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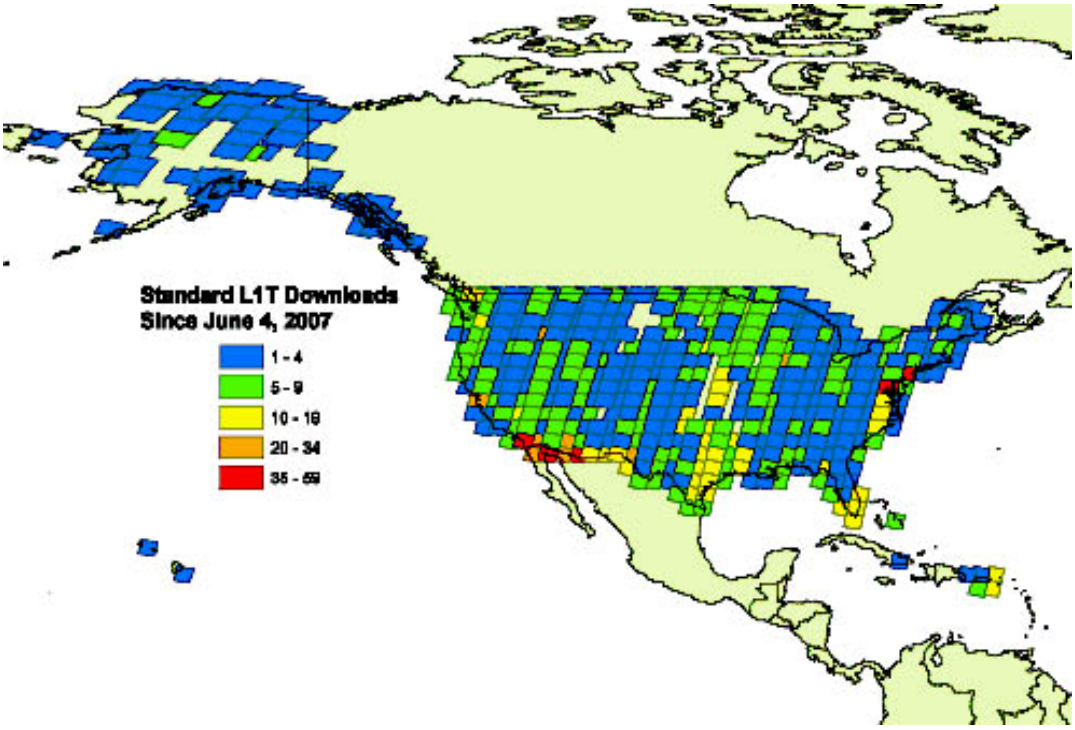
Landsat Updates - Volume 1, Issue 3, 2007

Web-enabled Landsat Data

June 4, 2007, marked the first day of the distribution of Web-enabled Landsat 7 ETM+ data. More than 2,500 scenes were distributed the first month, equivalent to three months of normal data sales. This Web-enabled distribution of new and recently acquired data is a pilot project for the Landsat Data Continuity Mission (LDCM). The project will allow the Landsat data user community to help refine the distribution system planned for the upcoming LDCM, currently projected for launch in 2011. Each scene will be registered to the terrain, or "orthorectified," prior to being placed on the Web. Copies of these data will also be available on CD or DVD for the cost of reproduction.

Landsat data have proven useful for a wide range of applications. From disaster monitoring after Hurricane Katrina and the Indonesian tsunami to global crop condition analysis, Landsat data are being used by scientists around the world. The Web-based distribution system will allow the user community easier access to Landsat 7 data.
The pilot project will be carefully examined. Customer response will be evaluated and their insight will influence the future distribution system. Please contribute feedback via the Web at http://landsat.usgs.gov/links/contact.php or contact USGS Center for EROS Customer Service at 800-252-4547.

The map below displays the number of scenes downloaded for each path/row available. Areas outside the United States are not included in the data set.



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Landsat Science Team Spotlight

To address the science goals of the Landsat Data Continuity Mission (LDCM), the Landsat Science Team has been selected to investigate and advise the U.S. Geological Survey (USGS) and the National Aeronautics and Space Administration (NASA) on issues critical to the success of this endeavor. With that in mind, we would like to take the opportunity for you to get to know Dennis Helder.

Dennis Helder
Image Processing Laboratory – South Dakota State University (SDSU)

Degrees:

Ph.D. in EE, North Dakota State University, 1991
Dissertation Title: Debanding Thematic Mapper Imagery
M.S. in EE, South Dakota State University, 1985
B.S. in EE, South Dakota State University, 1980
B.S. in Animal Science, South Dakota State University, 1979

Primary Focus:

The research work mainly focuses on satellite radiometry of Landsat 4, 5 and 7. Radiometric calibration of satellites involves characterization and correction of systematic degradations affecting the imagery. These degradations are caused by instrumentation and the Earth's atmosphere. Our work allows users to extract more information from remotely sensed data. Currently, we are working on ALIAS (Advanced Land Image Assessment System) and TMIAS (Thematic Mapper Image Assessment System) developments.

Current Projects by Dr. Helder and His Staff:

http://iplab2out.sdstate.edu/

- ALIAS development
- Radiometric Characterization and Calibration of Landsat 4/5 Thematic Mappers
- Landsat 7 DARK/PAC/FAC Coherent Noise Characterization
- Landsat 7 Night Scene (row 179-191) Coherent Noise Characterization
- Field Campaigns
- IKONOS and QuickBird Modulation Transfer Function (MTF) Measurement Project

Publications:

http://iplab2out.sdstate.edu/

How well does Landsat accuracy meet users' needs?

The article on the Landsat nonfederal customer satisfaction survey in the last issue focused on cost as a barrier to data usage. Next we will present a series of follow-on articles to explore some of the other topics covered in the survey.

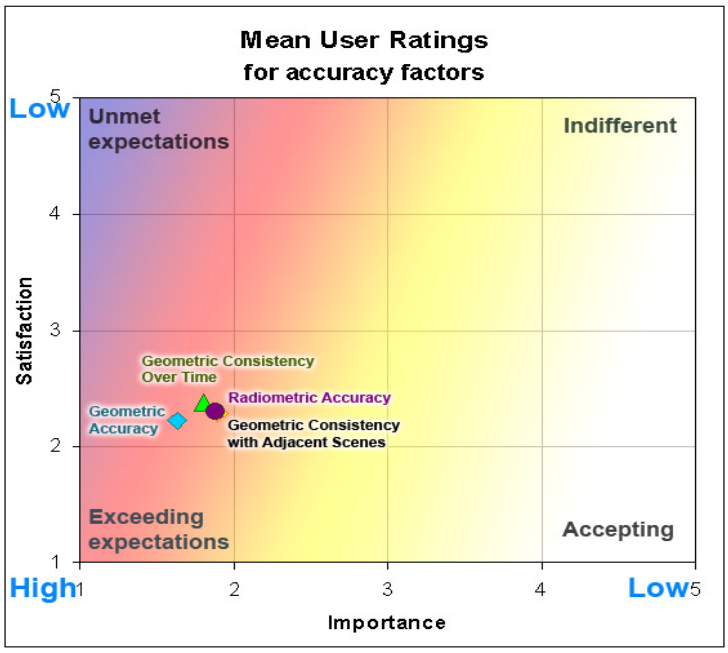
In this issue we are focusing on accuracy.

In the recent nonfederal survey, we asked several questions about accuracy:

- What is your level of satisfaction and importance with
  - geometric accuracy and consistency.
  - radiometric accuracy.
- What is the level of importance of radiometric consistency
  - within a scene.
  - with adjacent scenes.
  - over time.
- What level of geometric accuracy do you require?

For satisfaction and importance, we asked users to rate their satisfaction from 1 to 5, where 1 is high and 5 is low. Similarly, we asked respondents to rate the importance of each of the factors.

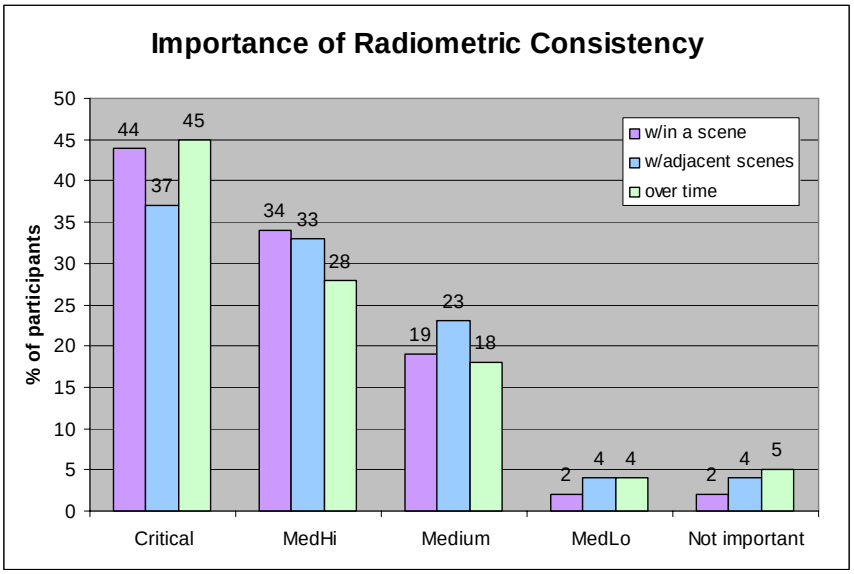
Mean ratings of satisfaction and importance with accuracy and consistency factors are shown in the scatter plot below. (Geometric consistency with adjacent scenes falls behind the radiometric accuracy point.) The users' surveyed rate geometric and radiometric factors highly important, but they are not entirely satisfied with the current levels of accuracy. Their responses indicate that the users would like to see some improvements in these areas.



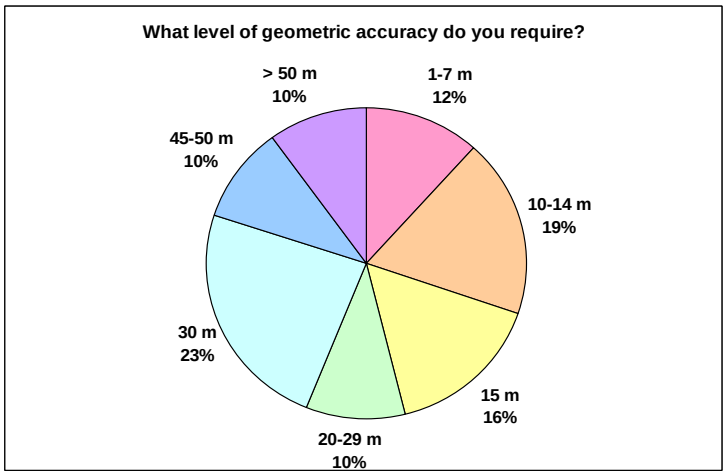
A similar scale (from 1 to 5 where 1 is critical and 5 is not important) was used to rate radiometric consistency. Results are shown in the bar graph below. Grouping the critical and medium-high responses as "important" and the rest as "not important" indicates:

- 78% of respondents think radiometric consistency **within a scene** is important.

- 73% of respondents believe radiometric consistency **over a time series of scenes** is important.
- 70% of respondents indicate radiometric consistency **with adjacent scenes** is important.



The geometric accuracy information was collected as a freeform text entry field where users entered a number indicating required accuracy in meters. Responses are grouped and shown in the pie graph below. Adding up the responses, 80 percent of users indicate that they need geometric accuracy of 30 m or higher (for recently acquired Landsat data, this translates to “within a pixel”).



What is USGS doing to improve accuracy?

Radiometric accuracy and consistency

The Landsat Project continues to monitor and characterize the radiometric and geometric performance of the Thematic Mapper (TM) and Enhanced Thematic Mapper Plus (ETM+) instruments in order to update and apply calibration parameters using the best information available. These efforts will further enable cross-calibration and integration of TM and ETM+ data for monitoring land surface change and coastal processes. Characterization and calibration of historic satellite data from Landsat 4 TM is underway, in addition to a feasibility assessment for Multi-Spectral Scanner (MSS) data, which encompasses 23 years of the Landsat archive.

The Operational Land Imager (OLI) on LDCM is being designed to achieve improved radiometric performance. For example, measurements will be quantized to 12-bit resolution, rather than the 8-bit quantization for TM and ETM+, so there will be no need for high or low gain data collection modes. The relative spectral response functions of the OLI spectral bands have improved specifications to increase signal-to-noise performance. In addition, LDCM OLI data will be cross-calibrated, to the extent practicable, with Landsat ETM+ data to assure consistency and continuity of use.

Geometric accuracy and consistency

The Landsat Project has released Level 1T (L1T) products for the conterminous United States, Alaska, Hawaii, and U.S. Territories for Web-enabled access since June 4, 2007. These L1T products are generated using the most current radiometric calibration parameters, geodetically referenced using definitive ephemeris and ground control points, and terrain corrected using the National Elevation Dataset (NED) or GTOPO30 elevation data.

In the era of the Landsat Data Continuity Mission (LDCM), the standard data product made available via web-enabled access will also be L1T data, yet we anticipate the geodetic accuracy will be enhanced due to improvements in platform and instrument ephemeris information.

LDCM Announces OLI Instrument Developer

July 16 – Ball Aerospace and Technologies Corp. of Boulder, Colorado, was selected to develop the Operational Land Imager (OLI) for the Landsat Data Continuity Mission. The LDCM is the successor to Landsat 7 and is scheduled for launch in July 2011.

NASA's Goddard Space Flight Center, Greenbelt, Maryland, will manage the LDCM development in partnership with the U.S. Geological Survey. The USGS will be responsible for LDCM operations after launch and on-orbit checkout. For more information, visit the LDCM Web site (http://ldcm.nasa.gov/07-16-2007.html).

Landsat Science Team Meeting

The Landsat Science Team met June 12–14, 2007, at Oregon State University, Corvallis, Oregon. The meeting was hosted by team member Warren Cohen of the USDA Forest Service.

The meeting included three objectives: (1) review the status of key LDCM and Landsat program activities, (2) review and receive Landsat Science Team input on key LDCM ground systems requirements, and (3) activate the Landsat Science Team working groups.

The status reports included NASA and USGS LDCM development progress, Landsat 5 and 7 operations status, the Mid-Decadal Global Land Survey, Landsat Data Gap Study, and the Future of Land Imaging. In addition, Landsat Science Team members presented brief updates of ongoing scientific research related to the LDCM project.

The ground system requirements discussion involved a summary of the LDCM Ground System Concept Review (SCR) held at the USGS Center for EROS on February 21–22, 2007. Several policy and technical issues were identified in the SCR, and the dispositions of these issues were reviewed with the Team so members could provide comments and recommendations.

The Team also presented an overview of the Ground Systems Requirements Review (SRR) that will be held on August 28–29, 2007, at USGS EROS. The SRR will be conducted by an independent panel of experts and represents a major milestone for the mission.

A major focus of the meeting was to convene working groups to discuss operations (long-term acquisition plan), Landsat data policy, data products (processing levels, information content), and instrument engineering (calibration of the LDCM Operational Land Imager, consistent calibration across the historical Landsat archive).

Key conclusions included Landsat Science Team recommendations to accelerate and expand USGS Web-enabled Landsat data plans and to pursue the consolidation of global Landsat holdings into a central archive.

The full agenda and presentation materials can be viewed at http://ldcm.usgs.gov/meeting.php

The next meeting will be held at USGS EROS in January 2008.

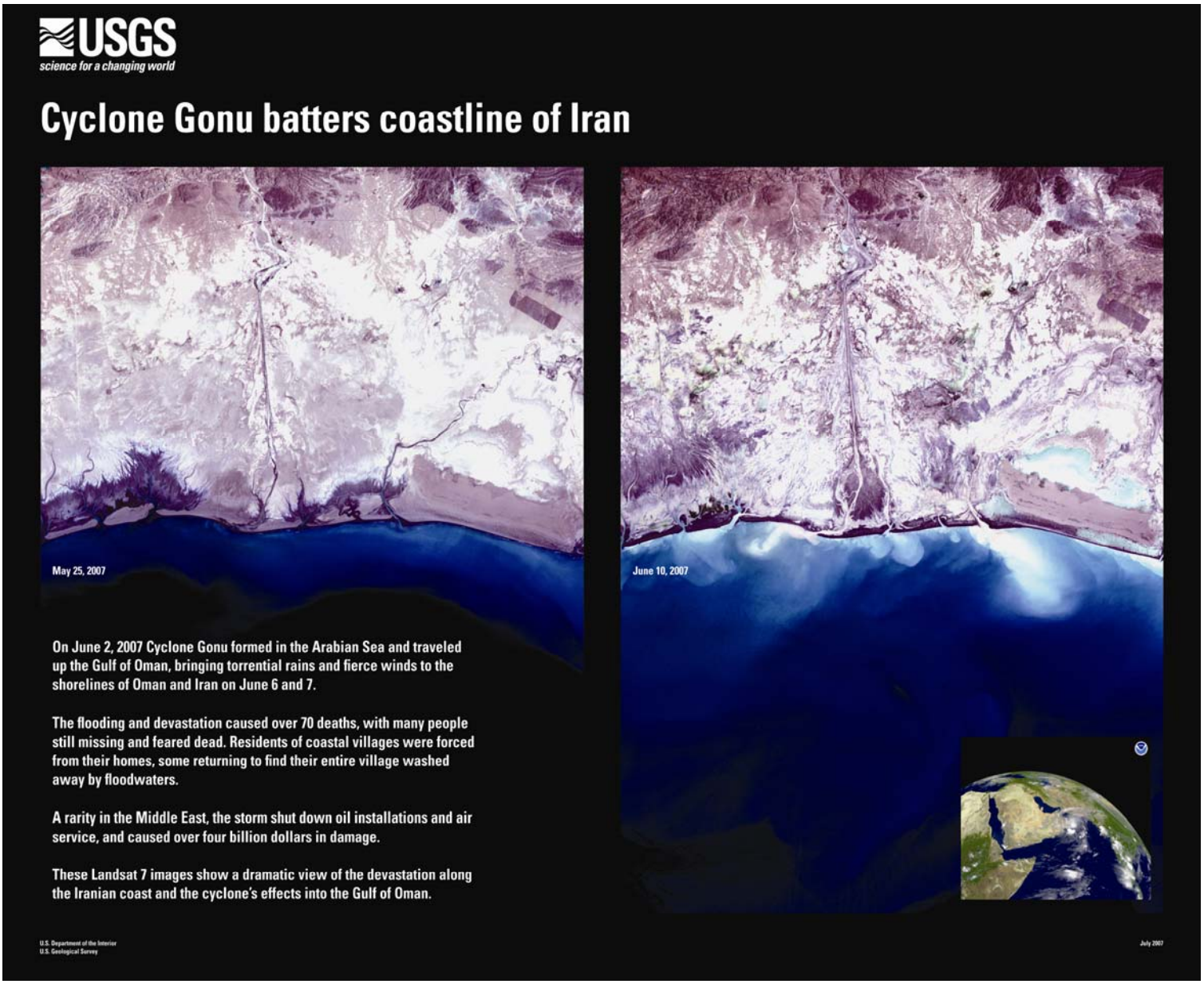
Cyclone Gonu

On June 2, 2007, Cyclone Gonu formed in the Arabian Sea and traveled up the Gulf of Oman, bringing torrential rains and fierce winds to the shorelines of Oman and Iran on June 6 and 7.

The flooding and devastation caused more than 70 deaths, with many people still missing and feared dead. Residents of coastal villages were forced from their homes, some returning to find their entire village washed away by floodwaters.

A rarity in the Middle East, the storm shut down oil installations and air service and caused more than/at least $4 billion in damage.

These Landsat 7 images show a dramatic view of the devastation along the Iranian coast and the cyclone’s effects into the Gulf of Oman.



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Did You Know?

You can export a listing of selected scenes from GloVis (USGS Global Visualization Viewer) to a text file format, as well as import a text file into GloVis?

Question:
I would like to use GloVis to develop a list of available Landsat scenes for a certain study area, but I want that list in a text file format. 1) Is there a way to export the list from GloVis to text? 2) I have another text file of Scene IDs—is it possible to import that list into GloVis?

Answer:
1. You can create a text file of all scenes you've added to the Scene List while searching on GloVis:
    a. Select scenes for your area of interest from each **Collections** and **Add** to the **Scene List** on each.
    b. When you have added all desired scenes, click **File → Save All Scene Lists**.
    c. Navigate to the destination where this file is to be saved.
    d. Name the file and click **Save.**

2. You can import an existing text file of Scene IDs into GloVis:
    a. In GloVis, select **File → Load Saved Scene List**.
    b. Navigate to the location of the file. When selected, the scenes are populated into the appropriate collection, and all footprints show on the GloVis map.

Example of Scene List:

```
sensor=Landsat ETM+
7029030000234750
7030029000311750
sensor=ASTER TIR
AST_L1A.003:2007291967
```

The first line indicates the file is a GloVis scene list file. The second line indicates the data set for the following scenes. After the second line, each line is interpreted as a Scene ID until the next "sensor=" line is found. The data set name for a "sensor=" line is the same name that shows up in the collection menu of the GloVis application.
**Follow this format correctly when loading scene lists into GloVis.*

Landsat Information

The maps below show the locations of ground stations operated by our International Cooperators (ICs) for the direct downlink and distribution of Landsat 7 (L7) and/or Landsat 5 (L5) image data. The red circles show the approximate area over which each station has the capability for direct reception of Landsat data. The green circles show the components of the U.S. Geological Survey (USGS) ground station network, while the dashed circles show stations with dual status.

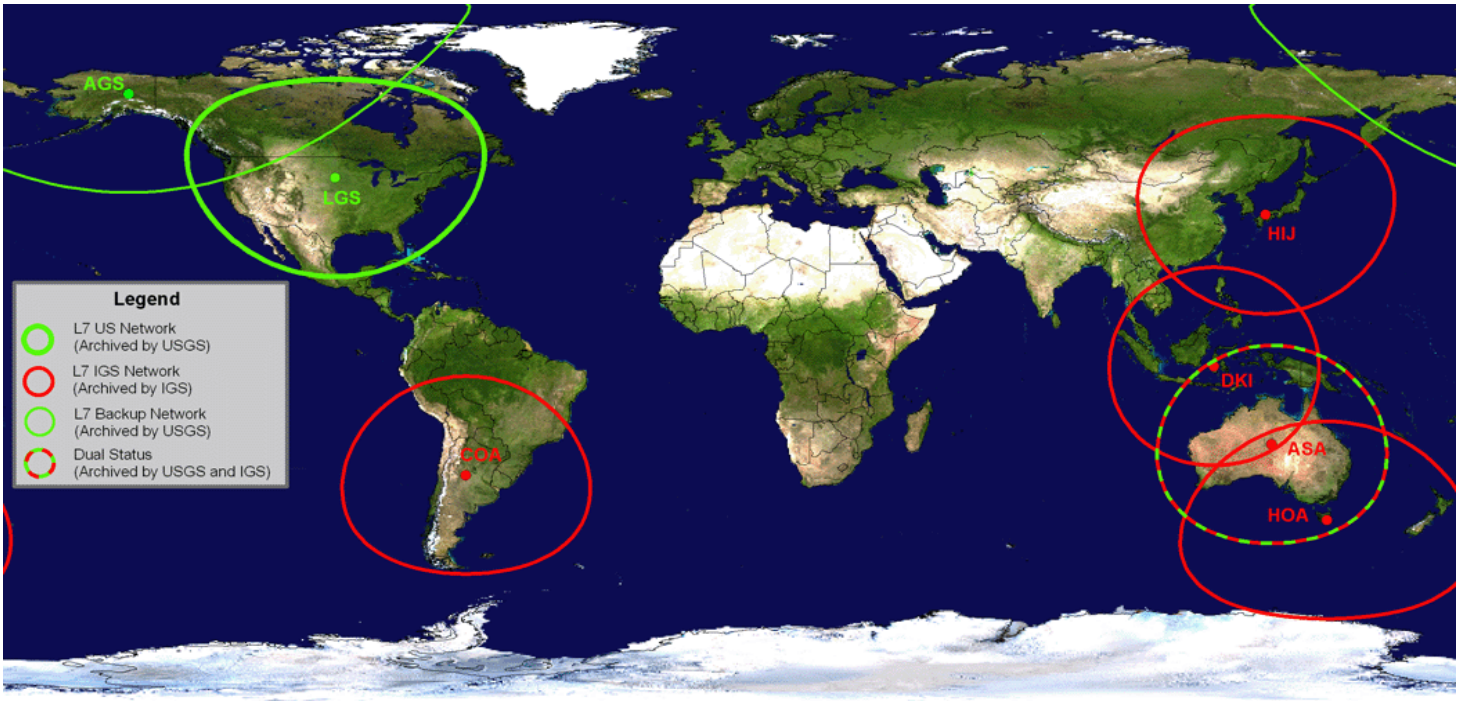
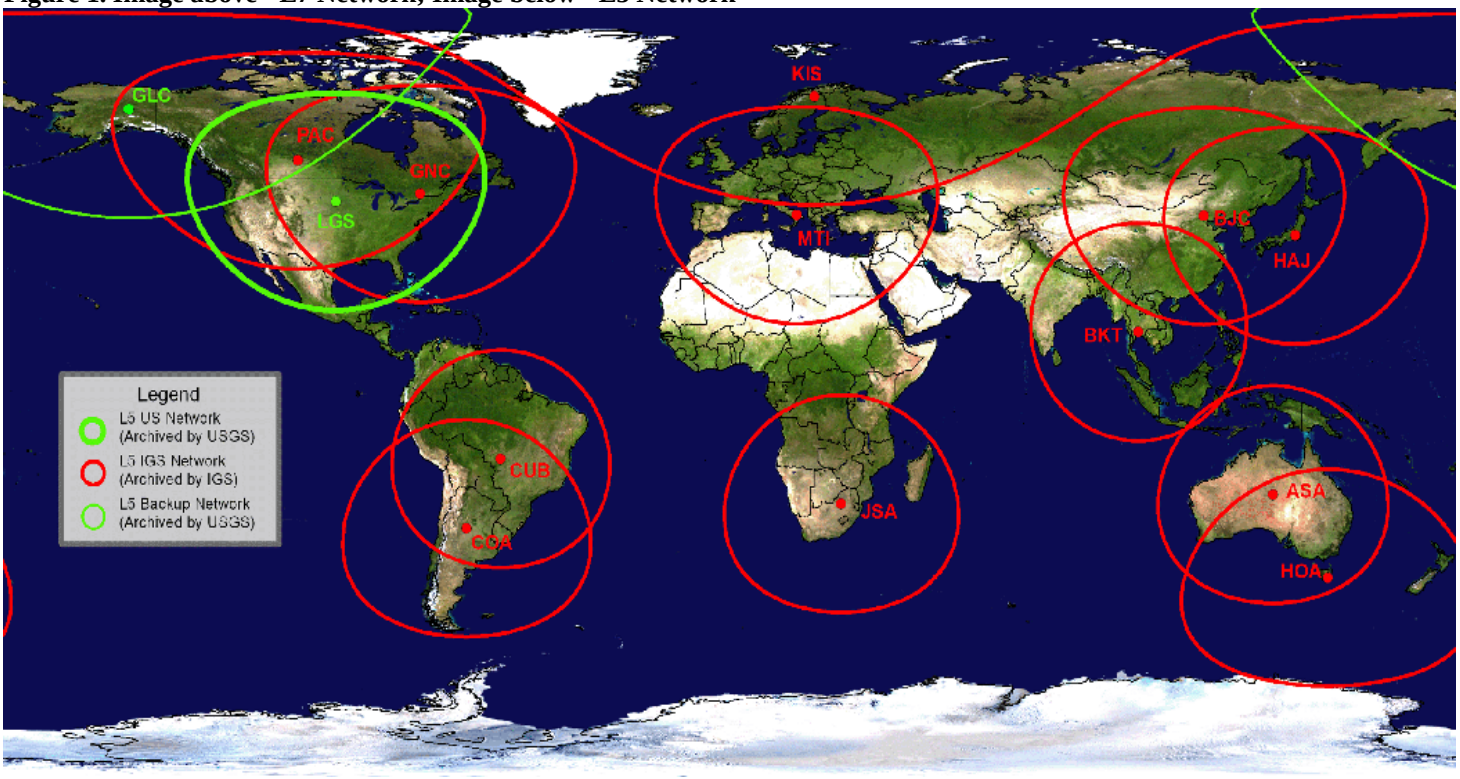


Figure 1. Image above - L7 Network; Image below - L5 Network



The table below provides a list of the International Ground Stations (IGSs) currently collecting Landsat data (as of March 2006).

International Cooperator	Ground Station Location	Ground Station ID	Landsat 5	Landsat 7
Argentina	Córdoba, Argentina	COA	x	x
Australia	Alice Springs, Australia	ASA, ASN	x	x
Australia	Hobart, Australia	HOA	x	x
Brazil	Cuíaba, Brazil	CUB	x	
Canada	Gatineau, Canada	GNC	x	
Canada	Prince Albert, Canada	PAC	x	
China	Beijing, China	BJC	x	
European Space Agency	Matera, Italy	MTI	x	
Indonesia	Parepare, Indonesia	DKI		x
Japan	Hatoyama, Japan	HAJ	x	
Japan	Hiroshima, Japan	HIJ		x
South Africa	Hartebeesthoek, South Africa	JSA	x	
Sweden	Kiruna, Sweden	KIS	x	
Thailand	Bangkok, Thailand	BKT	x	