

Landsat's Long-Term Acquisition Plan

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Long Term Acquisition Plan

- **The Landsat mission seeks to create a systematic and objective environmental record of the Earth's surface guided by the Long-Term Acquisition Plan**
- **Individual user requests, and science campaigns, including night and ocean requests, are accepted, but only so far as they do not perturb the Long-Term Acquisition Plan**
- **Landsat 8 OLI/TIRS images create a new opportunity to define a multi-mission acquisition strategy**

Landsat Schedulers

CVT & MOC

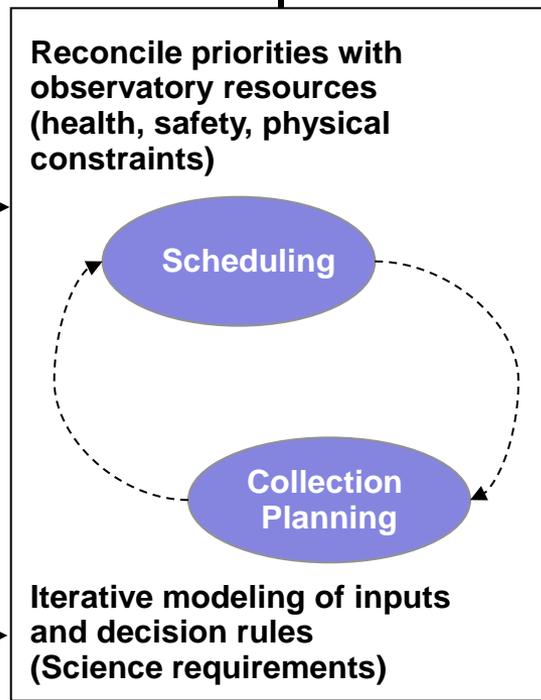
Calibration
SSR constraints
Power Constraints
Duty Cycle Constraints
Downlink opportunities

Science Office

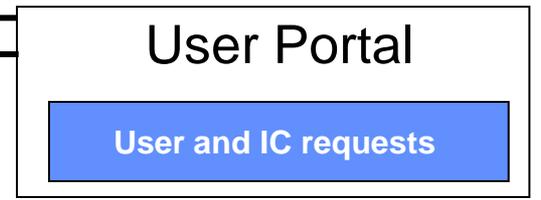
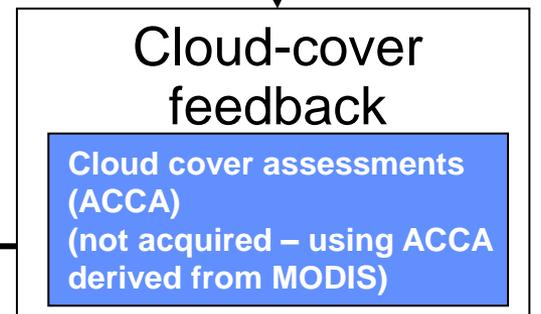
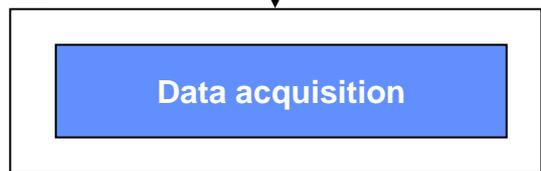
LTAP Science
Seasonality file
Land database
Cloud fraction climatology

NCEP

Cloud cover predictions



Observatory



Long-Term Acquisition Plan Summary

Status

- Landsat 7
 - ◆ Images 350 – 450 images per day out of 540 - 630 sun-lit land opportunities
 - ◆ ETM+ has strict duty cycle constraints
 - ◆ Power cycling incurs warm up and data overhead penalties for short intervals equivalent to 4 scenes
 - ◆ Storage capacity constraints
 - ◆ Since the Scan Line Corrector failure, the LTAP pursues image pairs
 - ◆ Acquires oceanic islands at reduced priority and frequency
 - ◆ Acquires arid regions at reduced frequency
 - ◆ Acquires Arctic once per season
- Landsat 8
 - ◆ Acquires using a formal LTAP
 - ◆ Specified to acquire and distribute 400 images per day
 - ◆ Deep Blue Band for ocean monitoring
 - ◆ Better cloud detection with Cirrus Band
 - ◆ Improved dynamic range

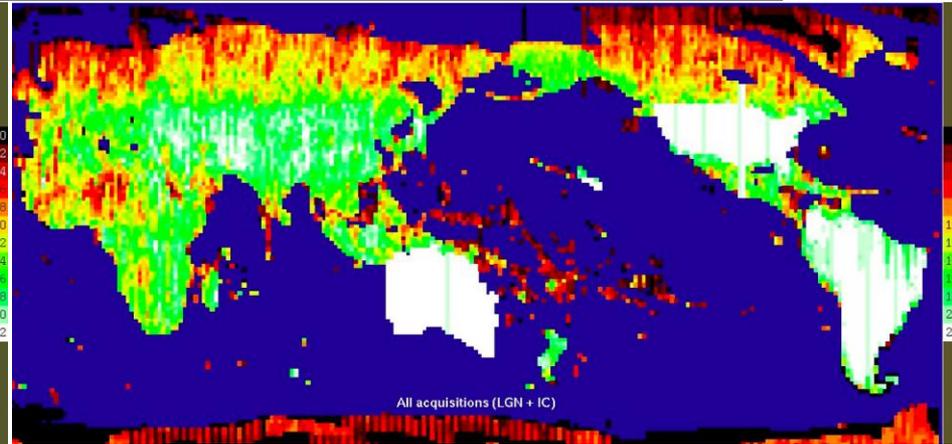
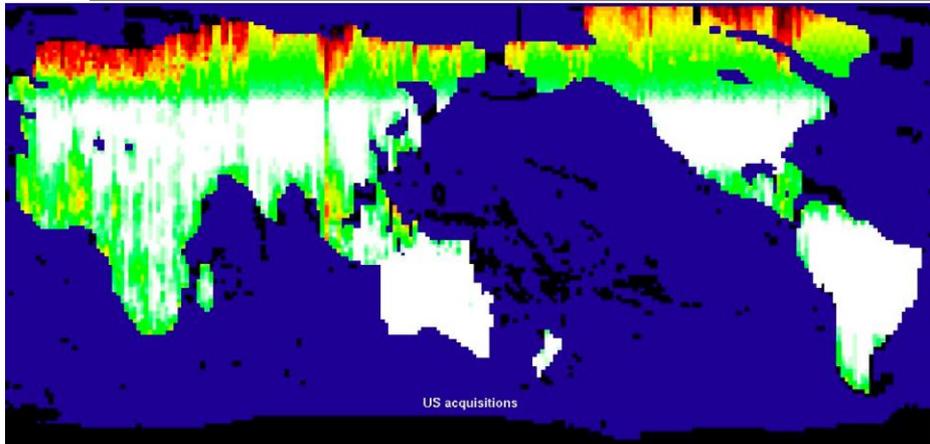
Proposed

- Landsat 7
 - ◆ Increased imaging of continental land masses improved coverage of persistently cloudy areas and better gap filling
 - ◆ Eliminate routine imaging of islands, water and Antarctica
 - ◆ Increase imaging from 369 images/day (69%) to approximately 438 images/day (91%)
 - ◆ Reduce ETM+ duty cycle from 15.1% to 14.4% and power cycles from 28.6 to 17.5 per day
- Landsat 8
 - ◆ Constrained by download costs/opportunities
 - ◆ Higher island priority
 - ◆ More frequent imaging for islands and Arctic
 - ◆ Lower sun elevation constraint from 15% to 5%
 - ◆ Increase Antarctica acquisitions
 - ◆ Support large night campaigns (such as urban heat islands, fires, sea ice, and volcanoes)
 - ◆ Support large water campaigns
 - ◆ Increase ascending node day acquisitions

Landsat 7 Continental Acquisition Strategy

- **We propose to focus the use of Landsat 7 on continental land masses**
 - ◆ Reduce the use of Landsat 7 for acquisitions of island, night, ocean, and Antarctica scenes
 - ◆ Landsat 8's larger daily acquisition limit and sensor characteristics provide opportunities for increased extreme latitude, island, ocean and night acquisitions to complement a Landsat 7 LTAP focused on continental land masses

Landsat 7 Continental versus Ops Model



Modeled one-year global coverage

Ops one-year global coverage

Daily Average Metrics	Continental Model	Operations
Qualifying Candidate Scenes	479 scenes/day	536 scenes/day
Acquisition Rate (LGN)	438 scenes/day (91% of candidates)	375 scenes/day (70% of candidates)
ETM+ duty cycle	14.4%	15.1%
ETM+ power cycles	17.5	28.6
Average ACCA	47.5	37.3
Clear scene acquisition rate (ACCA ≤ 10)	129 scenes/day (29% of acquisitions)	126 scenes/day (34% of acquisitions)
Marginal scene acquisition rate (ACCA ≤ 50)	230 scenes/day (53% of acquisitions)	238 scenes/day (64% of acquisitions)

Landsat 7 Continental versus Ops Model

Seasonal Average for December-February		
Daily Average Metrics	Continental Model	Operations ¹
Qualifying Candidate Scenes	358 scenes/day	470 scenes/day
Acquisition Rate (LGN)	357 scenes/day (99% of candidates)	354 scenes/day (75% of candidates)
ETM+ duty cycle	11.7%	14.5%
ETM+ power cycles	14.8	32.4
Average ACCA	53.9	38.0
Clear scene acquisition rate (ACCA ≤ 10)	90 scenes/day (25% of acquisitions)	110 scenes/day (31% of acquisitions)
Marginal scene acquisition rate (ACCA ≤ 50)	163 scenes/day (46% of acquisitions)	216 scenes/day (61% of acquisitions)

¹ Operations N.H. Winter Season was dominated by Antarctica coverage.

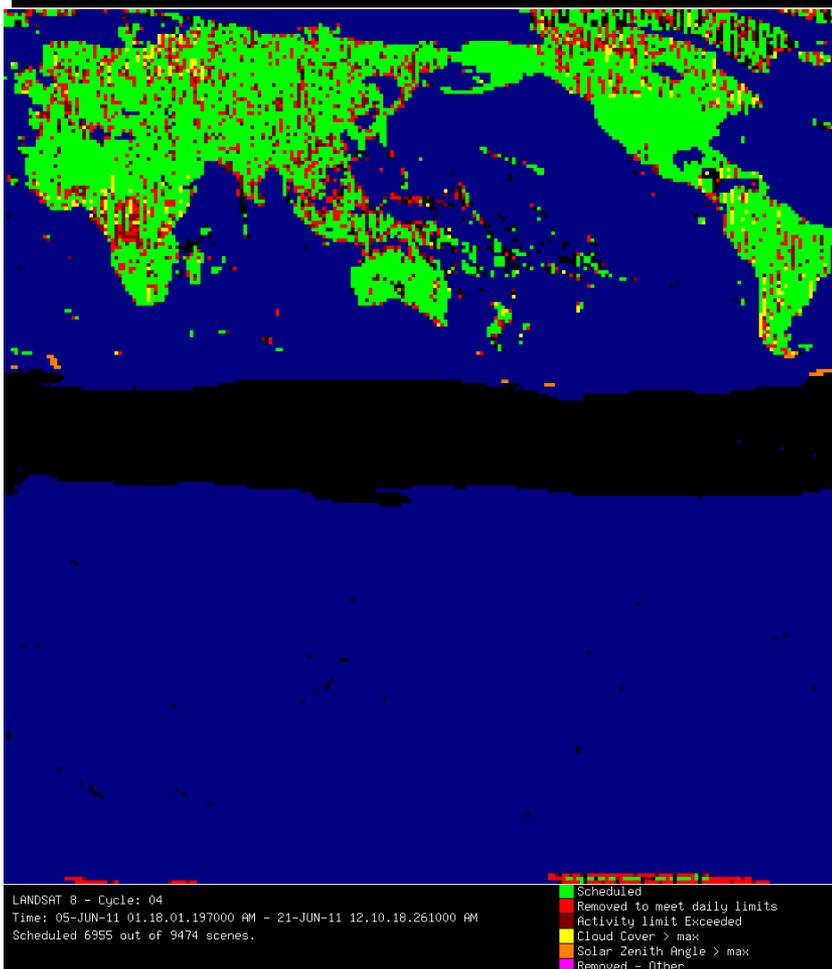
Seasonal Average for June-August		
Daily Average Metrics	Continental Model	Operations
Qualifying Candidate Scenes	550 scenes/day	588 scenes/day
Acquisition Rate (LGN)	470 scenes/day (85.5% of candidates)	392 scenes/day (67% of candidates)
ETM+ duty cycle	15.7%	15.5%
ETM+ power cycles	19.4	26.2
Average ACCA	44.0	36.9
Clear scene acquisition rate (ACCA ≤ 10)	144 scenes/day (31% of acquisitions)	132 scenes/day (34% of acquisitions)
Marginal scene acquisition rate (ACCA ≤ 50)	256 scenes/day (54% of acquisitions)	252 scenes/day (64% of acquisitions)



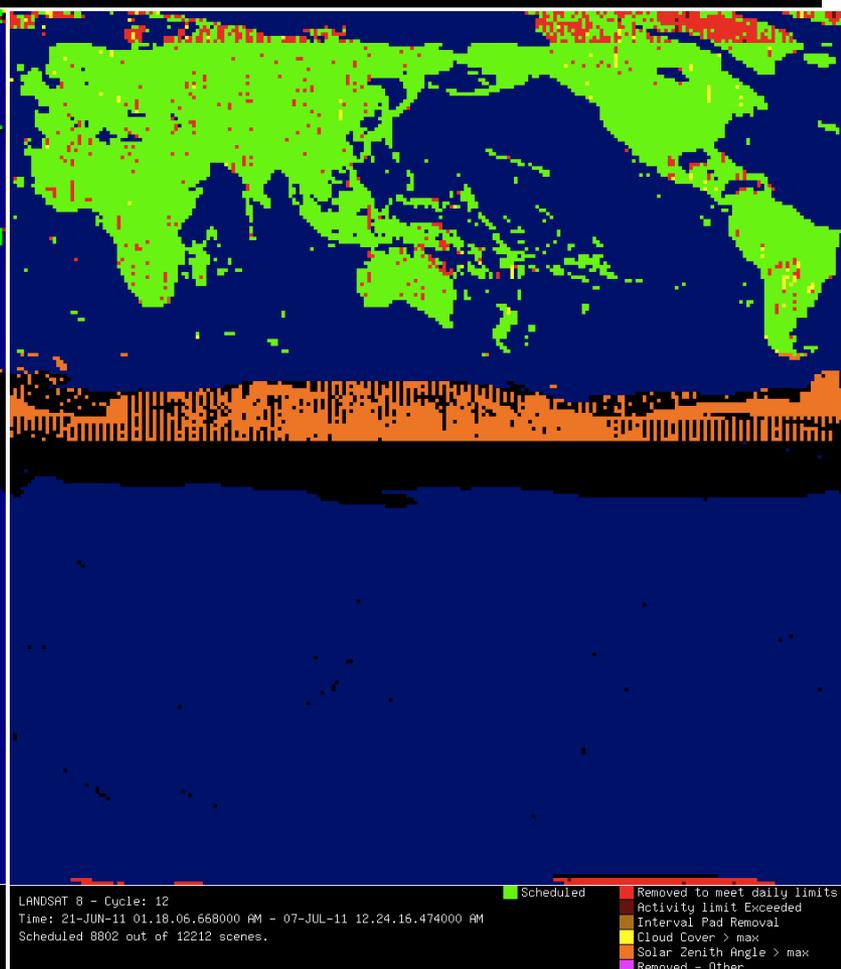
Landsat 8 acquisition Strategy

- **At 550 images per day:**
 - ◆ Most land images with better than 98% cloud prediction are acquired
 - ◆ Reefs and interior Antarctica are acquired at a reduced priority
- **Need to establish a budget for night and ocean acquisitions.**
- **Corollary: What day land imaging should we give up?**
- **Is there value to incorporating ascending land scenes into the LTAP?**
- **We need to improve cloud avoidance: currently we schedule two days in advance and do not use cloud confidence data.**

Landsat 8 16-day acquisition maps June

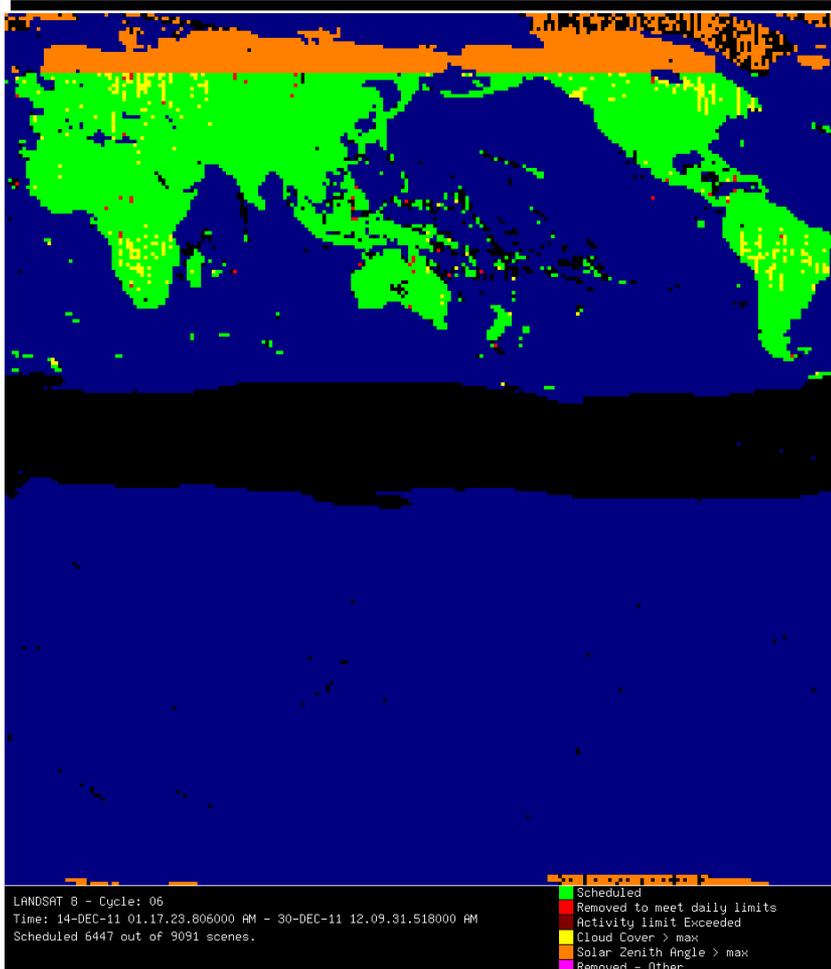


● 400 images/day (436)

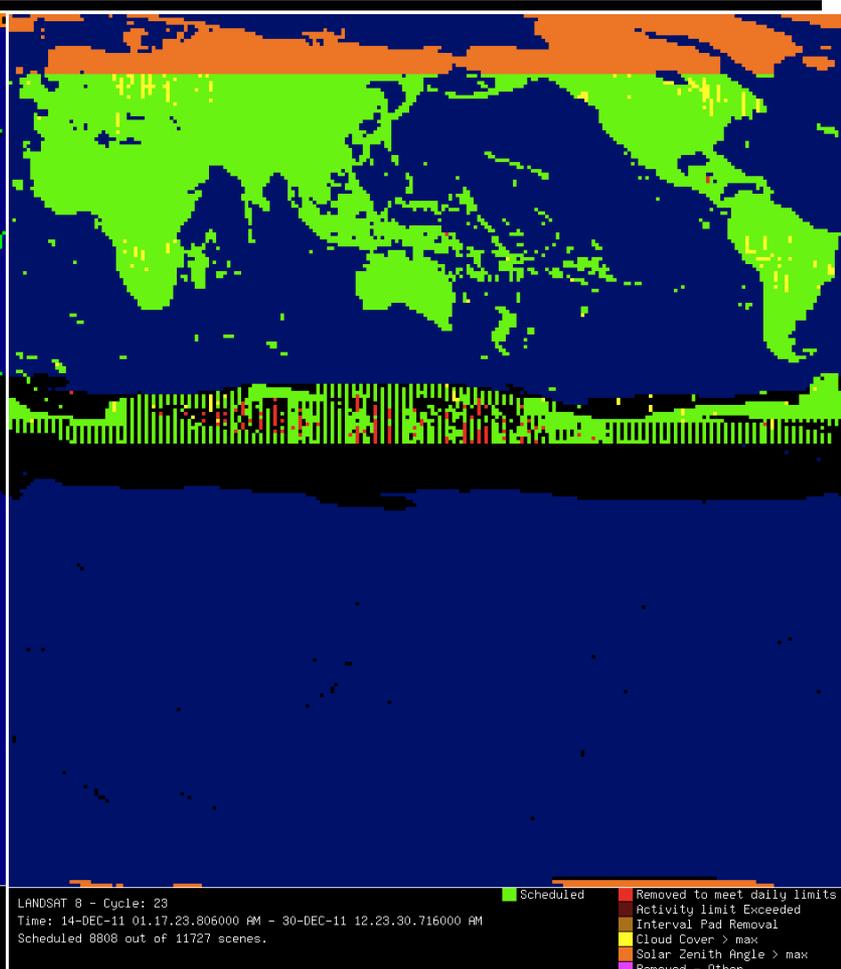


● 550 images/day (547)

Landsat 8 16-day acquisition maps December



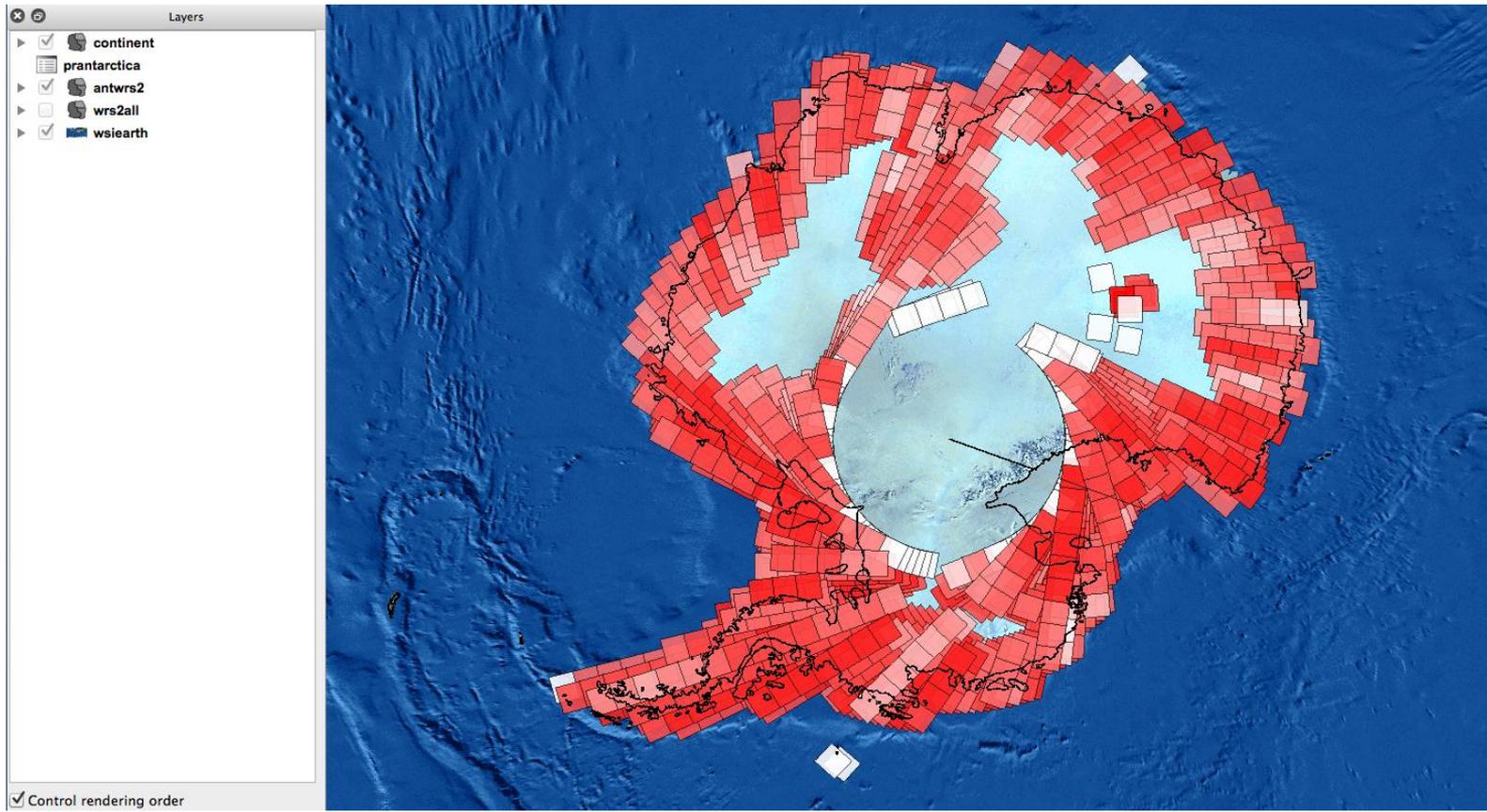
● 400 images/day (403)



● 550 images/day (550)

Landsat 7 Antarctica Campaign (Fall 2012-present)

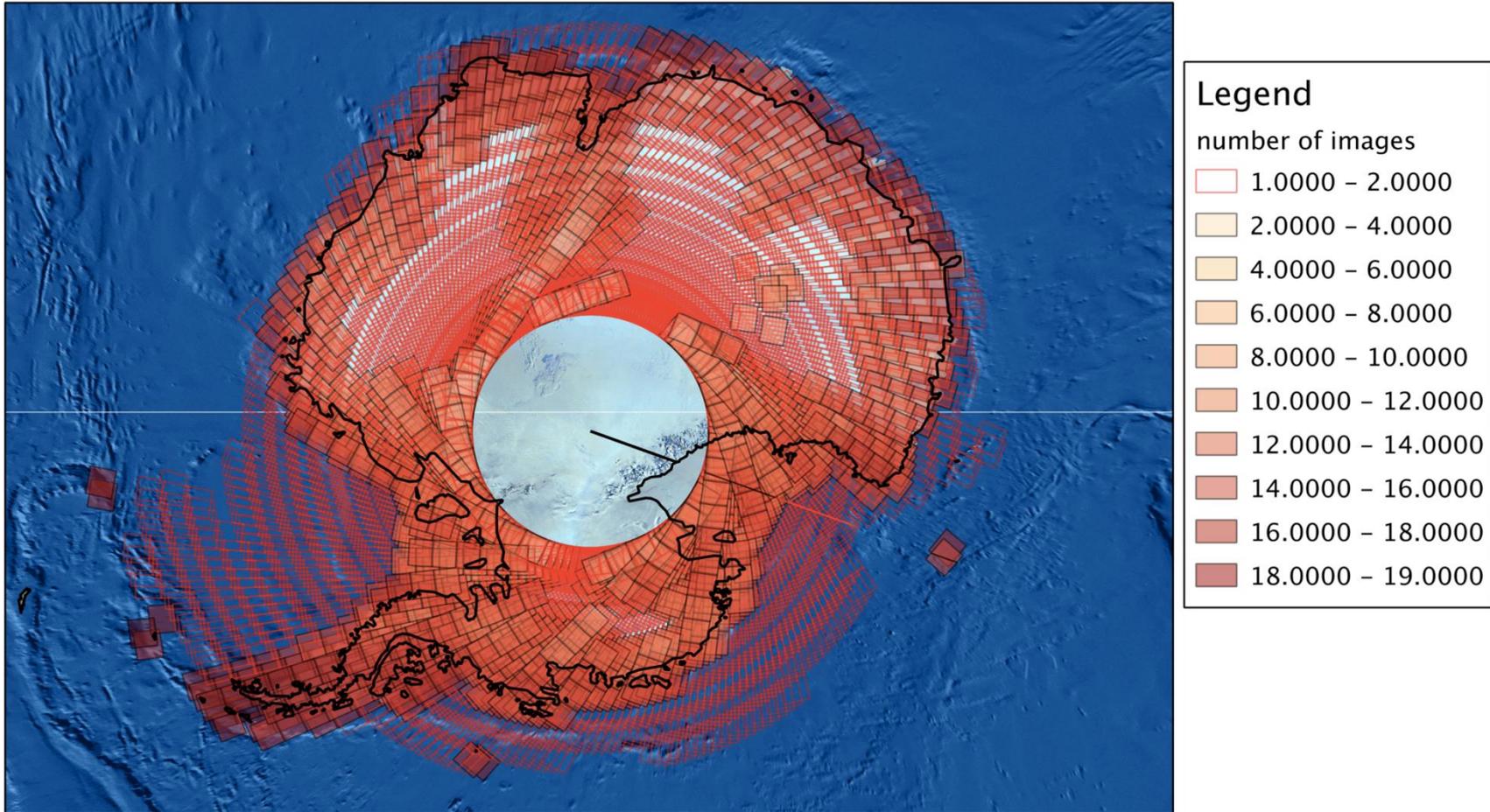
- Total images, 0: white, 7 red



Landsat Science Team, 29-31 October 2013, Sioux Falls, SD

Landsat 8 Antarctica Model Results

- 1-2: clear; 18-19: red



Special Requests: the exception, not the rule

- Individual User Requests
 - ◆ limited scope in time or space
 - ◆ will not impact the GAR
 - ◆ priorities range from low to high
 - ◆ field campaigns get higher priority
- Science Campaign Requests
 - ◆ large areas
 - ◆ modeled prior to approval
 - ◆ priorities range from low to high
 - ◆ field campaigns get higher priority
- Ground Look Calibration Requests
 - ◆ for specific test sites
 - ◆ often long term with field campaigns
 - ◆ high priority
- Emergency Nadir Requests
 - ◆ small areas and short term
 - ◆ disregard cloud cover and sun angle
 - ◆ highest priority
- Emergency Off-Nadir Requests
 - ◆ very small areas and short term
 - ◆ only Off-Nadir requests trump “CONUS”
 - ◆ causes lost opportunities in nadir
 - ◆ disregard cloud cover and sun angle
 - ◆ highest priority
- No request is approved for longer than one year
- All Special Requests are adjudicated by the Data Acquisition Manager (DAM)

Special Requests: the exception, not the rule

- *The vast majority of acquisitions by volume are “algorithmically” scheduled –the Landsat LTAP is designed to create an environmental record of the Earth*
- CAPE has limitations that prevent easy approval, monitoring and reporting of requests from multiple accounts
- CAPE has performance issues processing schedules with a large number of requests
- Special requests have less value, when imaging 550 images per day
- Since launch Special Requests are only submitted by the DAM – call me or send an email

Summary

- **Landsat 7 Continental LTAP model will acquire**
 - ◆ additional images over major land masses
 - ◆ over islands and Antarctica only by special request
- **Landsat 8 LTAP model is a work in progress**
 - ◆ We continue to acquire at 550 images/day
 - ◆ We will acquire significantly more data over islands and Antarctica within the LTAP
 - ◆ We will be able to acquire significantly more night and ocean data using special requests
 - ◆ Modeling to refine the LTAP has only begun
- **Feedback from the Science Team is encouraged.**