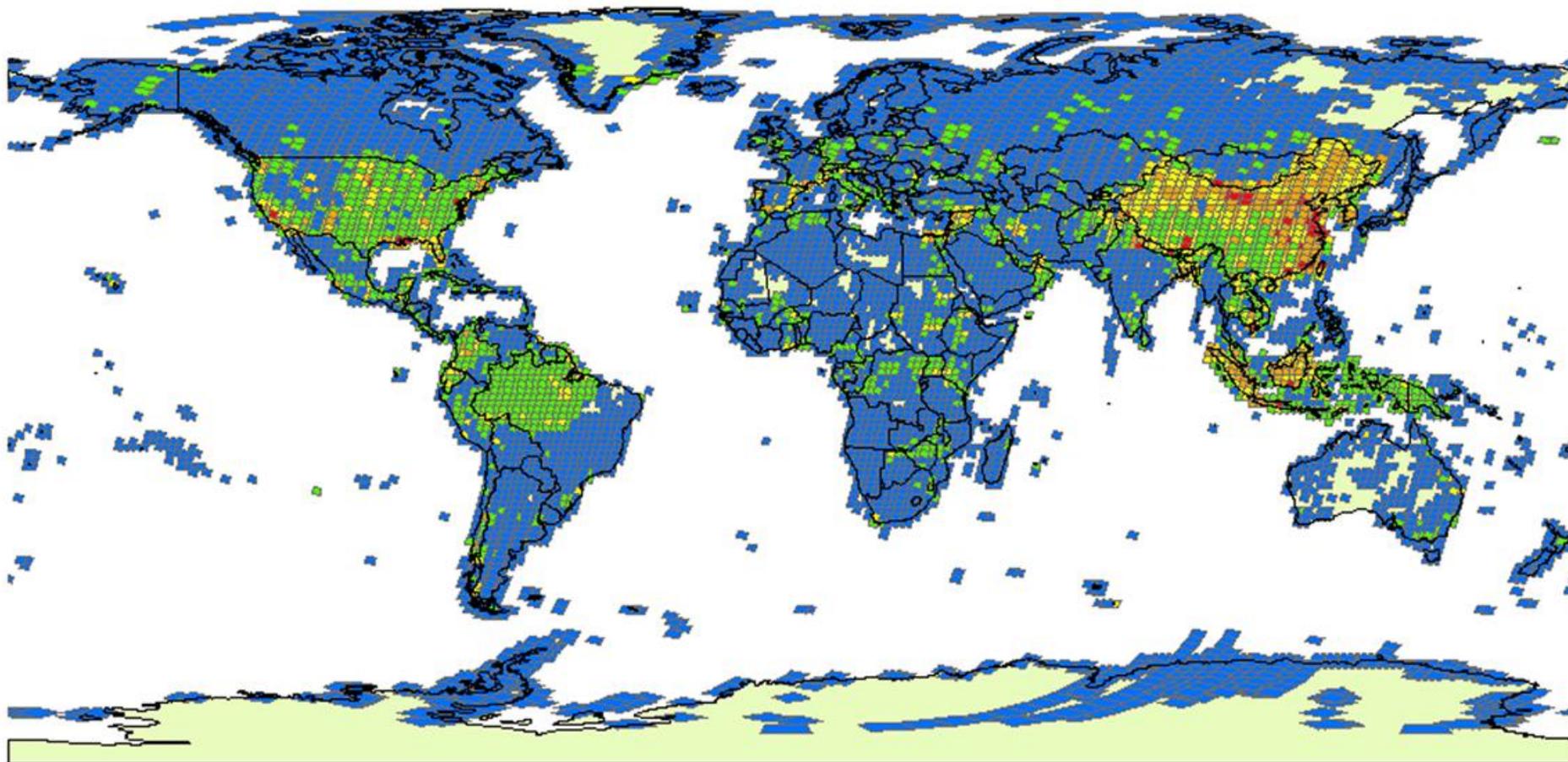


L1-3 MSS On-Demand Orders
Status through May 31, 2009
19,965 Total Scenes
3,860 Unique Locations

1 - 6 7 - 20 21 - 53 54 - 121 122 - 218



Downloads through EE/Glovis (ETM+)



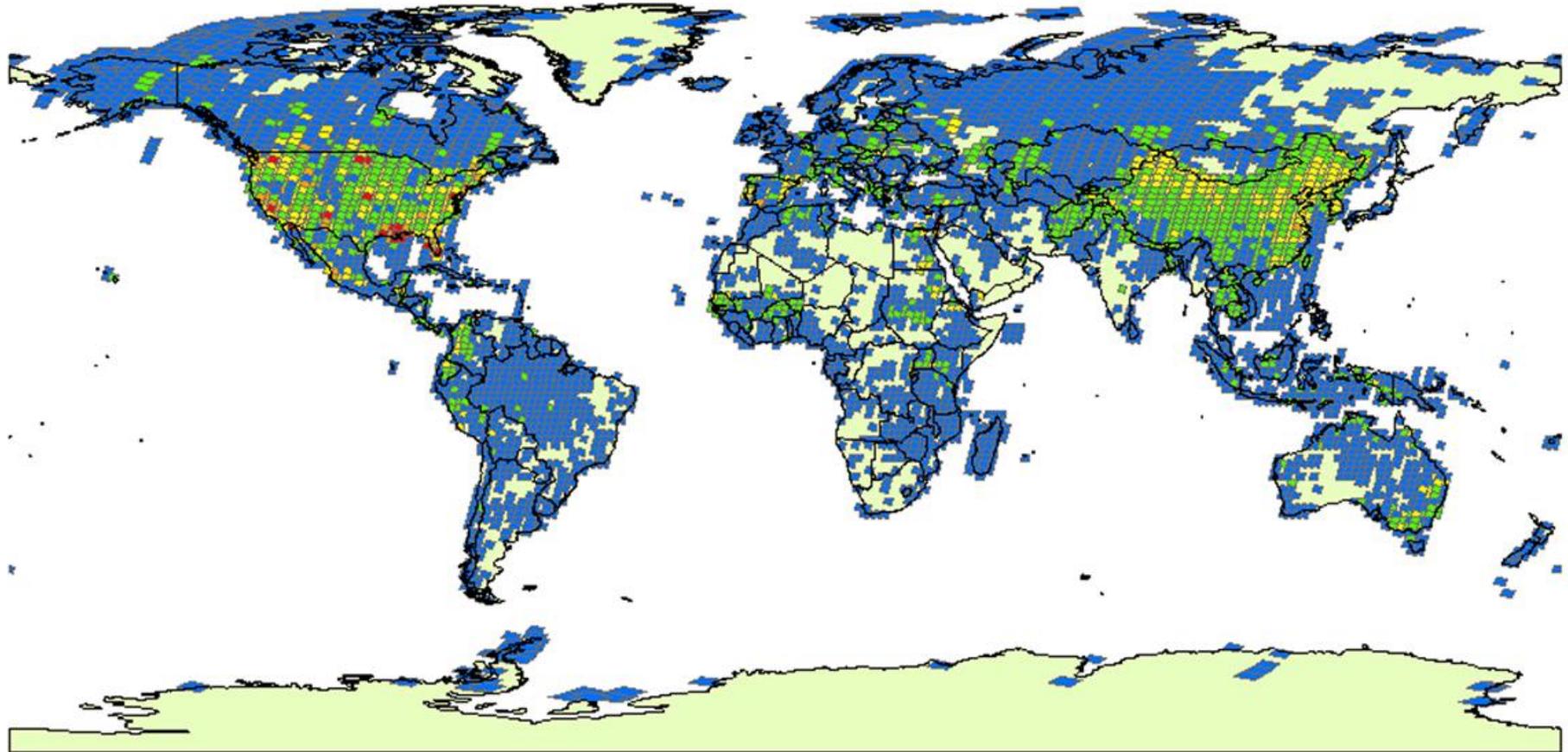
ETM+ Standard L1T Downloads
via User Interface
October 1, 2008 through May 31, 2009
451,964 Total Scenes
8,814 Unique Locations

1 - 51 52 - 145 146 - 279 280 - 530 531 - 1438



Landsat Project Status– Landsat Science Team
June 2009

Downloads through EE/Glovis (TM)

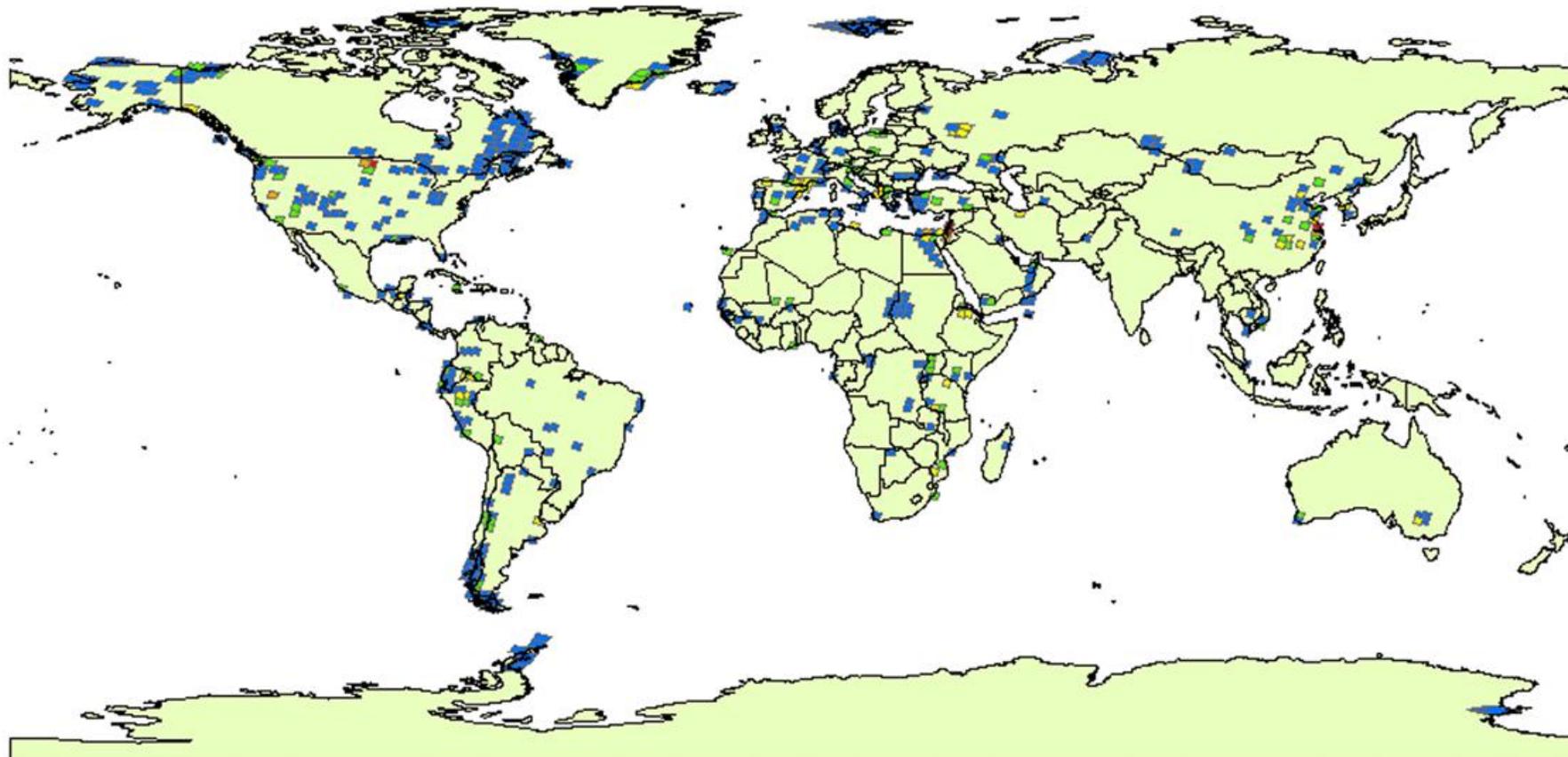


TM Standard L1T Downloads
via User Interface
October 1, 2008 through May 31, 2009
190,750 Total Scenes
5,846 Unique Locations

1 - 34 35 - 99 100 - 248 249 - 612 613 - 1557



Downloads through EE/Glovis (MSS – WRS2)

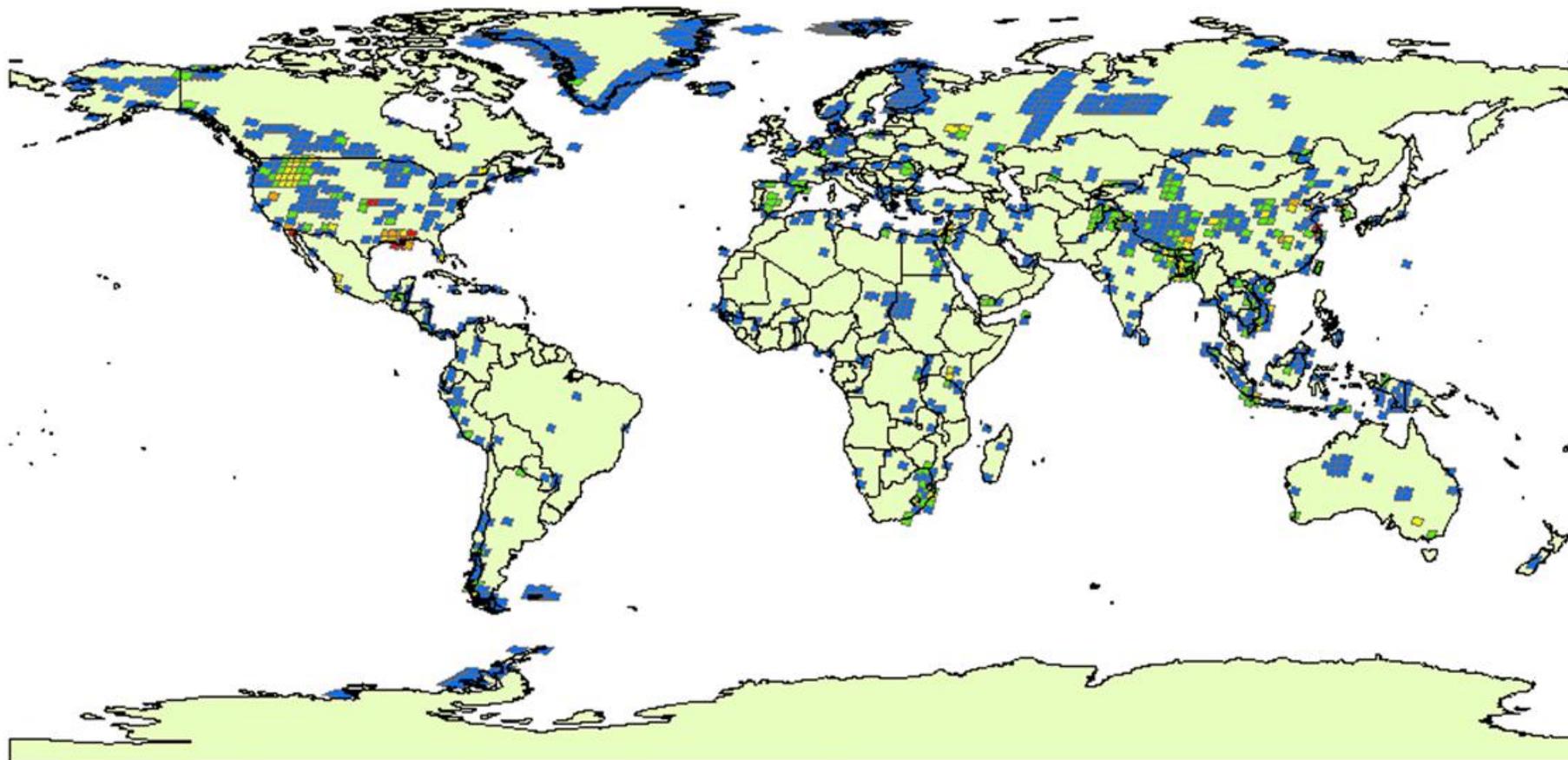


L4-5 MSS Standard L1T Downloads
via User Interface
December 8, 2008 through May 31, 2009
3,848 Total Scenes
488 Unique Locations

1 - 6 7 - 17 18 - 46 47 - 100 101 - 205



Downloads through EE/Glovis (MSS – WRS1)

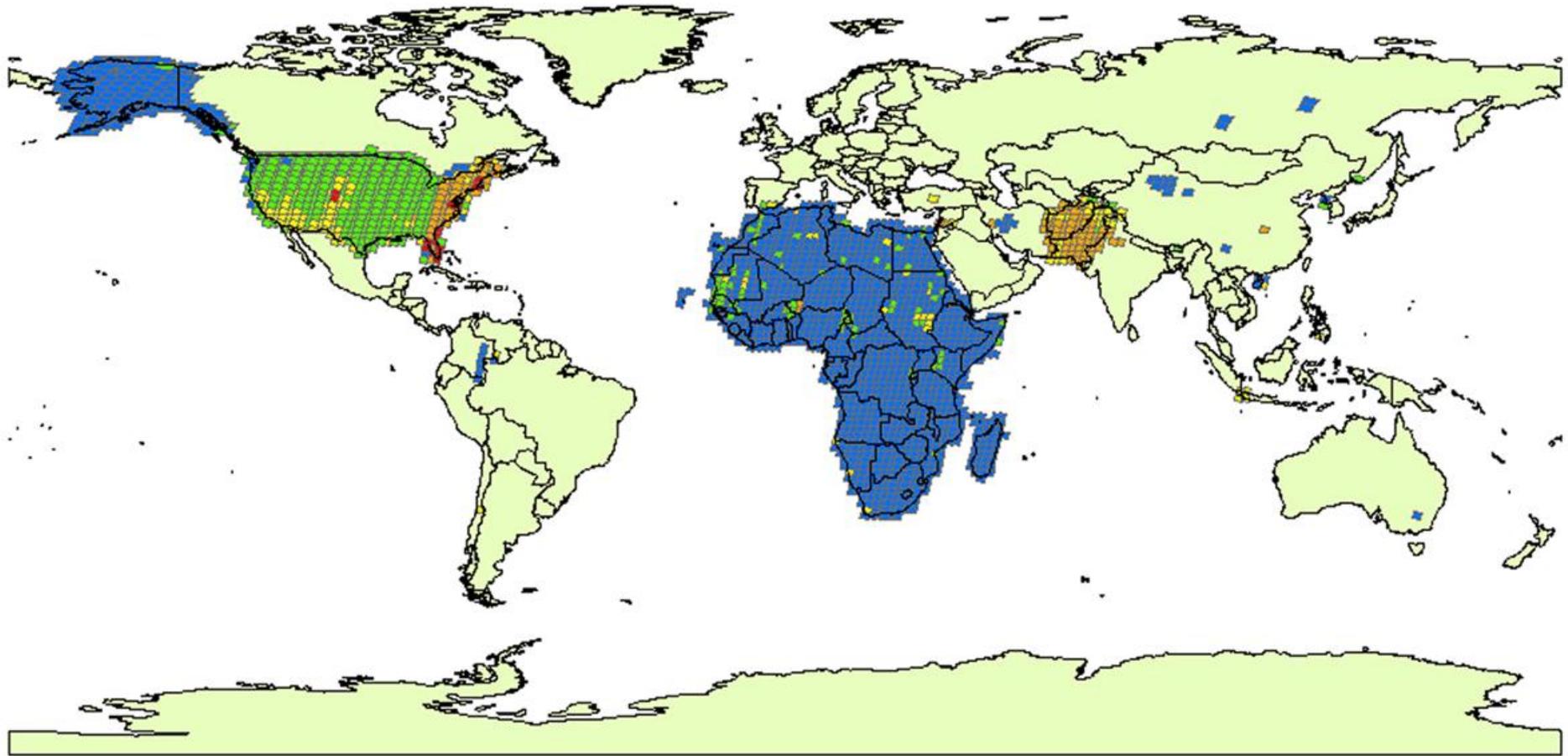


L1-3 MSS Standard L1T Downloads
via User Interface
December 8, 2008 through May 31, 2009
11,336 Total Scenes
1,135 Unique Locations

1 - 10 11 - 28 29 - 65 66 - 124 125 - 281



Bulk FTP Downloads (ETM+)

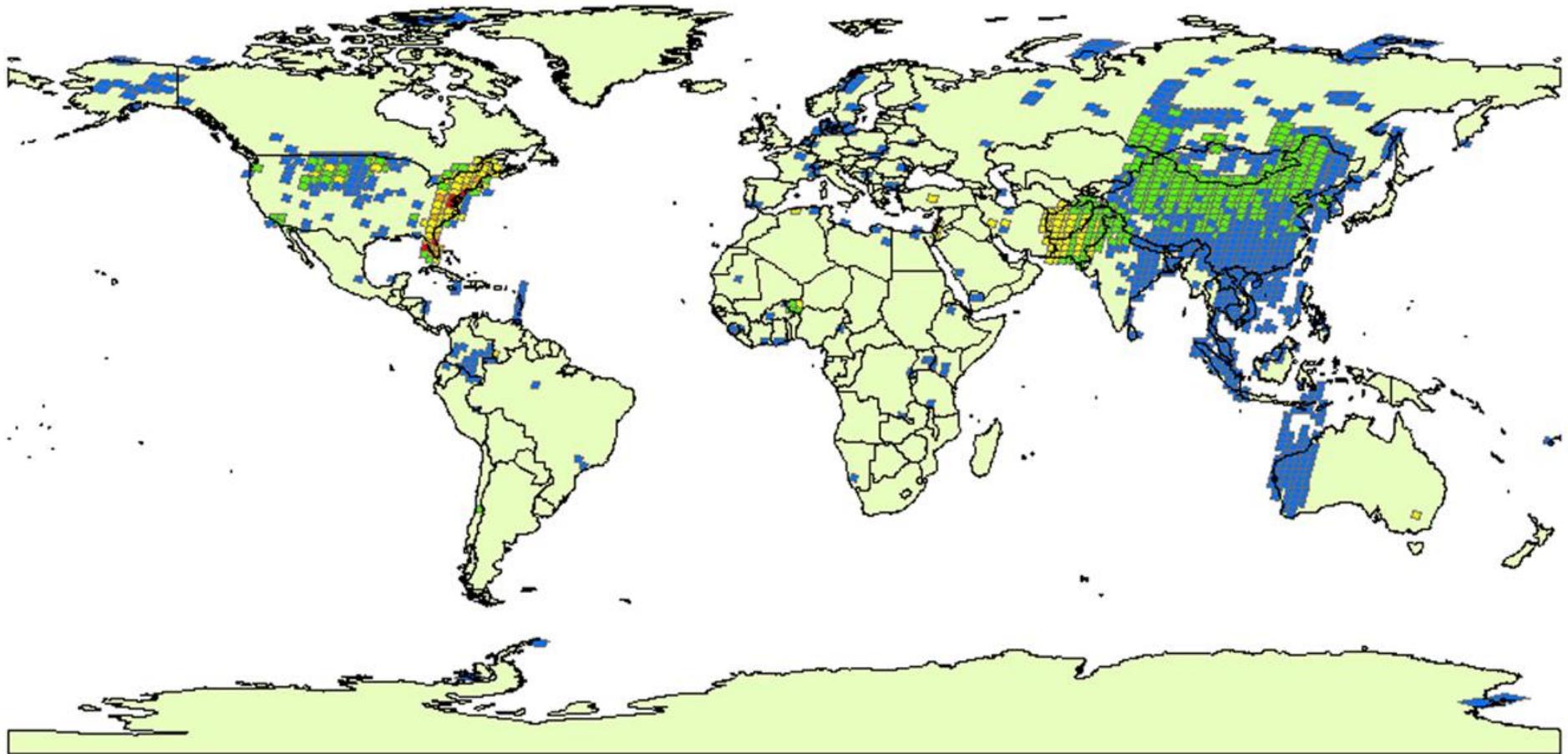


ETM+ Standard L1T Bulk User Downloads
October 1, 2008 through May 31, 2009
57,072 Total Scenes
2,110 Unique Locations

1-25 26-51 52-86 87-142 143-284



Bulk FTP Downloads (TM)

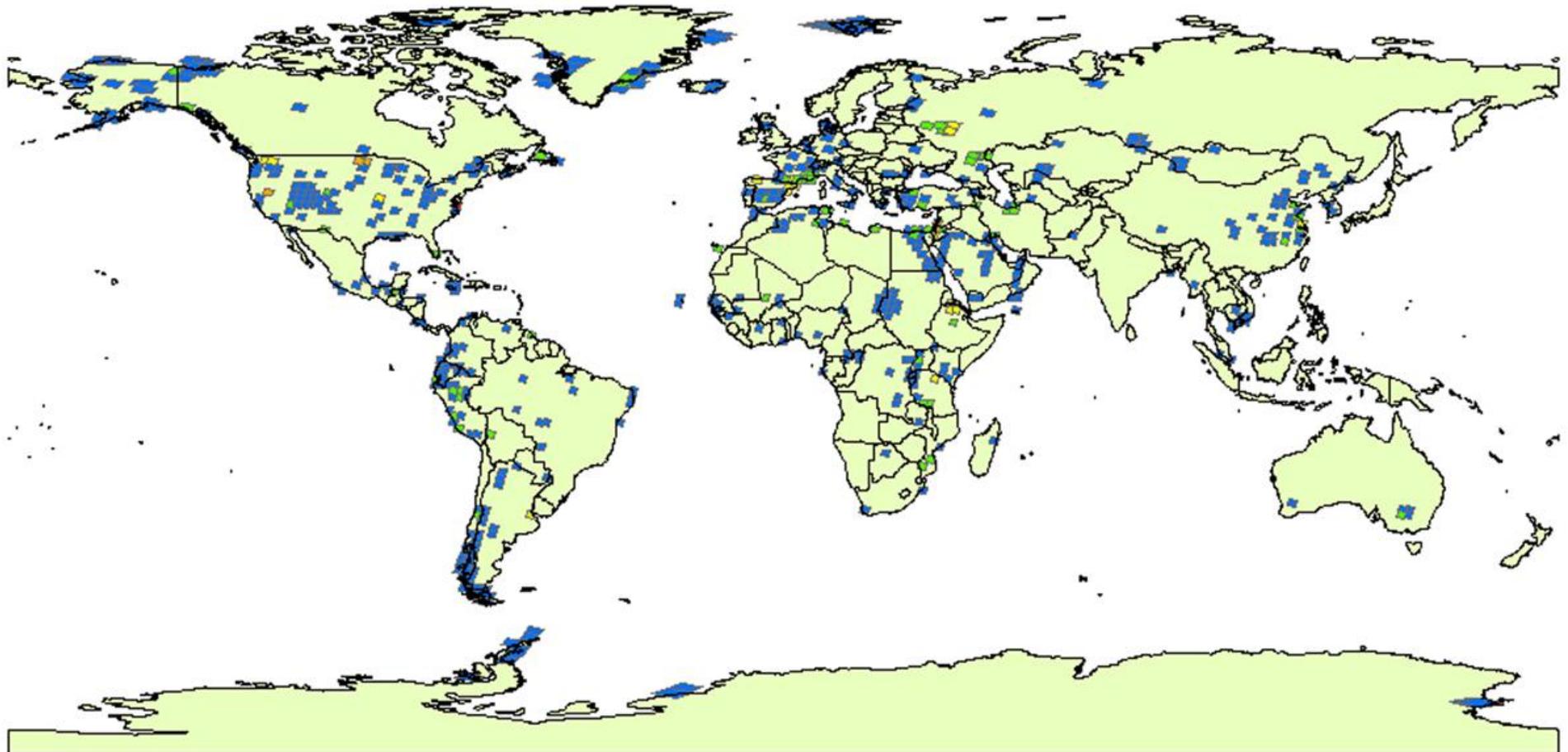


TM Standard L1T Bulk User Downloads
December 8, 2008 through May 31, 2009
16,207 Total Scenes
1,366 Unique Locations

1-8 9-30 31-87 88-180 181-278



Bulk FTP Downloads (MSS – WRS2)



L4-5 MSS Standard L1T Bulk User Downloads

January 13, 2009 through May 31, 2009

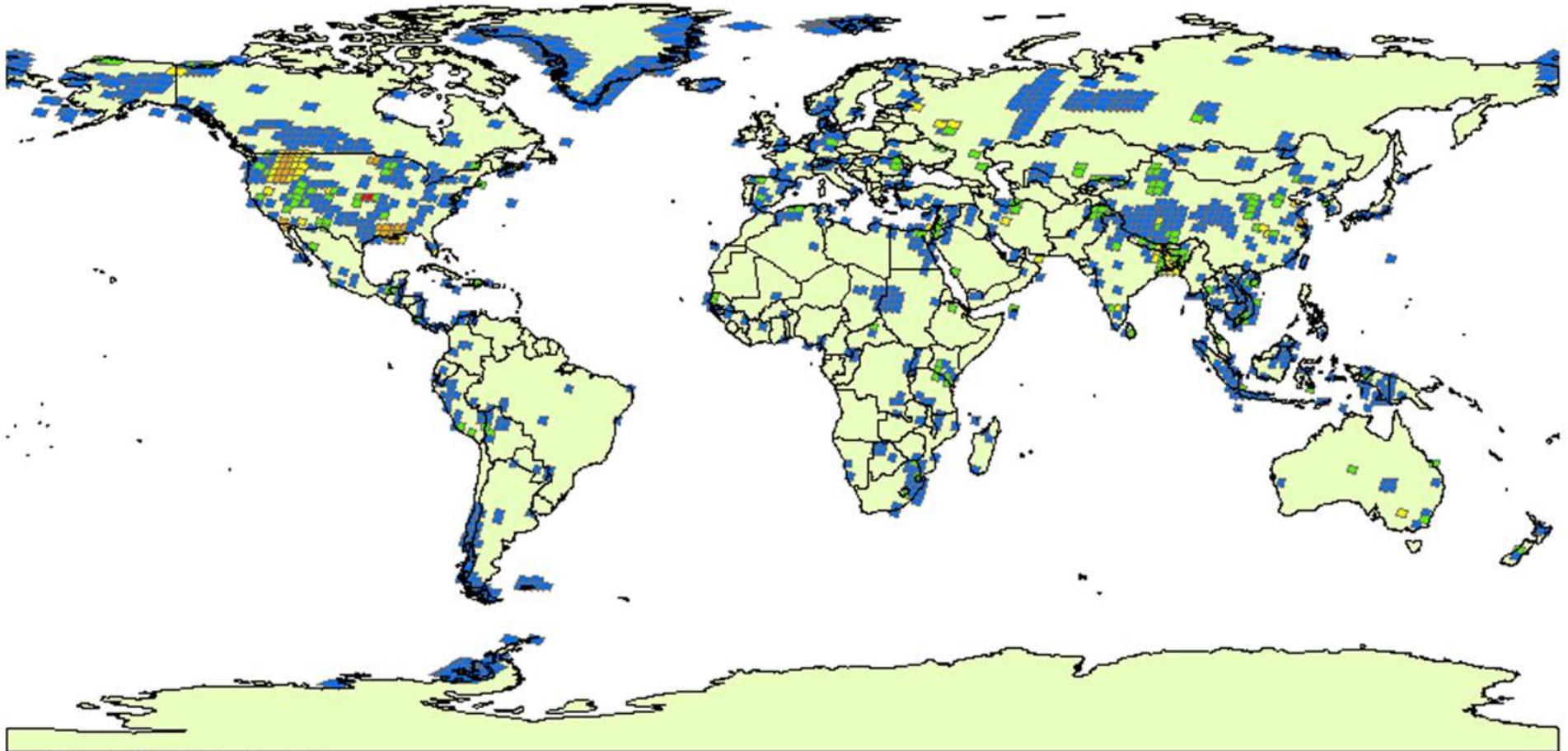
2,450 Total Scenes

560 Unique Locations

1-5 6-15 16-41 42-82 83-210



Bulk FTP Downloads (MSS – WRS1)



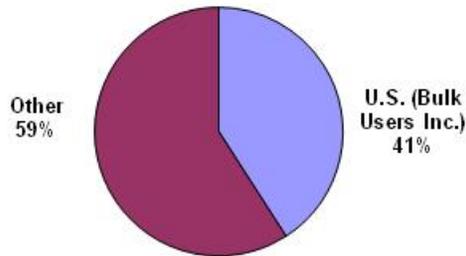
L1-3 MSS Standard L1T Bulk User Downloads
January 13, 2009 through May 31, 2009
6,380 Total Scenes
1,248 Unique Locations

1-5 6-18 19-38 39-73 74-212

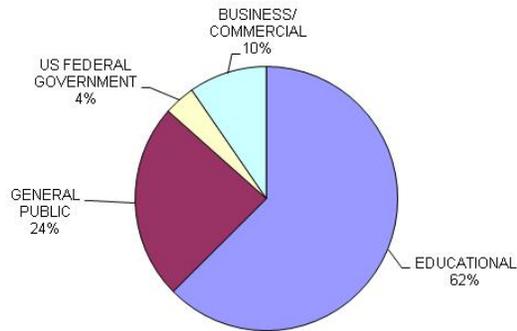


Web-enabled Customer Demographics

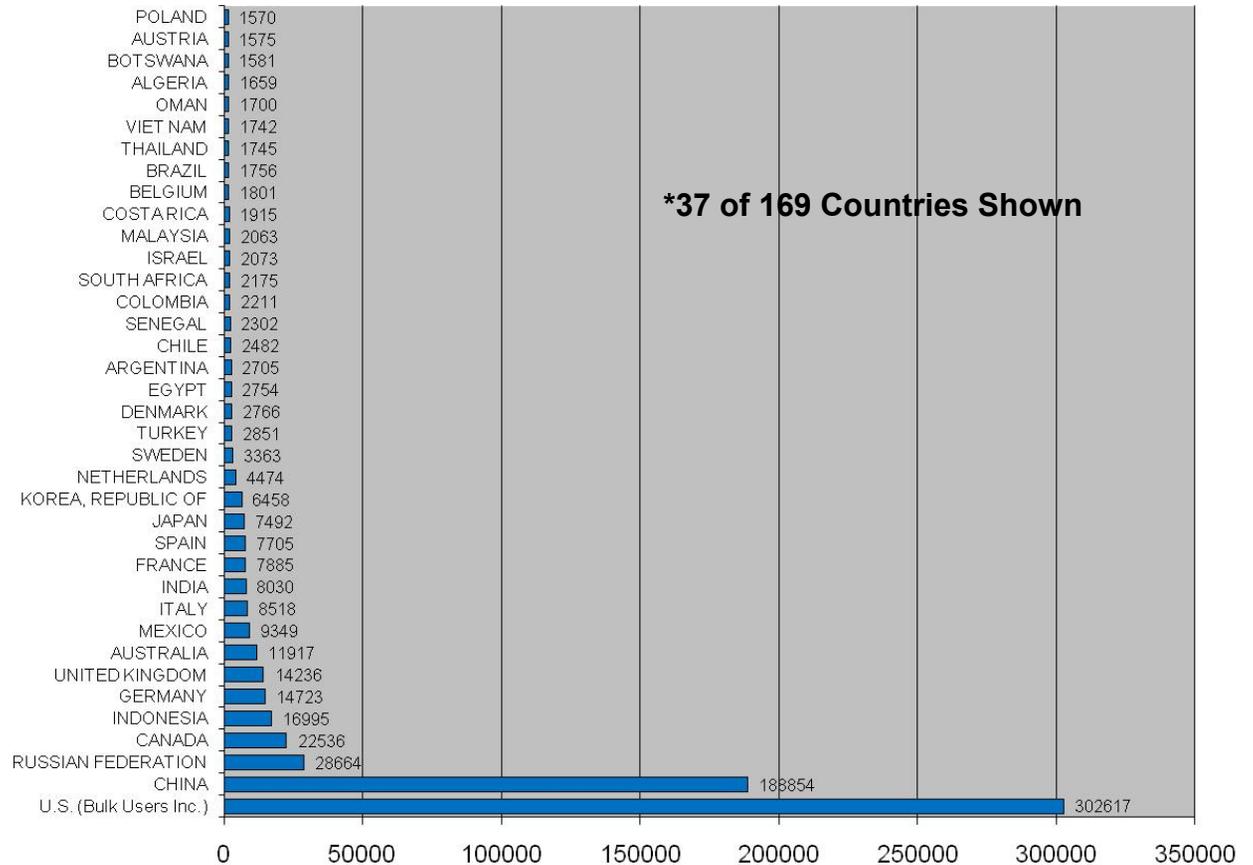
Downloads by Country



Downloads by Affiliation



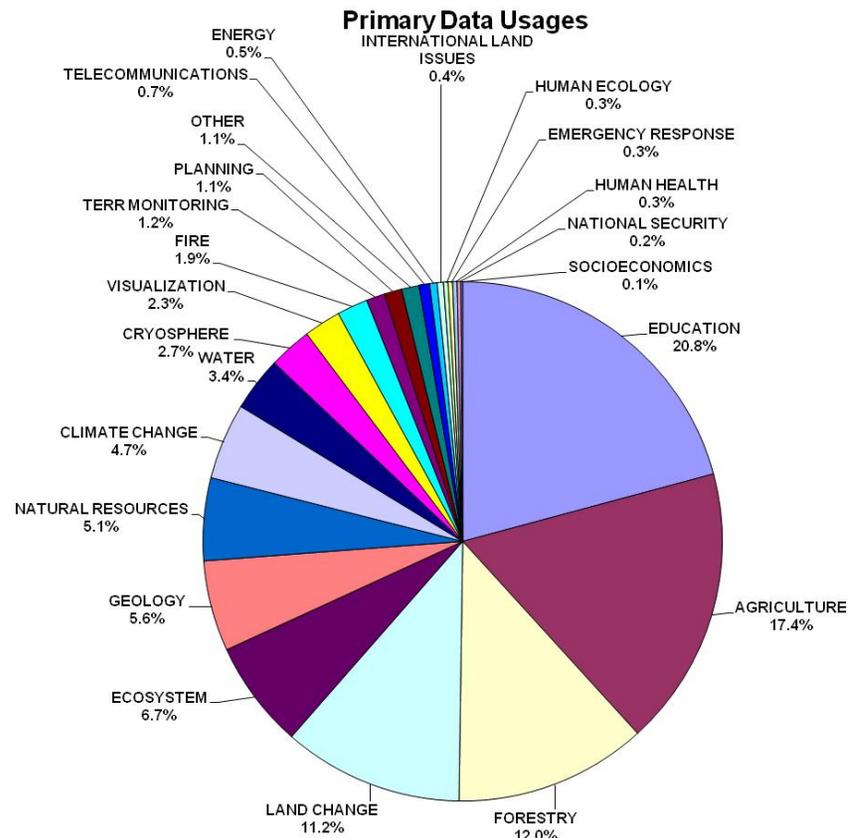
**Standard L1T Downloads by Country
(Countries with >1500 Scenes Downloaded)**



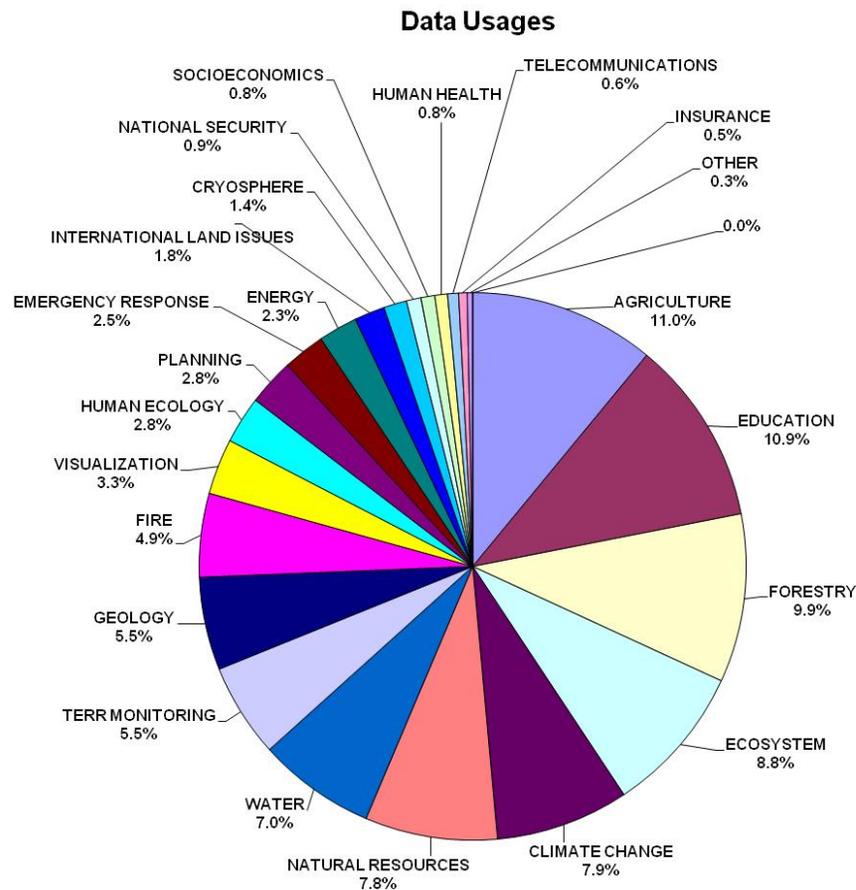
* Stats 10/1/08 through 5/31/08



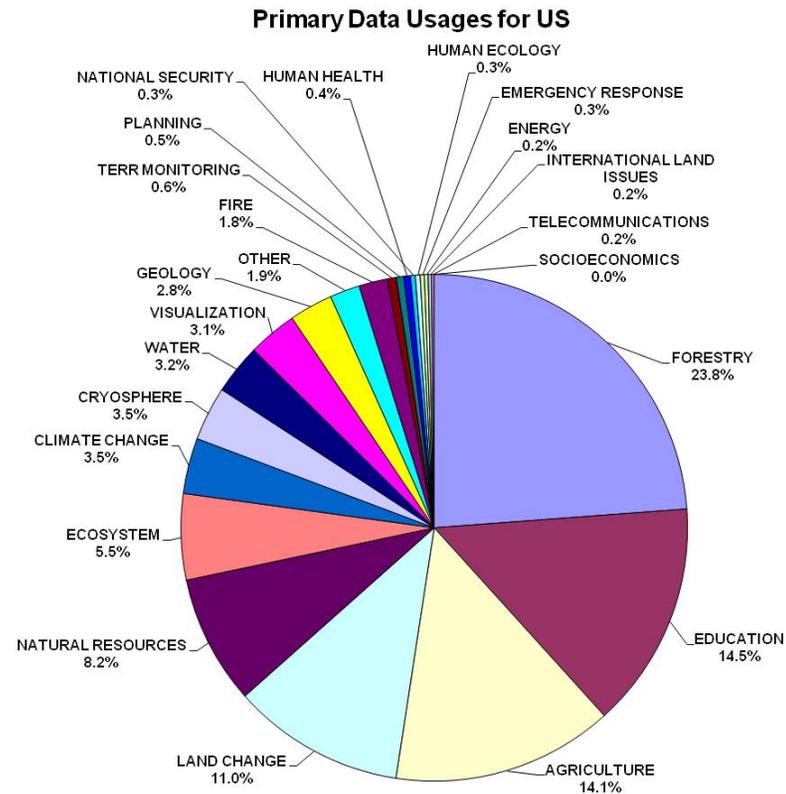
User Reported Primary Use of Landsat (Oct 1, 2008 – Mar 31, 2009)



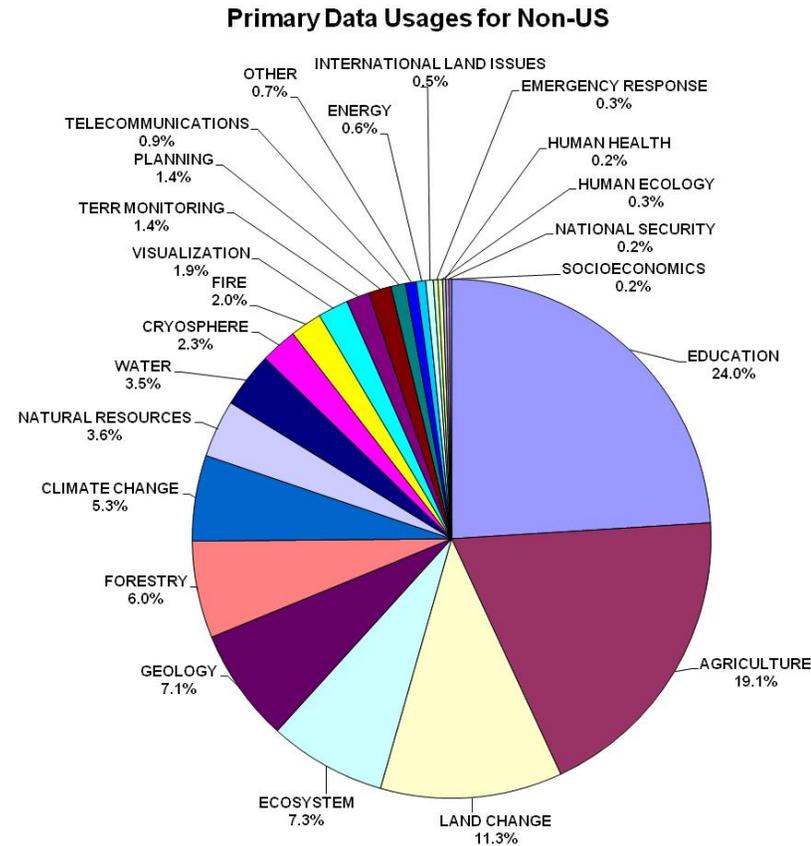
User Reported Other Use of Landsat (Oct 1, 2008 – Mar 31, 2009)



User Reported Primary Use of Landsat U.S. Users Only (Oct 1, 2008 – Mar 31, 2009)

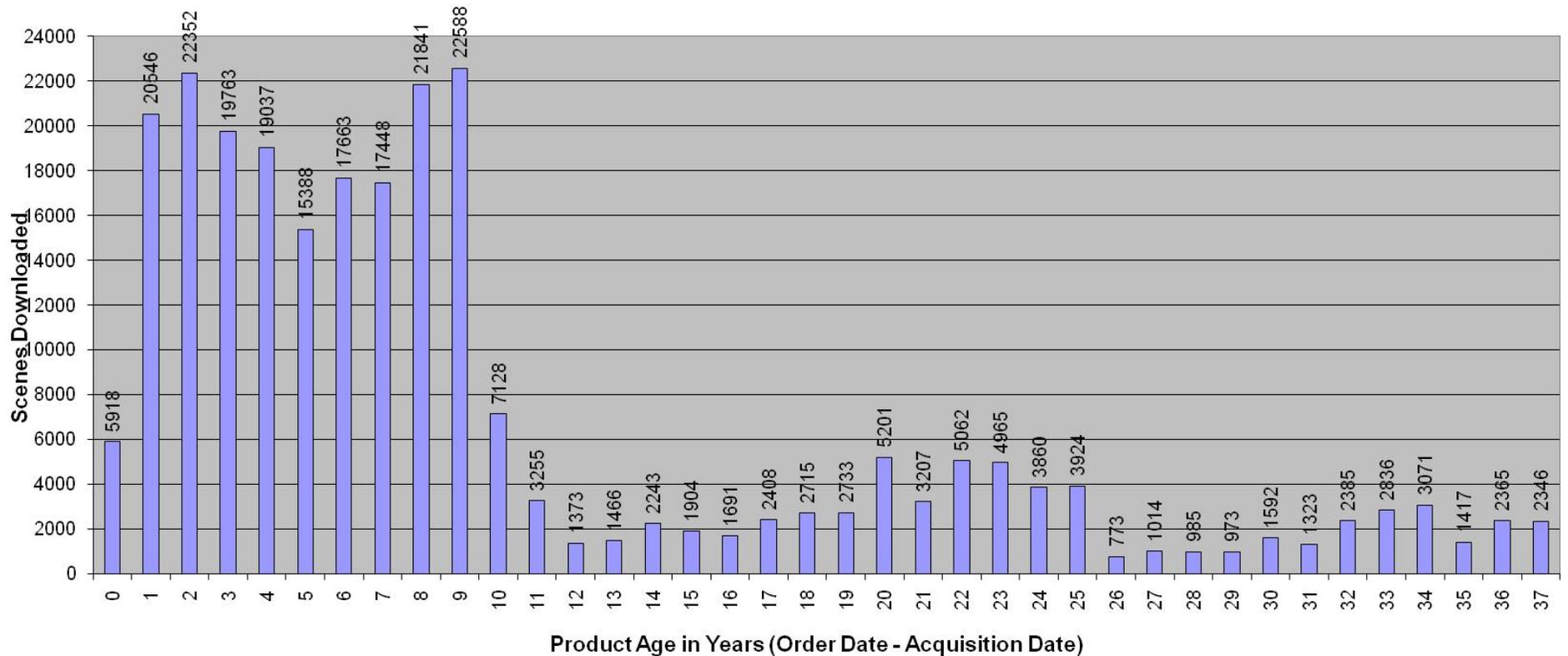


User Reported Primary Use of Landsat Non-U.S. Users Only (Oct 1, 2008 – Mar 31, 2009)

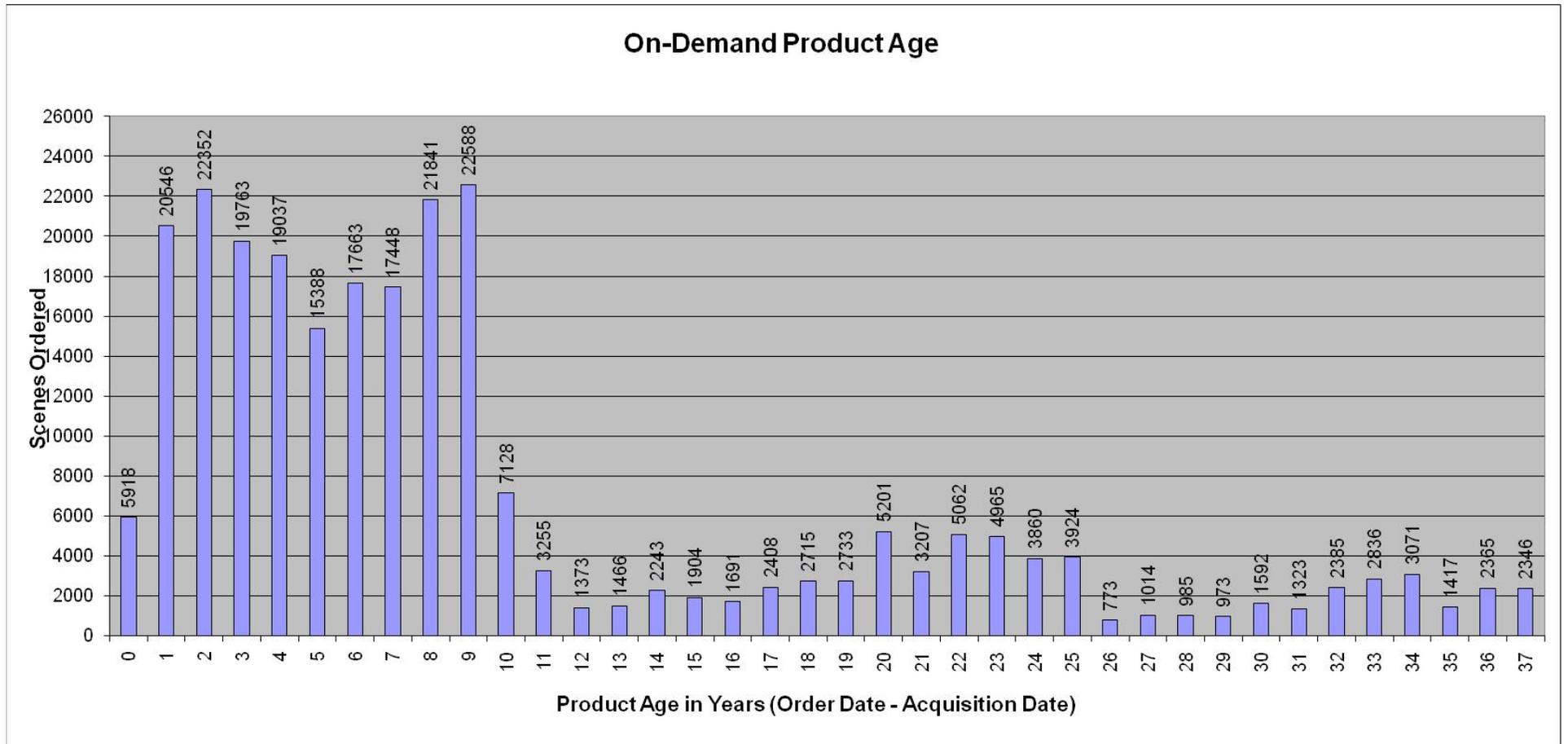


Age of Scenes Downloaded

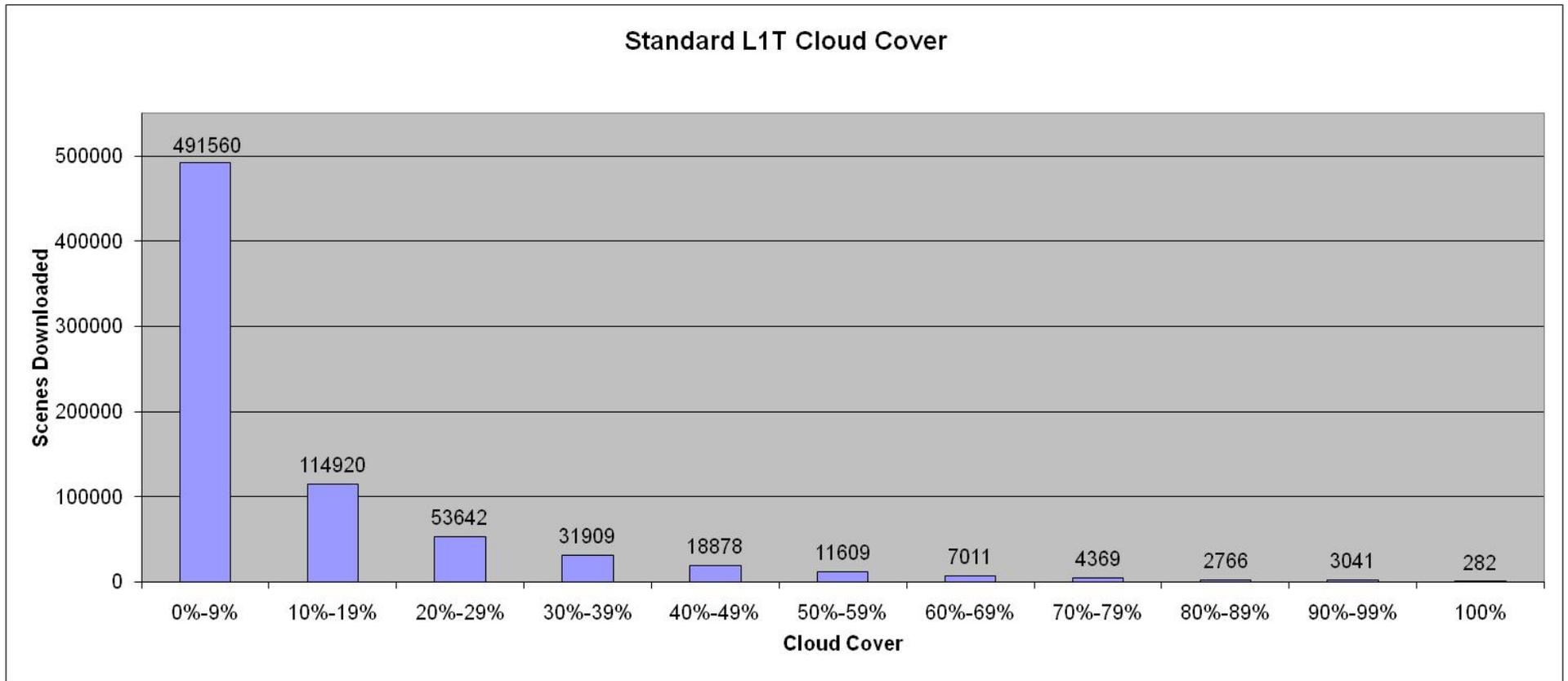
Standard L1T Downloads Product Age



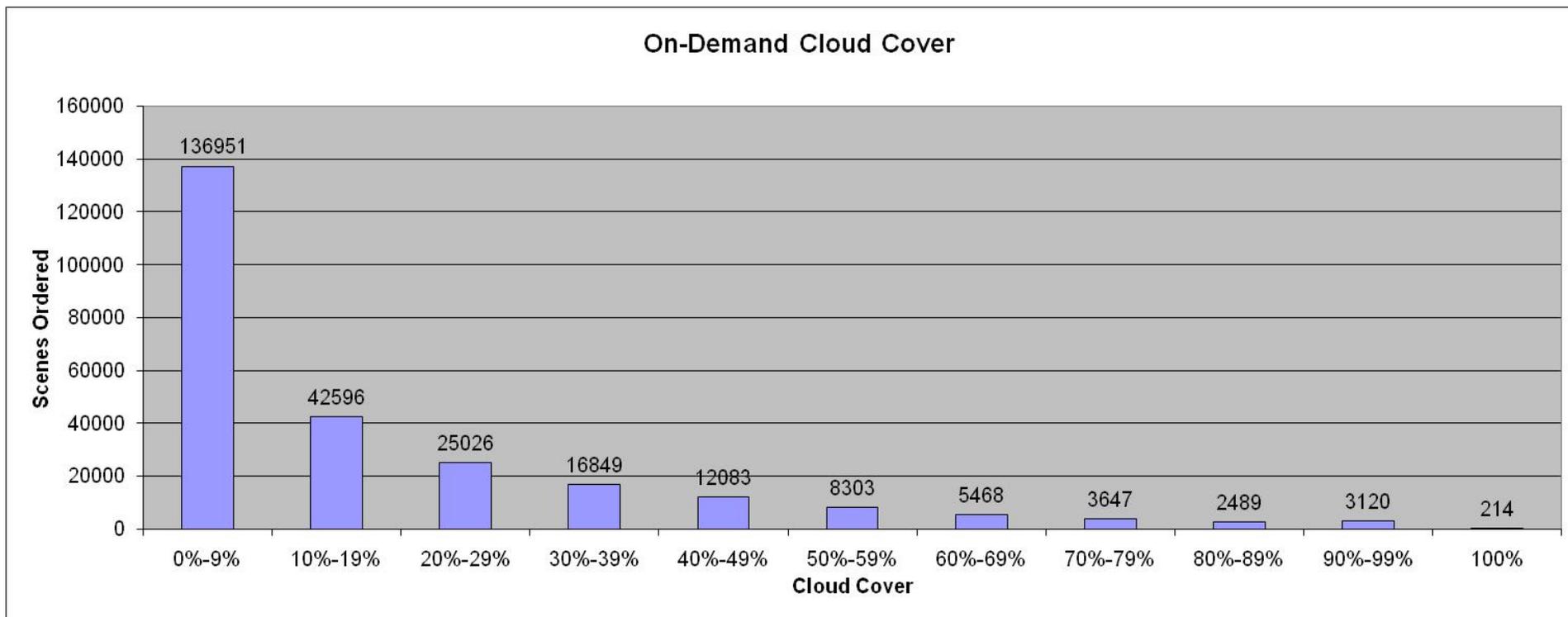
Age of Scenes Ordered from Archive



Cloud Cover of Scenes Downloaded



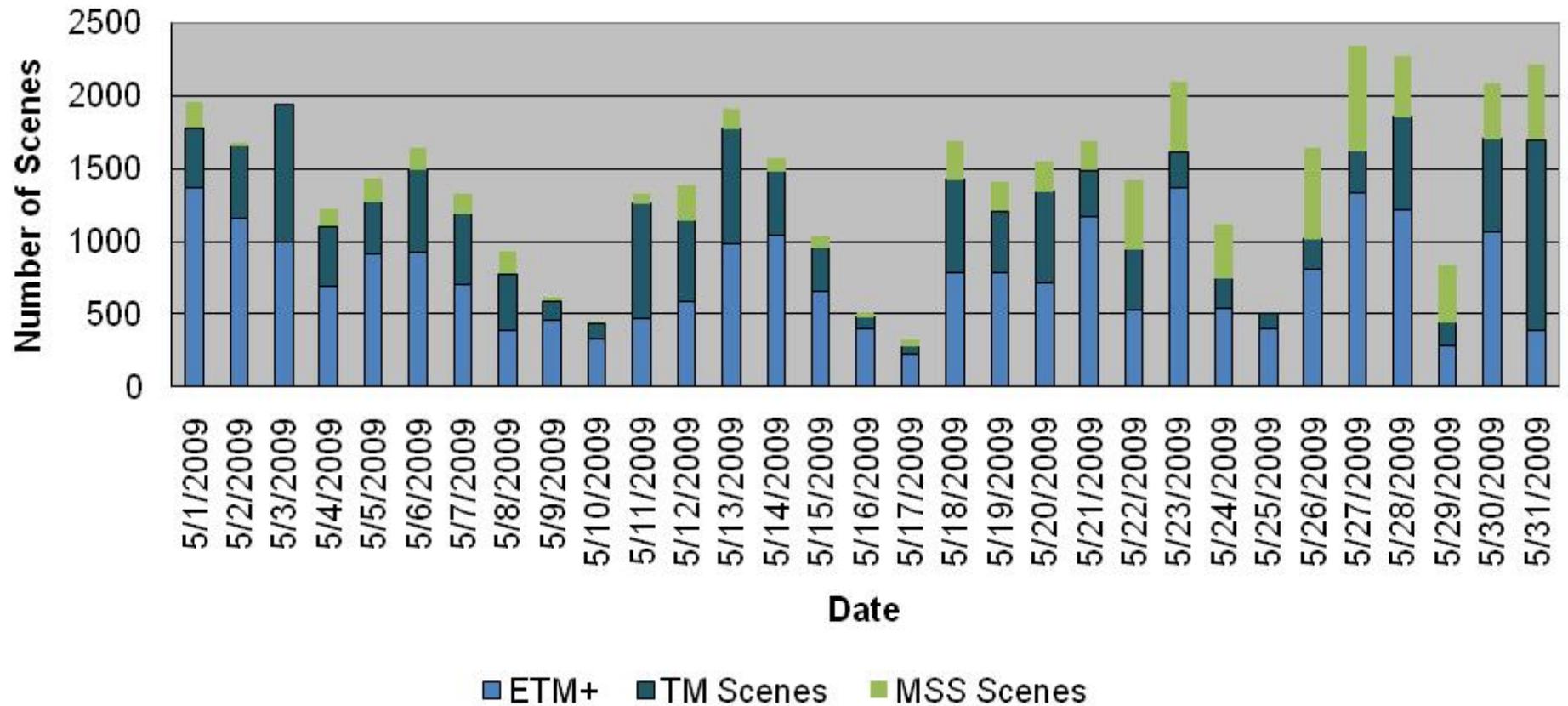
Cloud Cover of Scenes Ordered from Archive



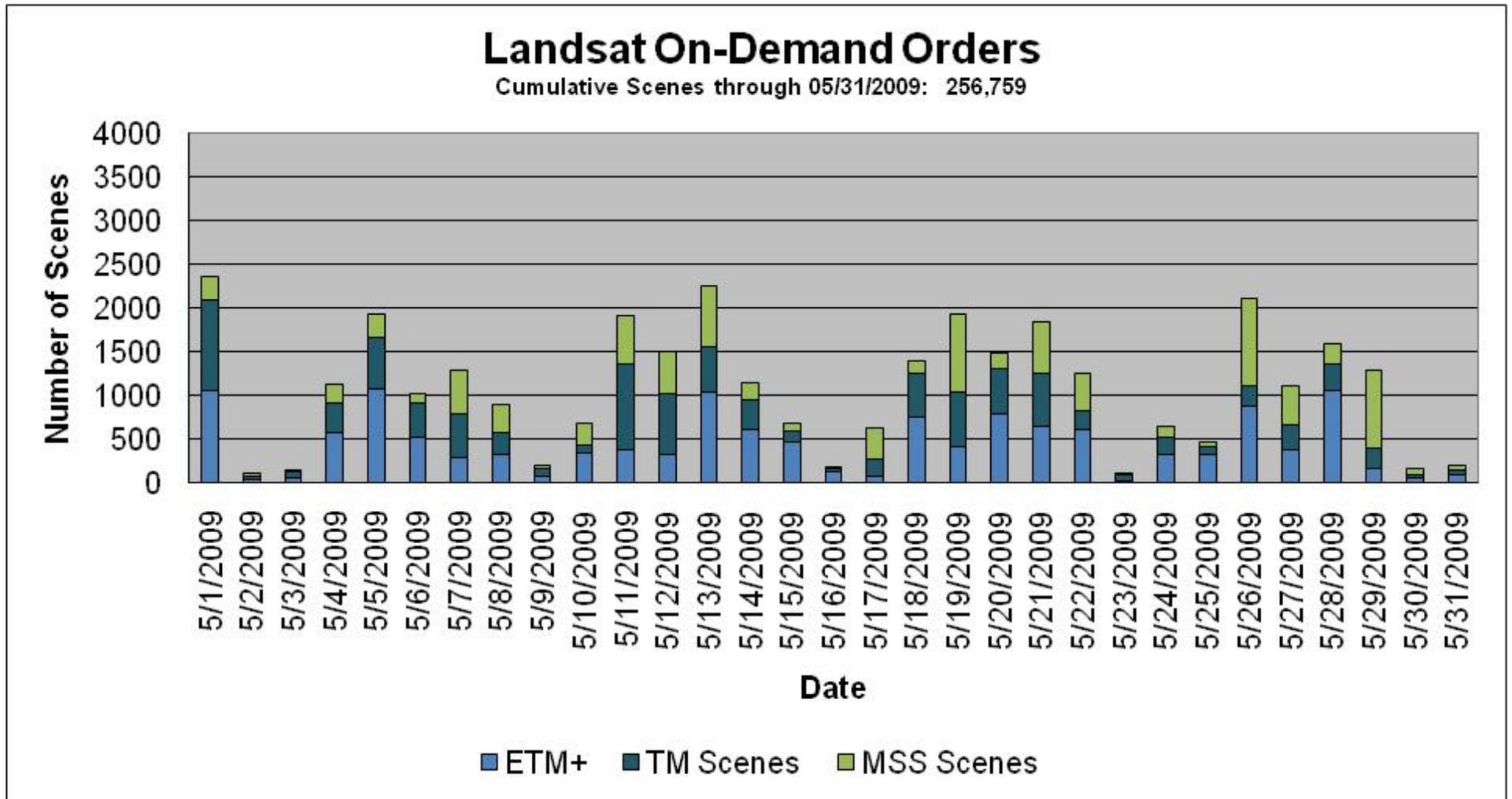
Daily Processing

Landsat Standard L1T Scenes Available on FTP Server

Cumulative Scenes through 05/31/2009: 275,407



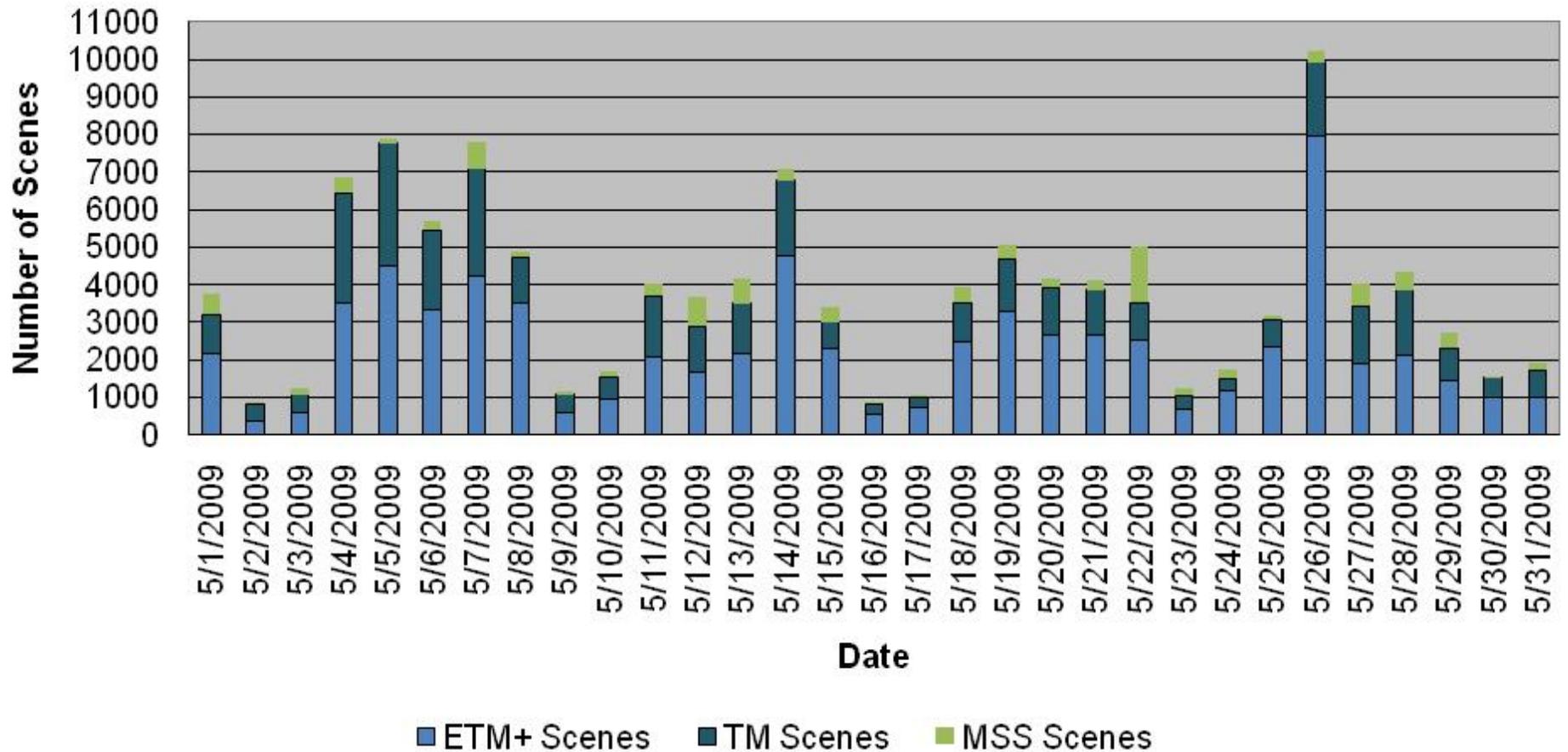
Daily On-demand Orders



Daily Downloads

Landsat Web-Enabled Downloads

Cumulative Scenes Downloaded 10/01/2008 through 05/31/2009: 744,165



Most Recent Customer Responses

1. I would very much like to know if you have a function that allows one to automatically download all downloadable images within the Landsat Archive for a certain image defined by WRS2 path/row?
2. I am now unable to open the TAR files (using WinZip or PicoZip Version 4.01). (RMKH: Both should work)
3. The link sends me to a page where I can then download the wrong image. (RMKH: an internet cache problem)
4. We are interested to purchase Landsat 7 imagery SLC-Off GAP FILLED which was acquired after 2003.
5. I got some error message when I tried to unzip the following ETM+ scene. (RMKH: Reprocessed the scene)
6. I was wondering if USGS offers a deal where I can purchase Landsat 7 images that are corrected in 2008 - Present for the whole United States?
7. My study area is Located in Libya around Tripoli city. I would be very happy if you could help me to collect some remotely sensed data.
8. How can I get them by buying or other ways? <preceded by a list of 13 L5 scenes>
9. I think GloVis is great and the service you provide is excellent!
10. Data sharing is very good

Most Recent Customer Responses

1. I would like L5 data over China.
2. User got a “missing file name” error. Investigating, but suspect it’s part of reprocessing effort.
3. Are Landsat data available for 2007 ? and what is SLC means ?
4. How many bands of the Landsat 7 available and which they are?
5. Can we ask Landsat imagery for two seasons like say for season April, May, June and Season October, November and December for the same year?
6. We do have internet connection and it is not that high speed to go into the website and search the catalog and make the order ...could we think of another method to make the order .
7. I have become fan of your service. I was thinking that I will not be able to using <remote sensing and GIS> due to financial constraints. Now, I can convert my dreams into reality using your admirable services. I am very much happy and express my sincere thanks to you all.
8. LE715202820022313GS00 is missing file name and will not download. (user had a typo in the scene ID).
9. There are no images in China between 1982 and 1985.
10. Will Landsat5 images from 1990-2000 become available for Path 203 & 204 Row 46? (Africa)

Top 10 Customer Responses

1. I would like to know how to order. How long we will get and How much for the prices?
2. There was a typo in my email address. Is it possible to fix this for my order?
3. Could you help me source an image from landsat 5 and between 2007 and 2009 with less than 10% cloud cover. There seems to be a big gap between 1995 and 2008.
4. I want to download the following Scenes, would you please help me in checking their availability. (A list of 168 scenes followed)
5. Is it possible to download all this data by use of a download script? Or can the following data be requested on a CD/DVD?
6. Would you please provide the facility to download all Landsat 5 TM images.
7. Too many sign in issues!
8. Thank you for tour excellent service
9. Thank you for the excellent service, very fast and professional. I have downloaded about 20 images without any problem congratulations
10. I am writing to ask you for advice in investigating the distribution of the Hairy Nosed Otter (*Lutra sumatrana*) in Asia. writing to ask if there are any satellite maps of this part of Asia which would help us to identify this habitat.

Top 10 User Comments

- I would like to let you know that I am very pleased with the result. It is very convenient that you remove imagery that is not successfully processed from Glovis; a very nice feature, as I will then not encounter these again when expanding my library of early Landsat imagery. Thanks for a great service and best regards.
- I was planning on using the image for a class project and no longer need it. You may cancel this order.
- We'd like to infill our archive with additional scenes each year. This could mean downloading over 10,000 images (depending on what will be available). At the current recommended download limit of 25 scenes per day this would take a very long time. Is there a way of bulk downloading or copying data onto a large external hard disk? We may be able to pay for this e.g. as a contribution to someone's salary.
- How likely is it that you will obtain the additional imagery currently held by Geosciences Australia and can make that available on-line during the next say 2 or 3 years?
- I need international L5 information.
- This is a great site. Thanks.
- The data is nice and helpful. For my case i have some request because i want to do image processing analysis to get land use of my country which is an input in my research about monitoring water quality from nonpoint source pollution. Thank you very much for it is really helping student in developing country who cannot afford, though in good quality, the satellite image they need for their study. Thousand times, thank you.
- Why are there no Landsat 5 data over Iceland?
- Thanks much - Earth Explorer has saved my Masters degree
- There's an international Landsat 5 TM scene that does not appear in the GLOVIS listing at all, as if it never happened. But why is this scene and other similar vintage scenes missing from the GLOVIS listings?

15 – 20 Most Recent User Comments

- I am very favorably impressed by how quickly orders for two Landsat TM images were made available for download -- within two hours of the request!
- **On behalf of the people of Myanmar and myself; we are most grateful for the contribution of your organization. This data set will be used in mangrove rehabilitation planning important for disaster risk reduction implementation of Nargis cyclone affected areas.**
- Now that more maps of my area are online, I find the system useful and easy to use. It was a bit confusing to find the page and learn how to use it the first time, but now that I have, it is indispensable to my work.
- Keep up the good work!
- If we had had a program of free imagery like this when Landsat TM first came out, Landsat would have been widely accepted far more rapidly.
- Thank you for all images of landsat... help me in my researches in geographie " remote sensing" in my region
- Free Data is invaluable for students and novice learners of GIS related technology.!!!
- Thank you for you high quality of on-line service.
- Well Done... Thanks for the quick turn around.
- Nice to be able to download immediately and not wait for it to be shipped!
- "Great system I have has no problems with it at all. You guys have done a great job."
- "I downloaded two images perfects, Landsat TM 4-5, that are very useful for my homework, I will use for a final project of a posgrade course.
- Thank you very much por this products.
- I appreciate the USGS policy to provide the free Download data. This give us opportunity for better research and education to improve knowledge and service for the human being.
- The cubic convolution resampling of the "standard recipe" blurs the edges of the gaps and makes it difficult to combine data from multiple images. The gaps can no longer be identified by a DN value.
- Constant failed requests to download. Maybe you should create a FTP download option to navigate to for downloads? This one seems to be failing.
- The only problem with this data obtention is the time, but the service is very good.
- It is not clear how to open the file. ENVI dos not open the file