



Landsat Project Status

Landsat Science Team Meeting

January 2009

Presented By:

Kristi Kline, PMP

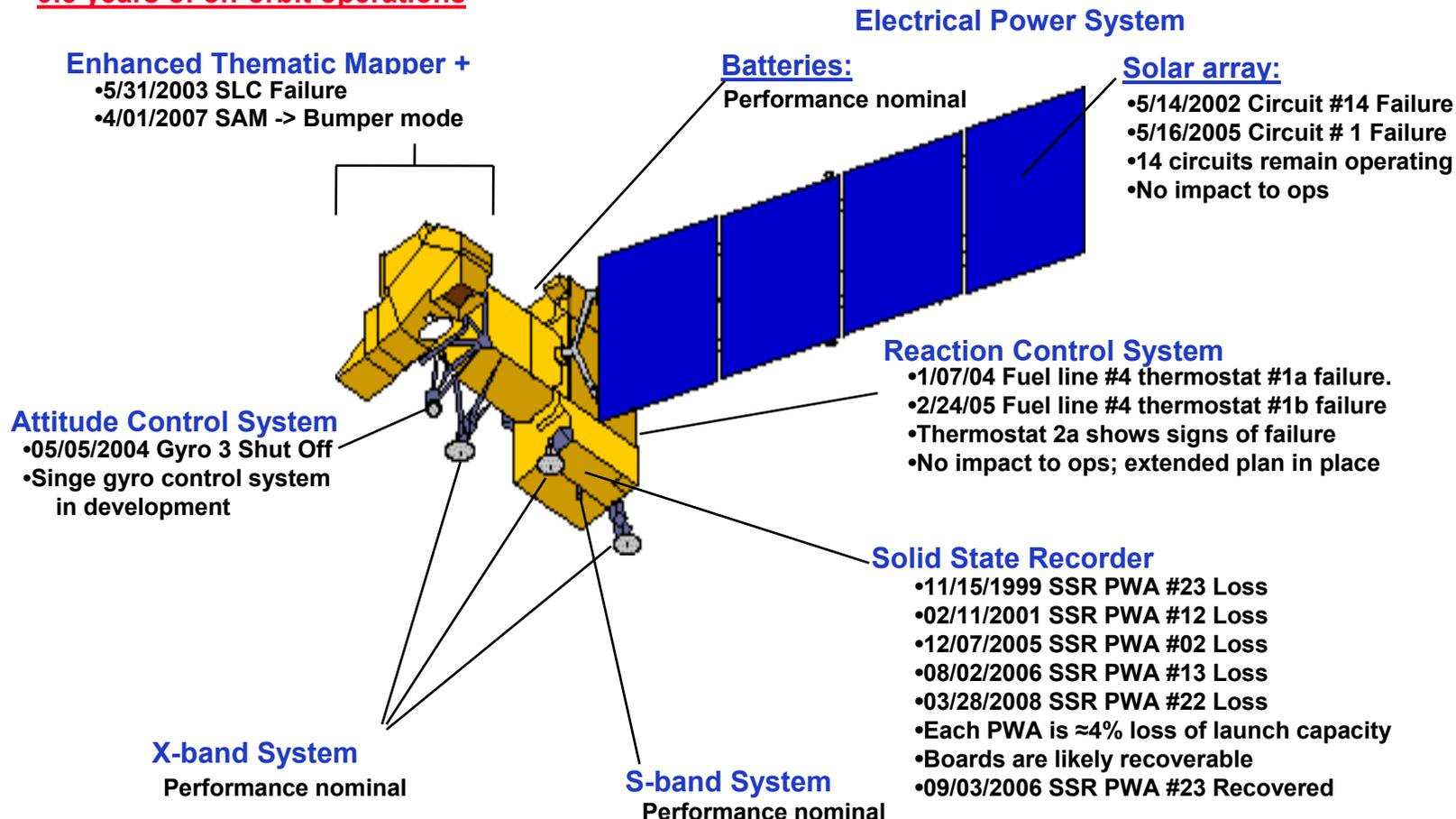
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Satellite Segment

Landsat 7 Flight Segment

9.5 years of on-orbit operations



Space Segment - Landsat 7 Status

- **Attitude Control System**

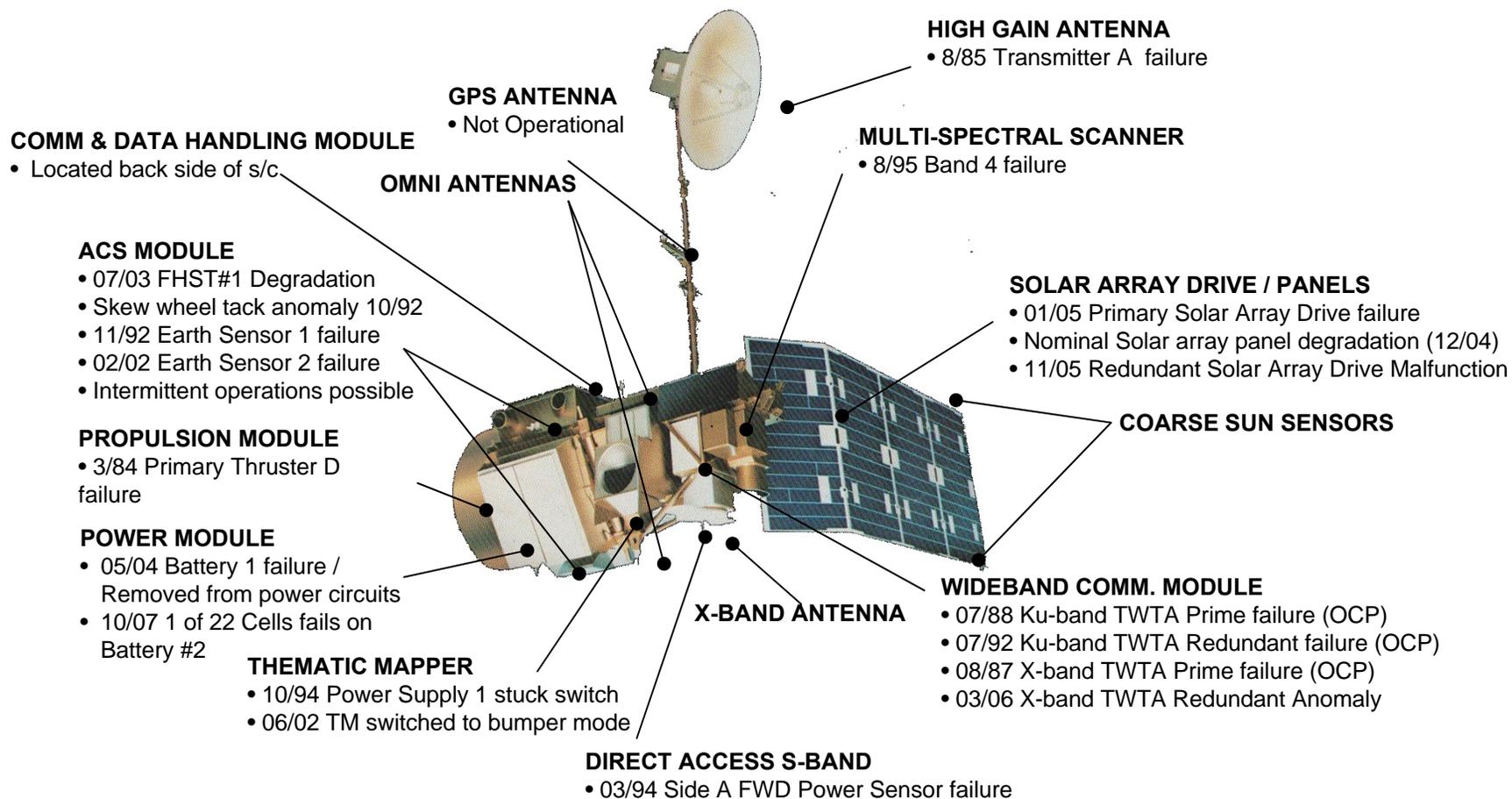
- ◆ Inertial Measurement Unit (IMU) Gyros

- Gyro 3 (of 3) shut down due to vibrations in 2005
- Gyros 1 and 2 operating nominally
- Began work on a single-gyro flight capability in 2005
 - ◆ Have current capability to maintain pseudo-stable flight with maneuver capability with 1 gyro.
 - ◆ Working with Lockheed-Martin and Honeywell on rate estimator that will provide up to an order of magnitude better performance with greater consistency
 - Approach validated on simulator
 - Algorithm being refined to fit within in processor capability
 - New mathematical approach delivered to flight software for evaluation
 - ◆ Completed review of simulator estimation code with Ops -- Code is being reviewed for feasibility of implementation by FSW engineer
 - ◆ Currently evaluating estimator performance sensitivity to spacecraft uncertainties to show estimator performance as a function of the level of knowledge of these spacecraft parameters. Purpose is to identify whether any special calibrations need to be performed by the Ops team to obtain requisite pointing performance using the estimator.
 - Solar array torques and momentum
 - Vehicle mass properties
 - Thruster force and torque
 - Gyro bias error

Space Segment - Landsat 7 Status

- **SSR PWA recovery test successfully run Sept 3rd**
 - ◆ 1 PWA successfully recovered
 - ◆ 1 PWA unsuccessfully recovered
 - ◆ Test confirms that all boards likely recoverable following a full SSR power cycling. (Not recommended unless necessary)
- **Delta-Inclination Maneuver completed on October 7th**

Landsat 5 Flight Segment



Space Segment - Landsat 5 Status (Cont.)

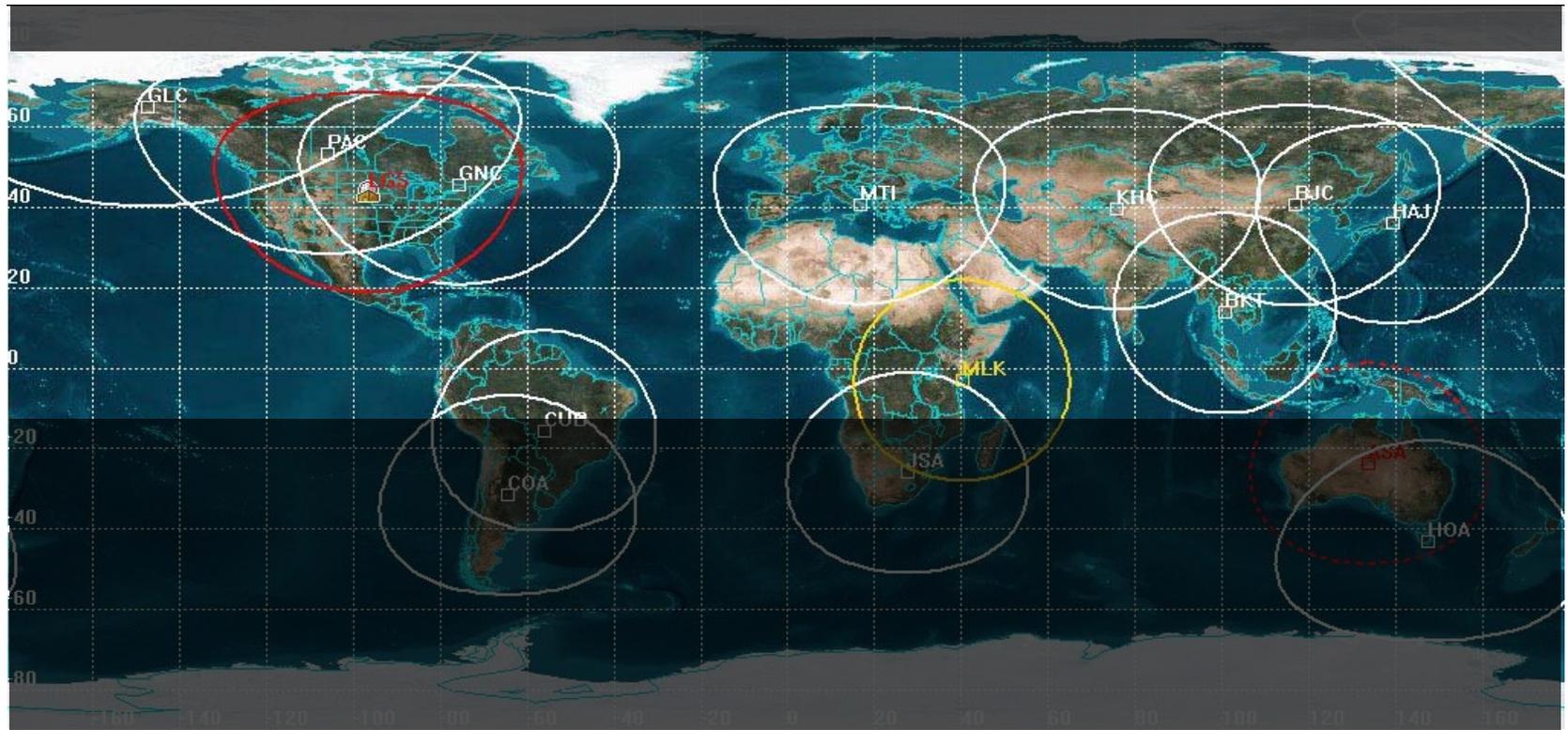
- **Ranging support for Lunar Reconnaissance Orbiter (LRO) completed successfully**
 - ◆ Proficiency passes will continue until LRO Launch
- **On-board Computer (OBC) Fix uplinked successfully on Sept. 9**
 - ◆ Fixes an erroneous halt command that could cause safe hold situation
 - ◆ Halt of the OBC would likely result end of mission
 - ◆ Same changes made on other mission with similar bus (EUVE, CGRO, and UARS NSSC-1)
- **Battery issues**
 - ◆ Still working on management of power balance between two remaining batteries

Space Segment - Landsat 5 Status

- **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
 - ◆ Flight Operations will perform outgassing of the instrument after the end-of-year rollover
- **Delta-Inclination Maneuver completed on November 5th**
 - ◆ Plan for three 22-minute burn windows
 - ◆ Burns more efficient than expected
 - ◆ Possible additional Delta-I; enough pressure for a partial maneuver next year
- **Traveling Wave Tube Amplifier (TWTA) – X-band downlink**
 - ◆ Unusual start-up profile that began in June returned to normal profile, but at a reduced current (read: good)
 - ◆ TWTA Helix current remains between 2.7 and 2.8-mA
 - ◆ Periodic spike, but no “trips”

Landsat 5 Sun Angle Constraints

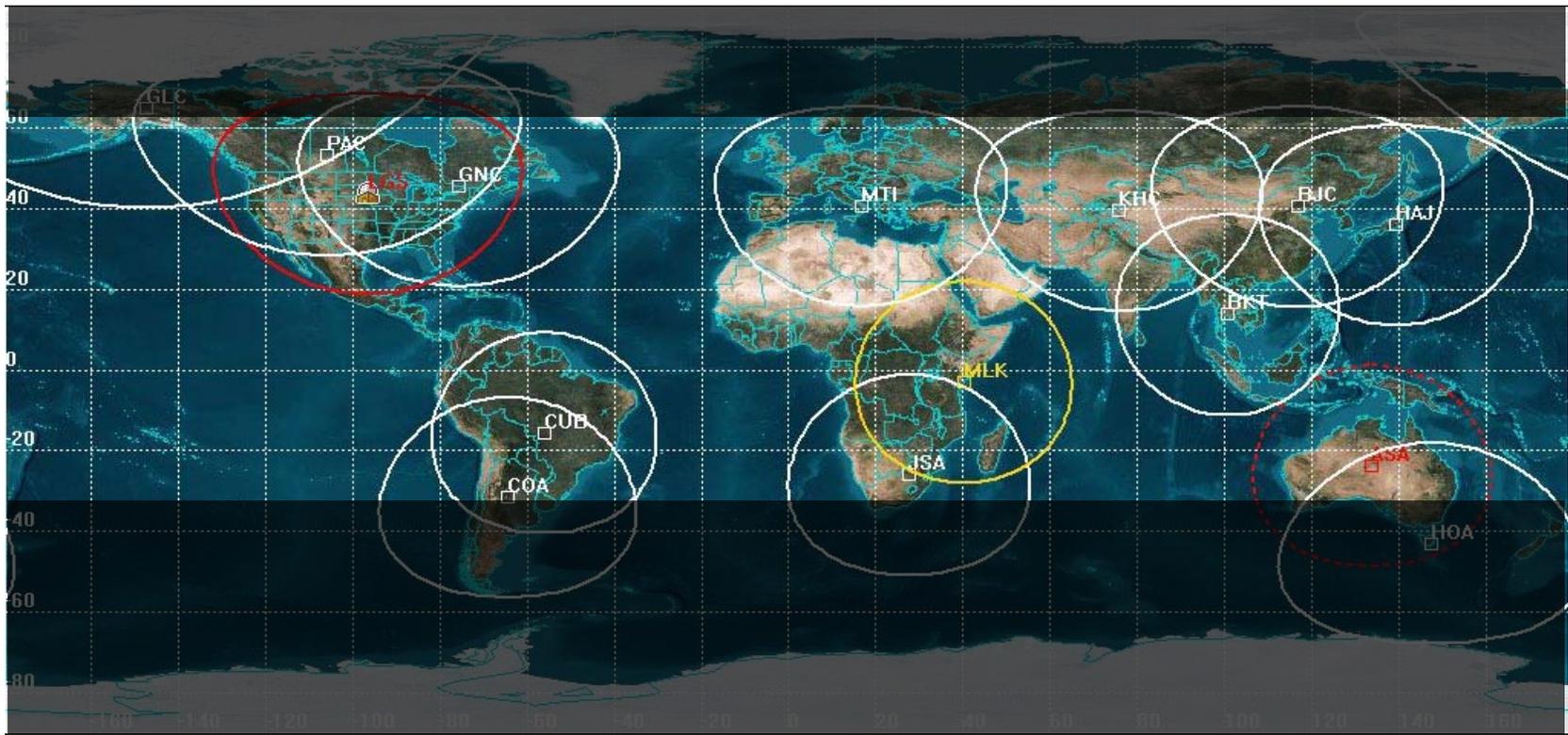
- Nominal coverage at summer solstice
 - ◆ June 21



Landsat 5 Sun Angle Constraints

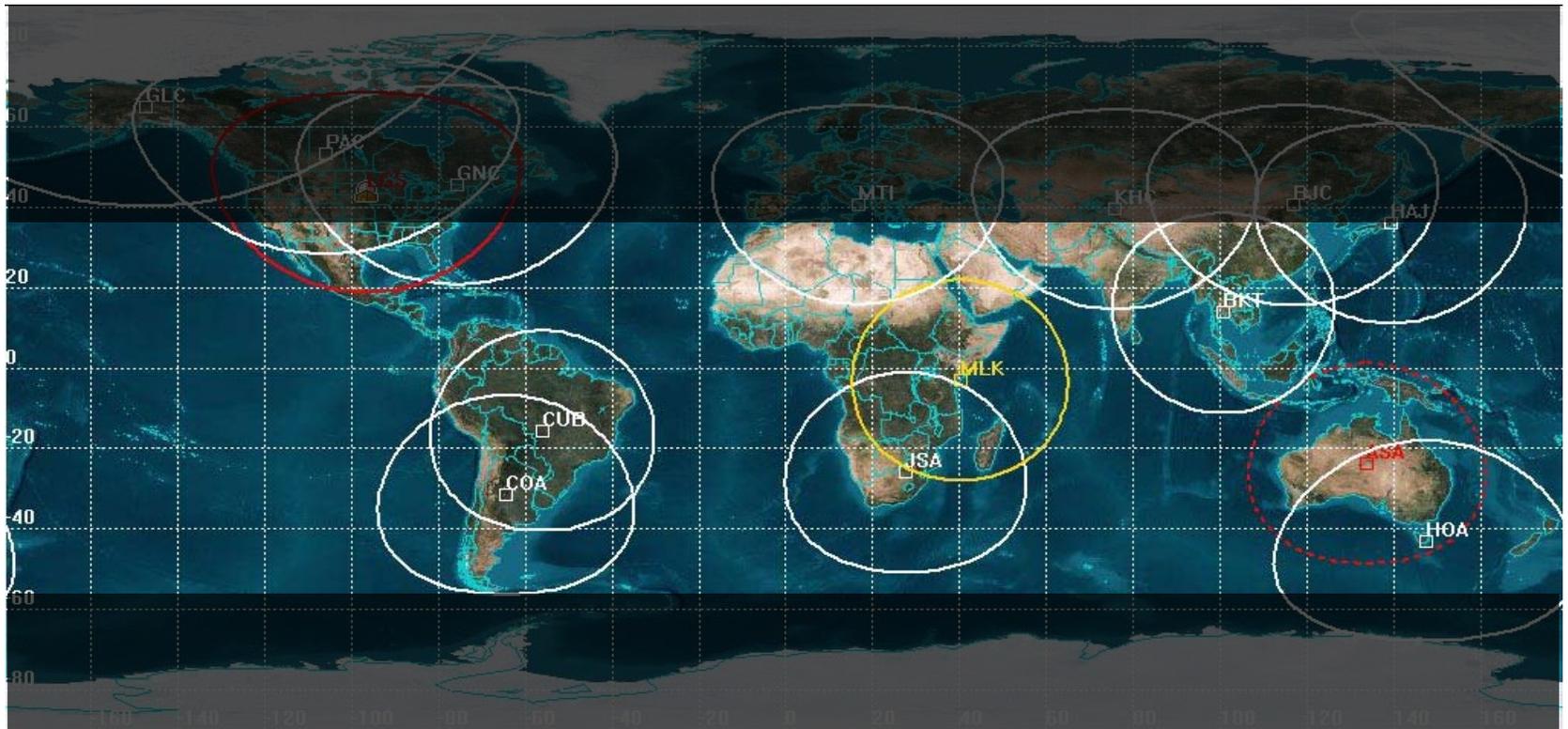
- **Nominal coverage at equinox**

- ◆ March 21
- ◆ September 21



Landsat 5 Sun Angle Constraints

- Nominal coverage at winter solstice
 - ◆ December 21



Ground Segment

U.S. Landsat Archive Overview

(Marketable Scenes through December 31, 2008)

- **ETM+: Landsat 7**

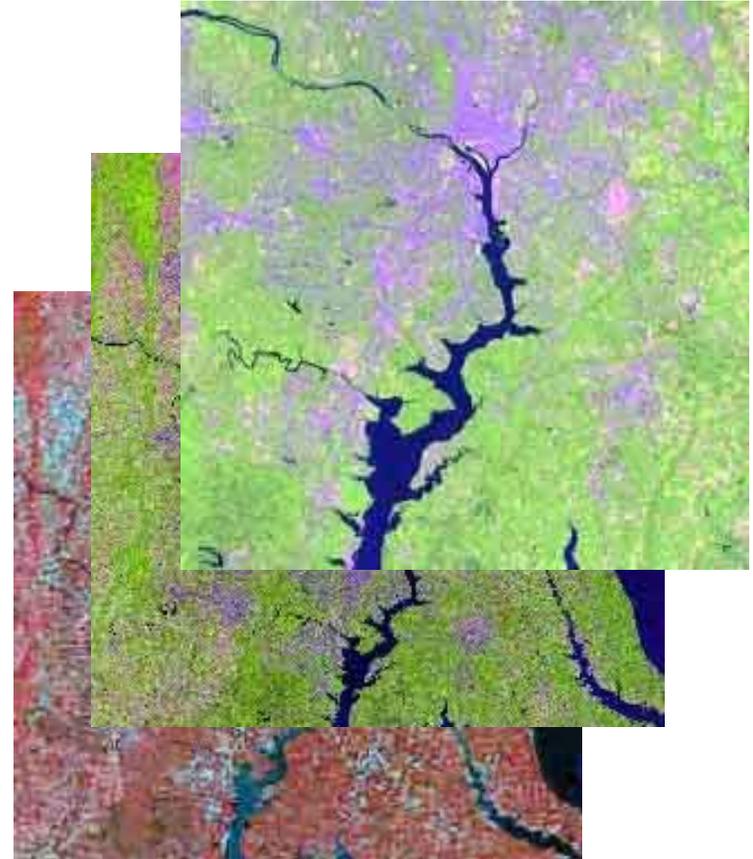
- ◆ 892,051 scenes
- ◆ 828 TB RCC and L0Ra Data
- ◆ Archive grows by 260 GB Daily

- **TM: Landsat 4 & Landsat 5**

- ◆ 780,191 scenes
- ◆ 391 TB of RCC and L0Ra Data
- ◆ Archive Grows by 40 GB Daily

- **MSS: Landsat 1 through 5**

- ◆ 652,173 scenes
- ◆ 20 TB of Data



Ground Segment Activities

- **Data Capture**

- ◆ 10-meter antenna – Completed repairs of S-band feed, install of new High Power Amplifier (HPA), and other maintenance items
- ◆ 5.4-meter antenna
 - Problem with S-band transmitter (Oct 6); Installed spare part
 - Completed Antenna Control Unit (ACU) upgrade (Dec 16)
 - Failure of HPA on Dec 15
 - ◆ Primary unit out for repair
 - ◆ 10-m Antenna will remain primary until repair of HPA

- **Archive**

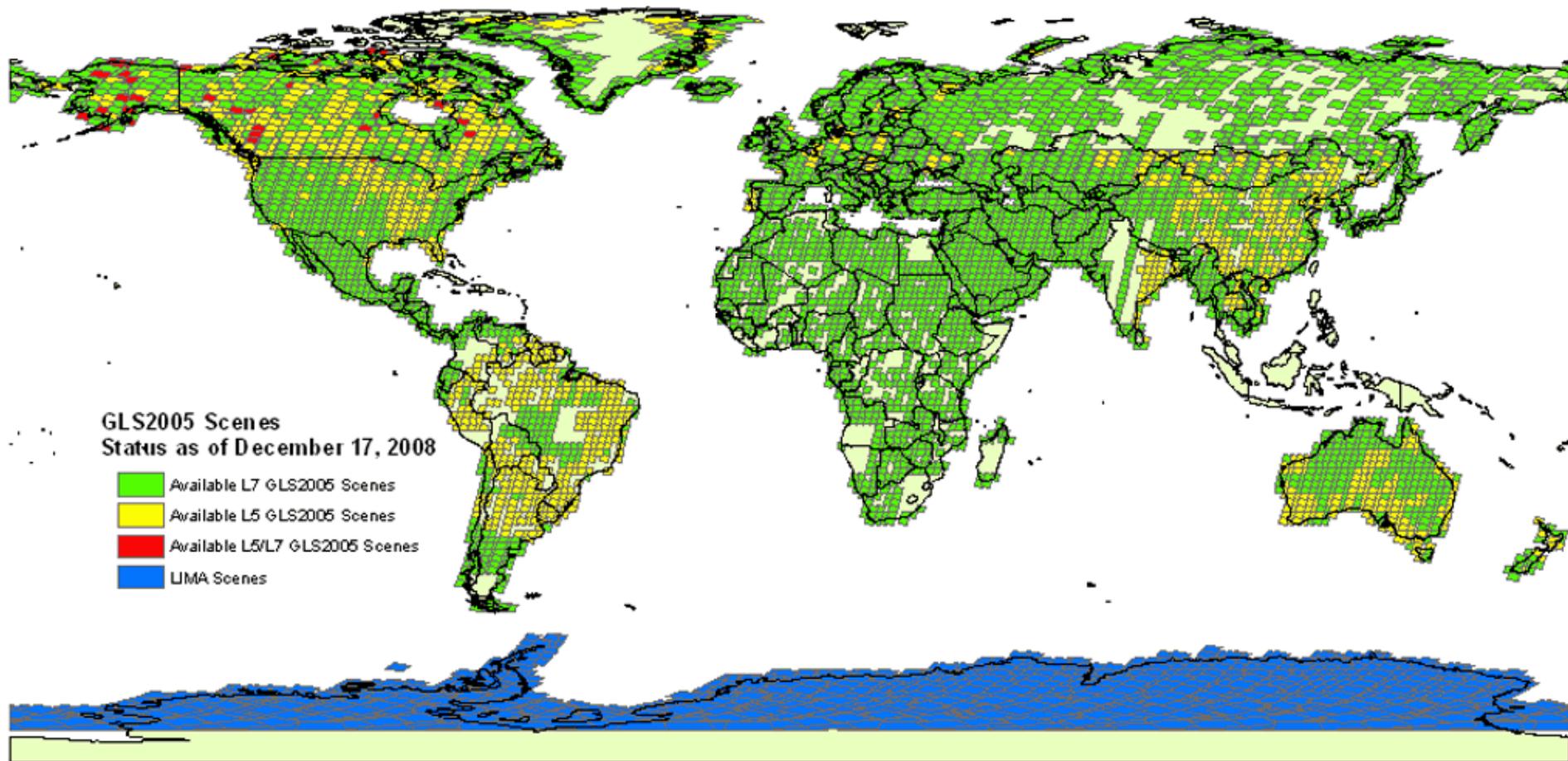
- ◆ Off-site archive
 - Continued work on off-site archive tape copies
 - ◆ 4074/4101 (99.34%) completed
- ◆ More tapes shipped to NARA managed limestone cave near Kansas City
 - 7 boxes – 10/17/2008
 - 2 boxes – 11/25/2008

Global Land Survey

MDA Federal Task Order

- **GLS2000 processing**
 - ◆ Completed all reprocessing and validation
- **GLS1975, GLS1990**
 - ◆ Metadata issues resolved
 - ◆ Two month extension granted to completed reprocessing
 - ◆ End of FY09 Q1 – all reprocessing should be completed
 - ◆ GLS1990 data validation near completion
 - ◆ GLS1975 data received
- **GLS2005**
 - ◆ L7 processing
 - Mostly complete
 - ◆ L5 processing
 - Processed North America
 - Processed portions of S. America, Europe, and Australia

GLS2005 Status



Landsat Global Archive Consolidation

- **Discussion with International Cooperators**

- ◆ Discussed at LGSOWG in September 2008 with participants
 - Positive feedback from most stations
 - Need to work details with each station individually
- ◆ Working with Canada (CCRS) on prototype delivery via the internet
- ◆ Brazil electronically delivered over 500 scenes for GLS2005
- ◆ Working on cost estimates for each station
- ◆ Discussing prioritization of target data or stations (I.e., get oldest data or at risk data versus easy stations with much data like Canada)

Web-enabled Schedule



Remaining Issues with Web-enabling

- **MSS Processing**

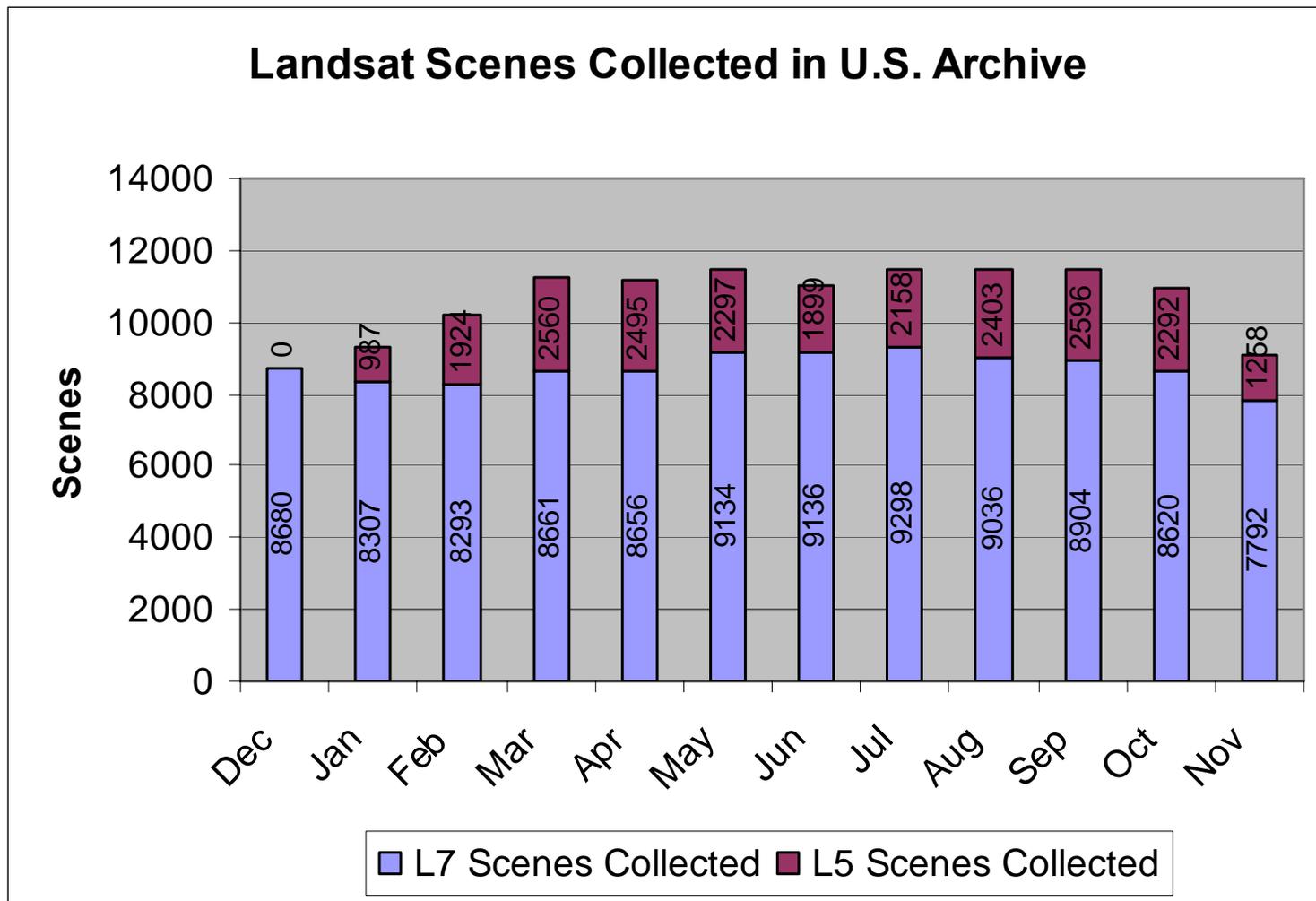
- ◆ NLAPS Ground Control Point (GCP) issue
- ◆ MSS L1T failure rate and speed
- ◆ Processing on LPGS

- **L4 TM on LPGS**

- **Bulk Server bottleneck and loading issues**

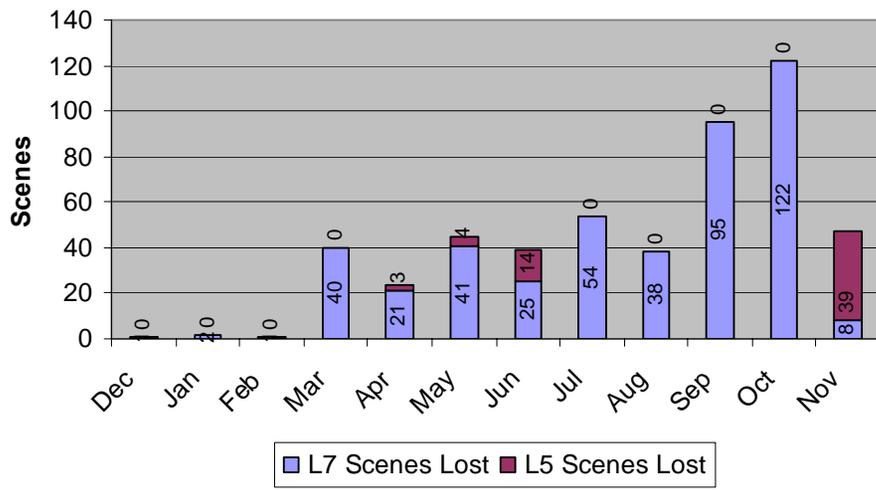
- **FTP space for processed products**

Landsat Data Acquired by Month



Capture Success Rate (CSR)

Landsat Scenes Lost
(Unsuccessful Capture Attempt)



- **October**

- ◆ Landsat 7 – 111 scenes lost from Australia due to equipment failures
- ◆ Landsat 7 – 11 scenes lost from Poker Flats due to operator error

- **November**

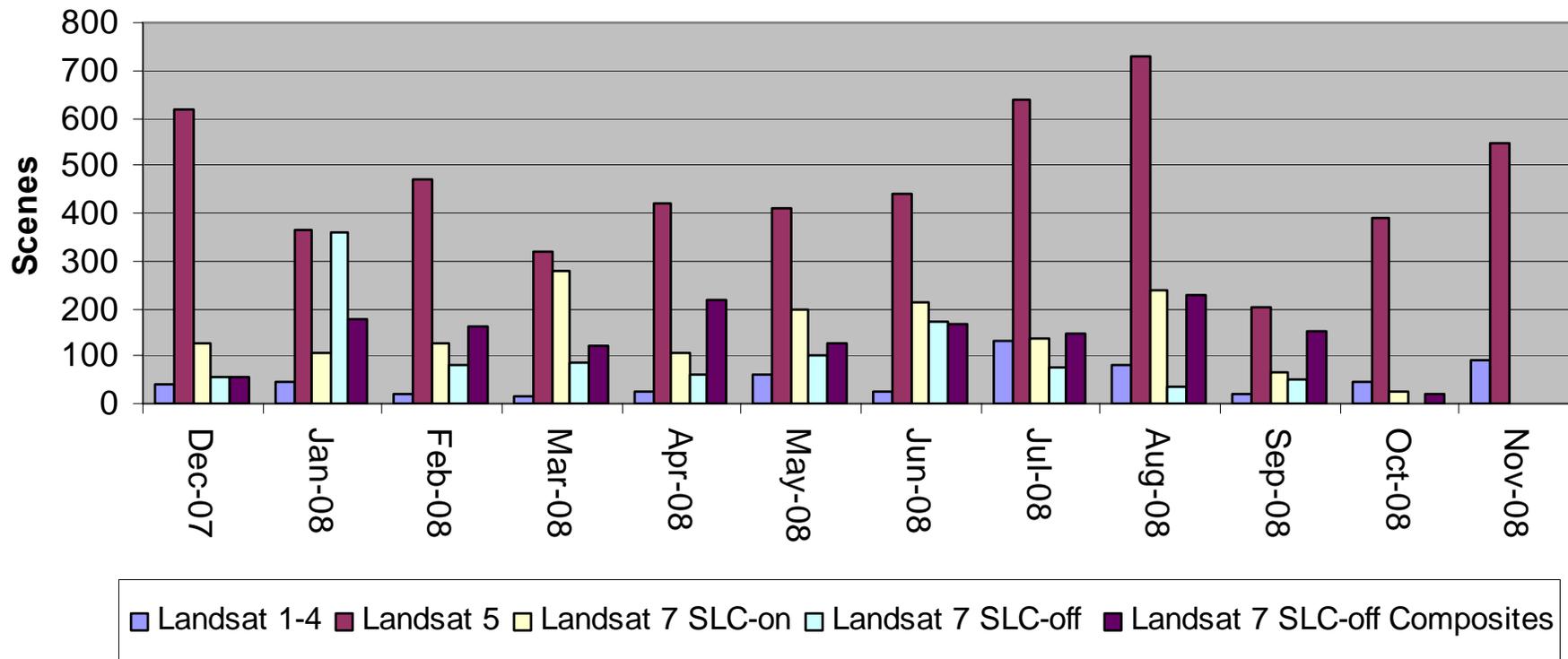
- ◆ Landsat 7 – 8 scenes lost from Australia due to equipment failures
- ◆ Landsat 5 – 39 scenes lost from Australia due to equipment failures

- **LGS (EROS) CSR for FY09**

- ◆ Landsat 5 – 100%
- ◆ Landsat 7 – 100%

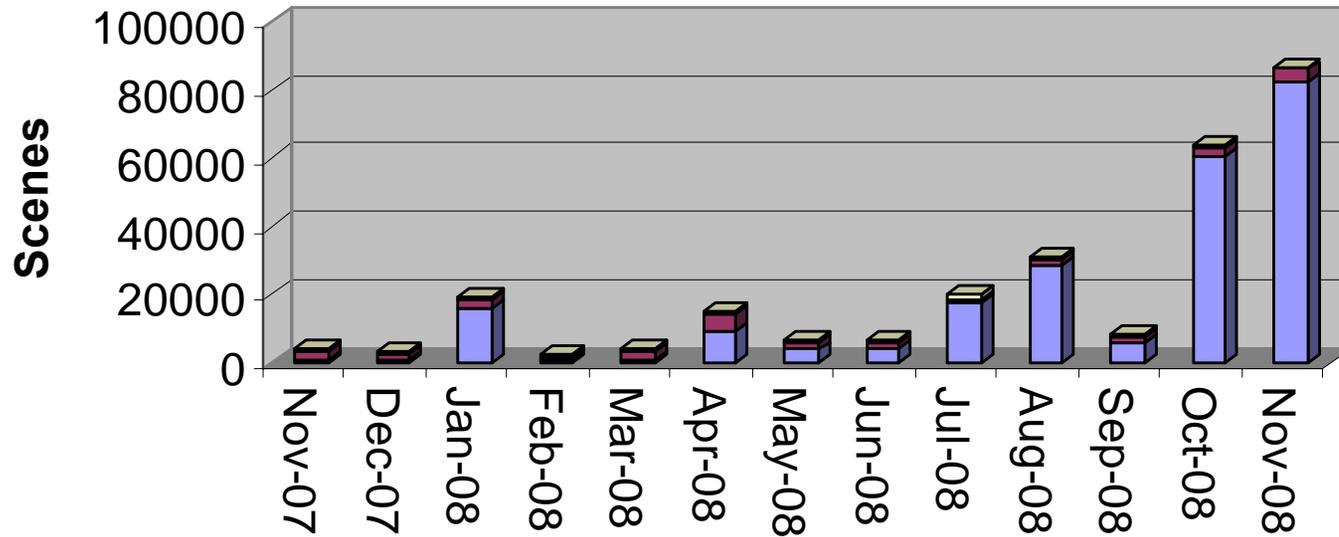
Landsat Sales by Month

Monthly Landsat Sales (Last 12 Months)



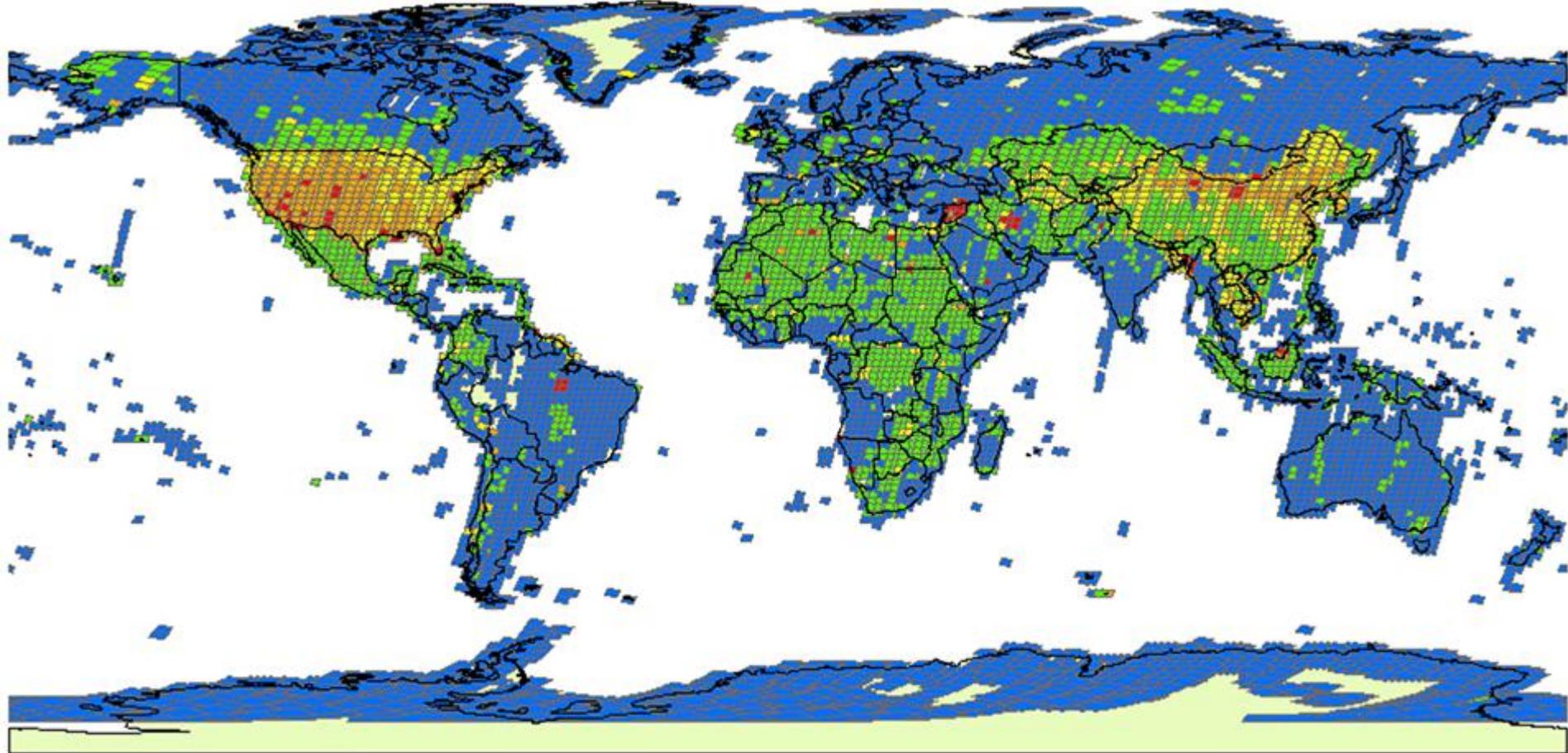
Total Landsat Data Distribution

Landsat Data Distribution



■ Landsat Free Downloads ■ Other Landsat Web-enabled Downloads ■ Landsat Products Sold

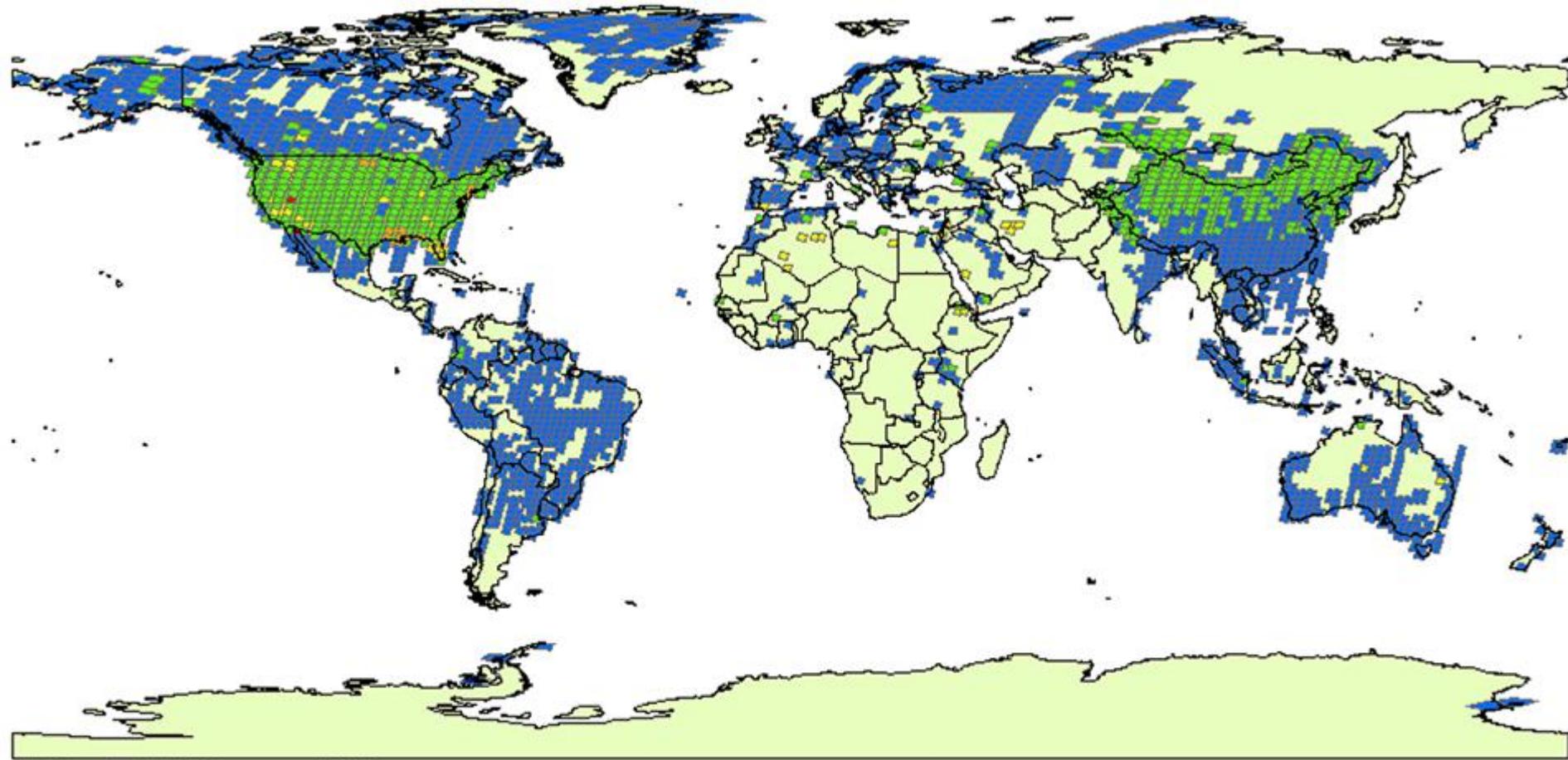
Scenes Processed (ETM+)



ETM+ Standard L1T Scenes on FTP Server
Status through December 31, 2008
124,326 Total Scenes
10,283 Unique Locations

1 - 10 11 - 30 31 - 55 56 - 92 91 - 211

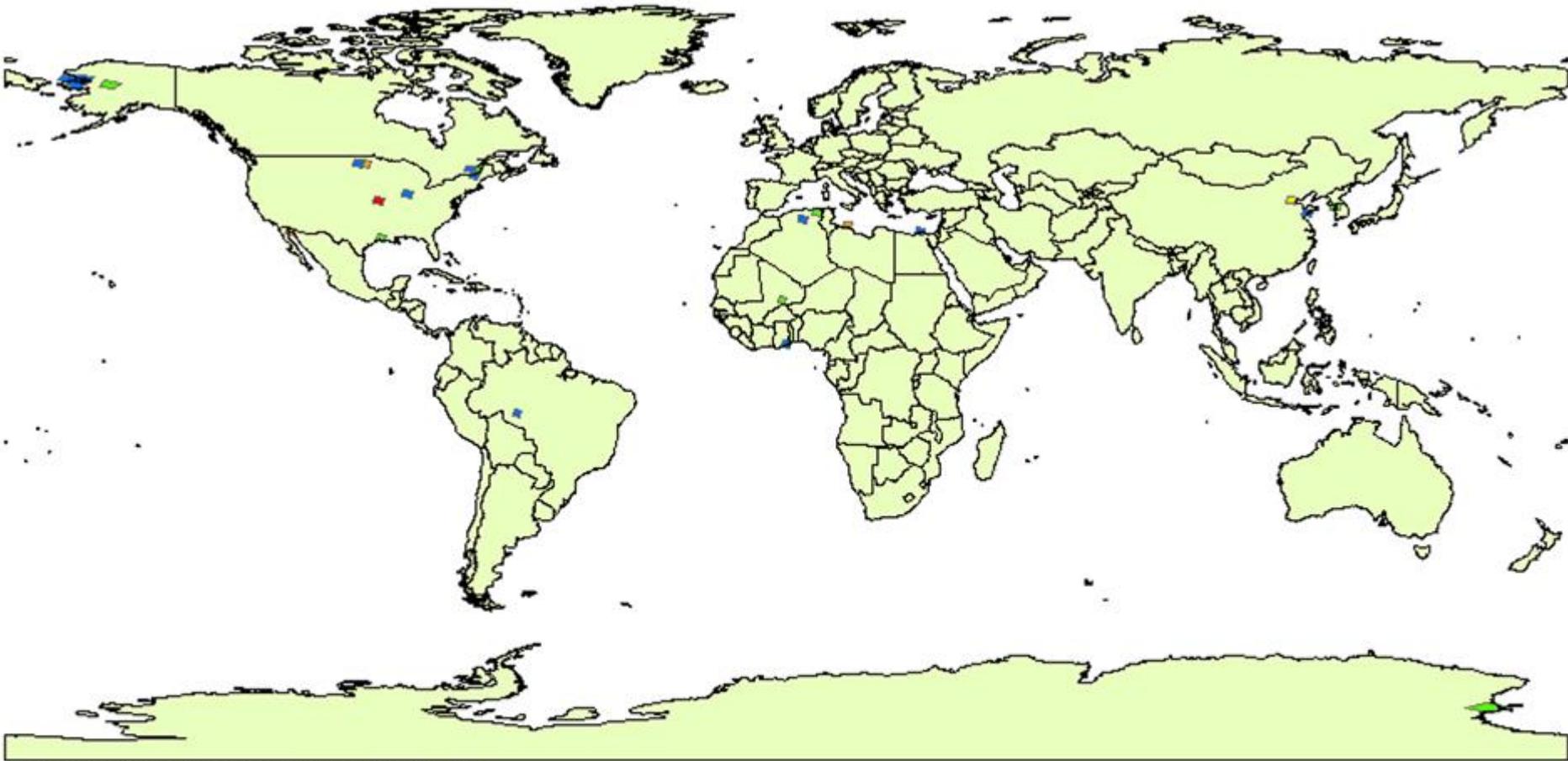
Scenes Processed (TM)



TM Standard L1T Scenes on FTP Server
Status through December 31, 2008
20,820 Total Scenes
2,989 Unique Locations

1-7 8-29 30-89 90-233 234-466

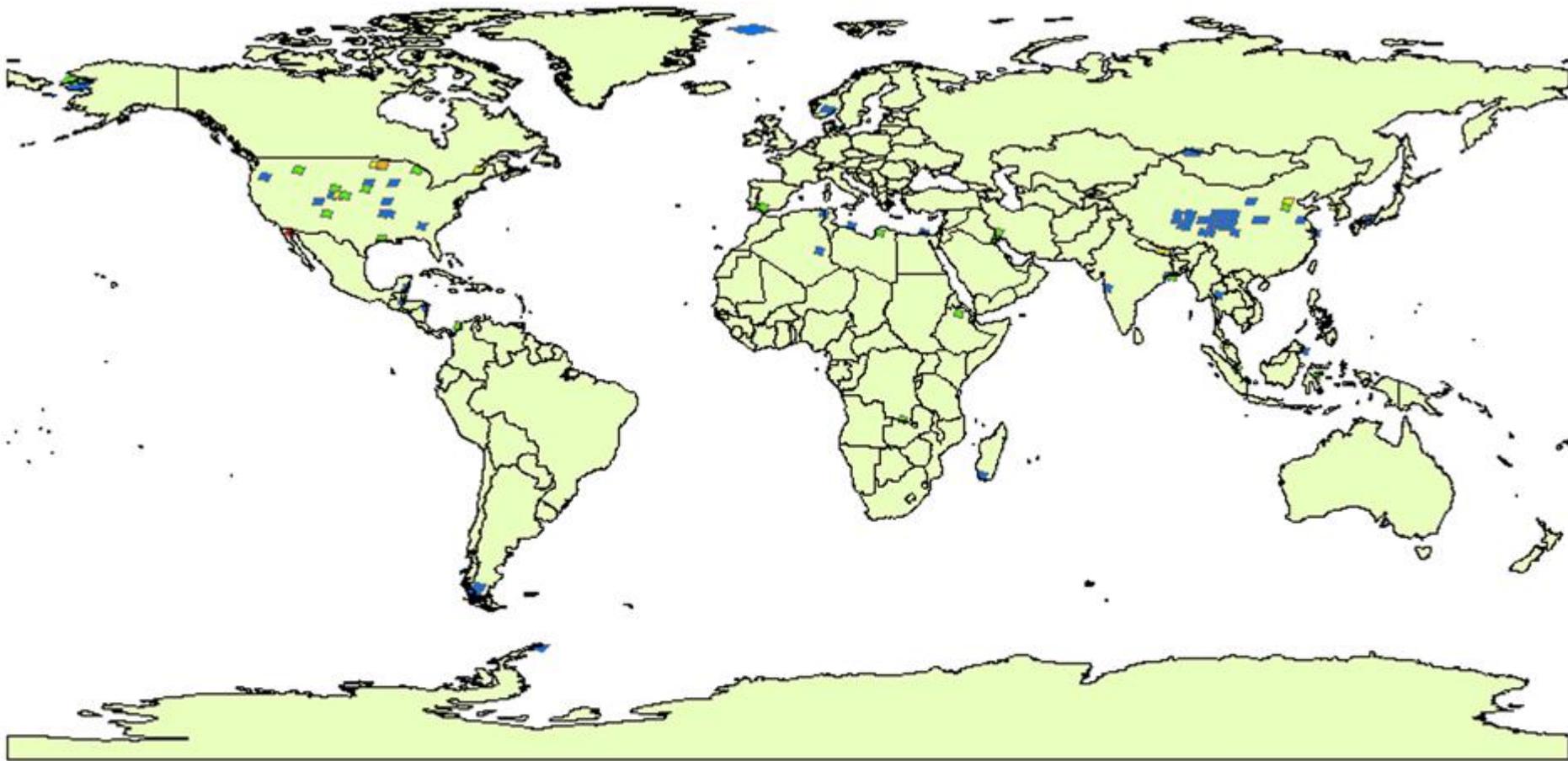
Scenes Processed (MSS – WRS2)



L4-5 MSS Standard L1T Scenes on FTP Server
Status through December 31, 2008
62 Total Scenes
25 Unique Locations



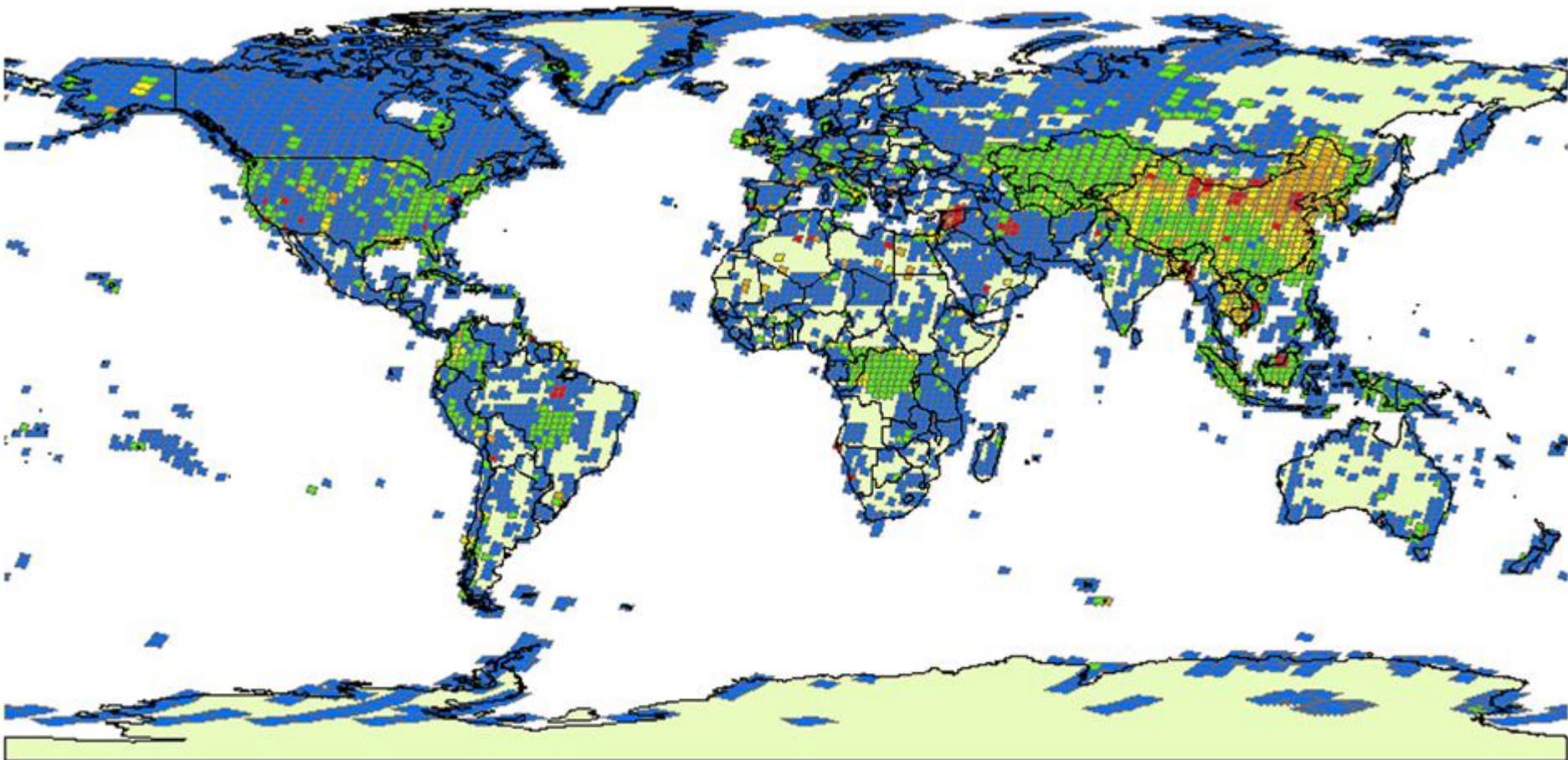
Scenes Processed (MSS – WRS1)



L1-3 MSS Standard L1T Scenes on FTP Server
Status through December 31, 2008
263 Total Scenes
89 Unique Locations

1 2-5 6-13 14-28 29-56

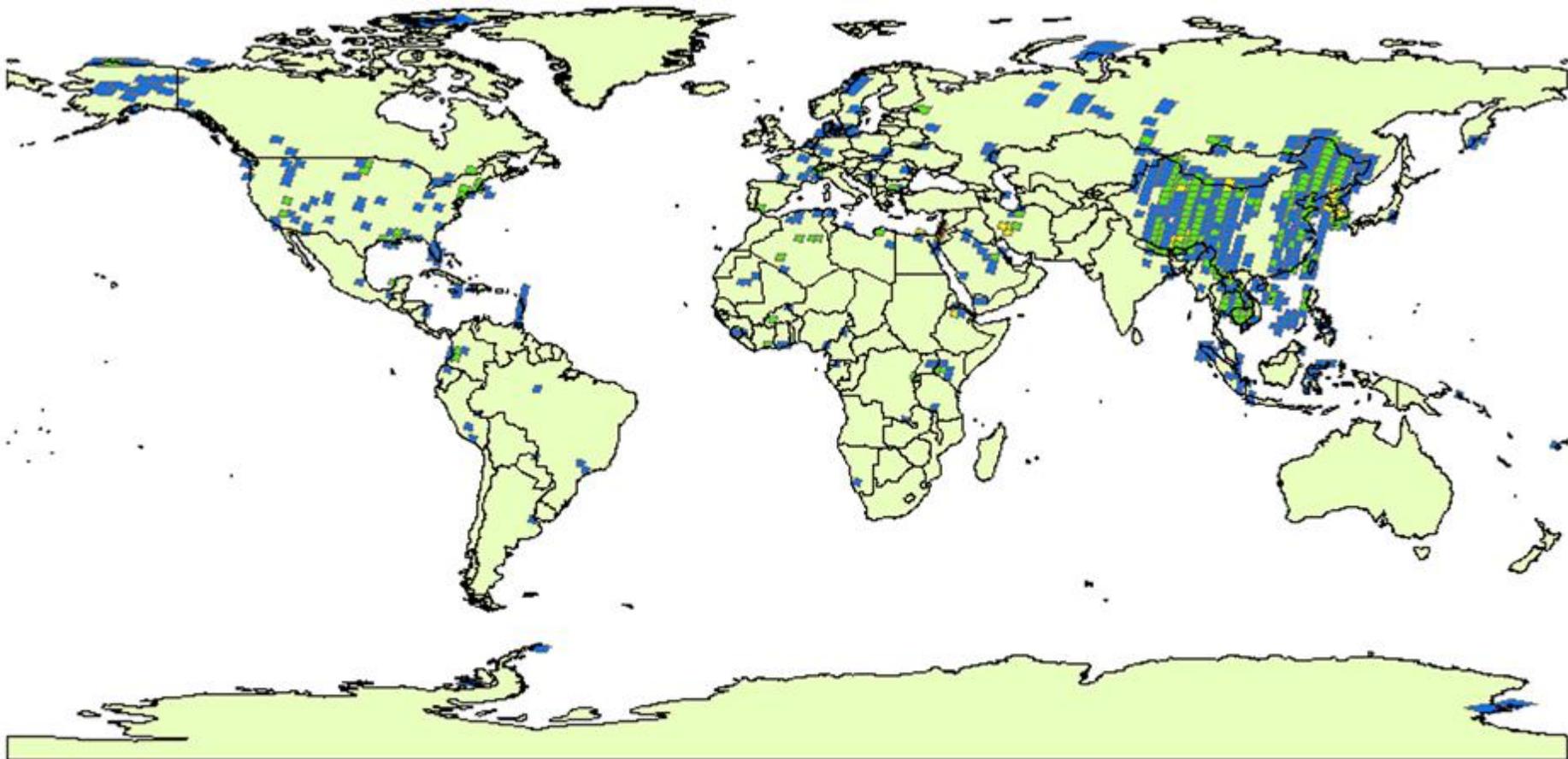
On-Demand Requests (ETM+)



ETM+ On-Demand Orders
Status through December 31, 2008
63,563 Total Scenes
6,059 Unique Locations

1-9 10-27 28-49 50-80 81-148

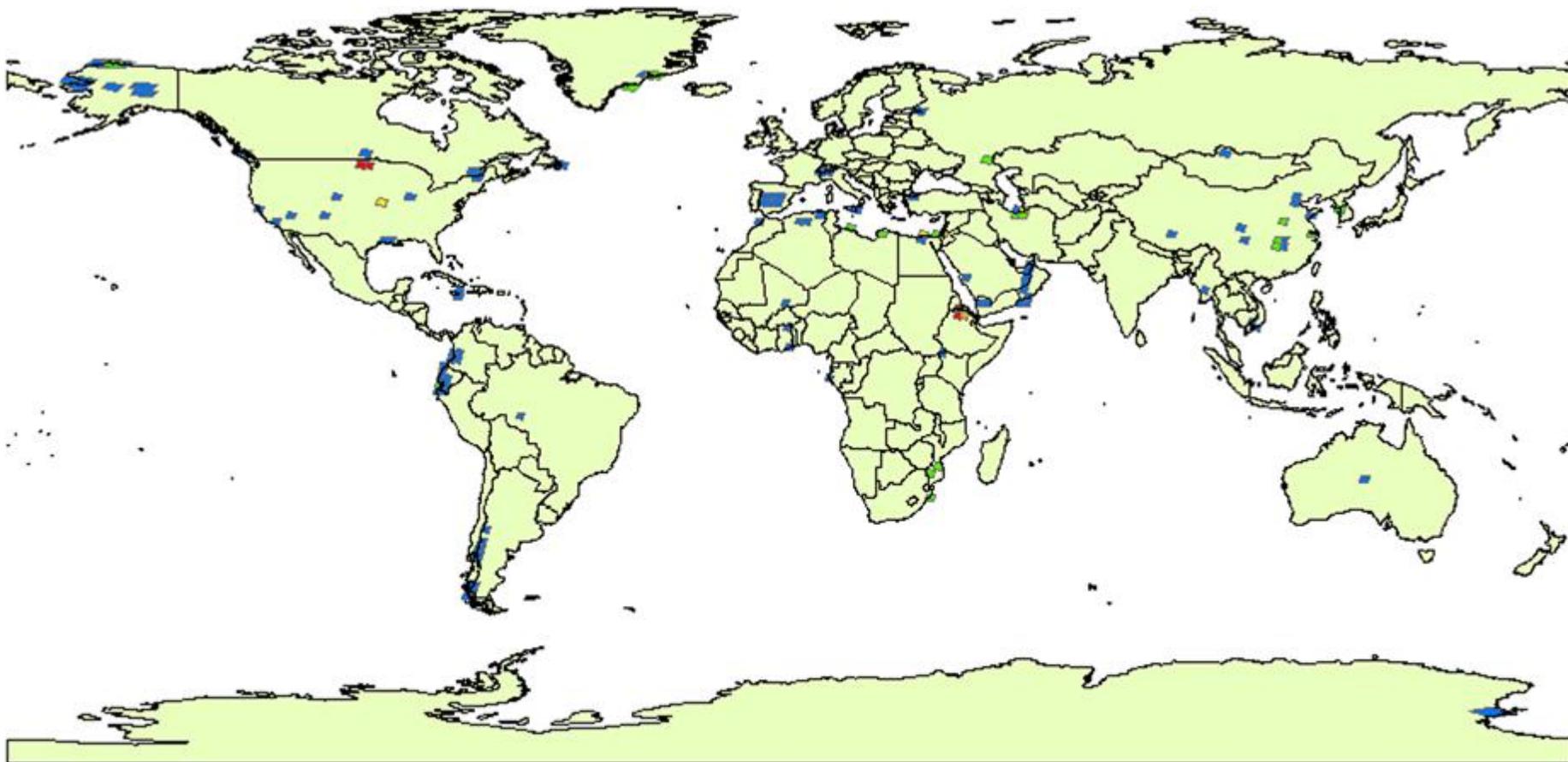
On-Demand Requests (TM)



TM On-Demand Orders
Status through December 31, 2008
2,582 Total Scenes
778 Unique Locations

1 - 3 4 - 10 11 - 24 25 - 45 46 - 90

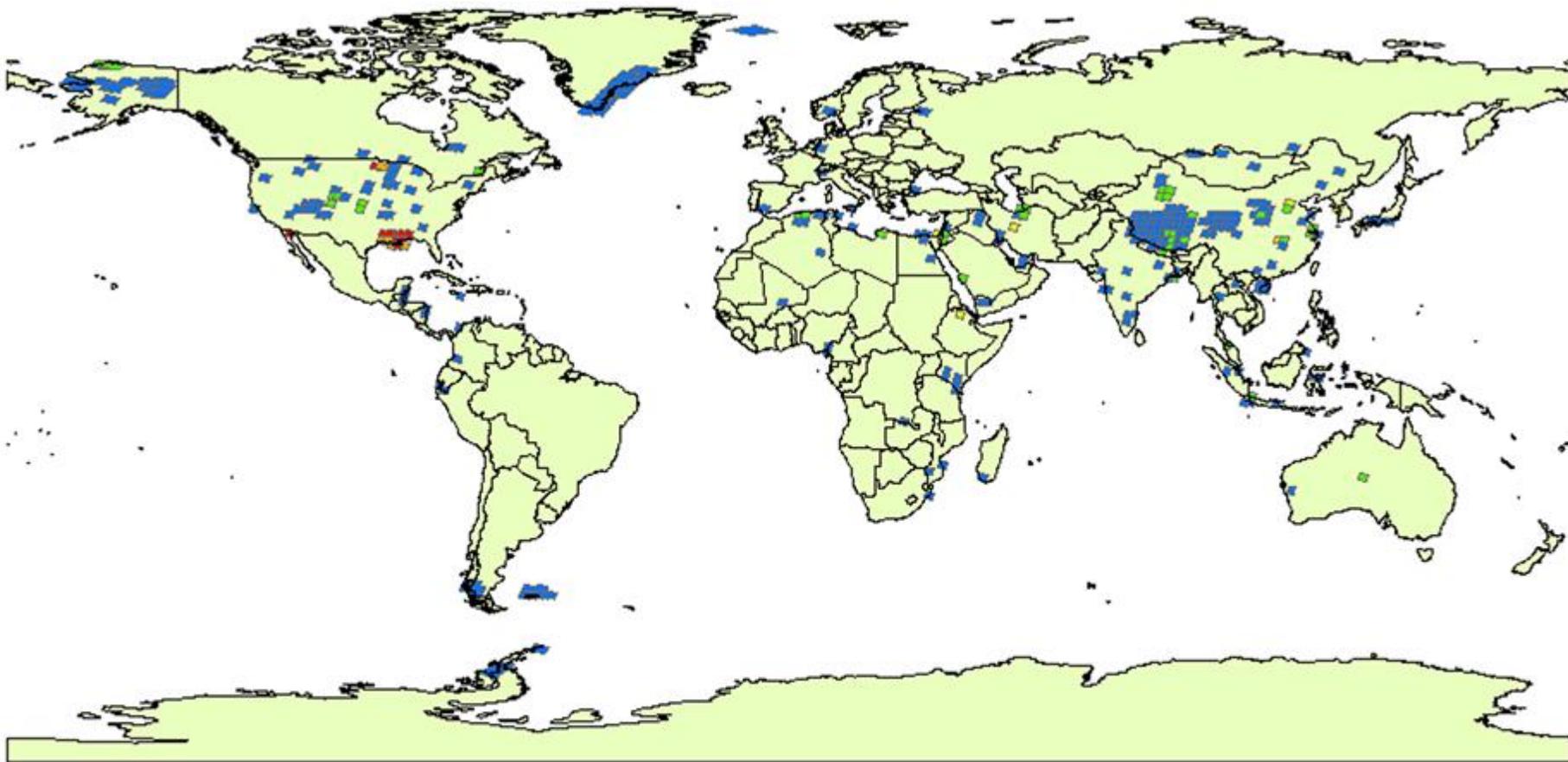
On-Demand Requests (MSS – WRS2)



L4-5 MSS On-Demand Orders
Status through December 31, 2008
675 Total Scenes
124 Unique Locations

1 - 3 4 - 10 11 - 17 18 - 52 53 - 77

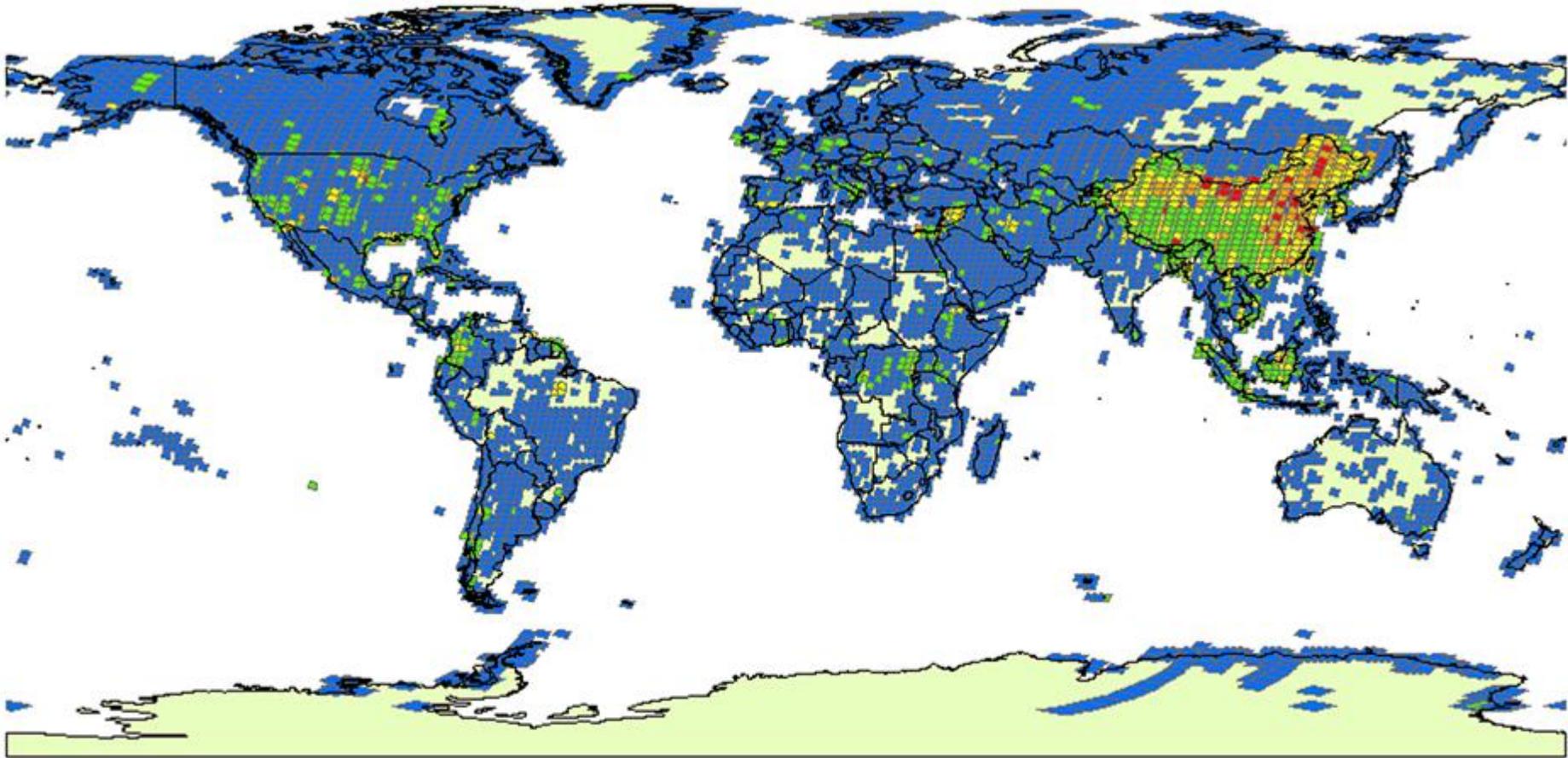
On-Demand Requests (MSS – WRS1)



L1-3 MSS On-Demand Orders
Status through December 31, 2008
1,723 Total Scenes
324 Unique Locations

1 - 5 6 - 15 16 - 27 28 - 45 46 - 64

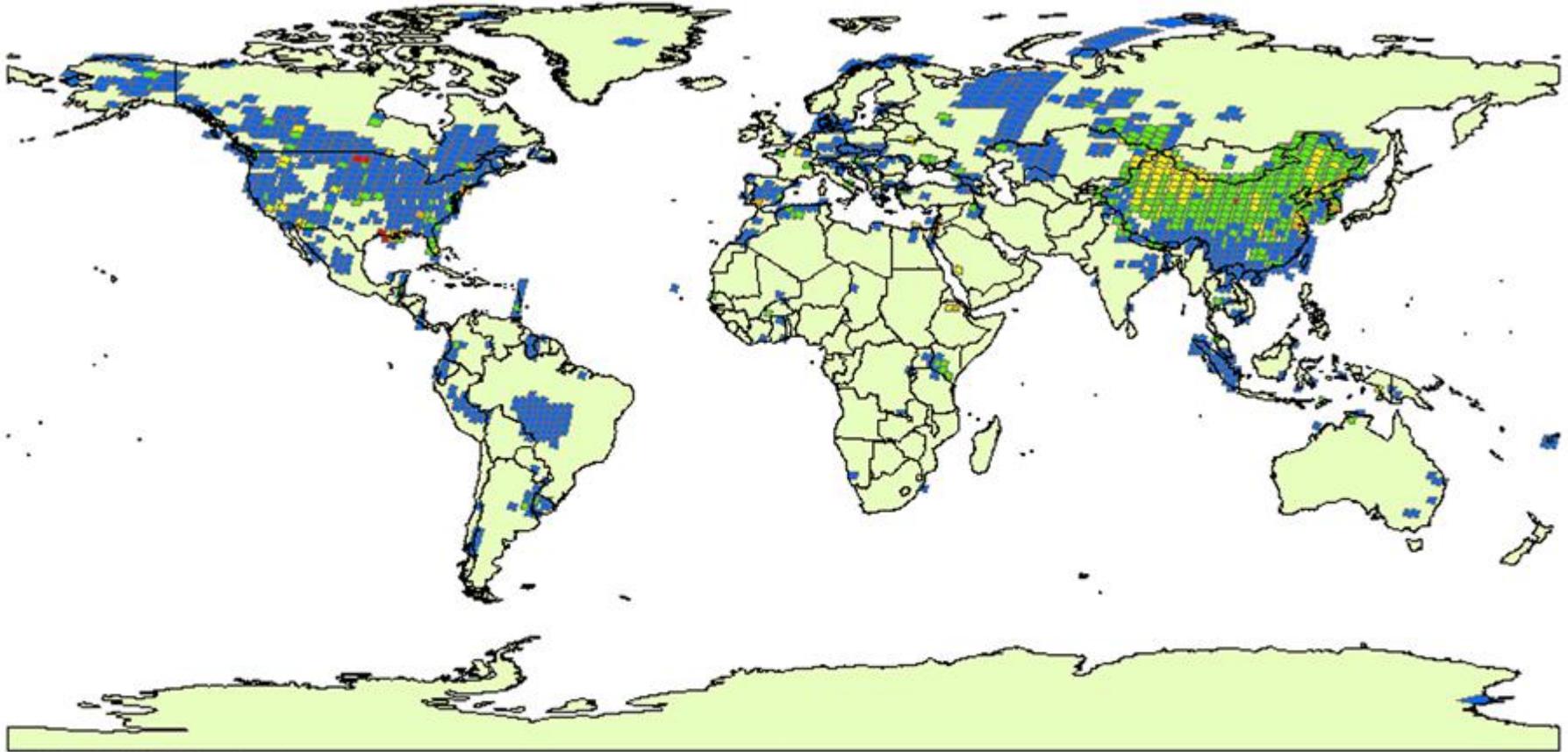
Downloads through EE/Glovis (ETM+)



ETM+ Standard L1T Downloads
via User Interface
October 1, 2008 through December 31, 2008
185,307 Total Scenes
6,659 Unique Locations

1 - 35 36 - 106 107 - 208 209 - 375 376 - 839

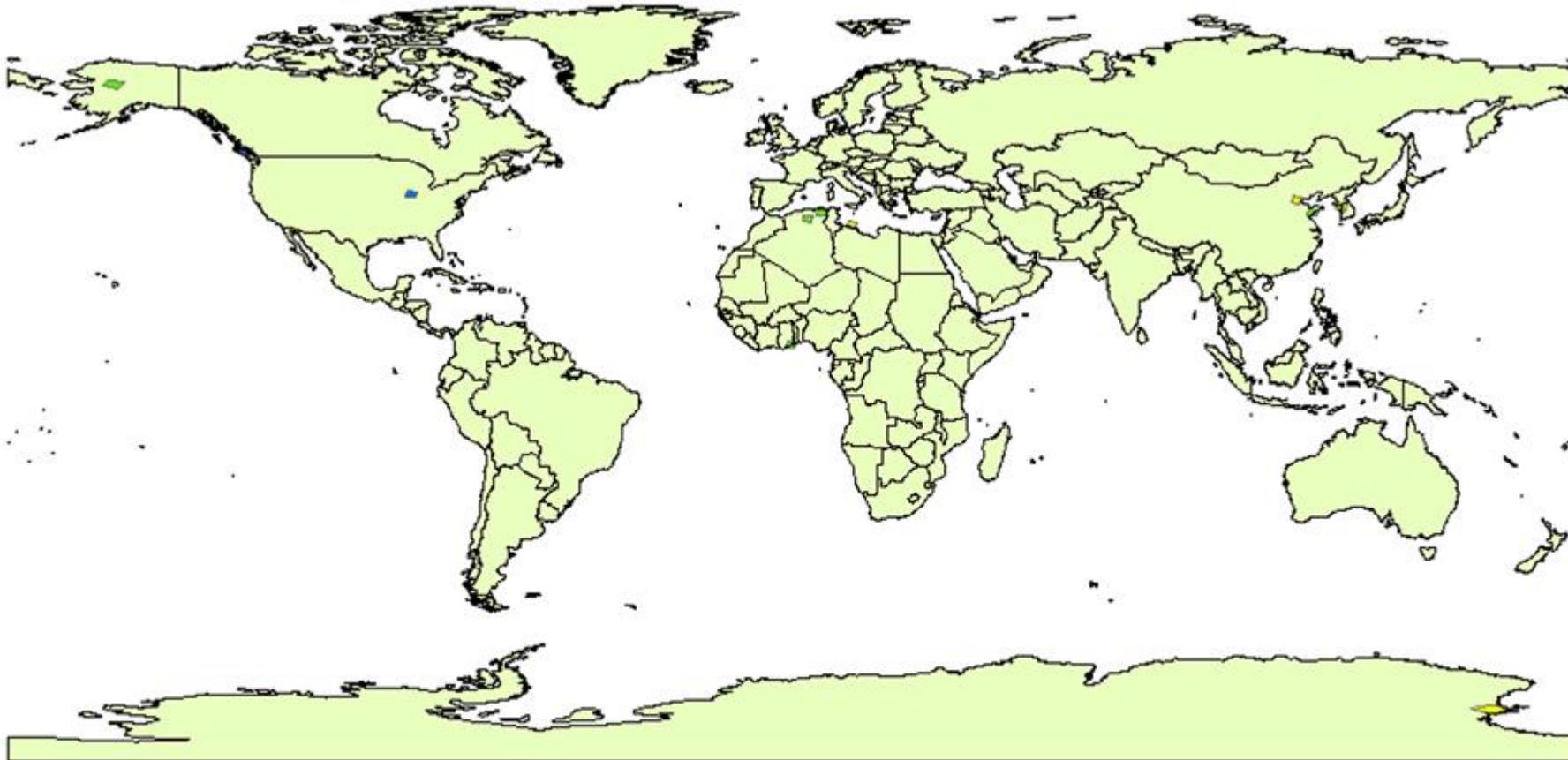
Downloads through EE/Glovis (TM)



TM Standard L1T Downloads
via User Interface
October 1, 2008 through December 31, 2008
22,956 Total Scenes
1,625 Unique Locations

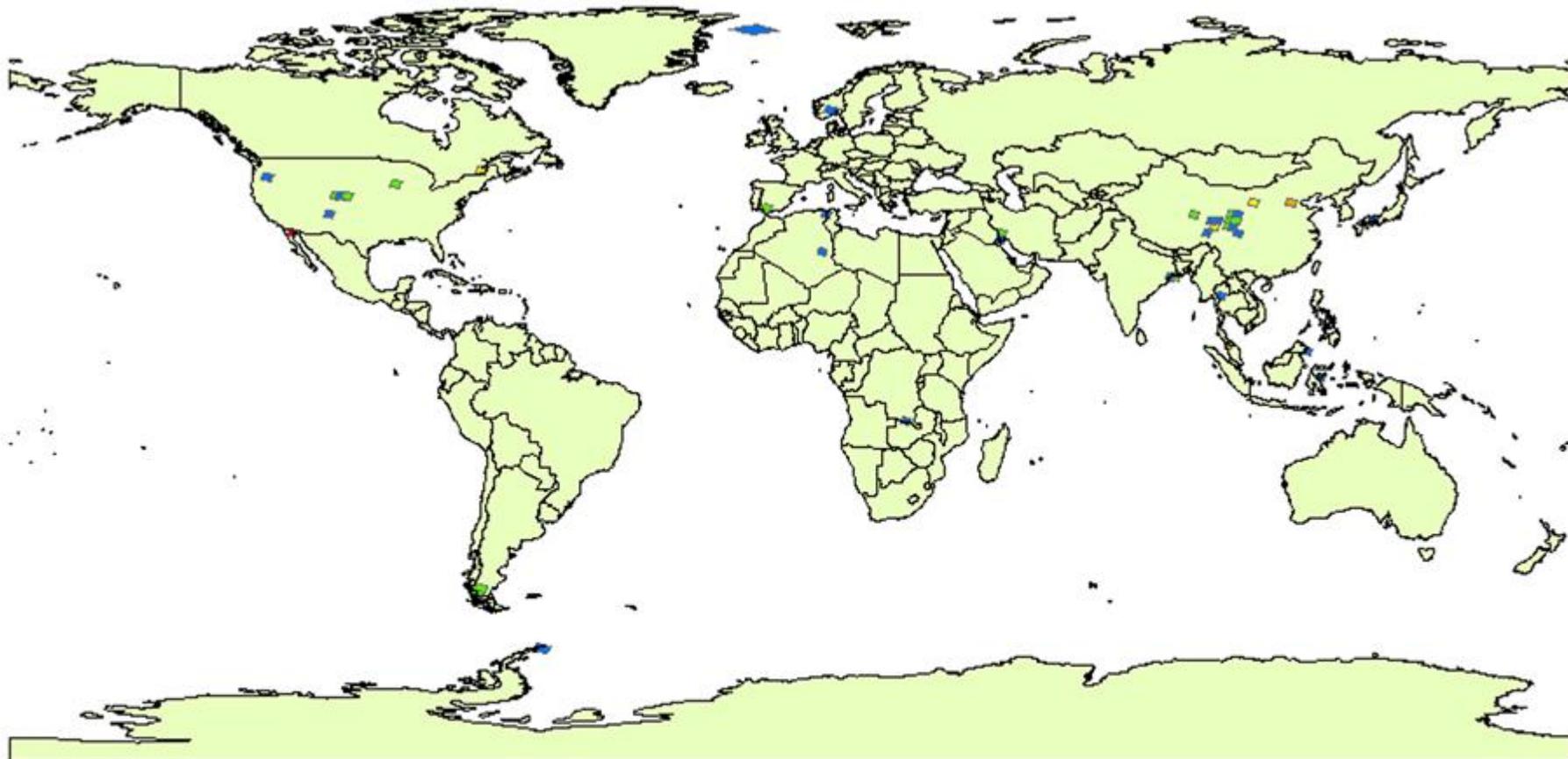
1 - 12 13 - 34 35 - 85 86 - 214 215 - 436

Downloads through EE/Glovis (MSS – WRS2)



L4-5 MSS Standard L1T Downloads
via User Interface
December 8, 2008 through December 31, 2008
41 Total Scenes
12 Unique Locations

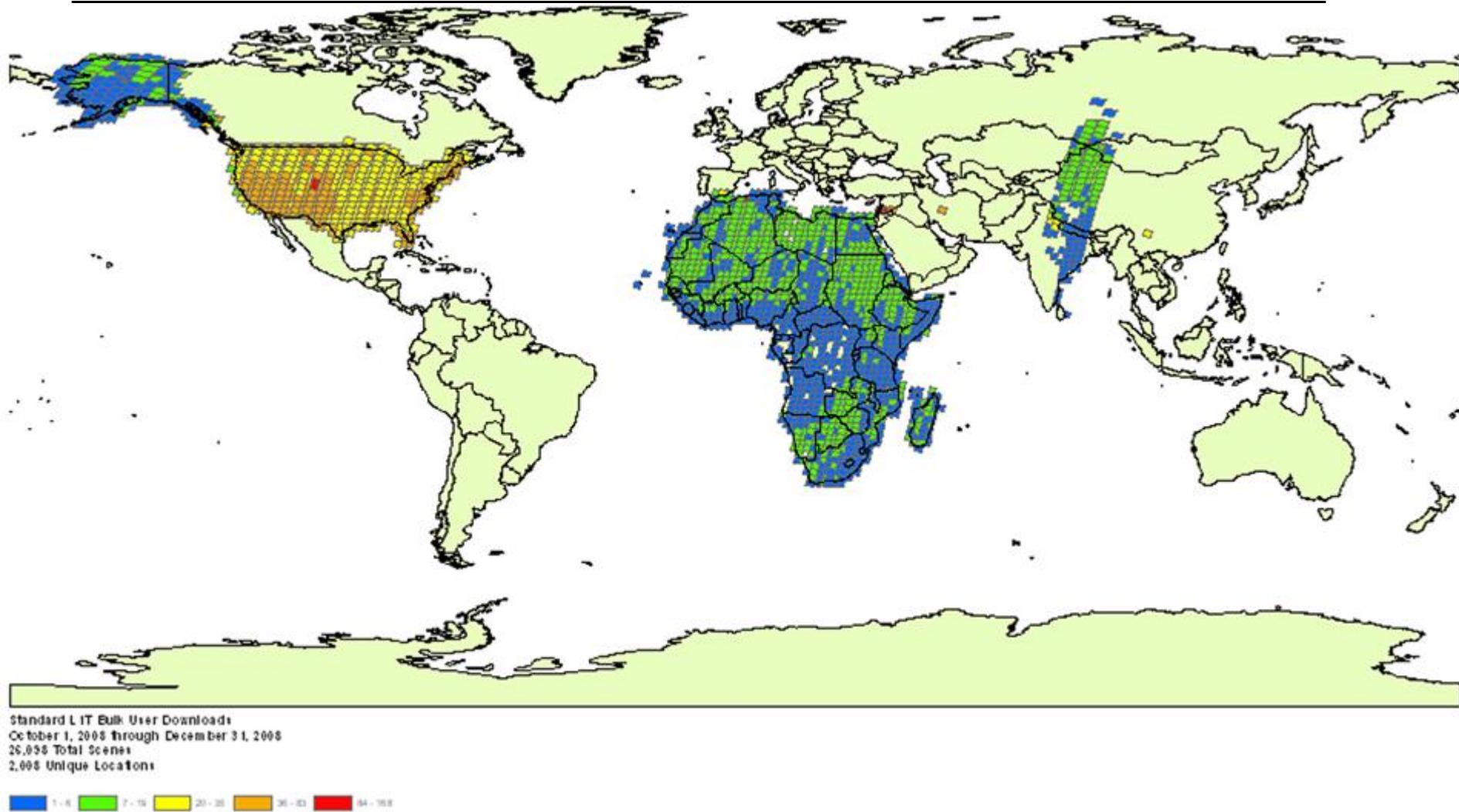
Downloads through EE/Glovis (MSS – WRS1)



L1-3 MSS Standard L1T Downloads
via User Interface
December 8, 2008 through December 31, 2008
222 Total Scenes
41 Unique Locations



Bulk FTP Downloads



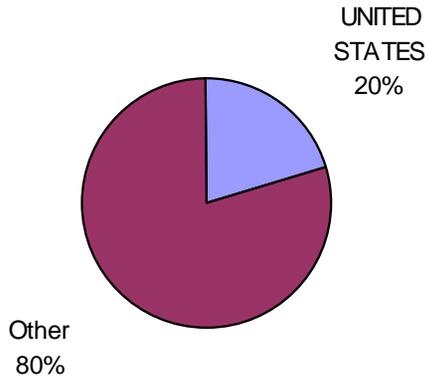
Web-enabled Customer Demographics

(*Does NOT Include Bulk FTP Downloads)

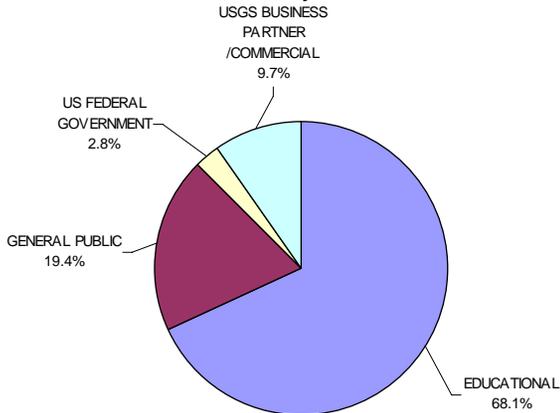
Access by Countries (Other than U.S.)

*Only Countries with > 235 Scenes Downloaded

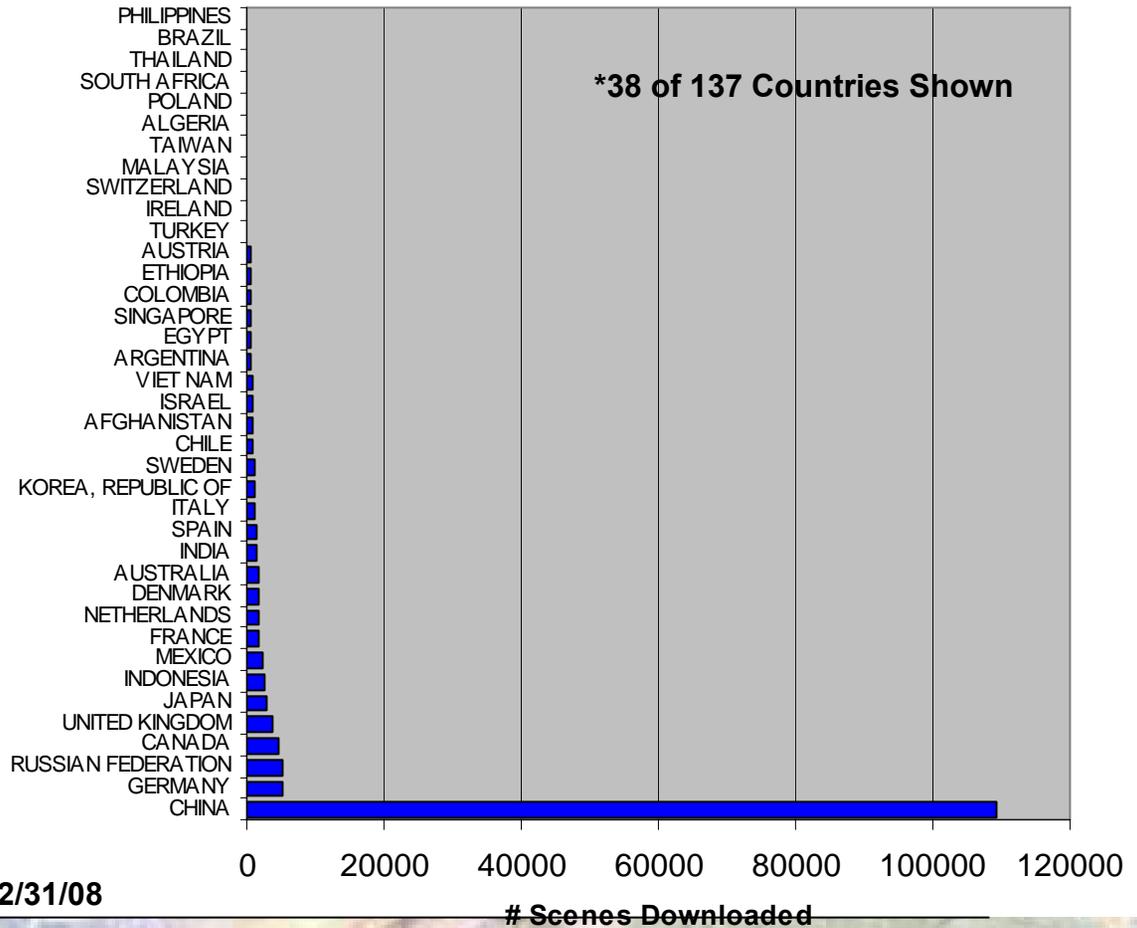
Downloads by Country



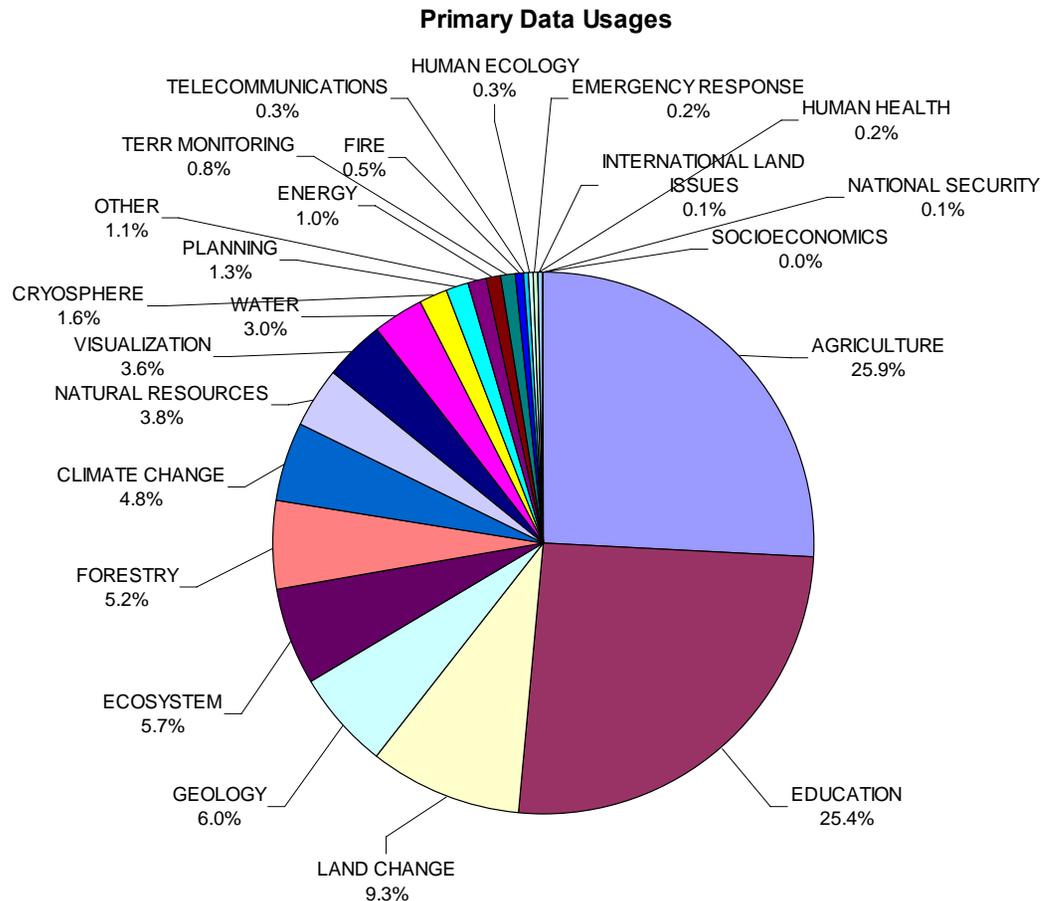
Downloads by Affiliation



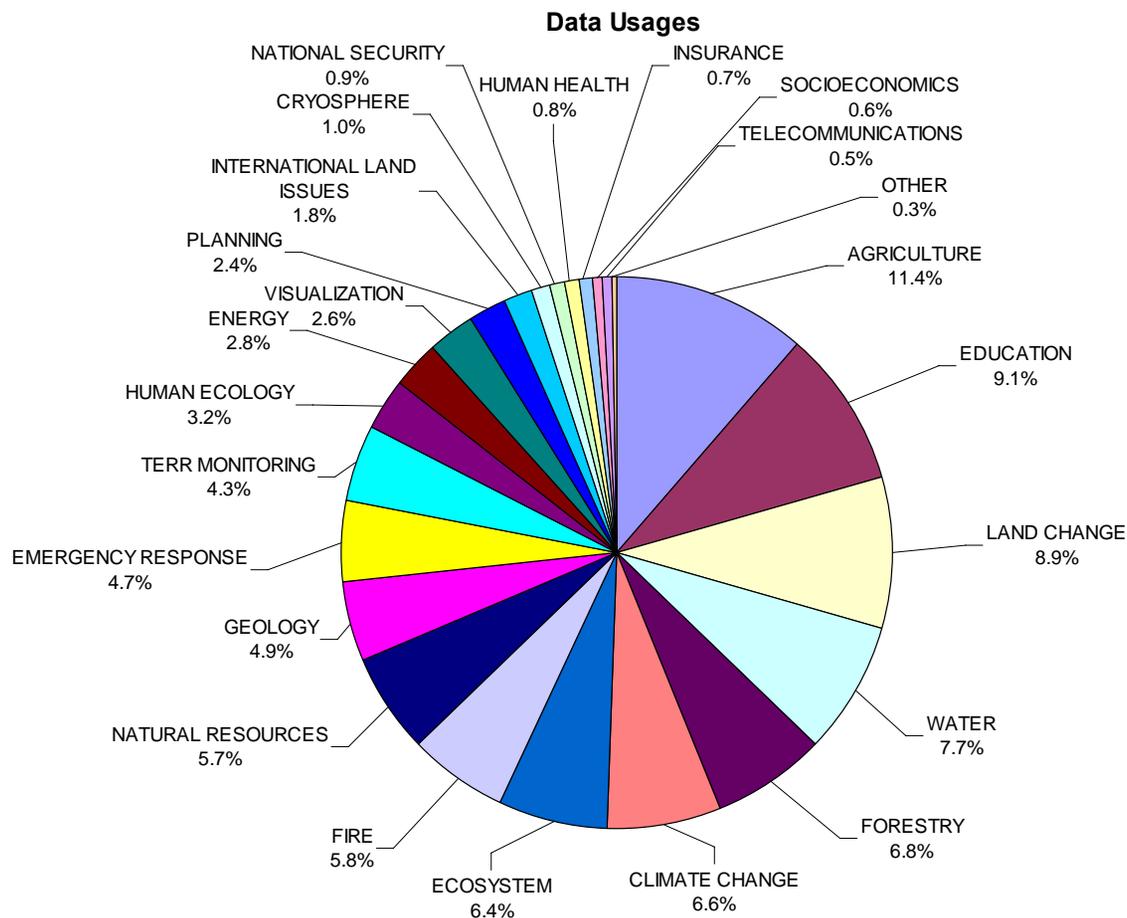
* Stats 10/1/08 through 12/31/08



User Reported Primary Use of Landsat (*Since Oct 1)

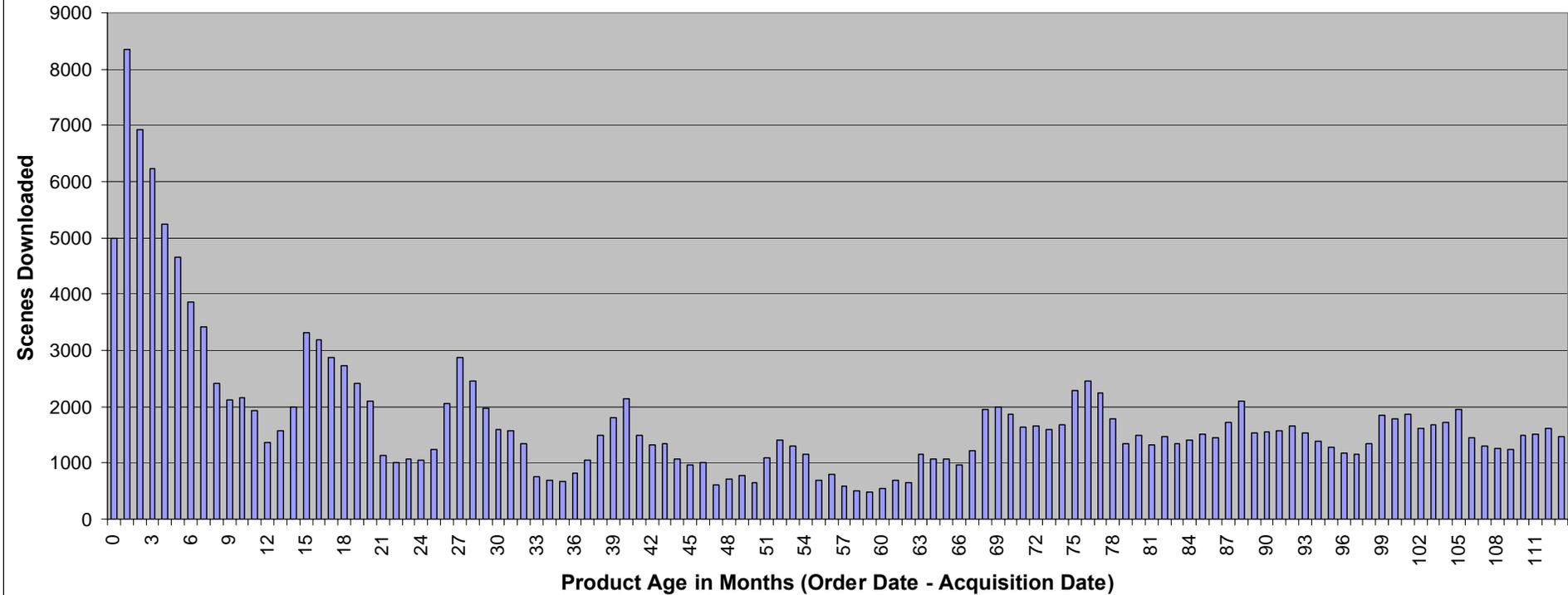


User Reported Other Use of Landsat (*Since Oct 1)



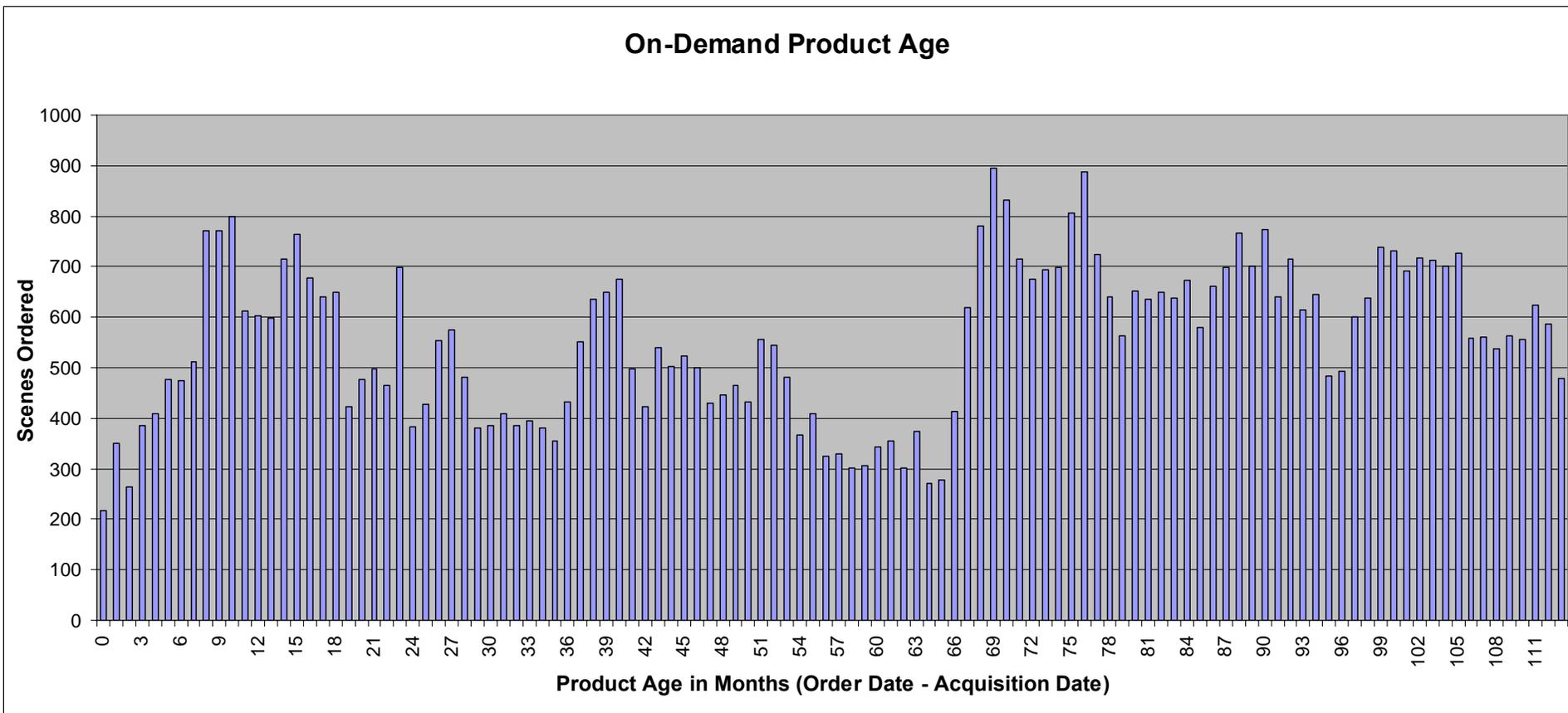
Age of Scenes Downloaded

Standard L1T Product Age



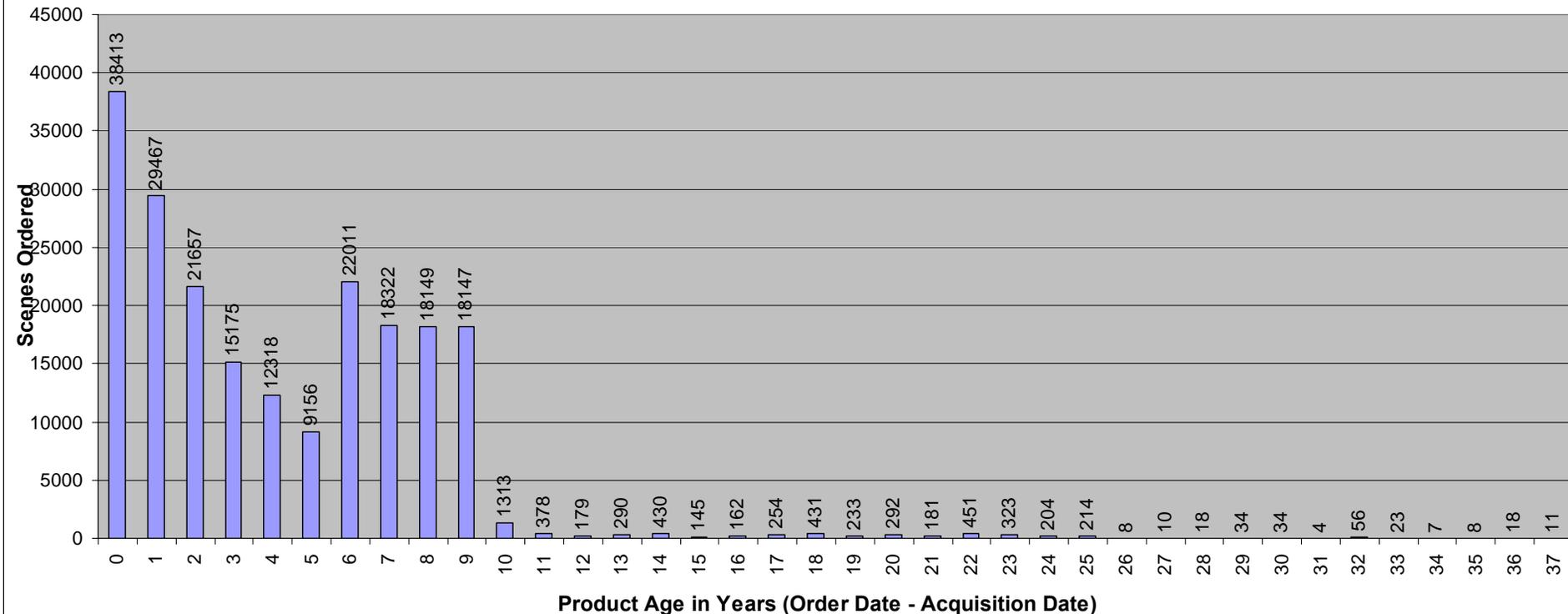
Age of Scenes Ordered from Archive

On-Demand Product Age



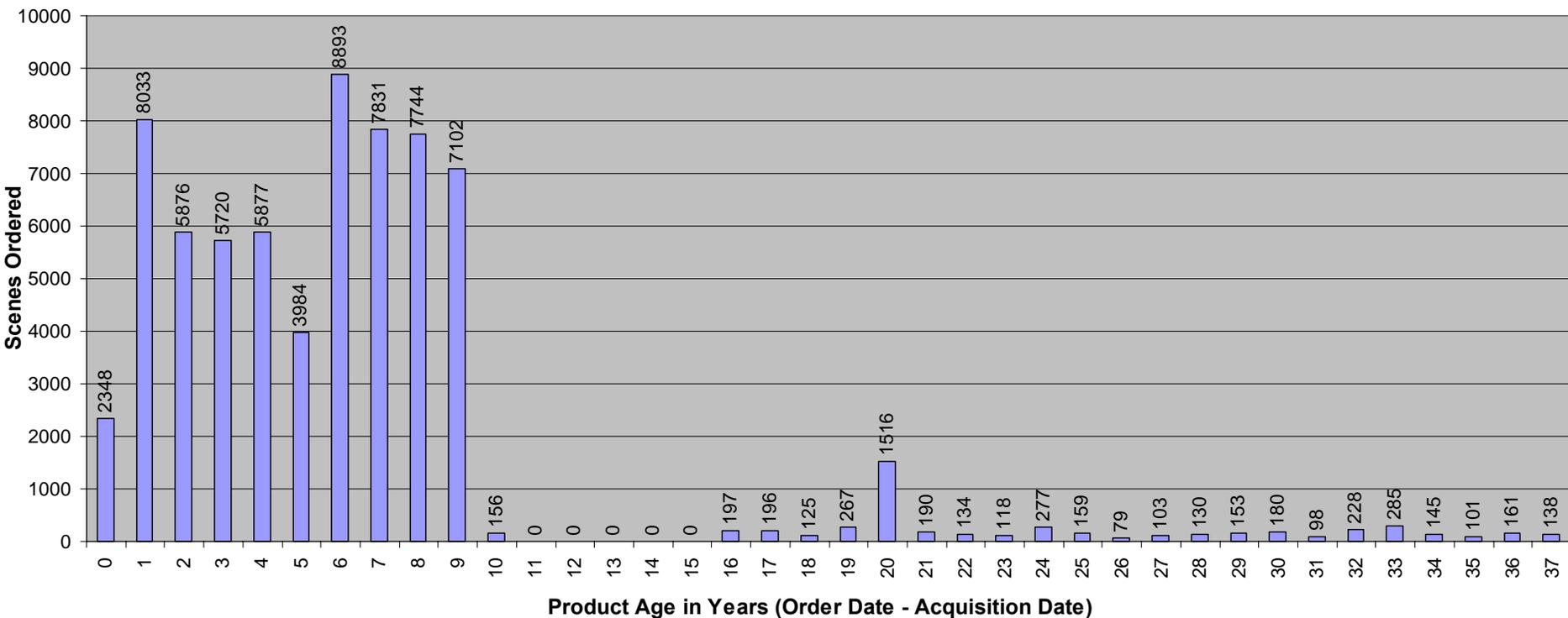
Age of Scenes Downloaded

Standard L1T Product Age



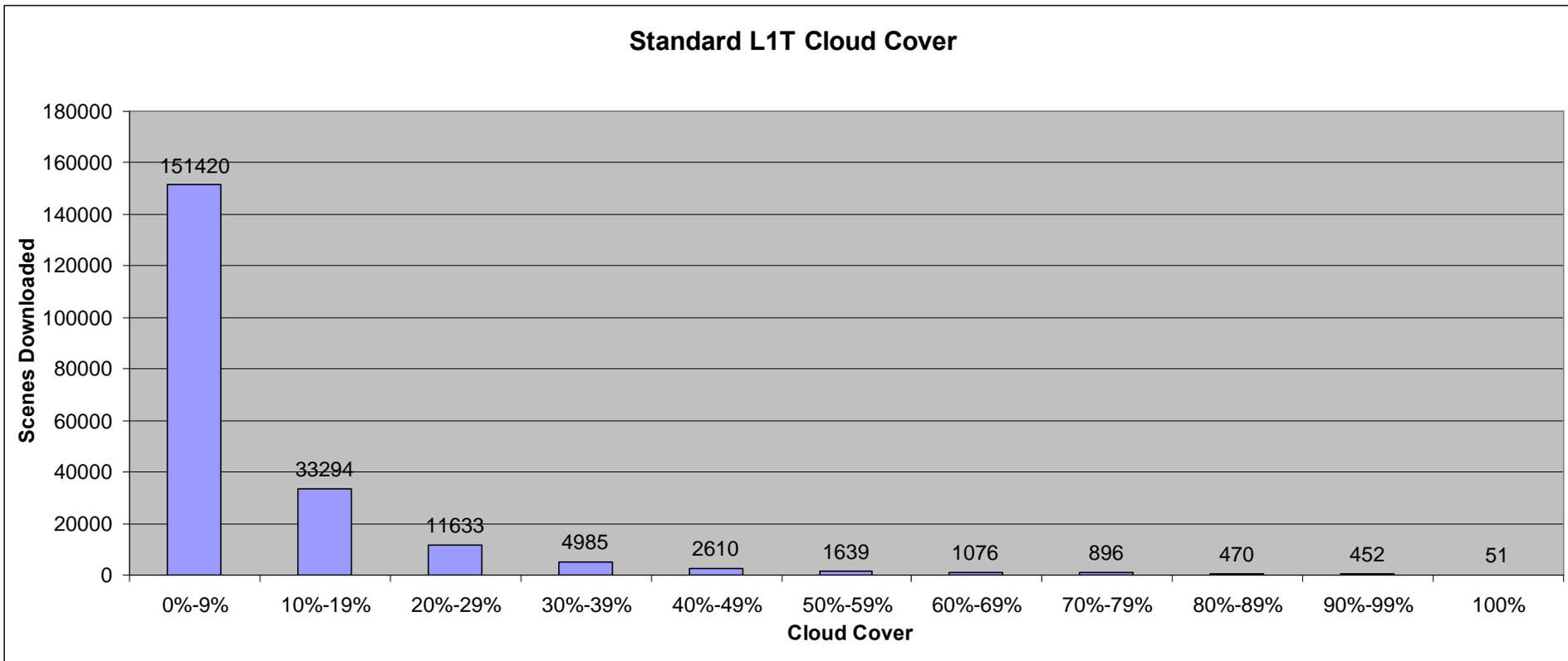
Age of Scenes Ordered from Archive

On-Demand Product Age



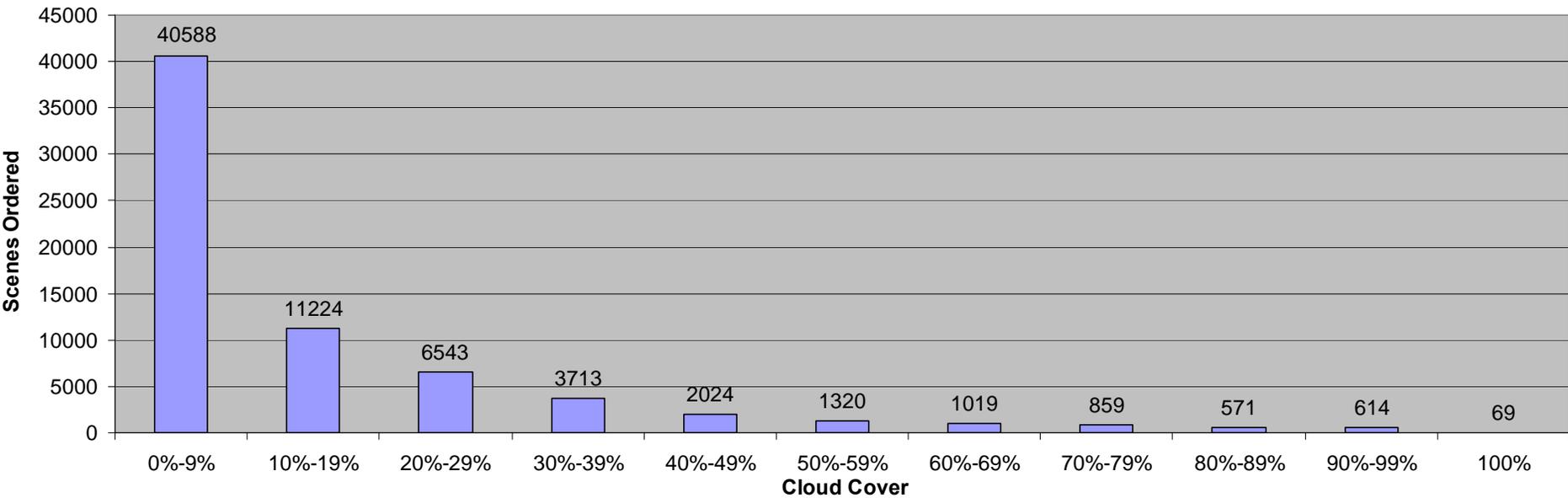
Cloud Cover of Scenes Downloaded

Standard L1T Cloud Cover



Cloud Cover of Scenes Ordered from Archive

On-Demand Cloud Cover



Daily Processing

Landsat Standard L1T Scenes Available on FTP Server

