Landsat Science Team

Landsat Operations Report

3 Feb 2015

Jim Lacasse
USGS, Landsat Operations Project Manager
jmlacasse@usgs.gov, (605) 594-6140

U.S. Department of the Interior
U.S. Geological Survey

Agenda

- Archive and Distribution Summary
- LGAC Update
- Archive and Distribution Metrics for Reference

USGS

U.S. Landsat Archive Overview

(January 2, 2015)

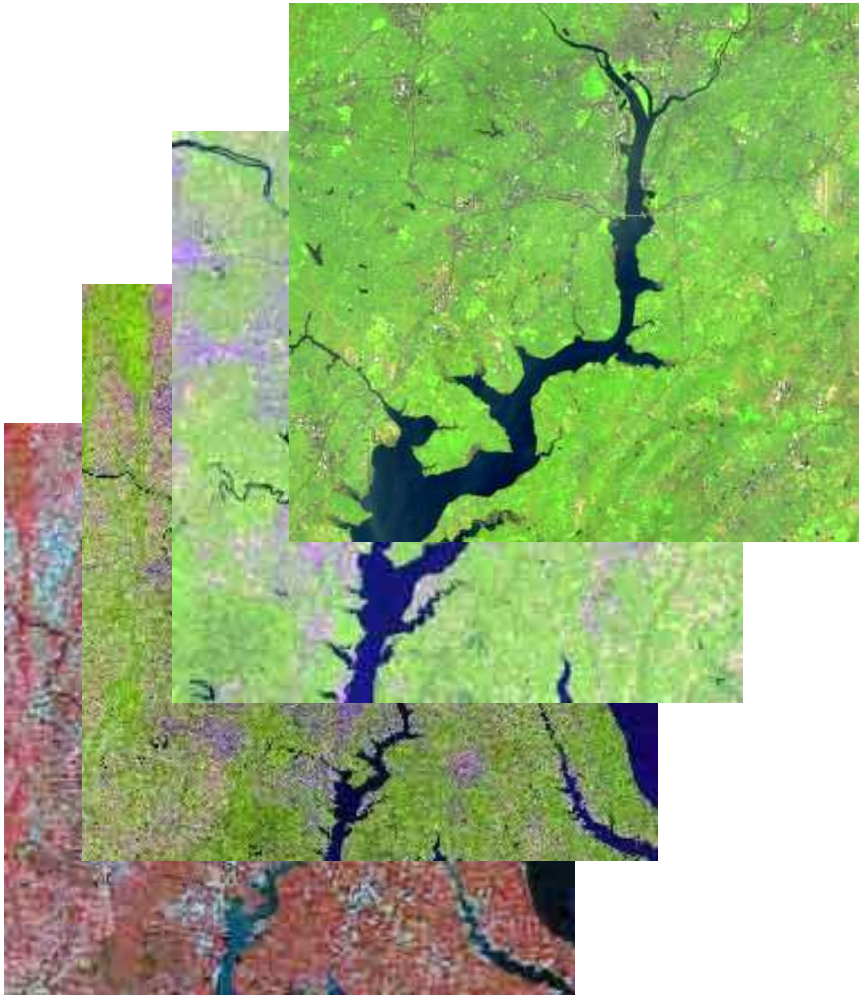
- **OLI-TIRS: Landsat 8**
  - **385,345 scenes**
    - **~ 1,332 TB Raw and L0Ra Data**

      average scene size 1813 MB
- **ETM+: Landsat 7**
  - **1,858,501 scenes**
    - **~ 1,726 TB Raw and L0Ra Data**

      average scene size 487 MB
- **TM: Landsat 4 & Landsat 5**
  - **1,988,982 scenes**
    - **~ 997 TB Raw and L0Ra Data**

      average scene size 263 MB
- **MSS: Landsat 1 through 5**
  - **1,299,626 scenes**
    - **~ 79 TB Raw and L0Ra Data**

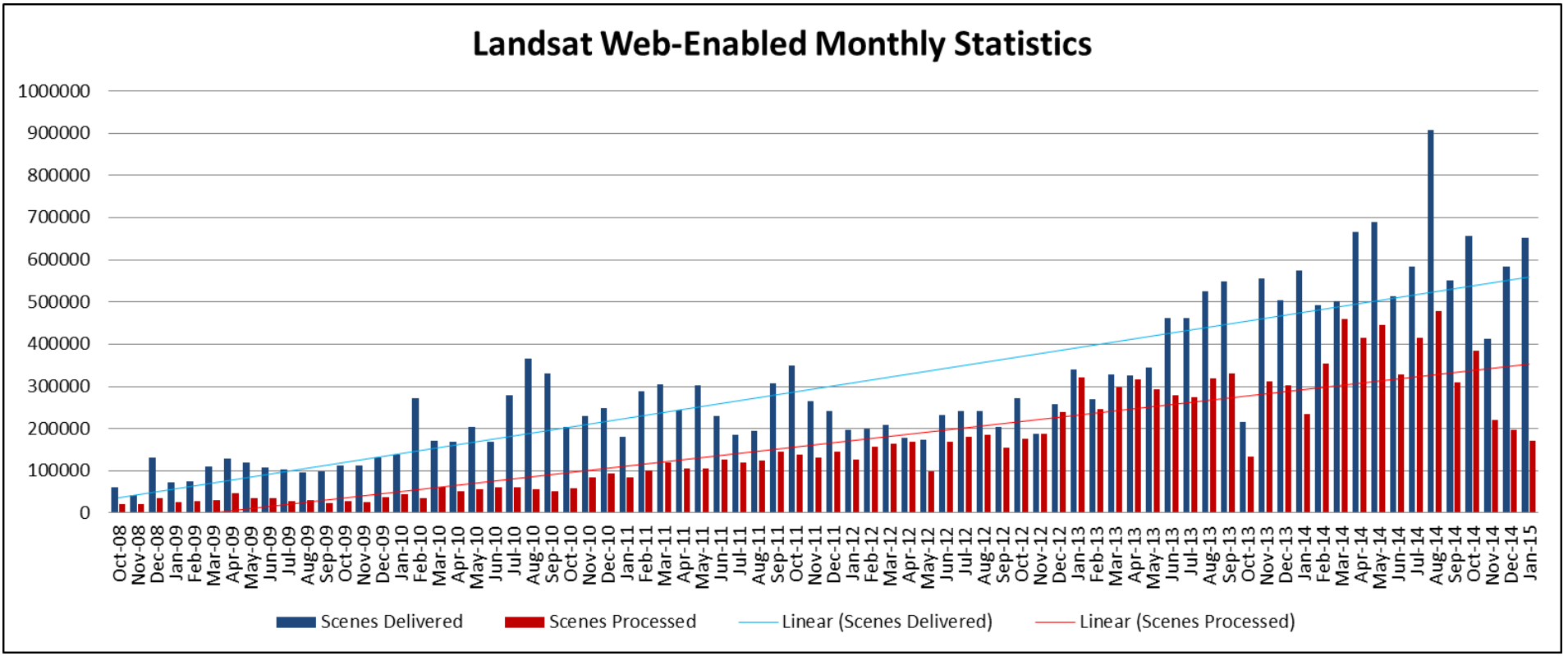
      average scene size 32 MB
- **Total:**
  - **5,532454 scenes**
    - **~ 4,134 TB Raw and L0Ra Data**



All average scenes sizes are for uncompressed data

USGS

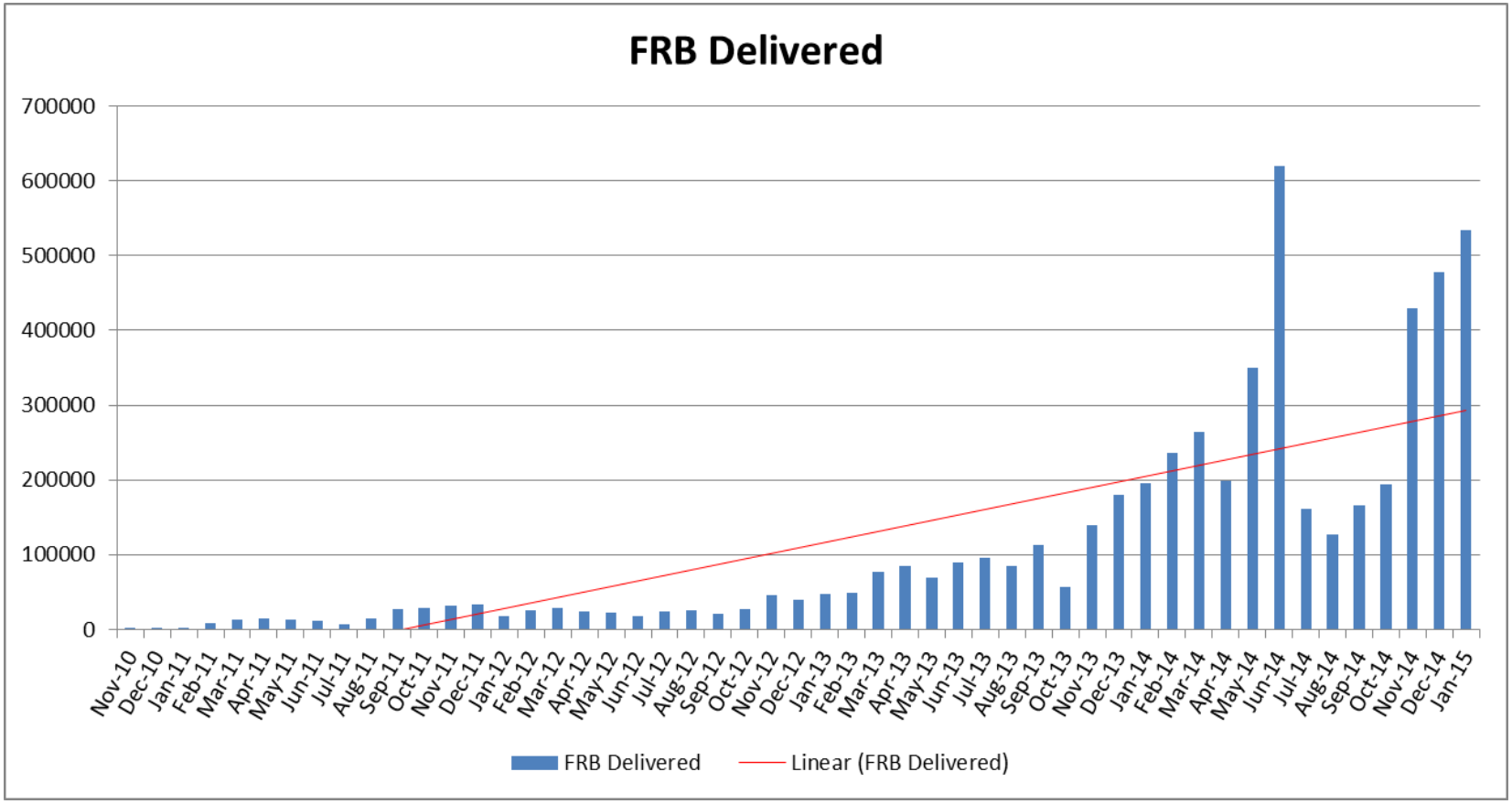
Monthly Downloads / Processed



FY09	FY10	FY11	FY12	FY13	FY14	FY15 (Oct-Jan)
Delivered: 1.14M	Delivered: 2.45M	Delivered: 2.92M	Delivered: 2.73M	Delivered: 4.32M	Delivered: 6.76M	Delivered: 2.31M
Processed: 358K	Processed: 567K	Processed: 1.27M	Processed: 1.82M	Processed: 3.28M	Processed: 4.19M	Processed: 972K

USGS

Monthly Full Resolution Browse Downloads

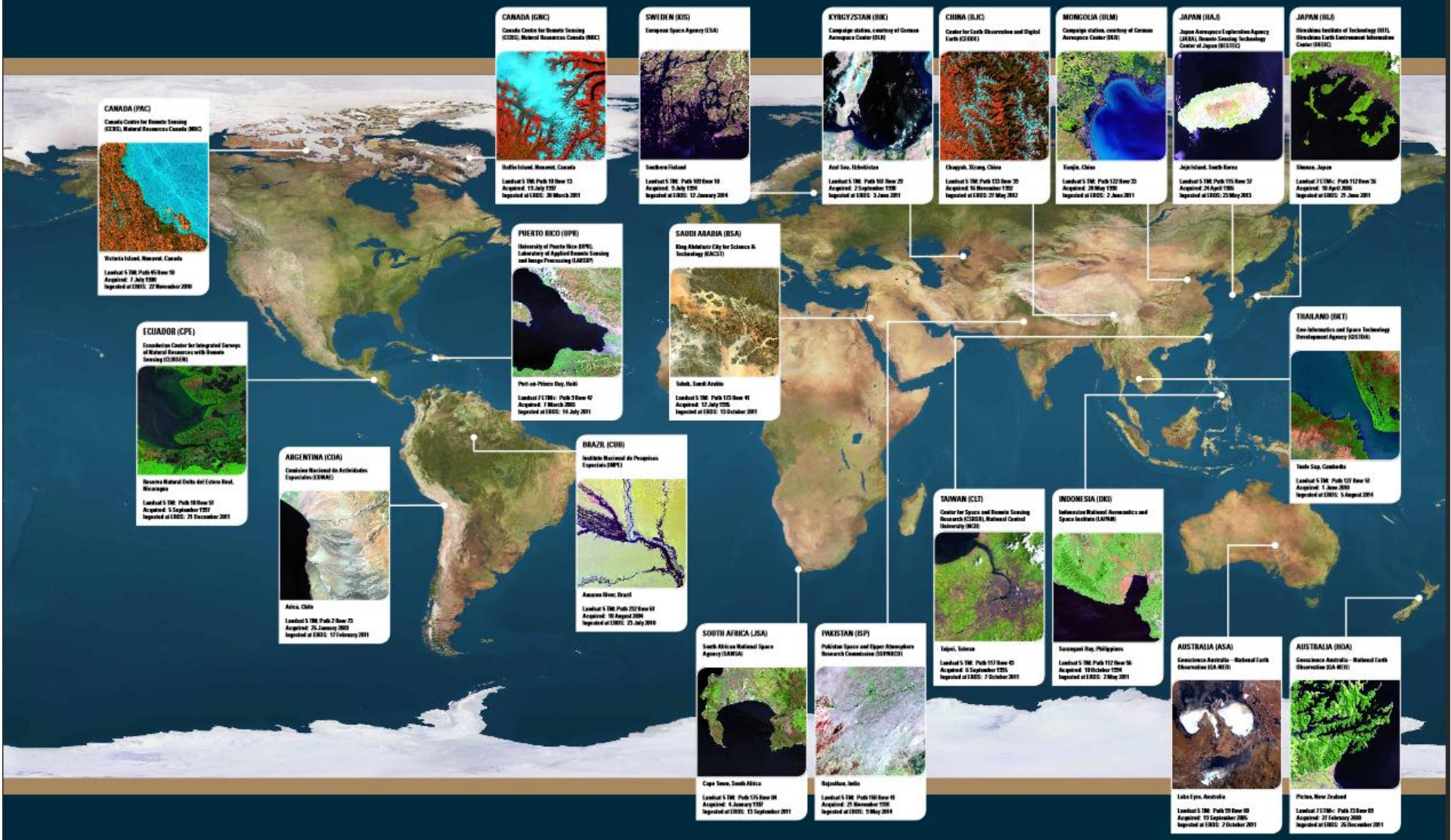


FY11	FY12	FY13	FY14	FY15 (Oct – Jan)
Delivered: 112K	Delivered: 301K	Delivered: 823K	Delivered: 2.70M	Delivered: 1.63M

USGS

USGS
science for a changing world

Landsat Global Archive Consolidation (LGAC)



U.S. Department of the Interior
U.S. Geological Survey

November 2014

Landsat Global Archive Consolidation (LGAC)

- **Over 3 Million scenes collected as of July 1, 2014**
- **Previous "Woodcock Metric":**

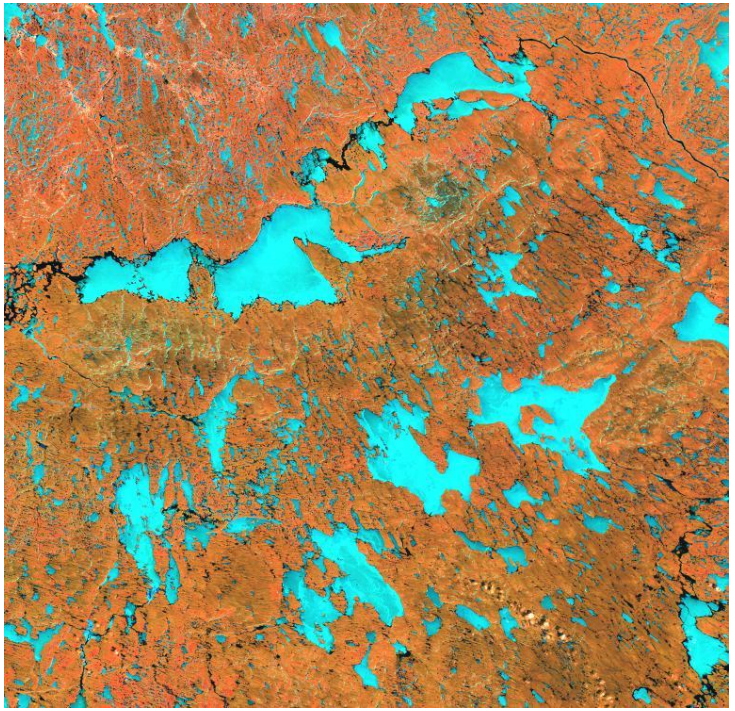
  3,025,557

  Current (1/2/2015):

  3,164,701

Revised estimate of about 6M total (last reported 5M) – what's left?

- *MSS ~= 600,000*
- *TM ~= 2,000,000*
- *ETM+ ~= 400,000*

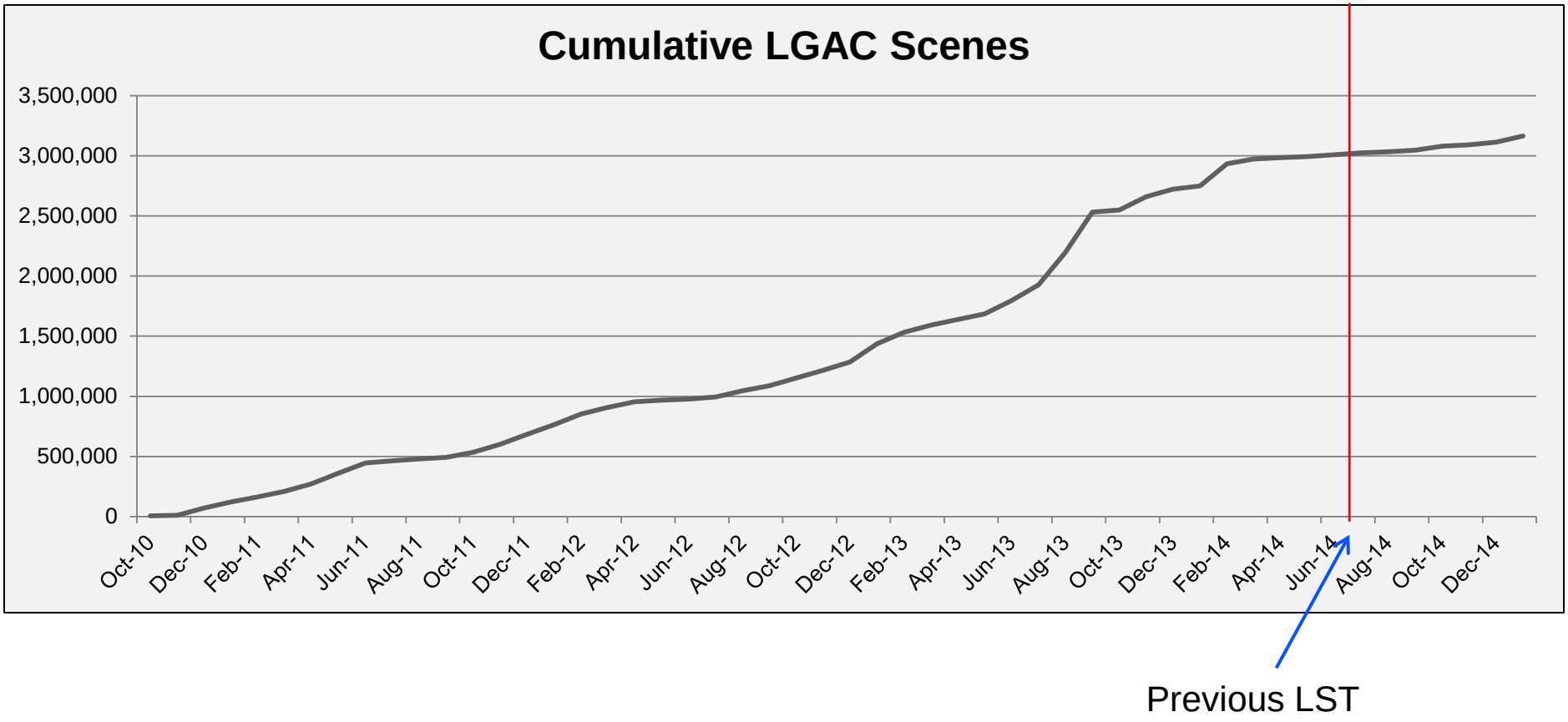


Landsat 5 TM image transcribed from CCRS D-1 tape – available in archive

USGS

LGAC Major Accomplishments

Cumulative LGAC Scenes Ingested into the Archive



USGS

LGAC Status

Country (Organization)	Ground Station	% LGAC Delivered	% LGAC Ingested
Argentina (CONAE)	COA	TM	TM
		ETM+	ETM+
Australia (GA-NEO)	ASA	MSS	MSS
		TM	TM
		ETM+	ETM+
Australia (GA-NEO)	HOA	TM	TM
		ETM+	ETM+
Brazil (INPE)	CUB	MSS	MSS
		TM	TM
		ETM+	ETM+
Canada (CCMEO)	GNC	MSS	MSS
		TM	TM
		ETM+	ETM+
Canada (CCMEO)	PAC	MSS	MSS
		TM	TM
		ETM+	ETM+

- Argentina - In process data delivery from on LTOs
- Brazil – MSS HDDTs
  - 1st set of sample HDDTs was unsuccessfully read
  - Investigating 2nd set of tapes
    - May need to test tapes on Wideband Video Drive
  - ~875 tapes waiting to be sent by Brazil
  - Very small number of TM intervals also contained on HDDTs

USGS

LGAC Status

Country (Organization)	Ground Station	% LGAC Delivered	% LGAC Ingested
China (RADI)	BJC	TM	TM
		ETM+	ETM+
China (RADI)	KHC	TM	TM
Ecuador (IEE)	CPE	TM	TM
Europe (ESA)	FUI	MSS	MSS
		TM	TM
		ETM+	ETM+
Europe (ESA)	KIS	MSS	MSS
		TM	TM
		ETM+	ETM+
Europe (ESA)	MTI	TM	TM
		ETM+	ETM+
Europe (ESA)	NSG	ETM+	ETM+
India (NRSA)	SGI	MSS	MSS
		TM	TM
Indonesia (LAPAN)	DKI	TM	TM
		ETM+	ETM+

- China – Electronic data delivery in process
- Europe (USB HDs)
  - Europe is reprocessing all data, allowing EROS to ingest raw data during reprocessing effort
  - Phase I LGAC support consisted of Kiruna (KIS) TM data
    - Issues with missing PCD for ~ 500,000 TM scenes
    - Data analysis currently in progress
  - Phase II LGAC data to consist of all outstanding TM and ETM+ data
    - Delivery within the next few weeks
- India – LGAC support agreement has been reached
  - Real-time L7 downlinks to be provided in exchange for copy of Landsat archive
  - Test downlinks provided and ground processing being worked by India

USGS

LGAC Status

Country (Organization)	Ground Station	% LGAC Delivered	% LGAC Ingested
Japan (HIT/HEEIC)	HIJ	ETM+	ETM+
Japan (JAXA/RESTEC)	HAJ	MSS	MSS
		TM	TM
		ETM+	ETM+
Kyrgyzstan (DLR)	BIK	TM	TM
Mongolia (DLR)	ULM	TM	TM
Pakistan (SUPARCO)	ISP	TM	TM
Saudi Arabia (KACST)	RSA	MSS	MSS
		TM	TM
South Africa (SANSA)	JSA	MSS	MSS
		TM	TM
		ETM+	ETM+
Taiwan (CSRSR-NCU)	CLT	TM	TM
Thailand (GISTDA)	BKT	MSS	MSS
		TM	TM
		ETM+	ETM+
US (U of Puerto Rico)	UPR	ETM+	ETM+

- Saudi Arabia – Initial sample set of HDDTs successfully received, read, and ingested
  - Awaiting additional TM and MSS data on DLTs and HDDTs
- South Africa – Electronic data delivery continues
- Thailand – TM and ETM+ data received on LTOs and DLTs and data ingest currently in process
  - Delivery of additional TM and MSS data on HDDTs, as well as three tape drives, in process

USGS

TM Data Completed & Notional Timeline

GSID	Country	Location	Scenes Ingested Since Sept. 2010						
			TM						
			Ingested	Scenes Added	Estimated	% Comp	Unique	% Unique	Notes / Notional Timeline
BJC	China	Beijing	170,075	18,243	560,000	30%	162,081	95%	Anticipate completion of TM by end of 2015
BKT	Thailand	Bangkok	42,942	37,504	185,000	23%	41,202	96%	Anticipate completion of TM and data (not on HDDTs) by mid-2015; Completion of TM data on HDDTs could take multiple years
COA	Argentina	Cordoba	103,598	0	190,000	55%	96,185	93%	Anticipate completion of TM and ETM+ by mid-2016
CPE	Ecuador	Cotapaxi	25,246	0	50,000	50%	12,304	49%	
CUB	Brazil	Cuiaba	306,656	306,656	307,000	100%	263,745	86%	
DKI	Indonesia	Parepare	17,001	0	32,000	53%	16,670	98%	Completion of TM data on DCRSi tapes could take some time due to mold problems on the tapes
FUI	Italy	Fucino	48	0	567,000	0%	48	100%	Anticipate completion of 1982-1986 and 2000-2001 TM data by early 2015; TM data from 1987-1999 have poor PCD -- decision on how to handle this data is pending;
ISP	Pakistan	Islamabad	13,310	7,363	66,000	20%	13,050	98%	Completion of TM data on HDDTs could take multiple years
JSA	South Africa	Hartebeest hoek	69,442	0	119,000	58%	61,309	88%	Anticipate completion of TM data by end of 2015;
KHC	China	KaShi	14,597	0	23,000	63%	13,542	93%	Anticipate completion of TM data by mid-2015
KIS	Sweden	Kiruna	183,508	0	300,000	61%	180,755	98%	Outstanding TM data contains poor PCD (~40% of TM data holdings) -- decision on how to handle this data is pending ~(1991 – 1996; some good data)
MTI	Italy	Matera	2,928	0	234,000	1%	2,907	99%	Anticipate completion of TM and ETM+ data by early 2015
RSA	Saudi Arabia	Riyahd	1,608	0	250,000	1%	860	53%	Completion of TM data on HDDTs could take multiple years
SGI	India	Shadnagar	0	0	39,000	0%	0	0%	USGS currently working with India to finalize LGAC support plan -- due to the uncertainty of media type and formats, no completion data can be estimated at this time
Totals			**1,647,353**		**3,640,500**	**45%**	**1,338,724**	**81%**	

USGS

Additional Information

USGS

Detailed LGAC TM Status Maps by Year

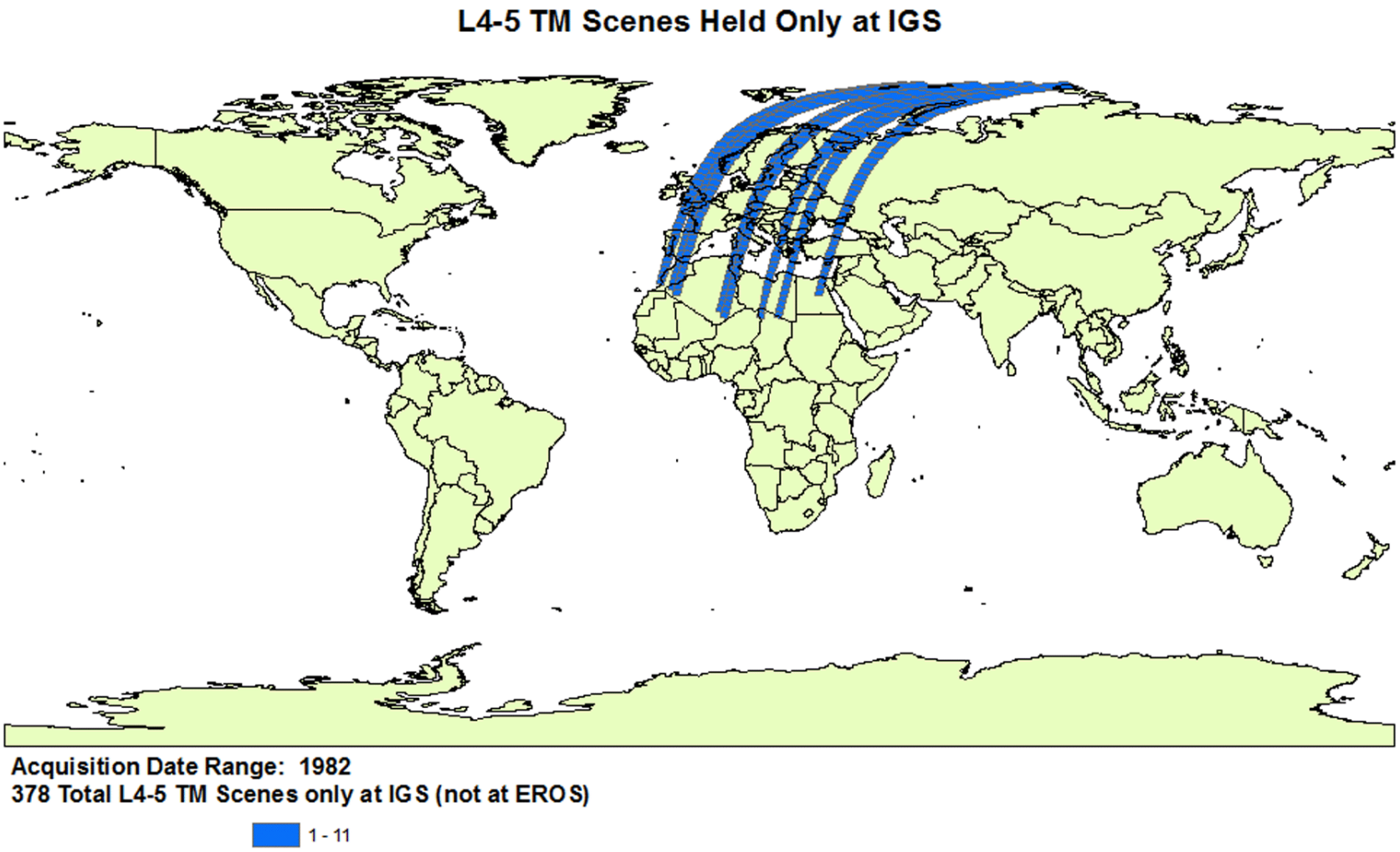
USGS

Notes

- **Landsat 4 - July 16, 1982 - December 14, 1993**
- **Landsat 5 - March 1, 1984 – November 2011.**

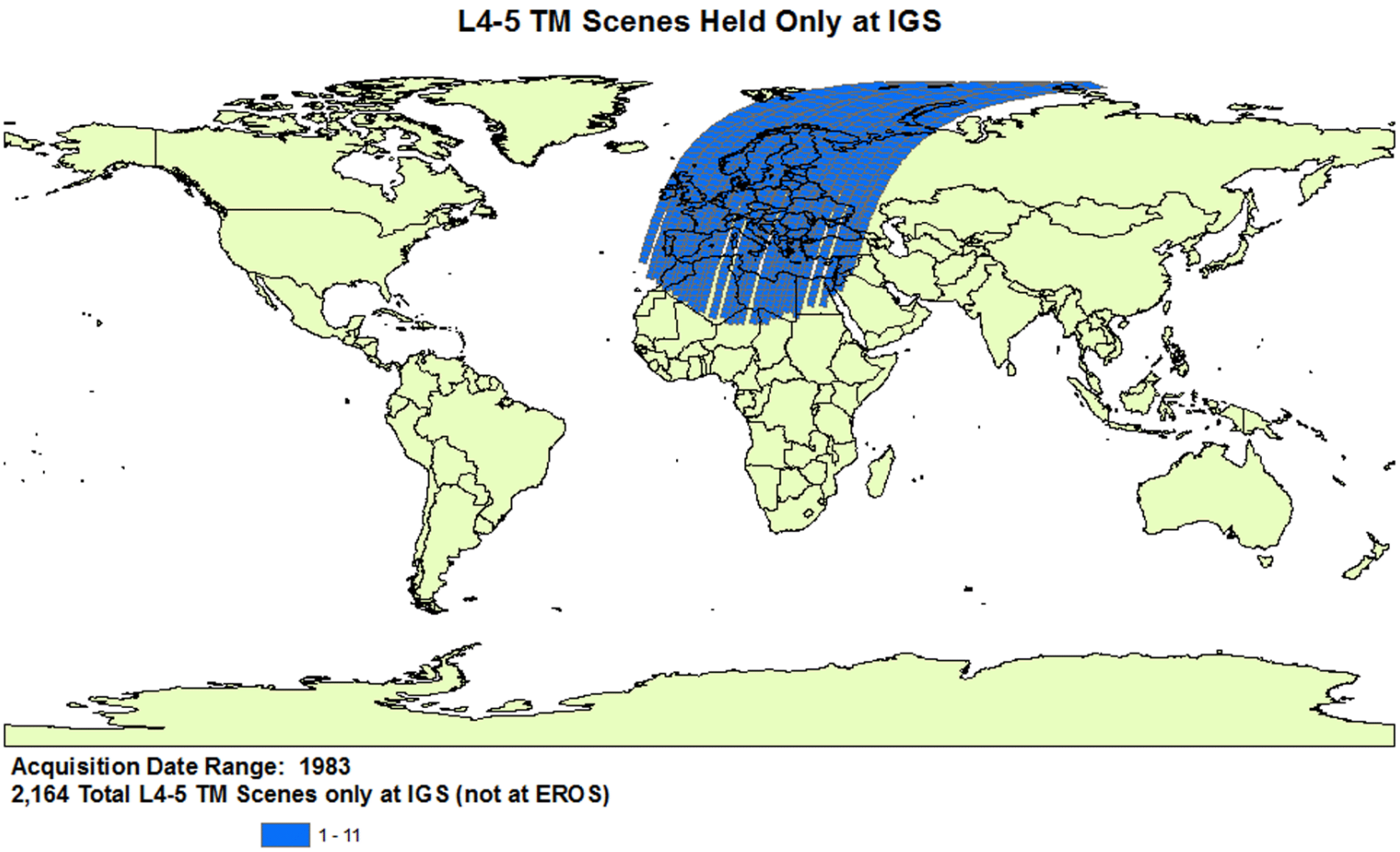
USGS

L4-5 TM 1982



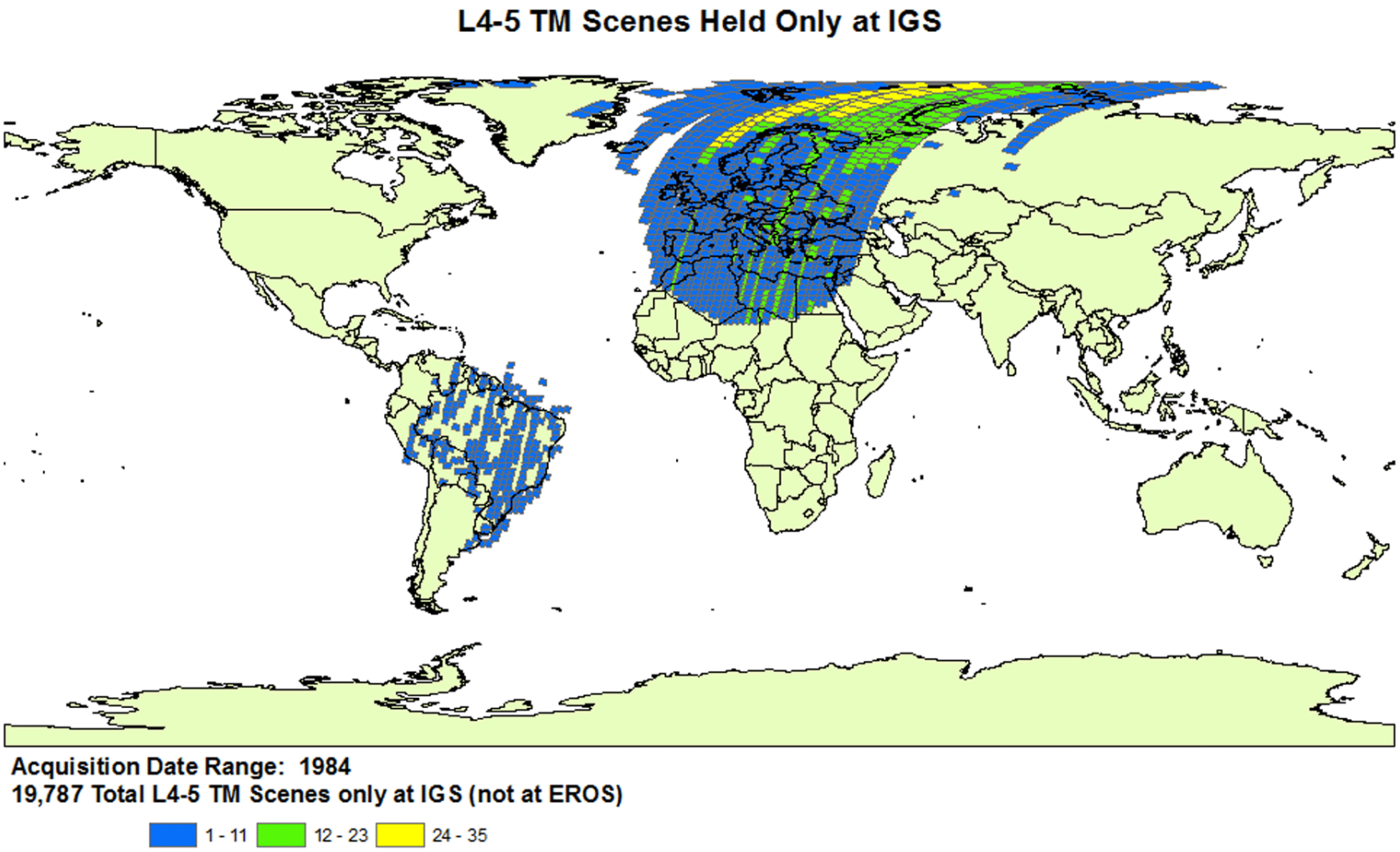
USGS

L4-5 TM 1983



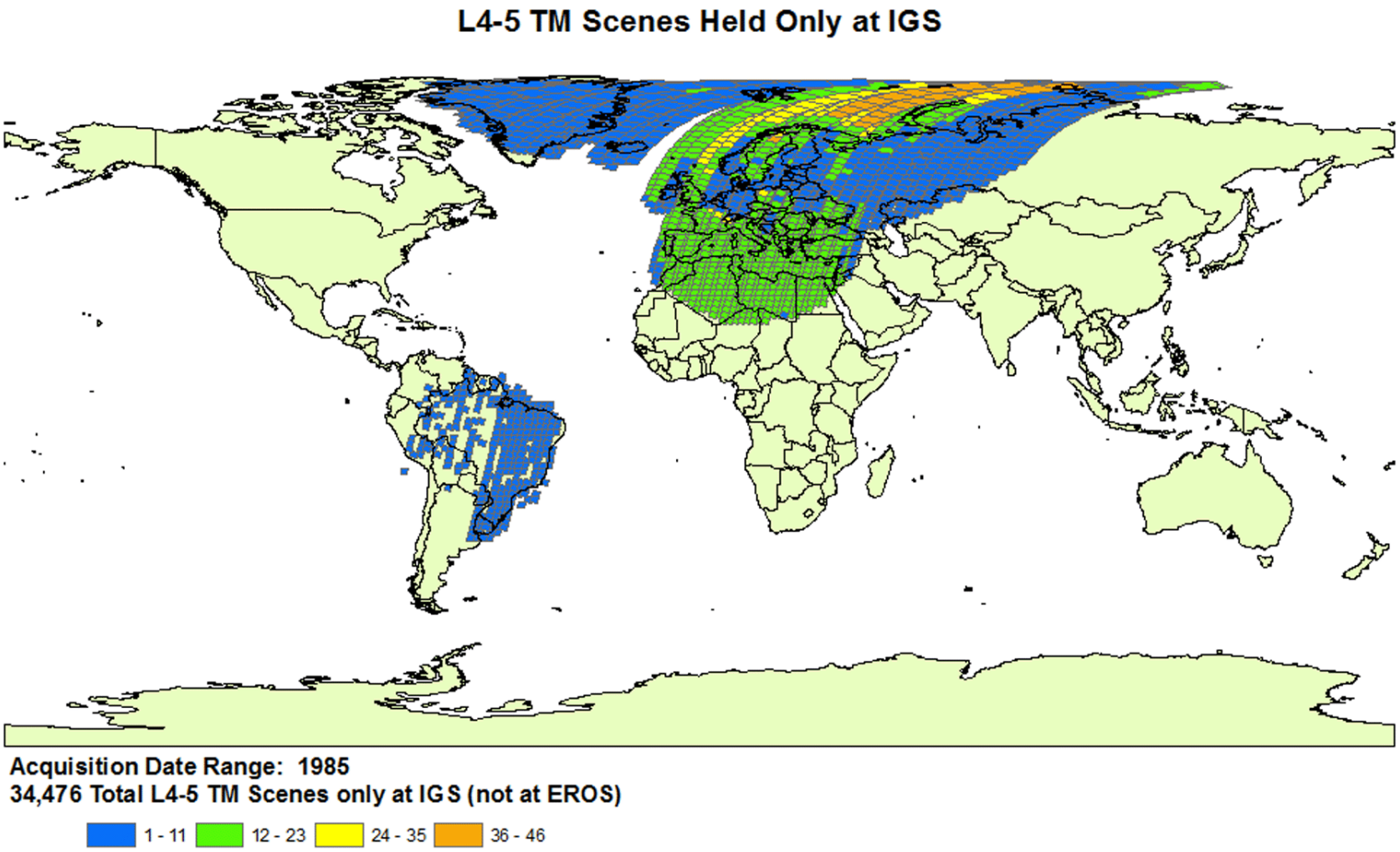
USGS

L4-5 TM 1984



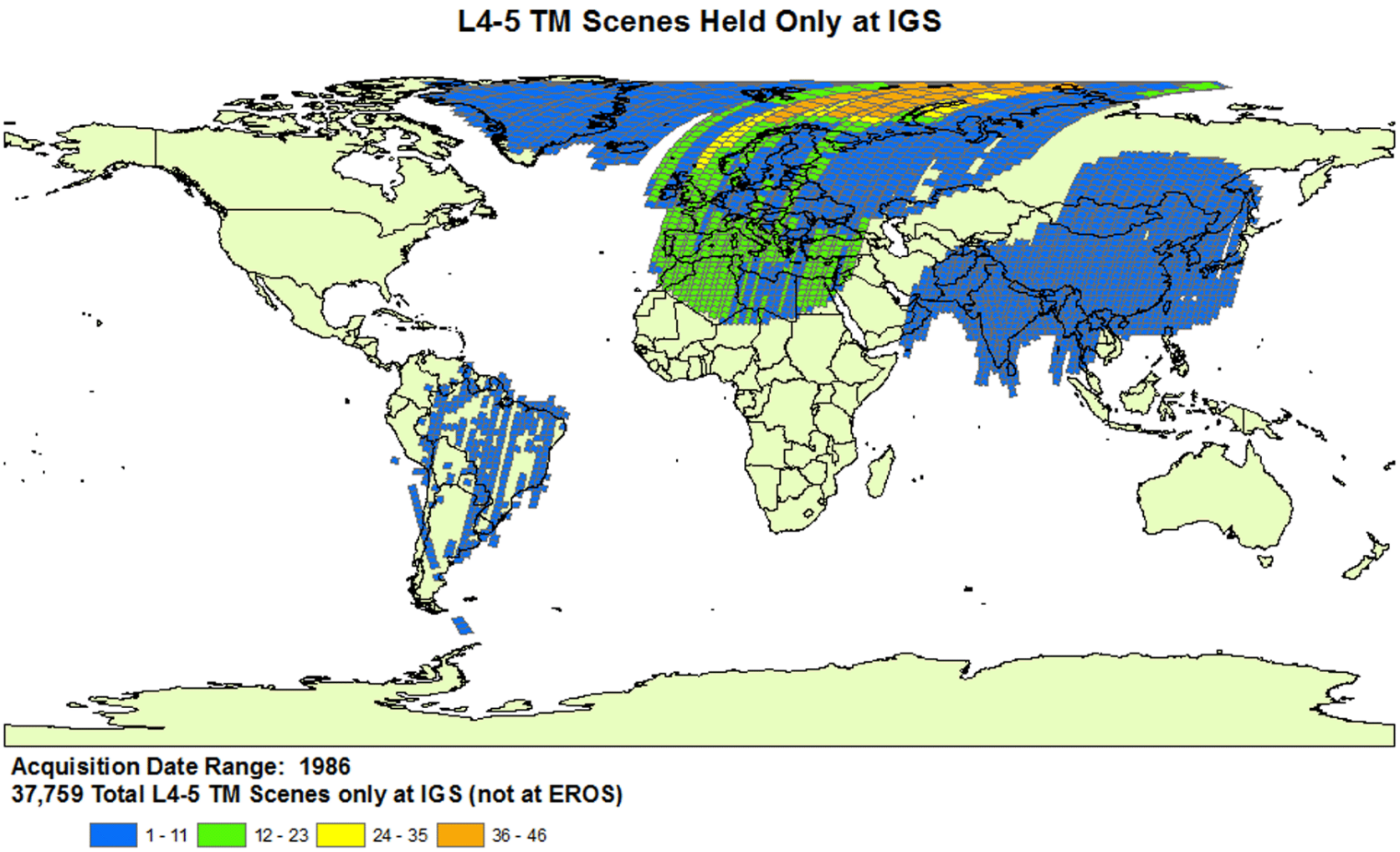
USGS

L4-5 TM 1985



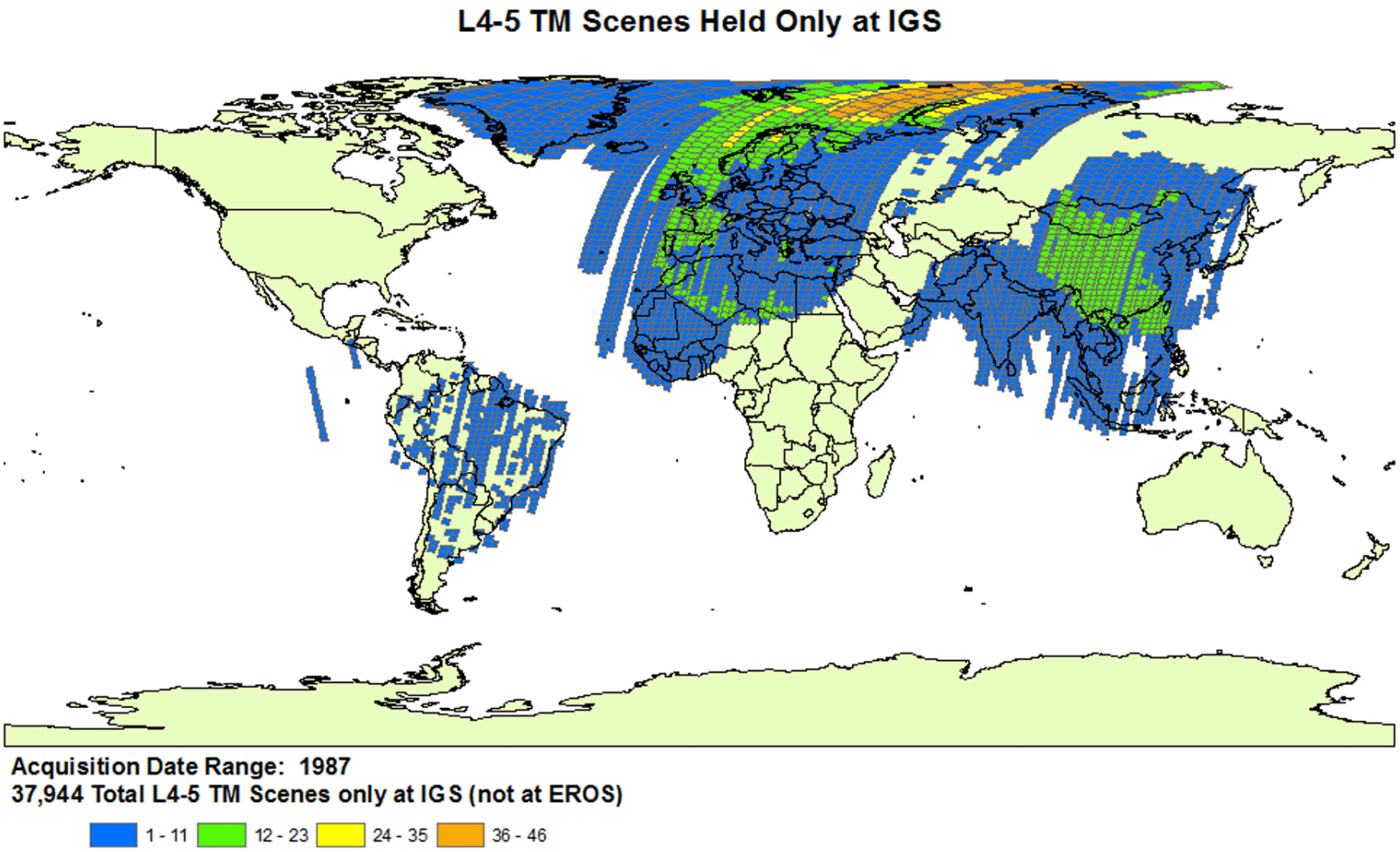
USGS

L4-5 TM 1986



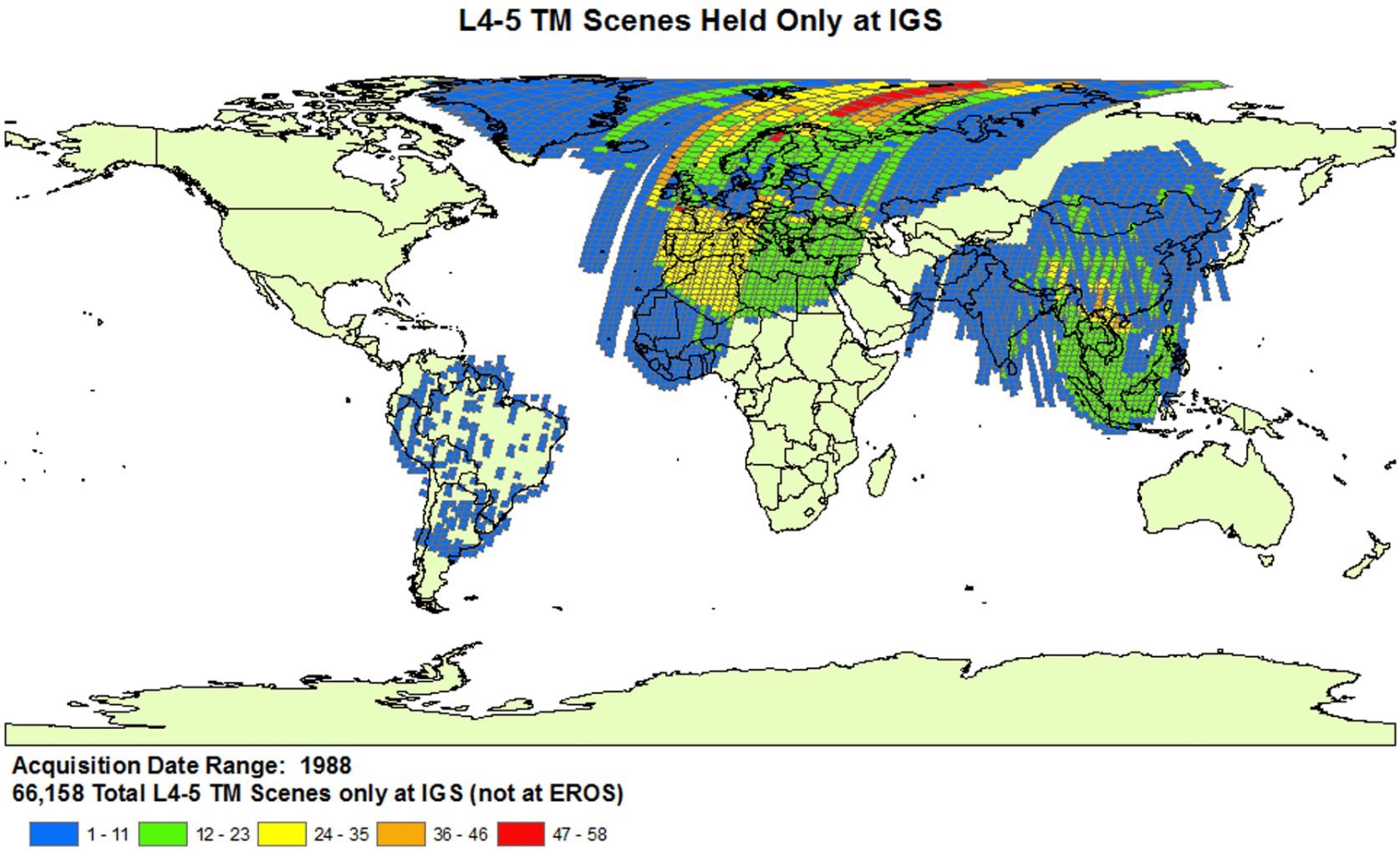
USGS

L4-5 TM 1987



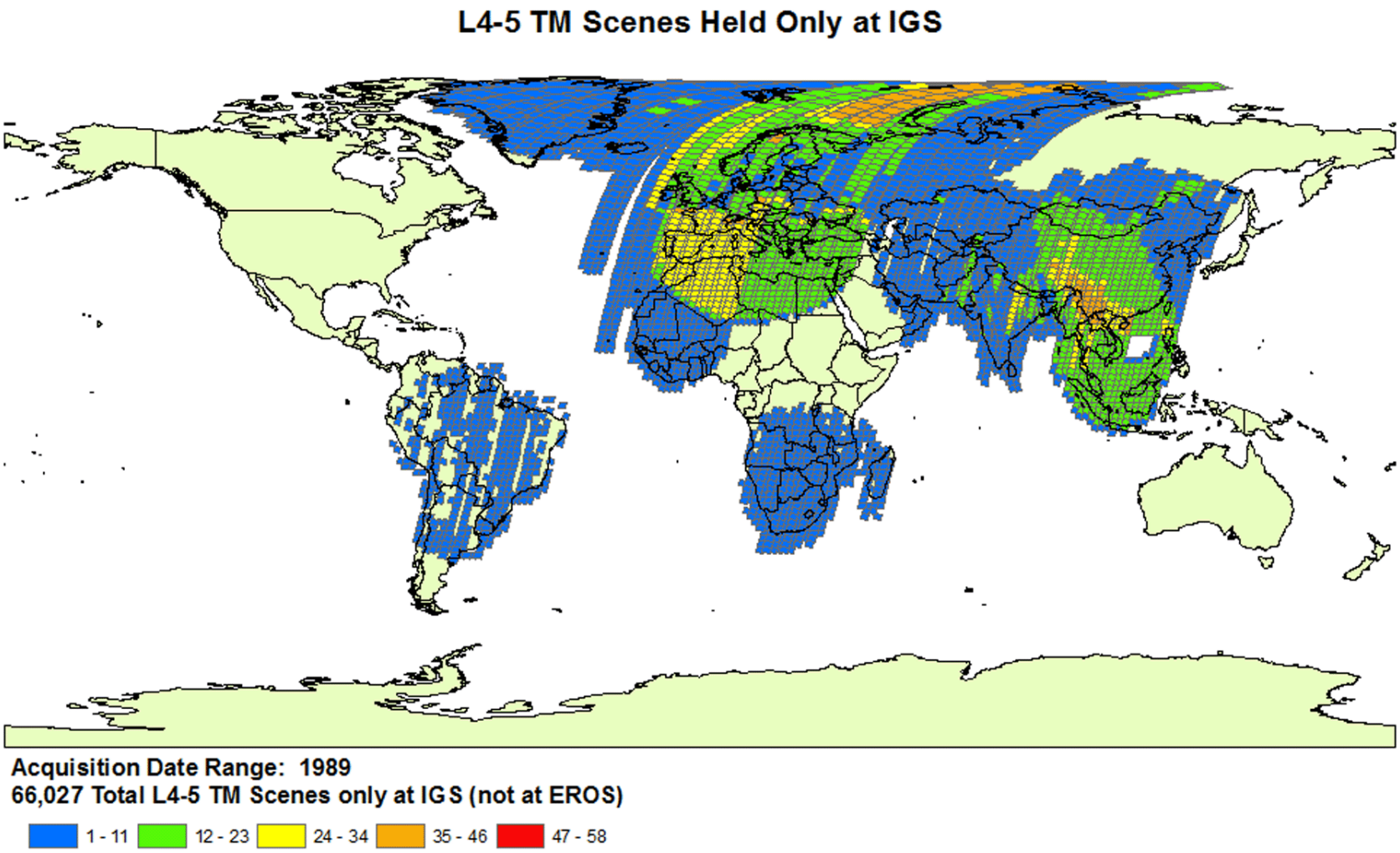
USGS

L4-5 TM 1988



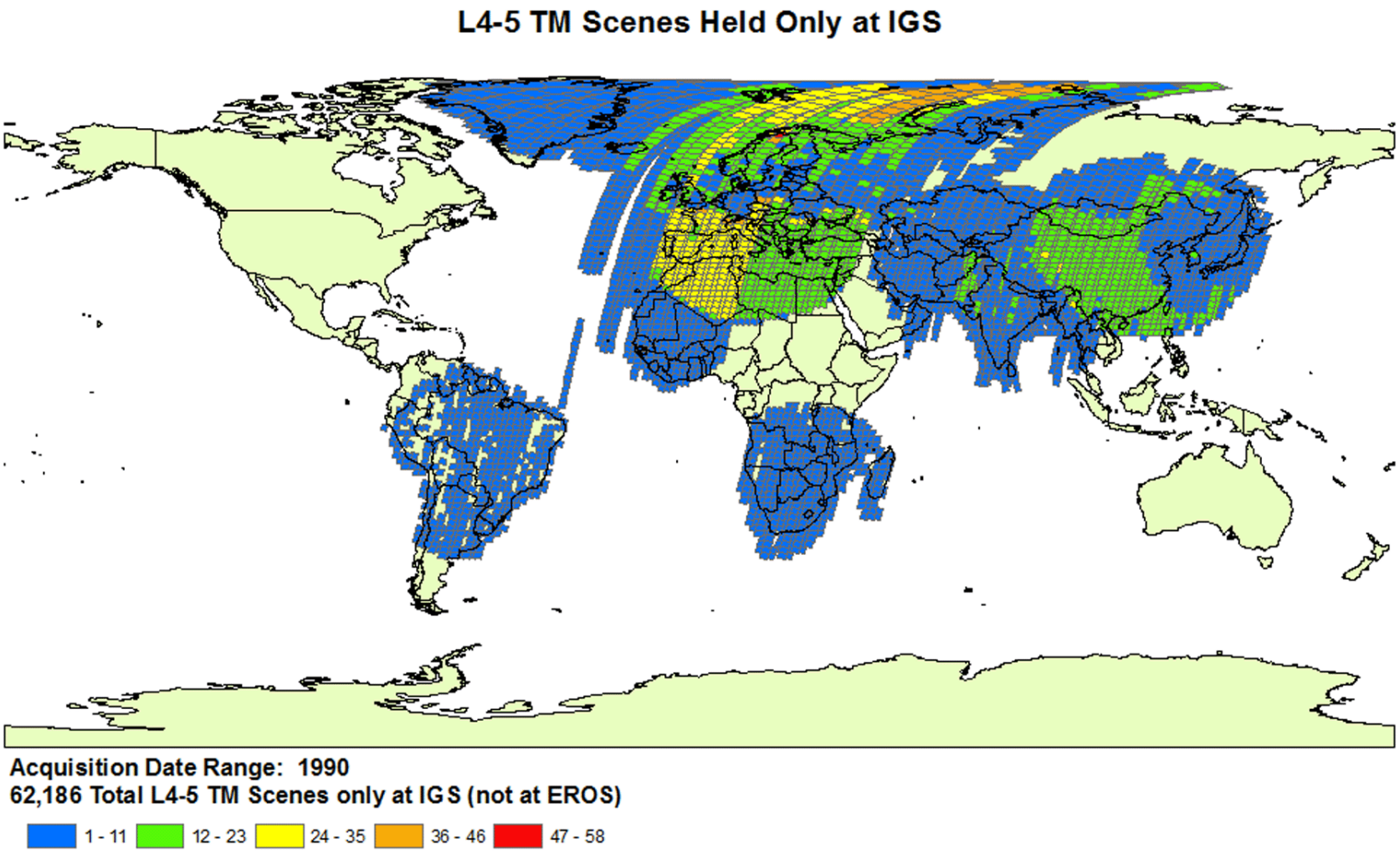
USGS

L4-5 TM 1989



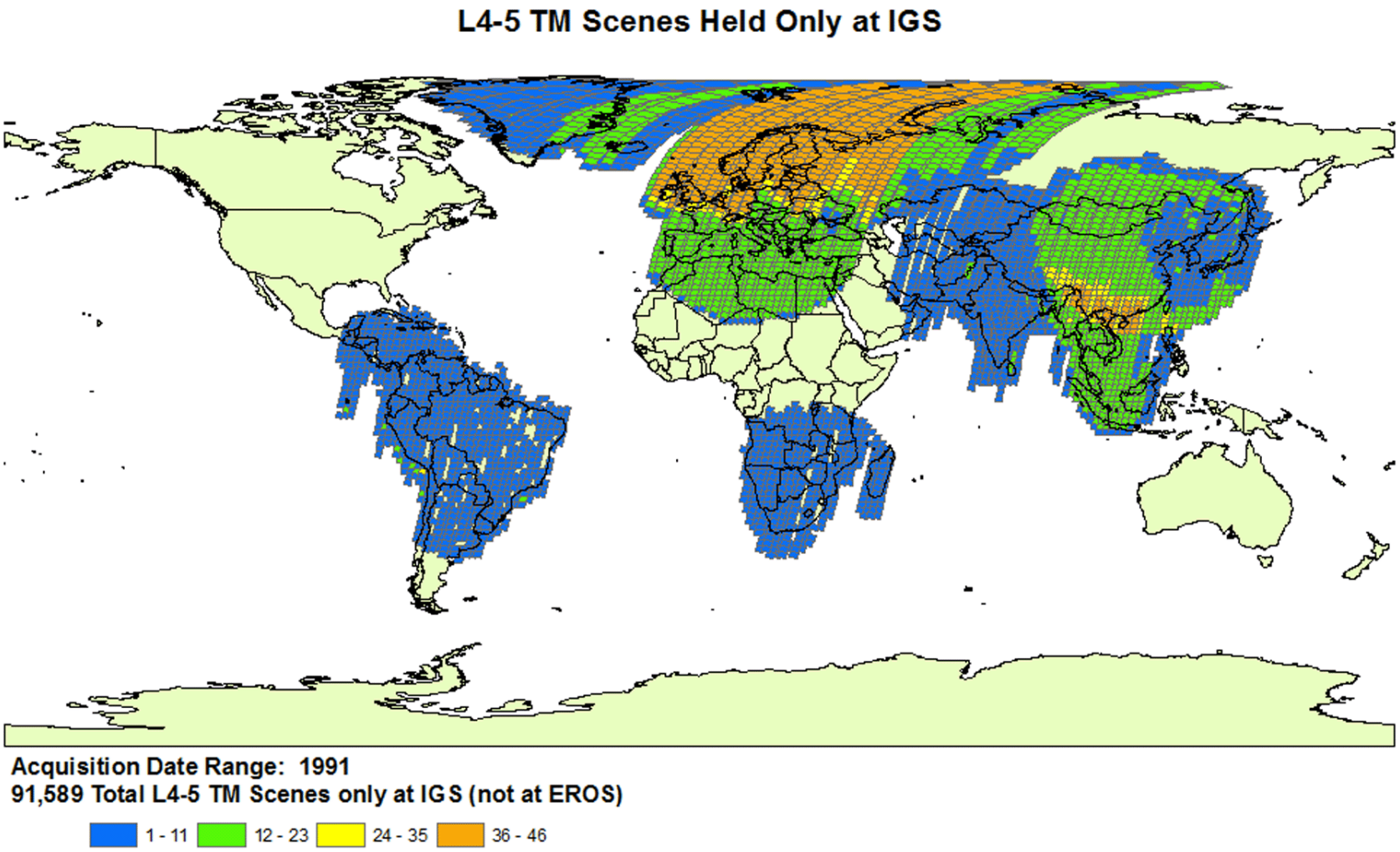
USGS

L4-5 TM 1990



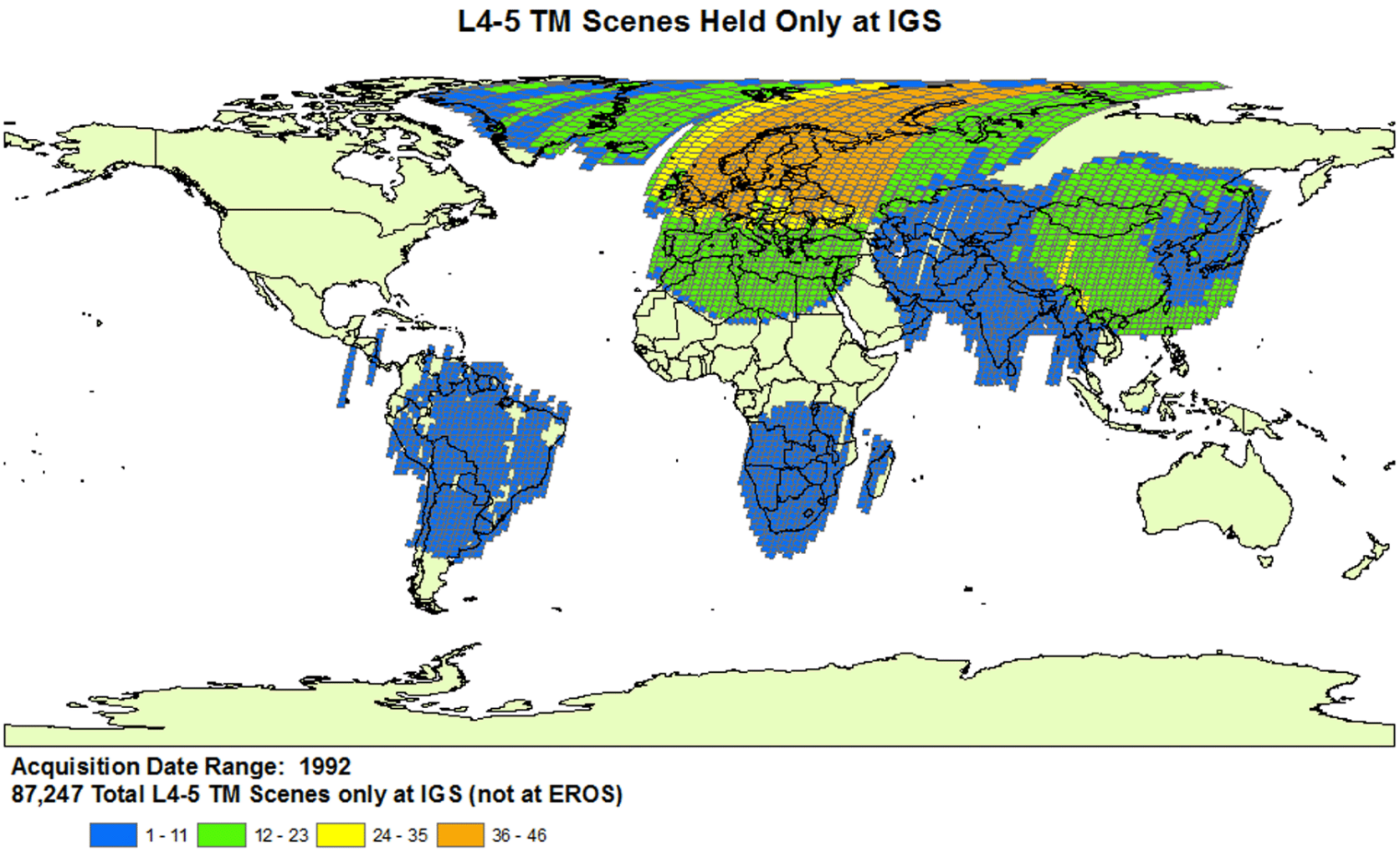
USGS

L4-5 TM 1991



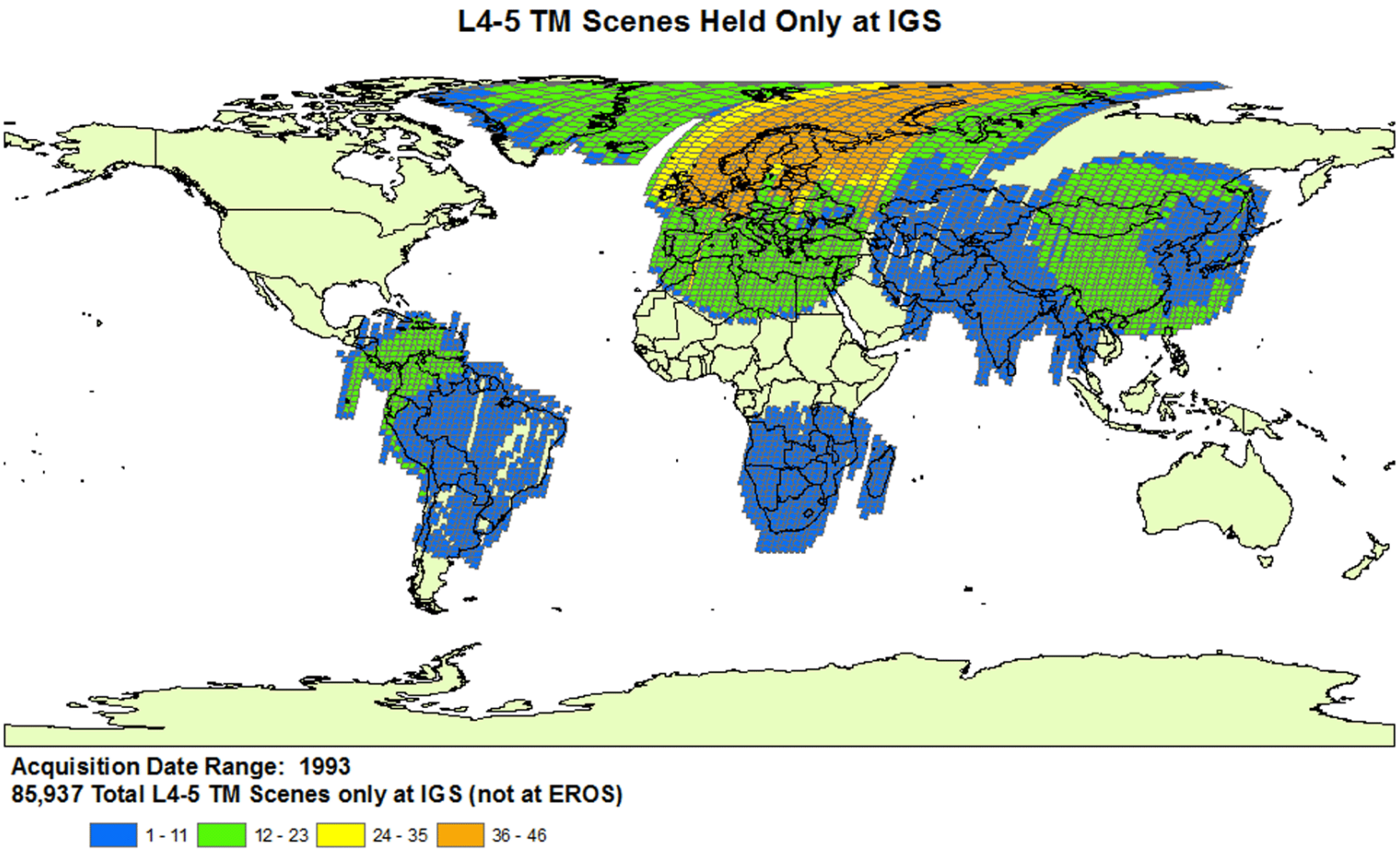
USGS

L4-5 TM 1992



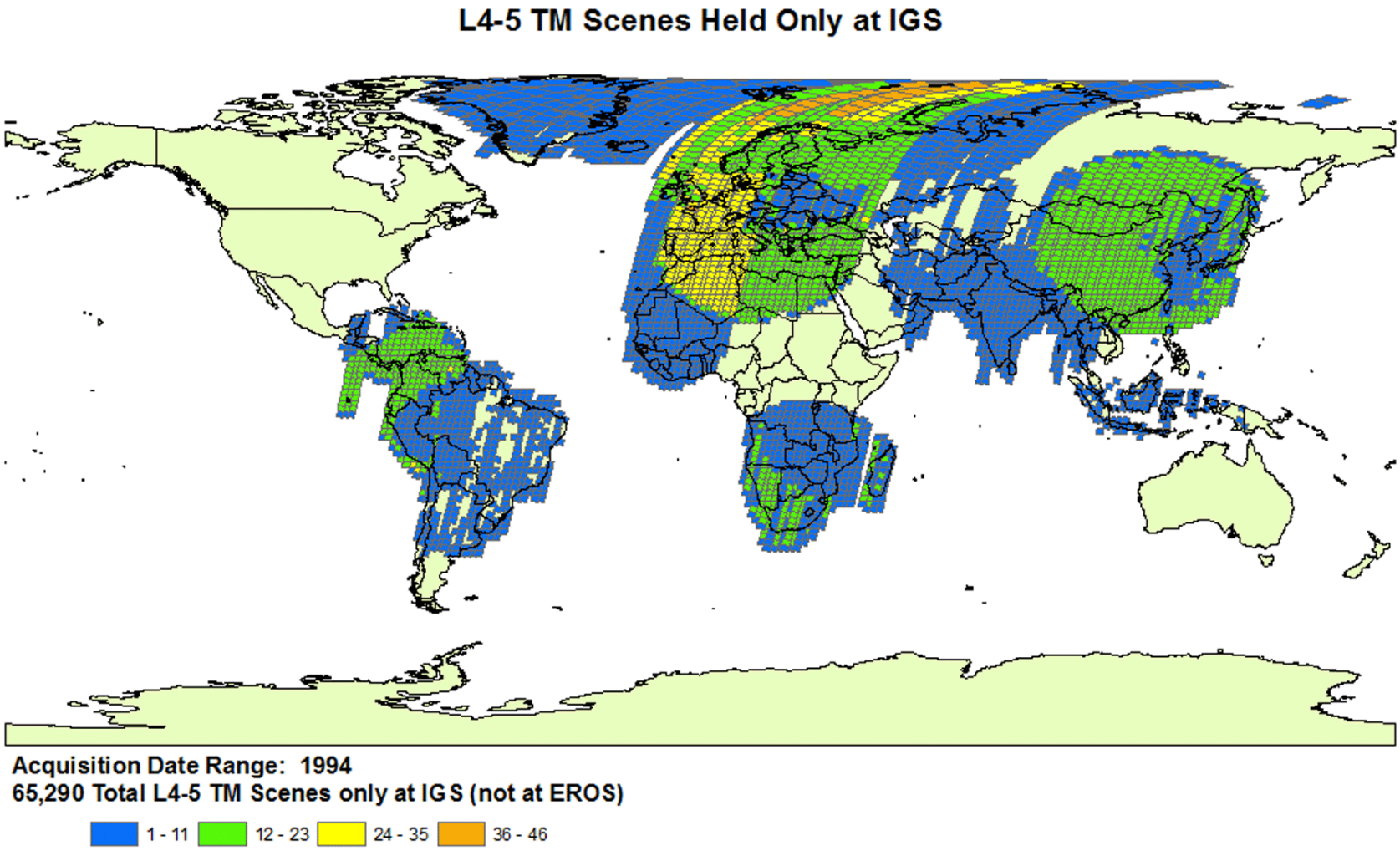
USGS

L4-5 TM 1993



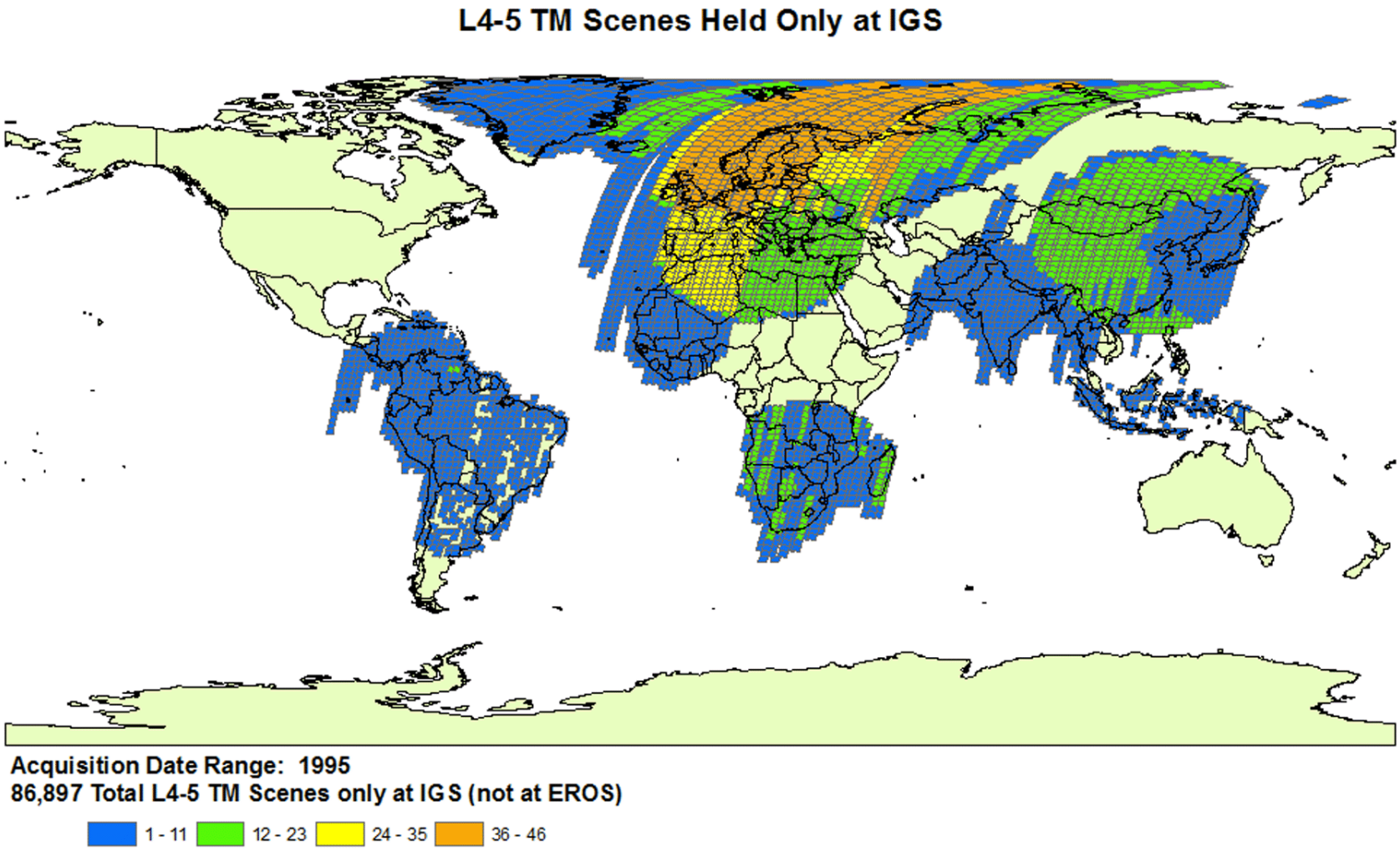
USGS

L4-5 TM 1994



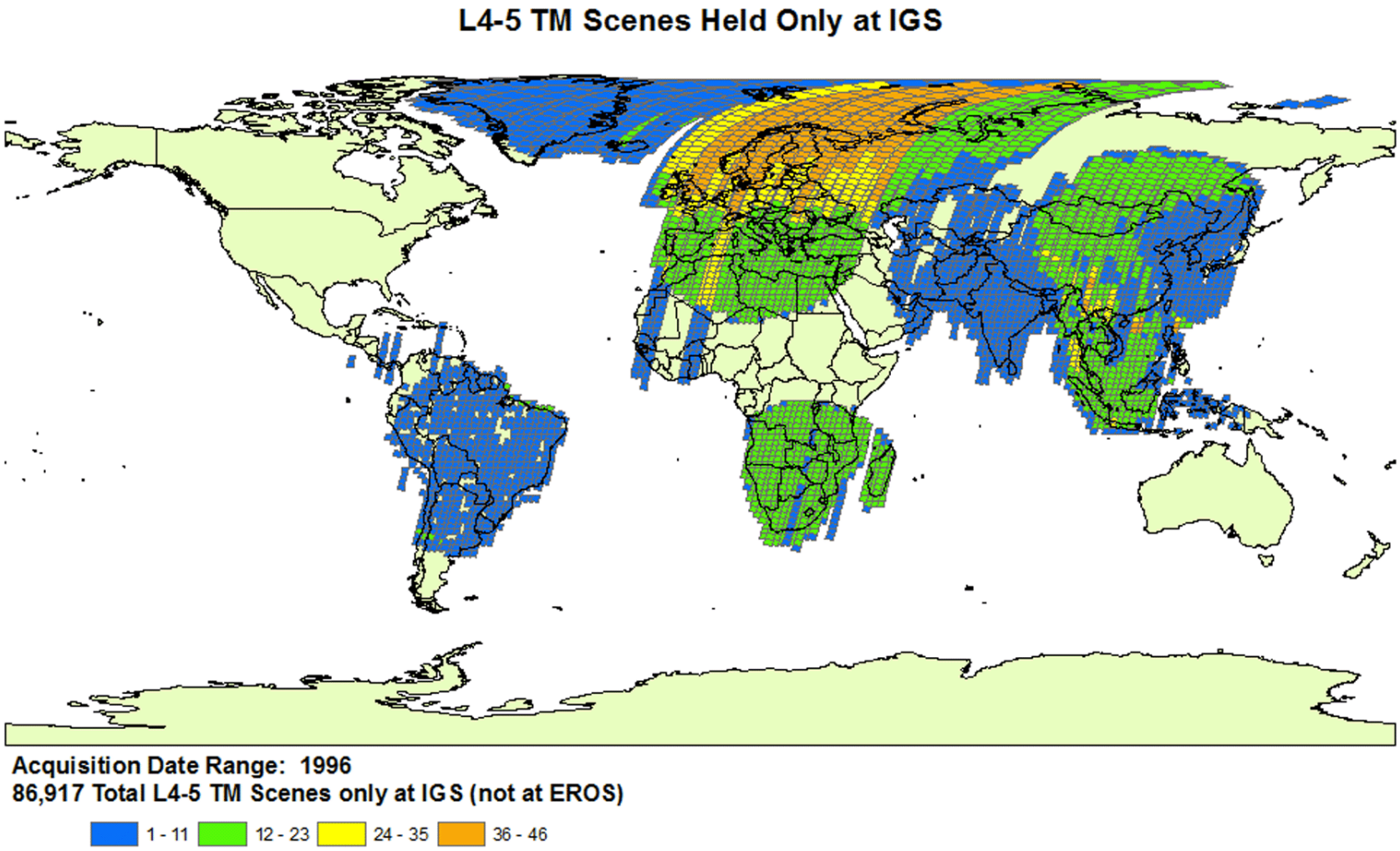
USGS

L4-5 TM 1995



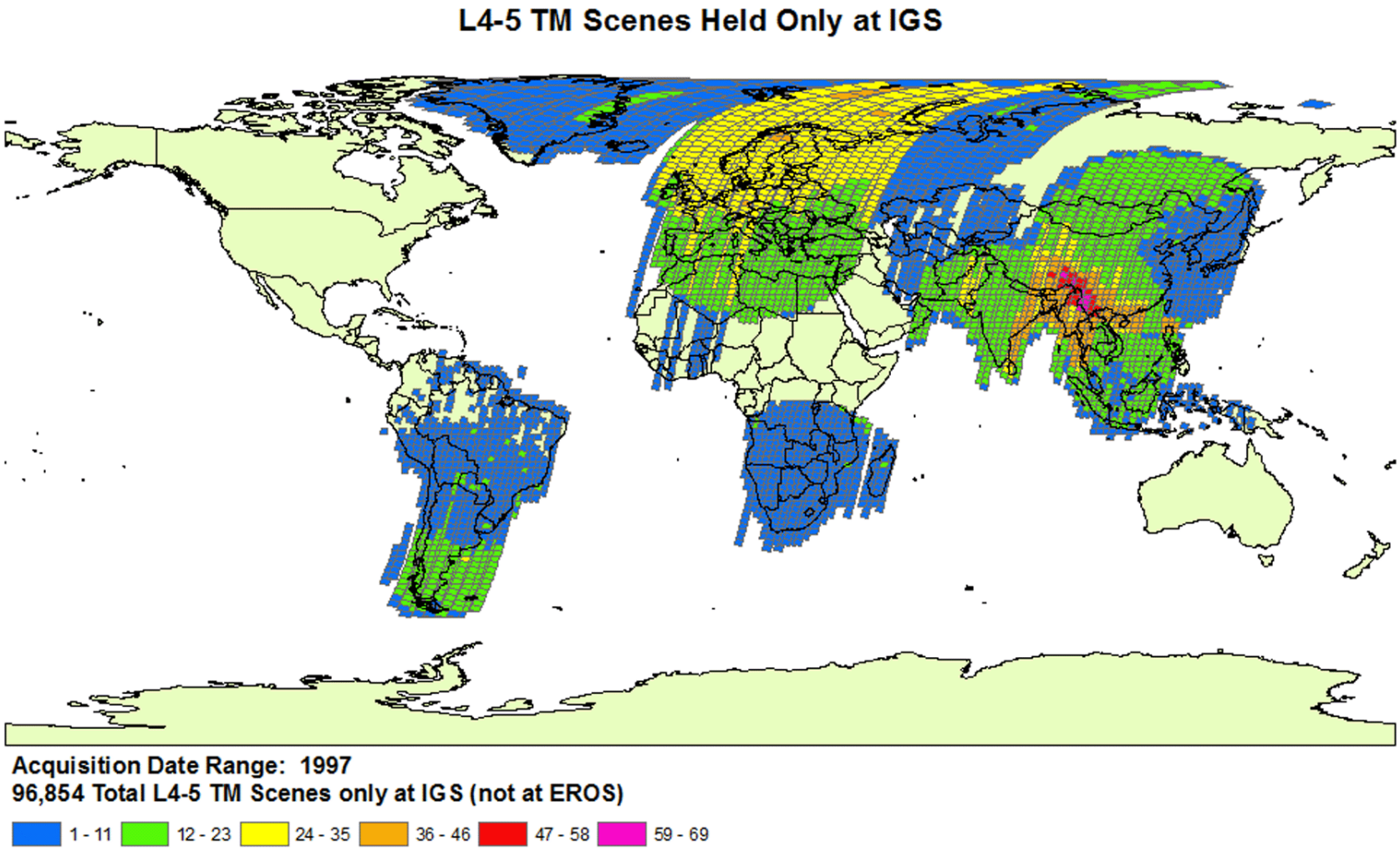
USGS

L4-5 TM 1996



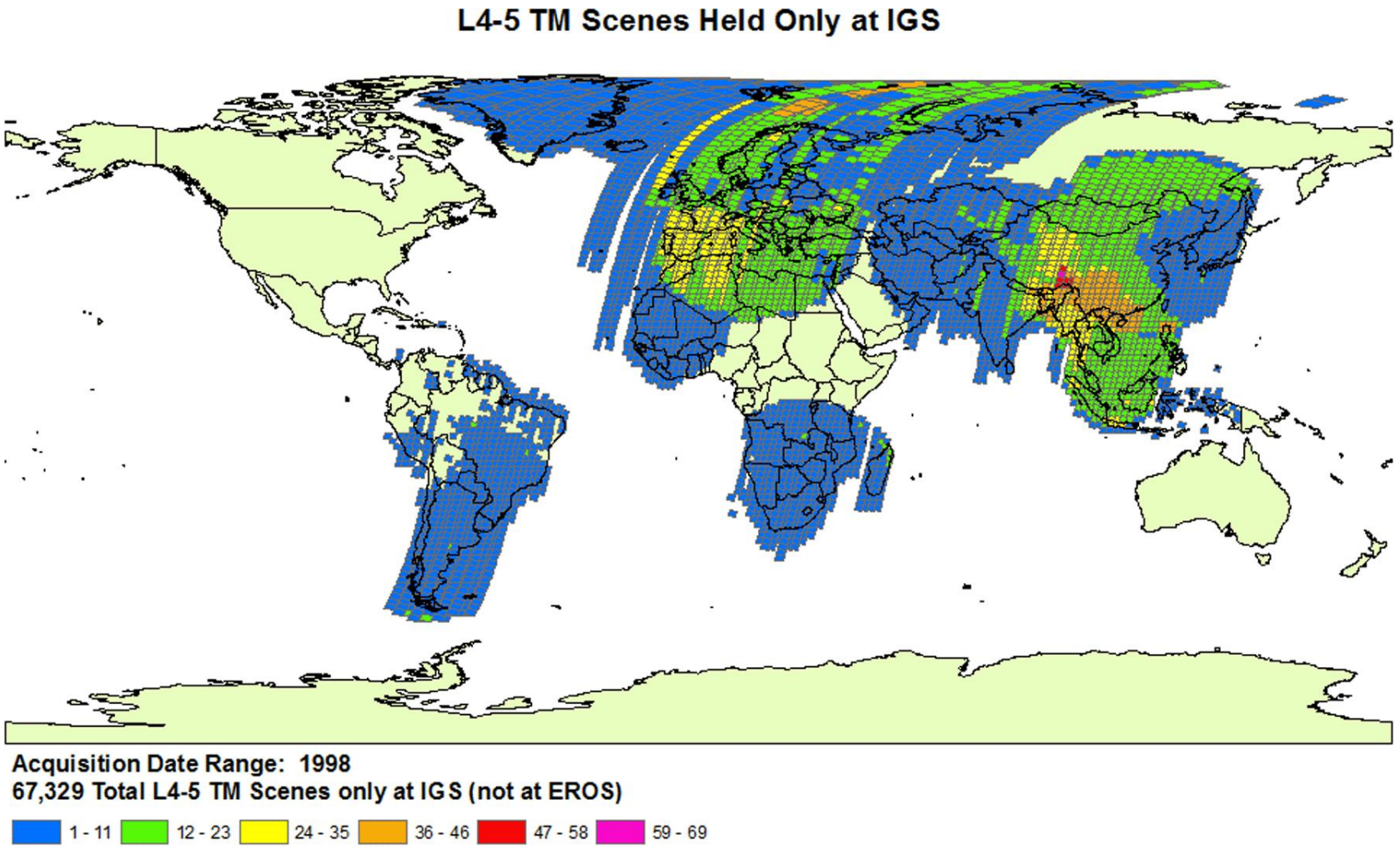
USGS

L4-5 TM 1997



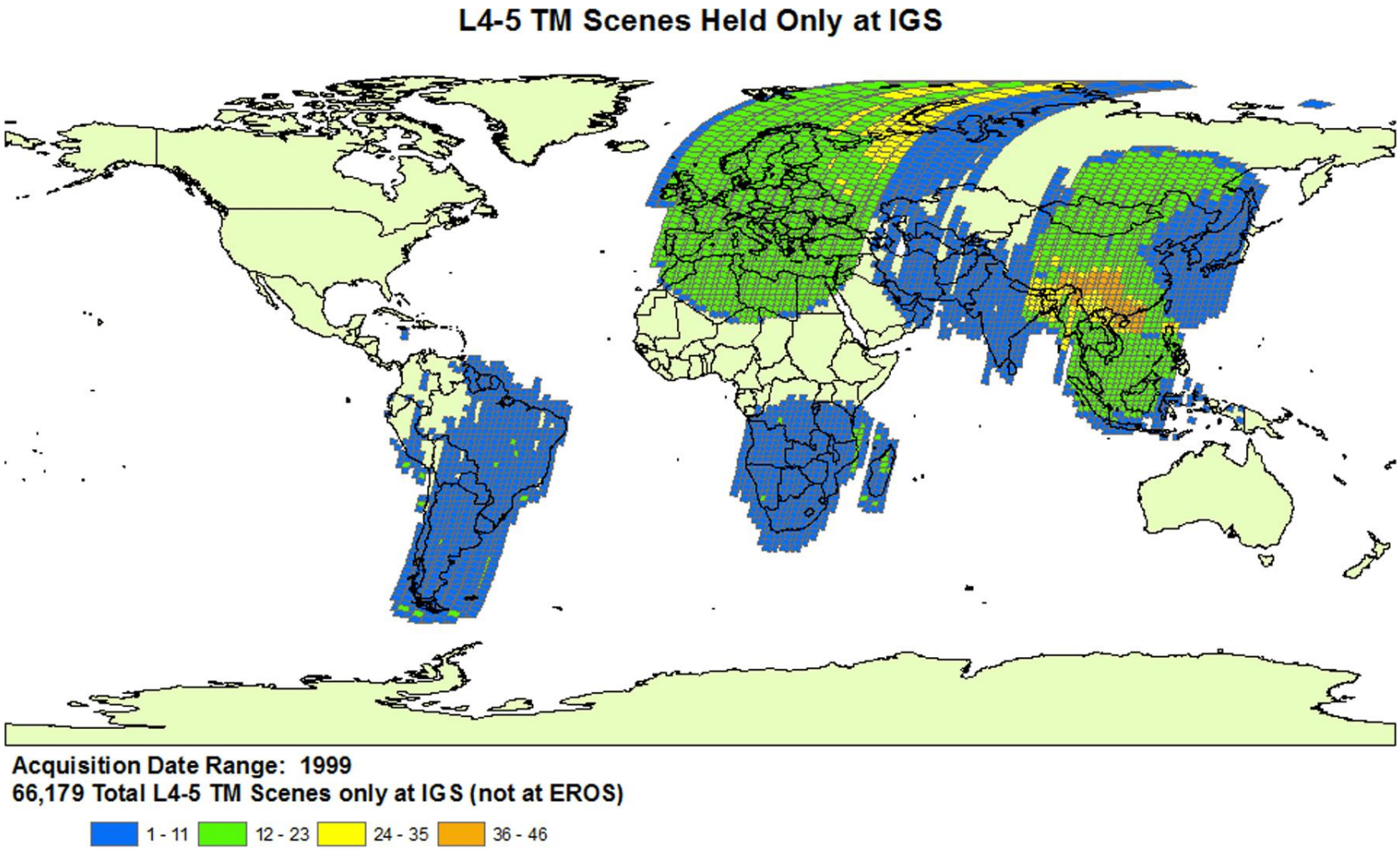
USGS

L4-5 TM 1998



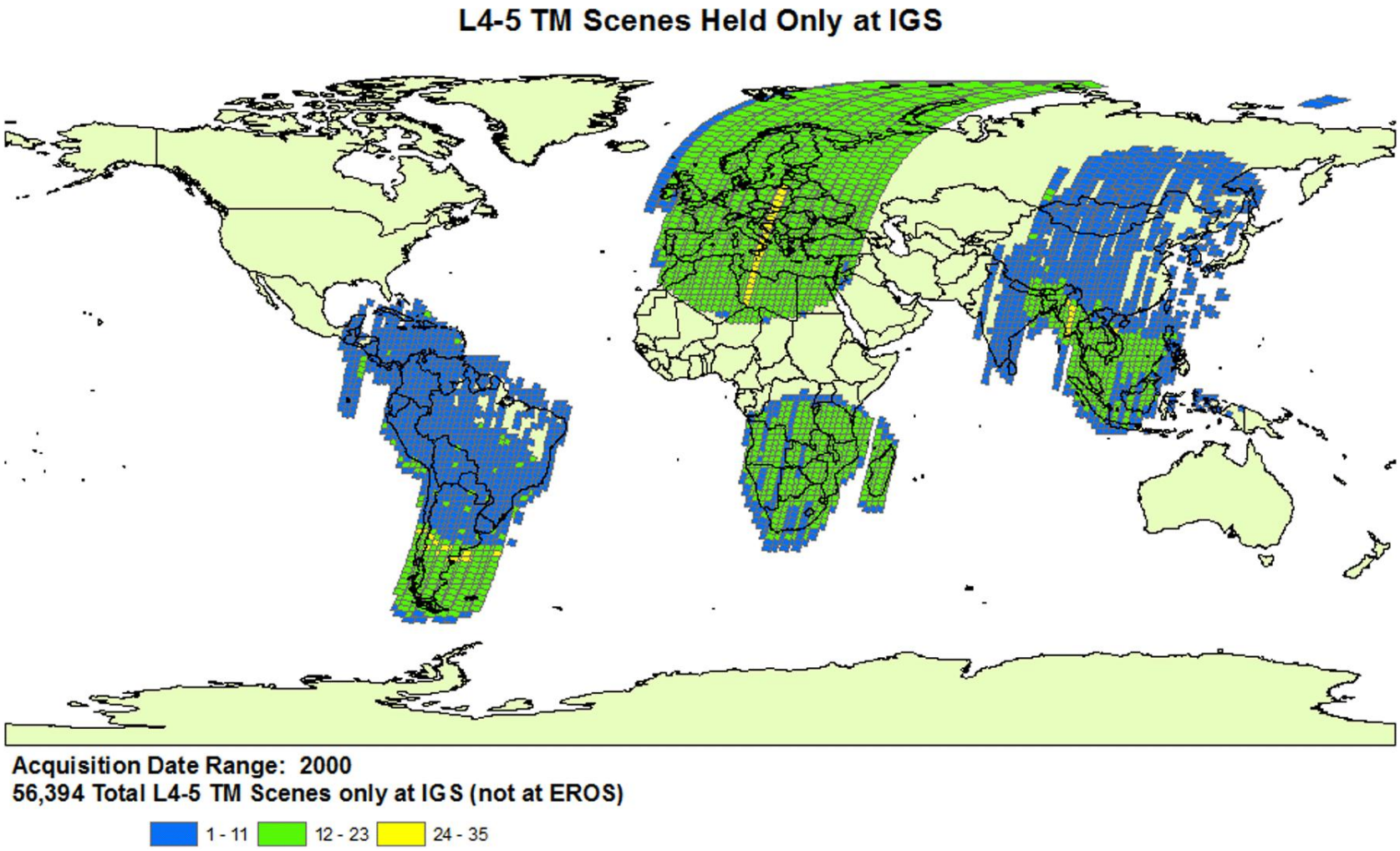
USGS

L4-5 TM 1999



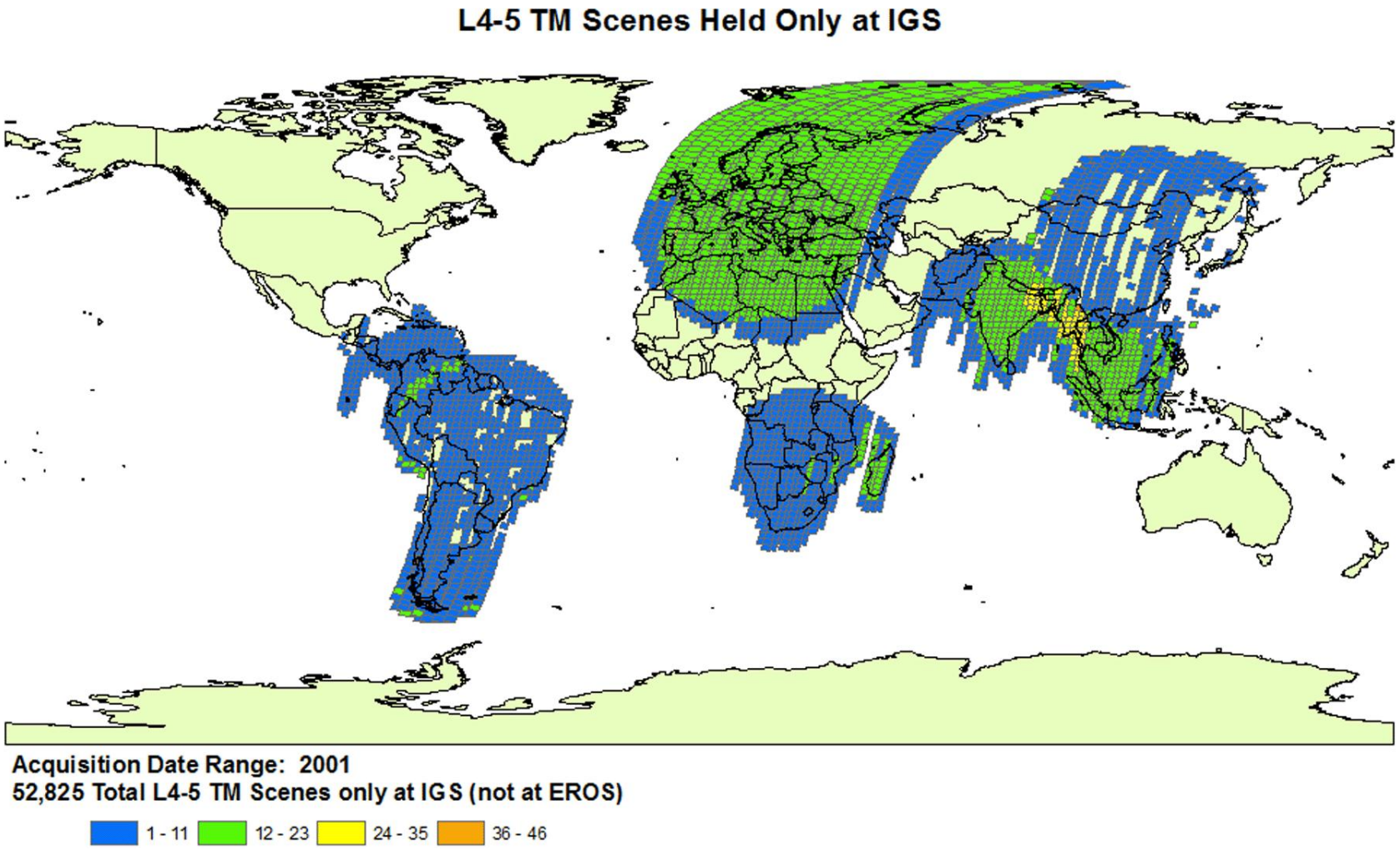
USGS

L4-5 TM 2000



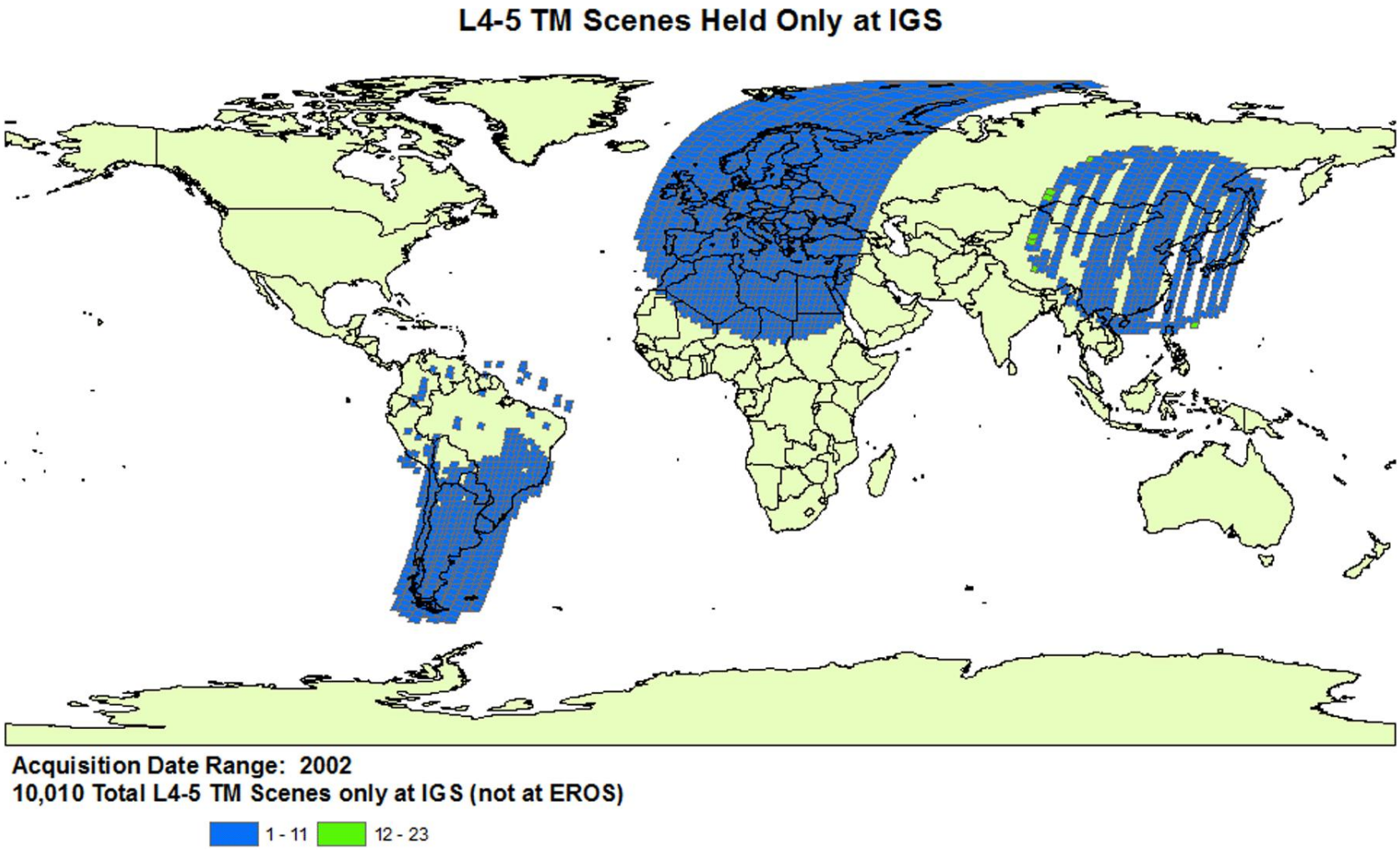
USGS

L4-5 TM 2001



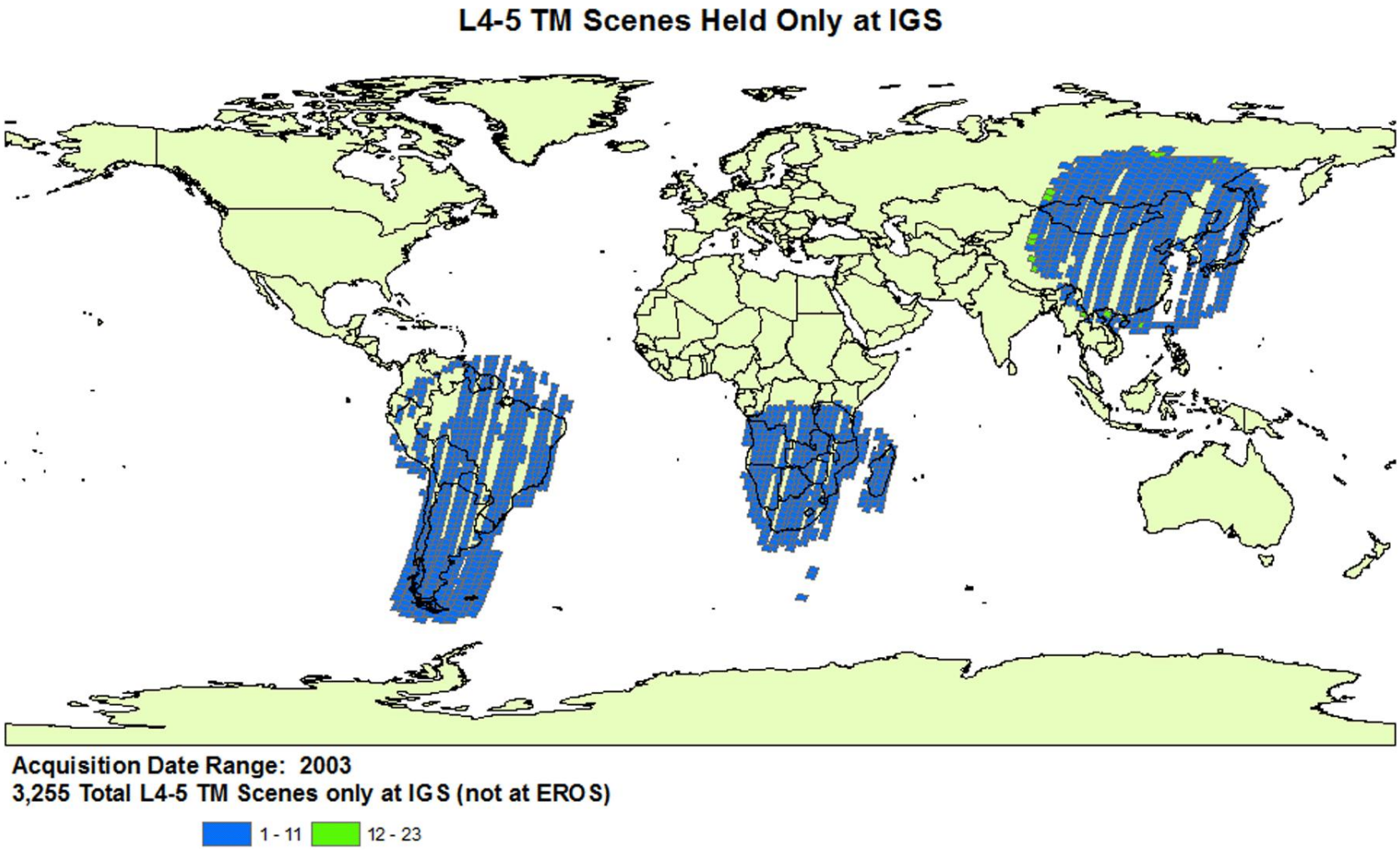
USGS

L4-5 TM 2002



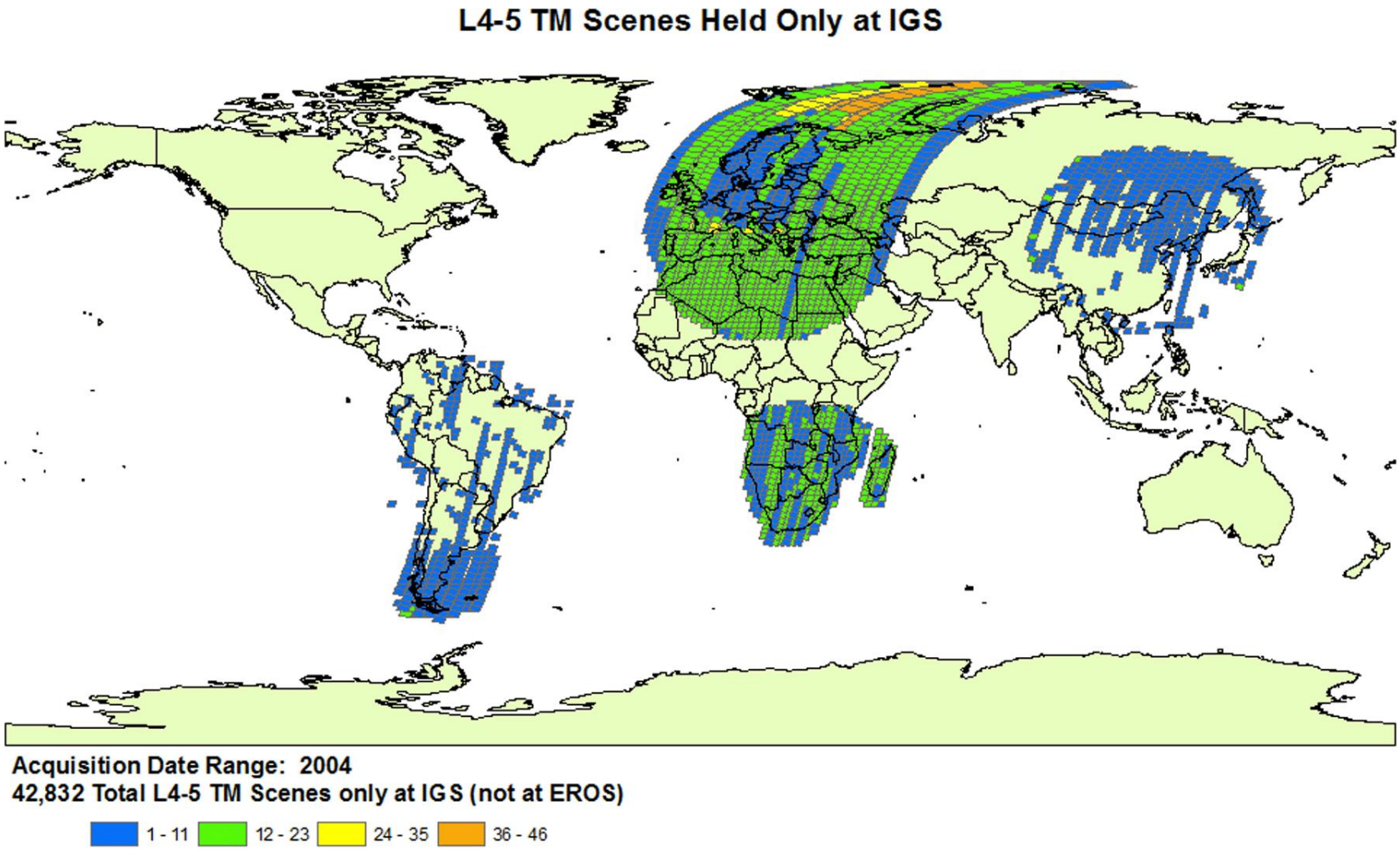
USGS

L4-5 TM 2003



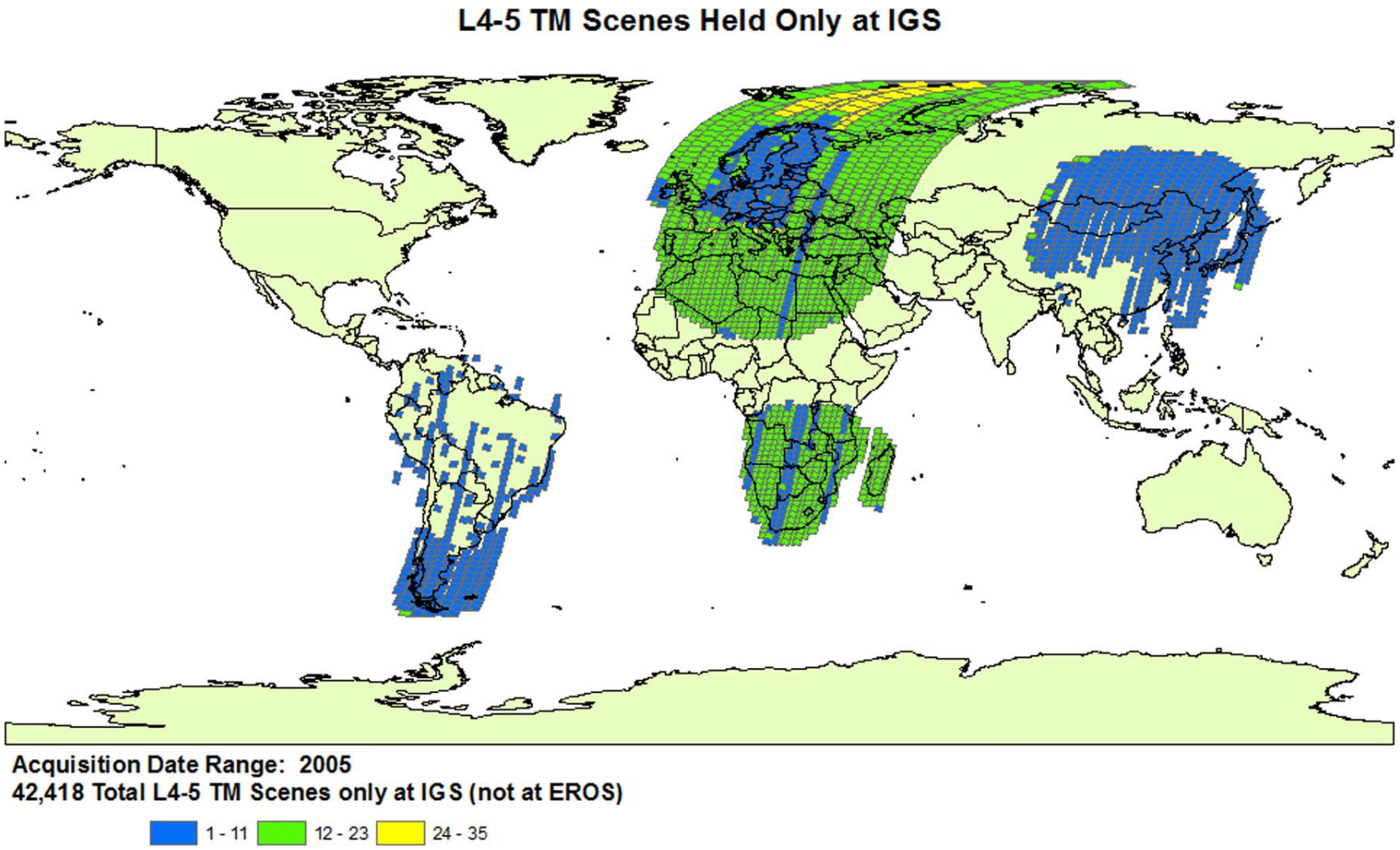
USGS

L4-5 TM 2004



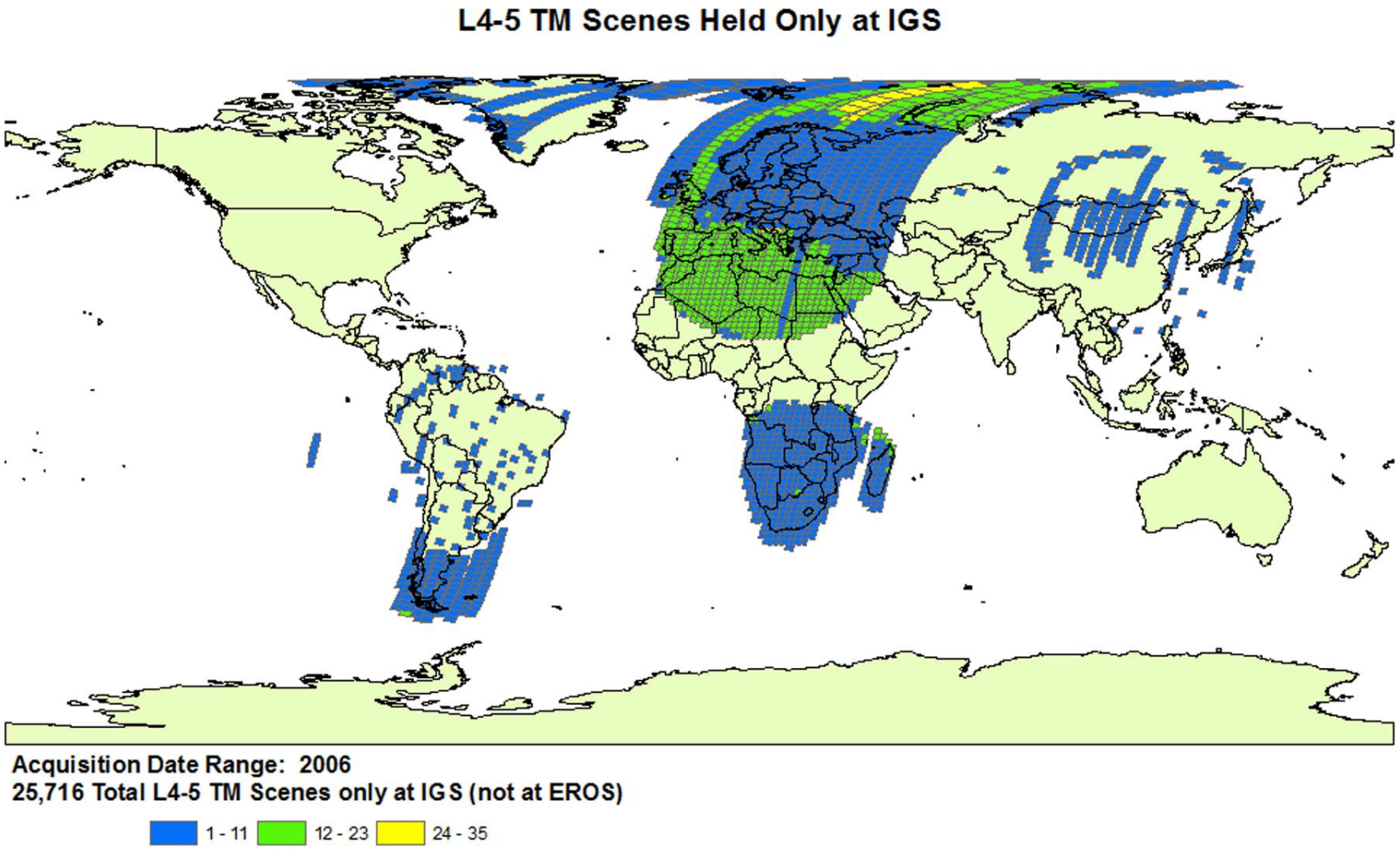
USGS

L4-5 TM 2005



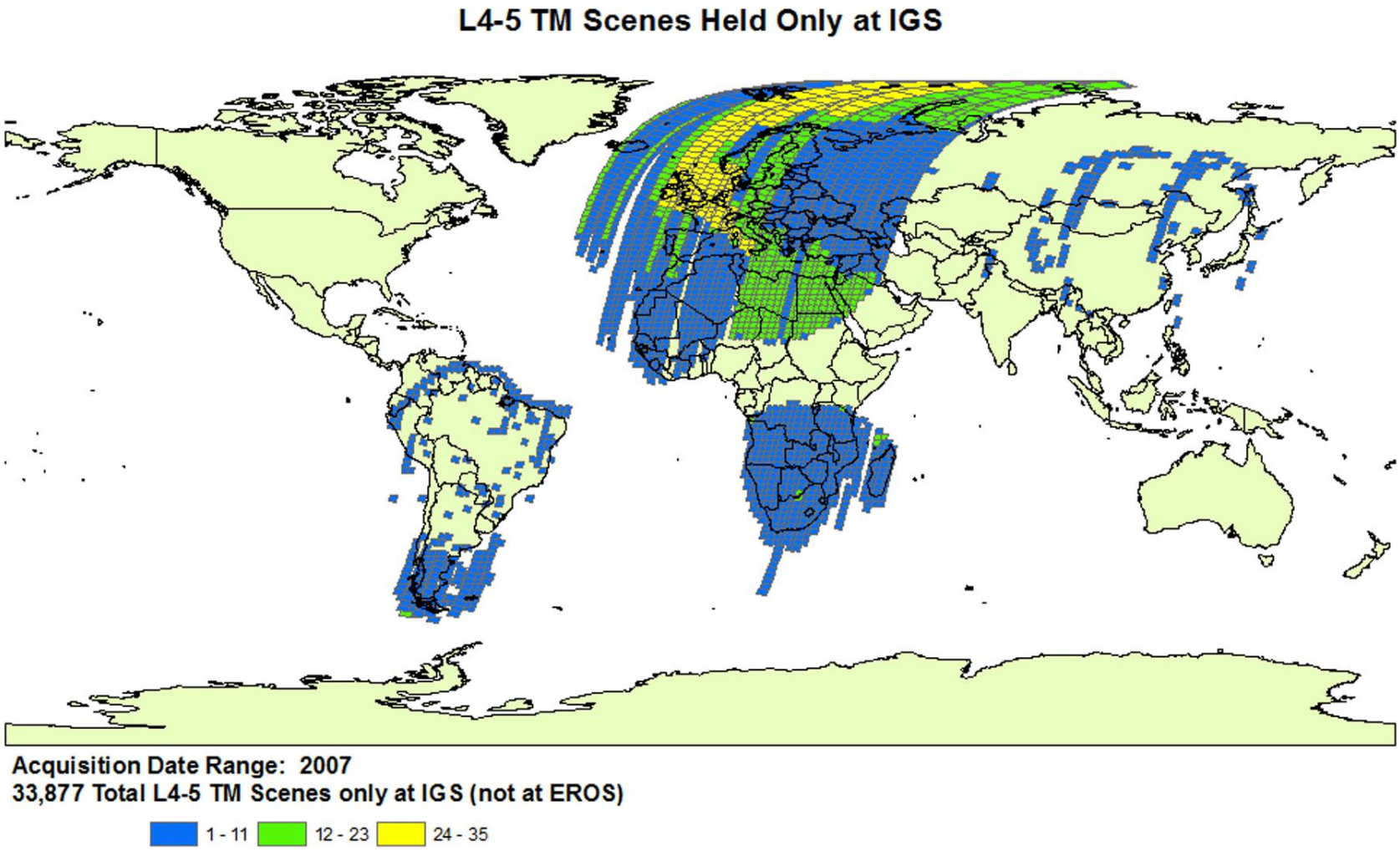
USGS

L4-5 TM 2006



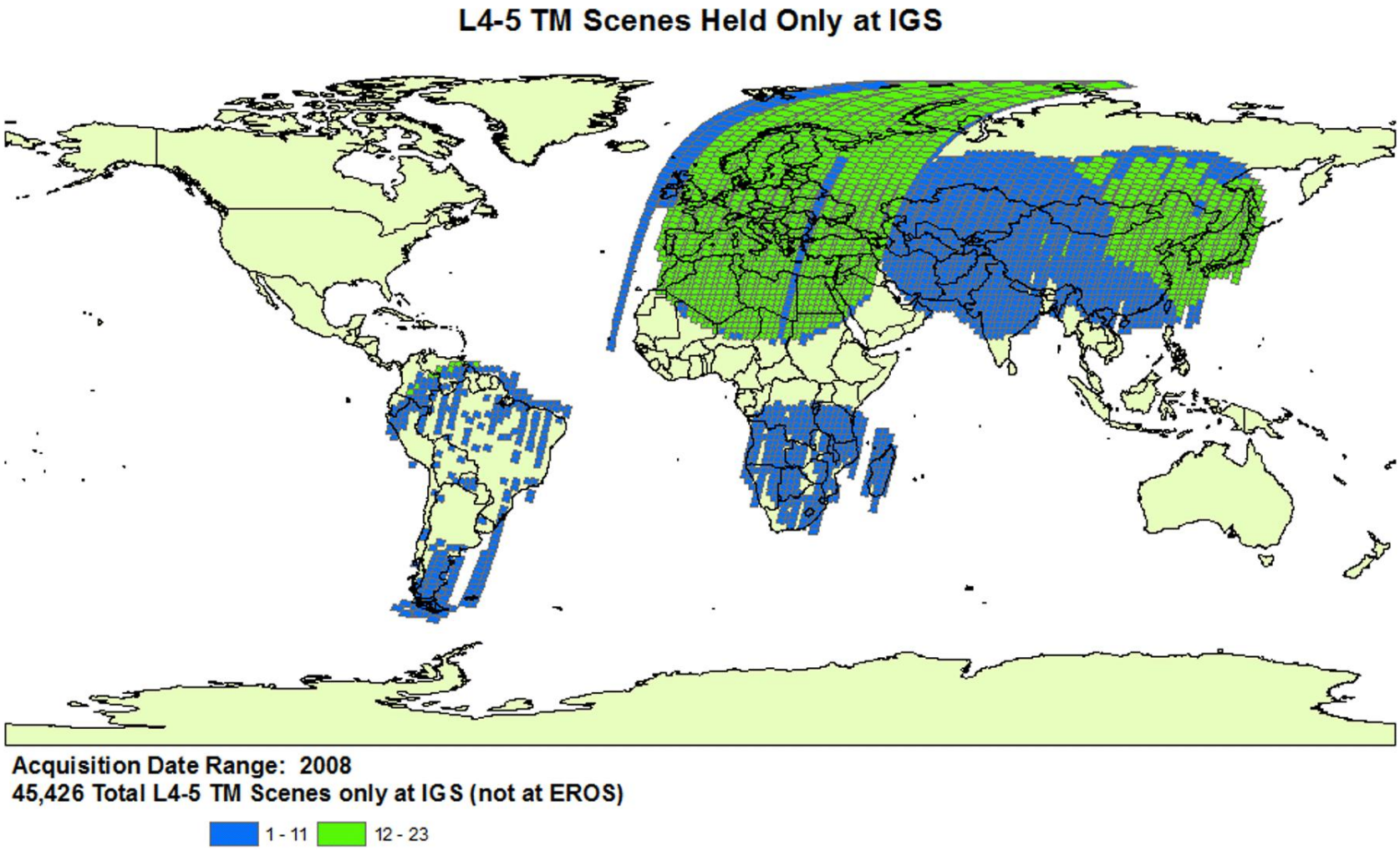
USGS

L4-5 TM 2007



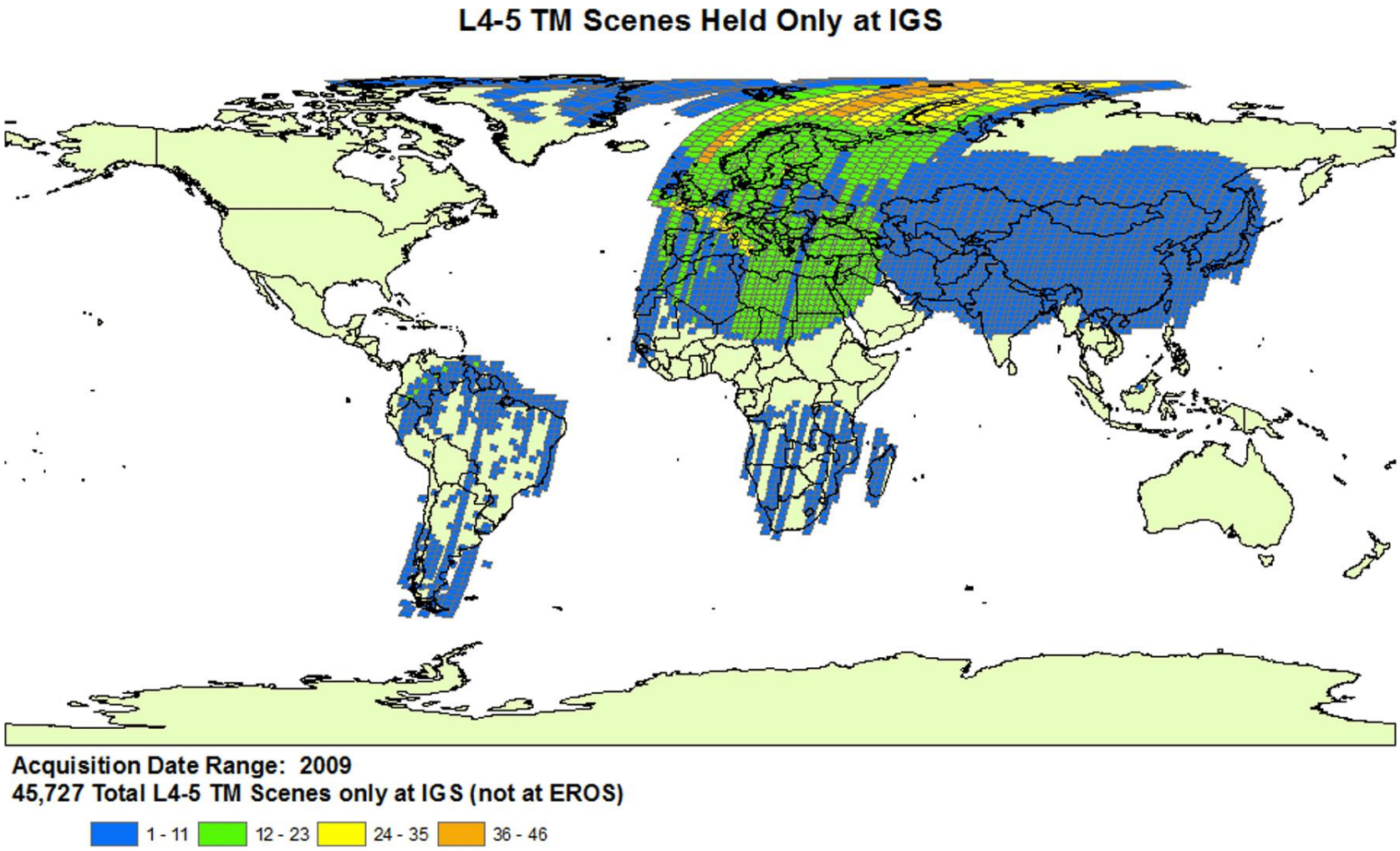
USGS

L4-5 TM 2008



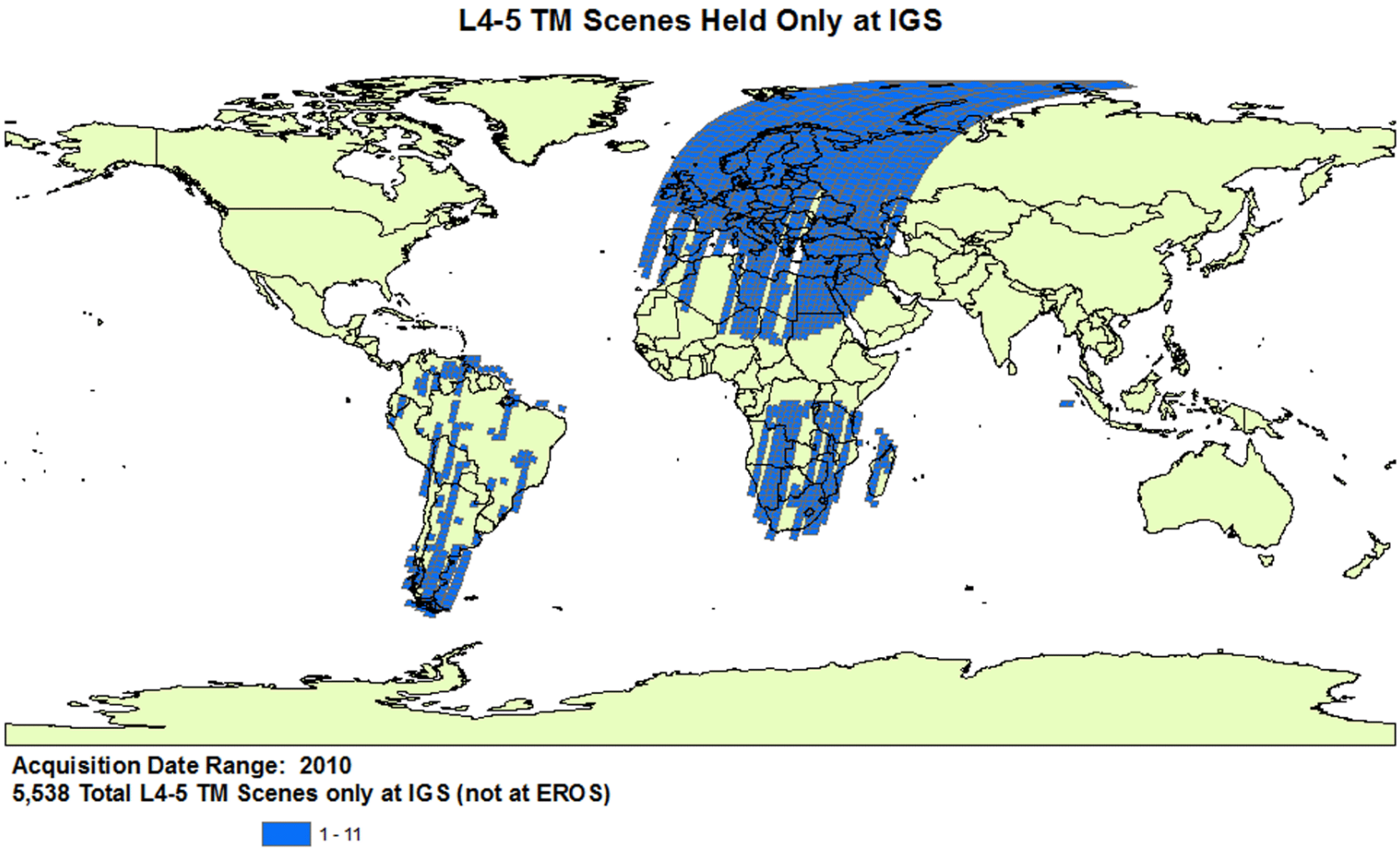
USGS

L4-5 TM 2009



USGS

L4-5 TM 2010



USGS

Detailed LGAC Status by Country/Sensor

USGS

Argentina

TM

- **54% complete**
- **103,598 scenes ingested**
- **96,185 scenes unique (93%)**
- **~86,500 scenes outstanding**

ETM+

- **49% complete**
- **93,288 scenes ingested**
- **33,193 scenes unique (36%)**
- **~97,000 scenes outstanding**

USGS

Australia (ASA)

MSS
- 100% complete
- 223,791 scenes ingested
- 166,582 scenes unique (74%)

TM
- 100% complete
- 184,963 scenes ingested
- 181,058 scenes unique (98%)

ETM+
- 100% complete
- 202,528 scenes ingested
- 107,995 scenes unique (53%)

(HOA)

TM
- 100% complete
- 5,812 scenes ingested
- 5,767 scenes unique (99%)

ETM+
- 100% complete
- 13,110 scenes ingested
- 5,255 scenes unique (40%)

USGS

Brazil

MSS

- **0% complete**
- **0 scenes ingested**
- **~76,000 scenes outstanding**

TM

- **99% complete** *(small number of TM scenes on unread HDDTs)*
- **306,656 scenes ingested**
- **263,745 scenes unique (86%)**

ETM+

- **100% complete**
- **78,669 scenes ingested**
- **45,256 scenes unique (58%)**

USGS

Canada (GNC)

TM

- 100% complete
- 53,004 scenes ingested
- 14,681 scenes unique (28%)

ETM+

- 100% complete
- 37,955 scenes ingested
- 9,988 scenes unique (26%)

(PAC)

MSS

- 100% complete
- 413,799 scenes ingested
- 201,692 scenes unique (49%)

TM

- 100% complete
- 369,687 scenes ingested
- 193,020 scenes unique (52%)

ETM+

- 100% complete
- 100,374 scenes ingested
- 28,671 scenes unique (29%)

USGS

China (BJC)

TM

- 30% complete
- 170,075 scenes ingested
- 162,081 scenes unique (95%)
- ~390,000 scenes outstanding

ETM+

- 0% complete
- 66 scenes ingested
- 17 scenes unique (26%)
- ~47,000 scenes outstanding

(KHC)

TM

- 63% complete
- 14,597 scenes ingested
- 13,542 scenes unique (93%)
- ~9,000 scenes outstanding

USGS

Ecuador

TM

- **50% complete** *(data format problem with remaining 50% -- Ecuador investigating)*
- **25,246 scenes ingested 12,304 scenes unique (49%)**
- **~25,000 scenes outstanding**

USGS

ESA (FUI)

MSS

- 0% complete
- 0 scenes ingested
- ~2,000 scenes outstanding

TM

- 0% complete
- 0 scenes ingested
- ~567,000 scenes outstanding

ETM+

- 0% complete
- 0 scenes ingested
- ~51,000 scenes outstanding

(KIS)

MSS

- 0% complete
- 0 scenes ingested
- ~432,000 scenes outstanding

TM

- 60% complete
- 183,508 scenes ingested
- 180,755 scenes unique (98%)
- ~116,500 scenes outstanding

(data received but contains bad PCD)

ETM+

- 0% complete
- 157 scenes ingested
- 115 scenes unique (73%)
- ~43,000 scenes outstanding

USGS

ESA (MTI)

TM

- 1% complete
- 2,928 scenes ingested
- 2,907 scenes unique (99%)
- ~231,000 scenes outstanding

ETM+

- 0% complete
- 20 scenes ingested
- 3 scenes unique (15%)
- ~48,000 scenes outstanding

(NSG)

ETM+

- 0% complete
- 183 scenes ingested
- 79 scenes unique (43%)
- ~87,000 scenes outstanding

USGS

India

MSS

- 0% complete
- 0 scenes ingested
- ~12,000 scenes outstanding

TM

- 0% complete
- 0 scenes ingested
- ~39,000 scenes outstanding

Indonesia

TM

- 53% complete
- 17,001 scenes ingested
- 16,670 scenes unique (98%)
- ~15,000 scenes outstanding

ETM+

- 100% complete
- 44,457 scenes ingested
- 16,670 scenes unique (44%)

USGS

Japan (HAJ) (HIJ)

MSS

- 100% complete
- 158,096 scenes ingested
- 95,208 scenes unique (60%)

TM

- 100% complete
- 131,556 scenes ingested
- 127,107 scenes unique (97%)

ETM+

- 100% complete
- 20,556 scenes ingested
- 10,667 scenes unique (52%)

ETM+

- 100% complete
- 39,365 scenes ingested
- 15,316 scenes unique (39%)

USGS

Kyrgyzstan

TM

- 100% complete
- 2,340 scenes ingested
- 1,749 scenes unique (75%)

Mongolia

TM

- 100% complete
- 556 scenes ingested
- 554 scenes unique (100%)

USGS

Pakistan

TM

- 20% complete
- 13,310 scenes ingested
- 13,050 scenes unique (98%)
- ~53,000 scenes outstanding

Puerto Rico

ETM+

- 100% complete
- 315 scenes ingested
- 118 scenes unique (37%)

USGS

Saudi Arabia

MSS

- 0% complete
- 0 scenes ingested
- archive size unknown at this time

TM

- 1% complete
- 1,608 scenes ingested
- 860 scenes unique (53%)
- ~250,000 scenes outstanding

South Africa

MSS

- 0% complete
- 0 scenes ingested
- ~18,000 scenes outstanding

TM

- 58% complete
- 69,442 scenes ingested
- 61,309 scenes unique (88%)
- ~49,500 scenes outstanding

ETM+

- 83% complete
- 22,354 scenes ingested
- 8,094 scenes unique (36%)
- ~3,000 scenes outstanding

USGS

Taiwan

TM

- 100% complete
- 11,586 scenes ingested
- 11,297 scenes unique (98%)

Thailand

MSS

- 0% complete
- 0 scenes ingested
- ~57,000 scenes outstanding

TM

- 23% complete
- 42,942 scenes ingested
- 41,202 scenes unique (96%)
- ~142,000 scenes outstanding

ETM+

- 0% complete
- 23 scenes ingested
- 12 scenes unique (52%)
- ~22,000 scenes outstanding

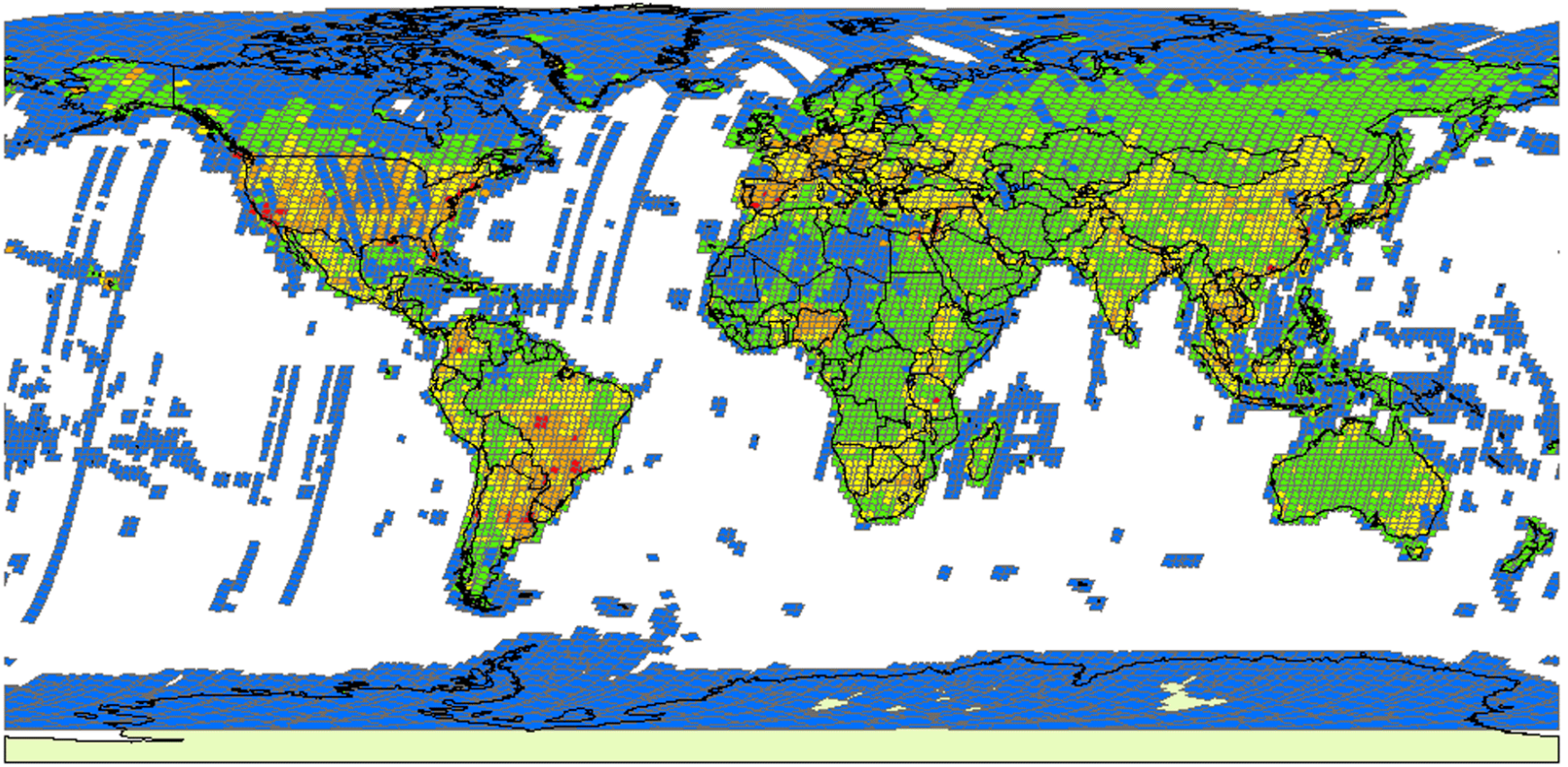
USGS

Statistics

- **All statistics generated for the period of October 2014 through January 2015**

USGS

OLI / TIRS Downloads

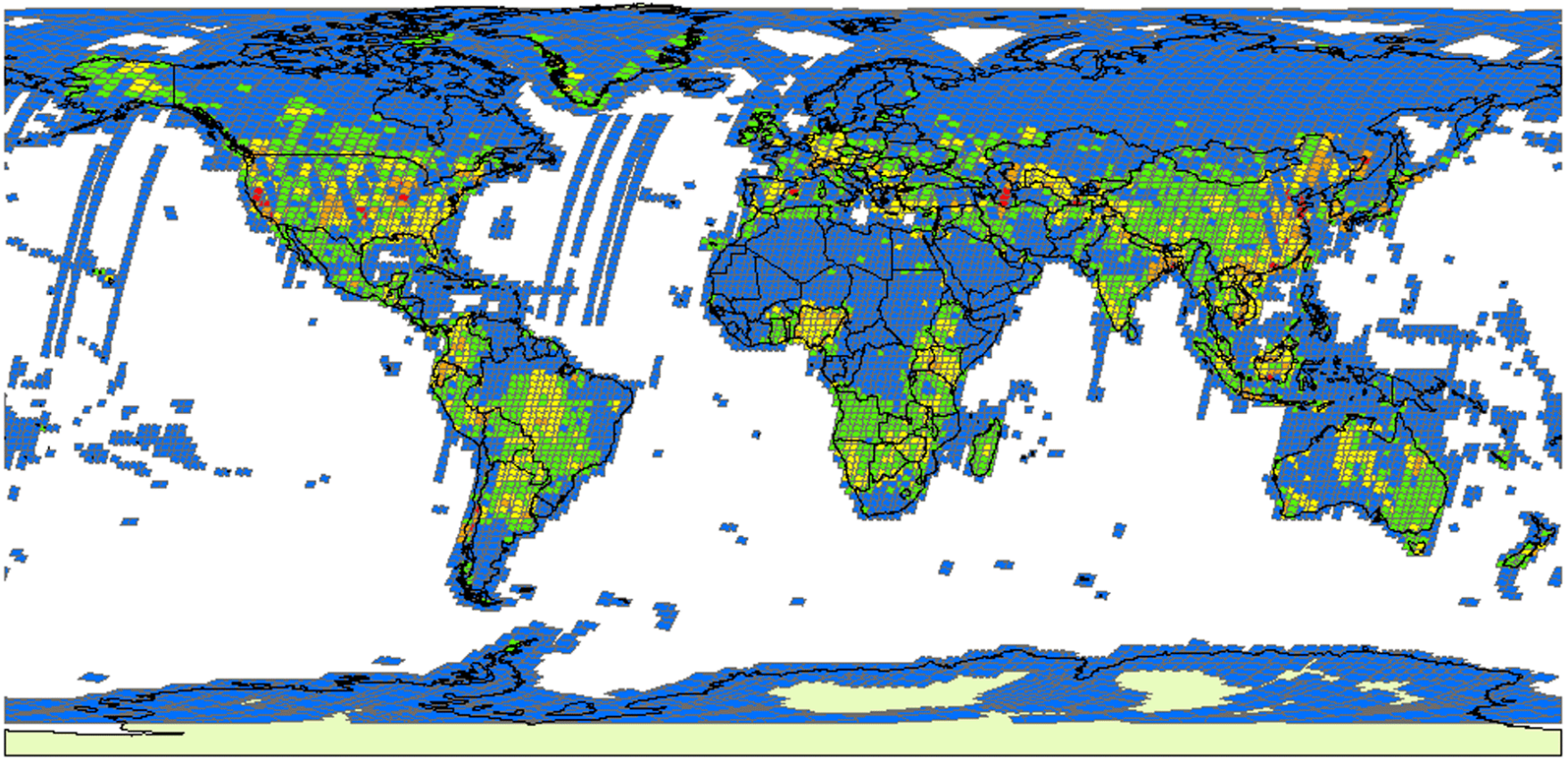


OLI & TIRS Standard Product Downloads
via User Interface
October 01, 2013 through September 30, 2014
3,729,264 Total Cumulative Scenes Delivered
1,103,642 Total OLI & TIRS Scenes Delivered
17,138 Unique OLI & TIRS Locations

1 - 49 | 50 - 140 | 141 - 272 | 273 - 539 | 540 - 1832

USGS

ETM+ Downloads

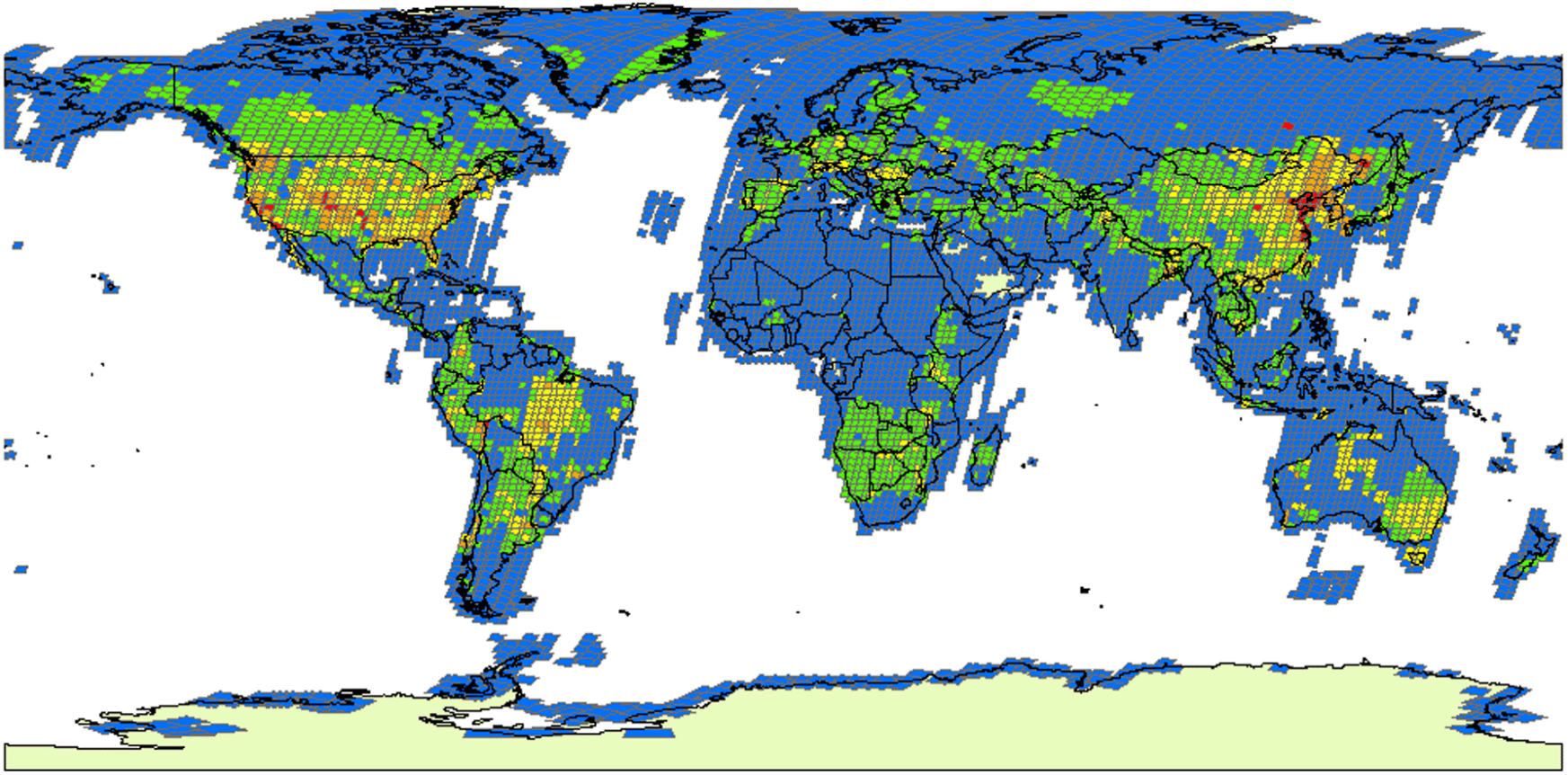


ETM+ Standard Product Downloads
via User Interface
October 01, 2013 through September 30, 2014
3,729,264 Total Cumulative Scenes Delivered
1,123,655 Total ETM+ Scenes Delivered
13,882 Unique ETM+ Locations

1 - 81 | 82 - 235 | 236 - 483 | 484 - 941 | 942 - 3281

USGS

TM Downloads

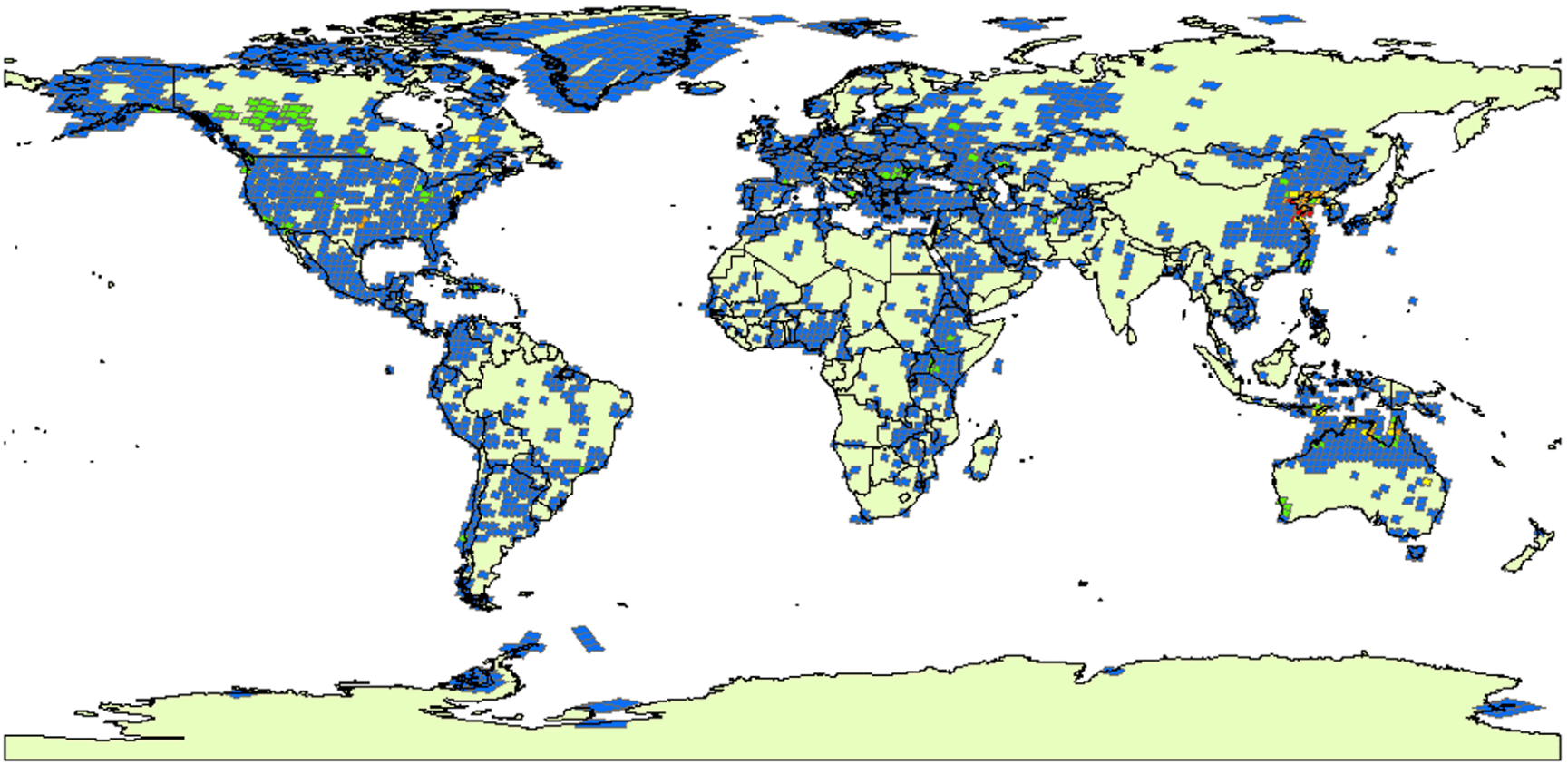


TM Standard Product Downloads
via User Interface
October 01, 2013 through September 30, 2014
3,729,264 Total Cumulative Scenes Delivered
1,086,584 Total TM Scenes Delivered
10,985 Unique TM Locations

1 - 94 | 95 - 284 | 285 - 643 | 644 - 1347 | 1348 - 3517

USGS

MSS WRS-2 Downloads

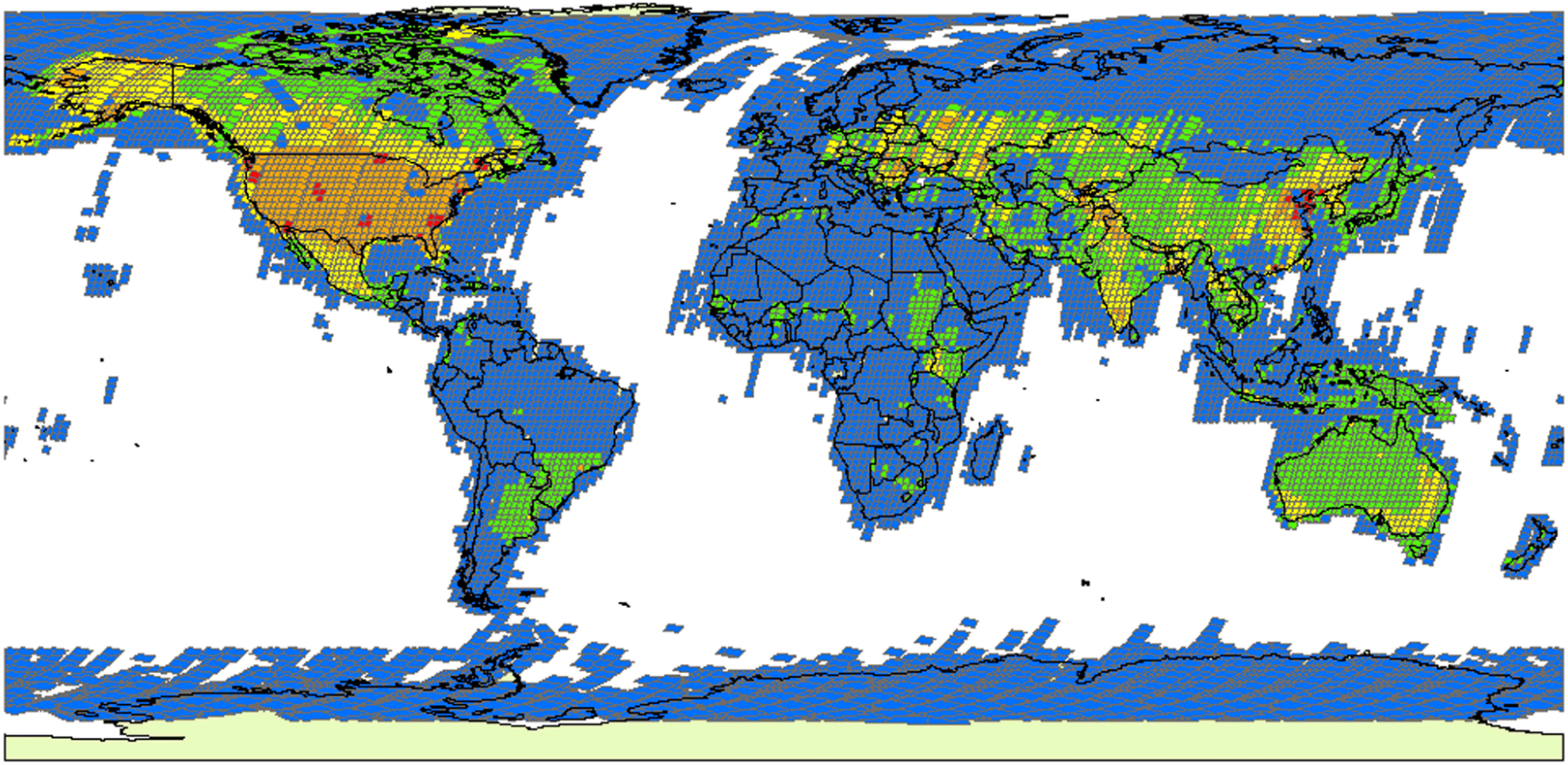


L4-5 MSS Standard Product Downloads
via User Interface
October 01, 2013 through September 30, 2014
3,729,264 Total Cumulative Scenes Delivered
415,383 Total MSS Scenes Delivered
57,636 Total L4-5 MSS Scenes Delivered
2,725 Unique L4-5 MSS Locations

1 - 52 | 53 - 201 | 202 - 466 | 467 - 1209 | 1210 - 2402

USGS

MSS WRS-1 Downloads

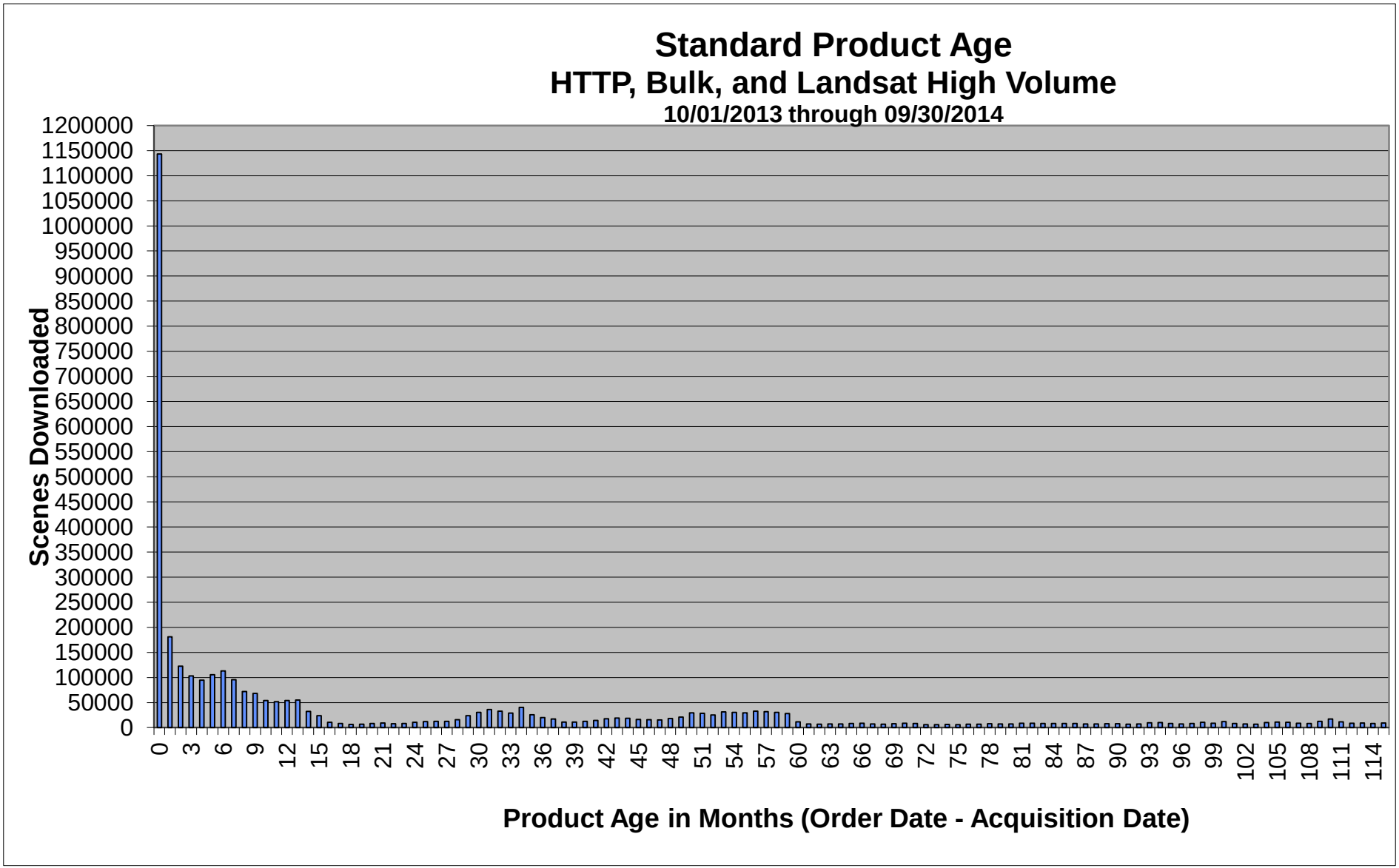


L1-3 MSS Standard Product Downloads
via User Interface
October 01, 2013 through September 30, 2014
3,729,264 Total Cumulative Scenes Delivered
415,383 Total MSS Scenes Delivered
357,747 Total L1-3 MSS Scenes Delivered
14,225 Unique L1-3 MSS Locations

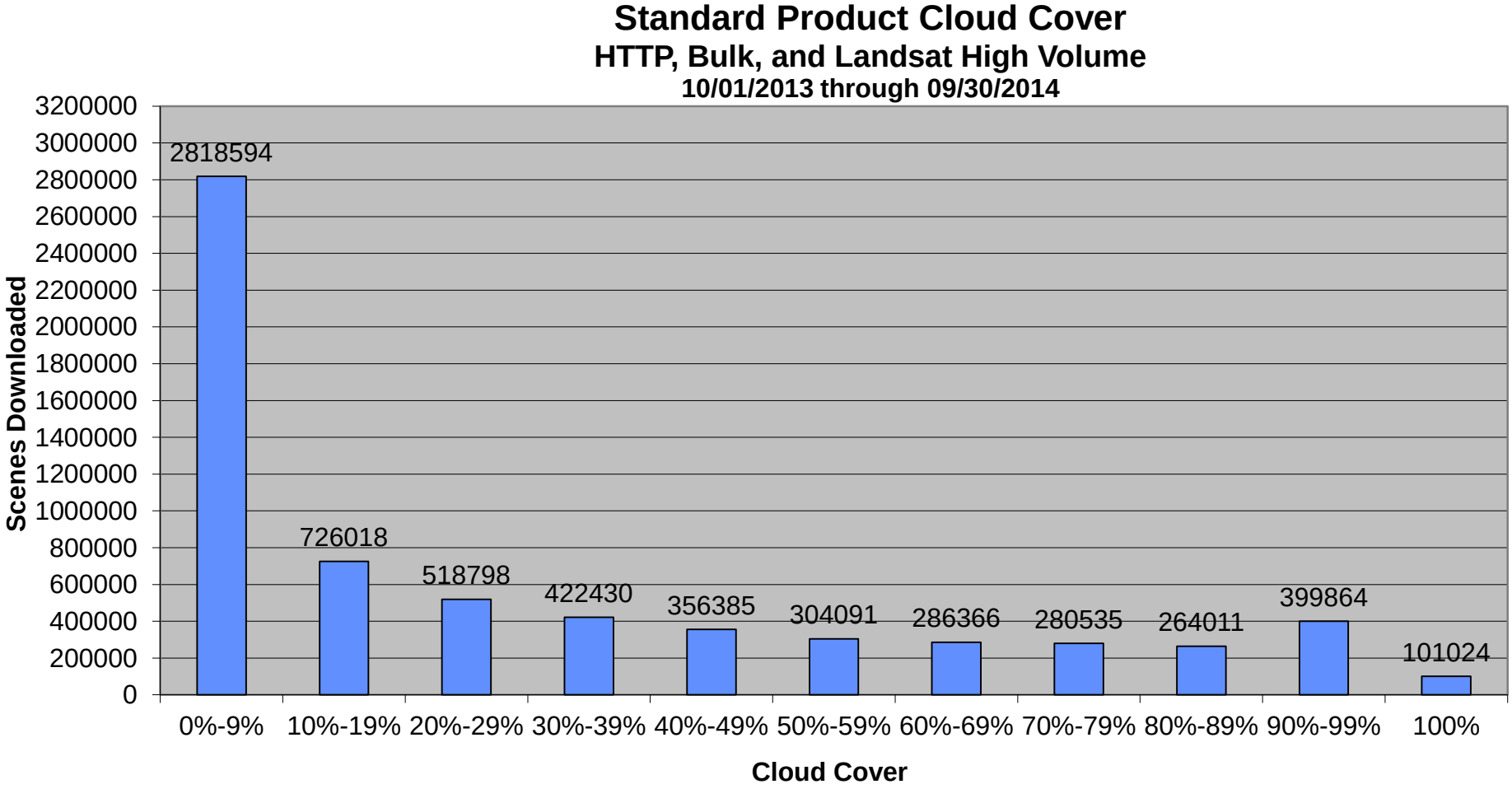
1 - 22 | 23 - 62 | 63 - 118 | 119 - 274 | 275 - 1116

USGS

Age of Scenes Downloaded

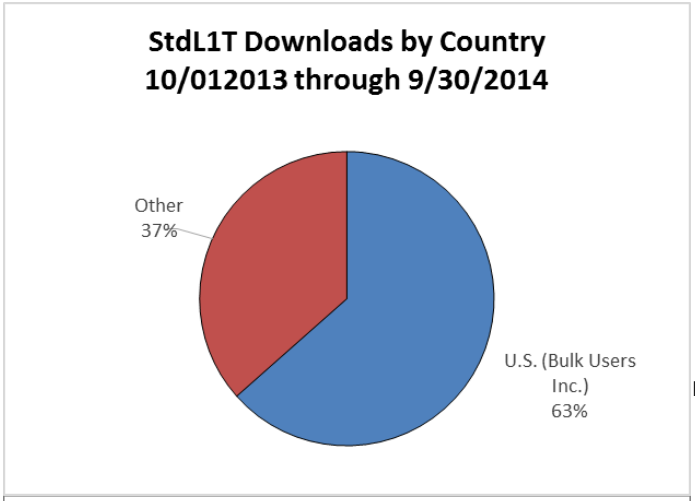


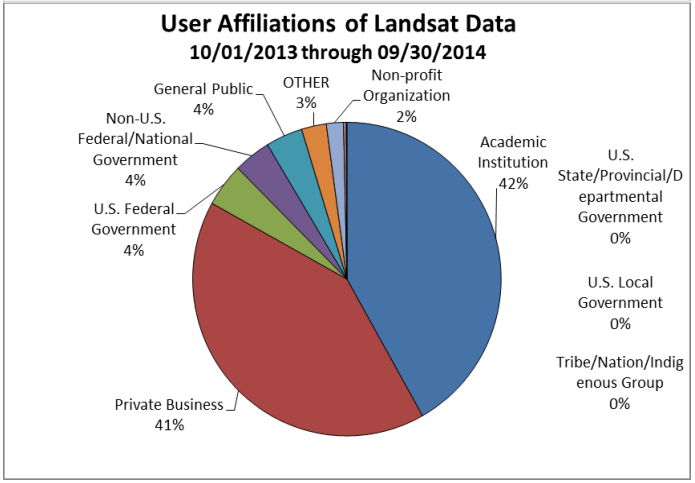
Cloud Cover of Scenes Downloaded

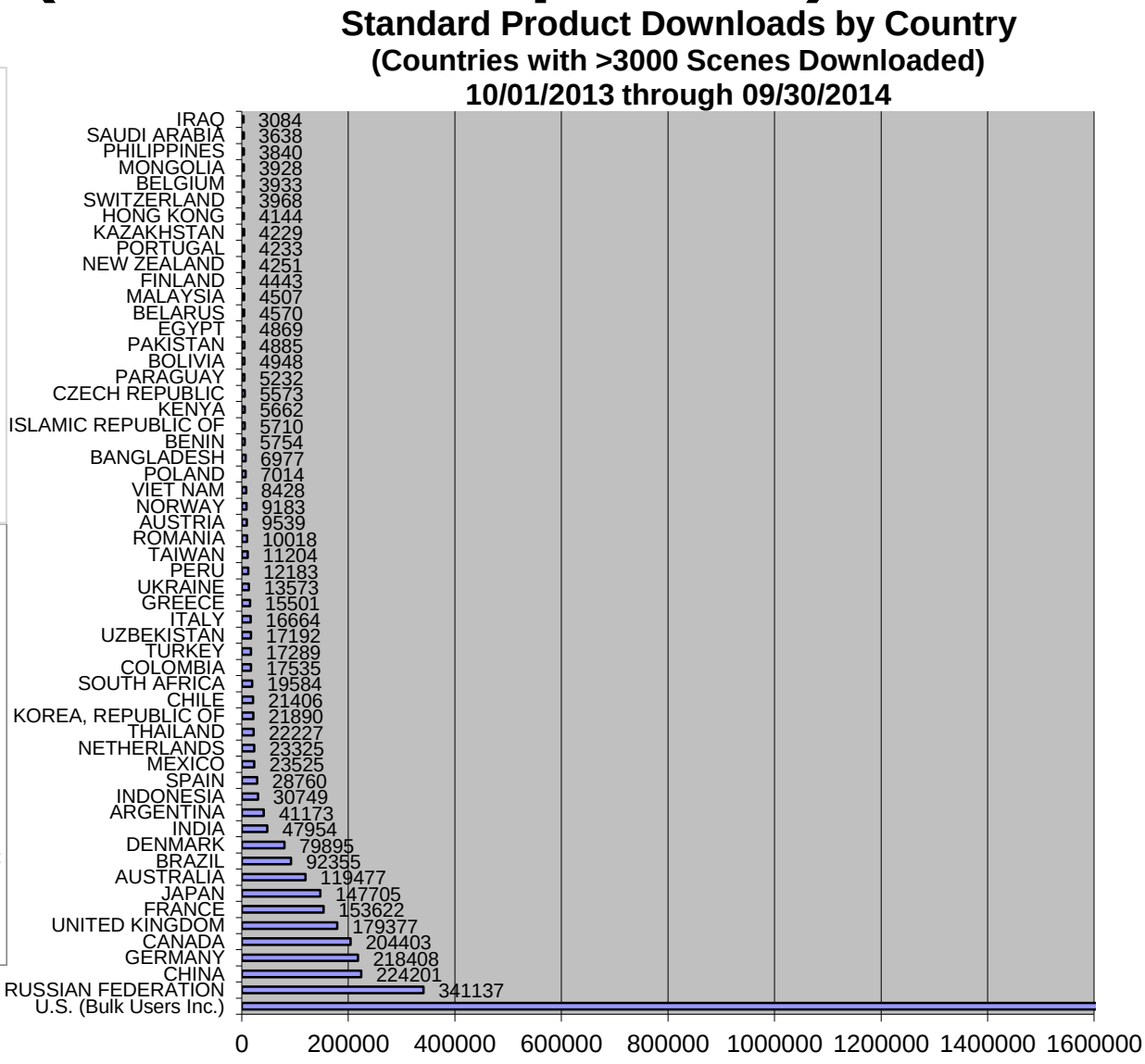


USGS

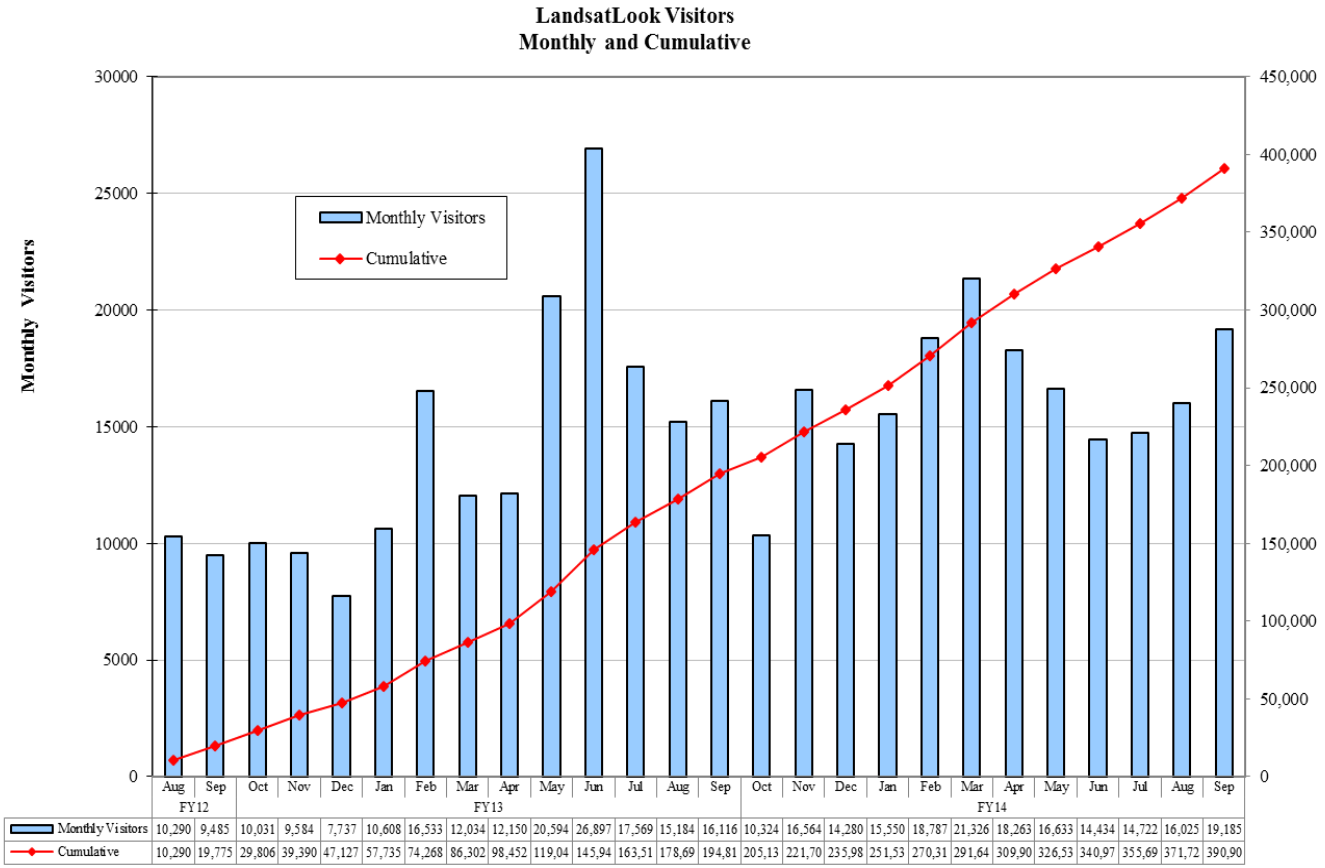
Landsat Distribution Customer Demographics (Oct 2013 – Apr 2014)







USGS

Full-Resolution Browse Statistics

January 2015			
	Country	Visitors	% of Total Visitors
1	United States	2,256	39%
2	Japan	465	8%
3	India	446	8%
4	Canada	439	8%
5	United Kingdom	417	7%
6	Russia	388	7%
7	China	386	7%
8	Indonesia	373	6%
9	Germany	352	6%
10	Australia	296	5%