Landsat Update

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Using the Landsat Archive

Since opening the Landsat archive earlier this year, more than 500,000 Landsat scenes have been downloaded at no charge. The availability of the Landsat archive allows opportunities for people to apply the data to more research projects, and has prompted other Landsat archives to remove the costs to some of their data holdings, such as:

- Conservation efforts in Sumatra Island, Indonesia: Developing maps on deforestation in one province in Sumatra to show the impacts on biodiversity and global climate: http://www.worldwildlife.org/who/media/press/2008/WWFPresitem7596.html

- Creation of large area land cover maps using chain classification: "...USGS' decision to provide free access to all Landsat data holdings offers opportunities for large area land cover classifications using Landsat imagery..." Read More (http://landsat.usgs.gov/documents/LandsatUseage.pdf)

- From the Brazilian Remote Sensing Data Center:
  The Brazilian Ministry of Science and Technology has decided to make available for download by interested users, at no cost, the INPE holdings of historical

(1973-1983) MSS imagery from Landsats 1, 2 and 3.
http://www.dgi.inpe.br/html/eng/

25 Years of Landsat 5 – Keeping the Spacecraft Orbiting Correctly

The Landsat missions follow a very strict orbital path to ensure that the same point on the globe is collected at the same time every 16 days. The Flight Operations Team constantly monitors and tightly controls the satellites' ground paths and equatorial crossing times. To accomplish this, precision timing measurements made during communication with the satellites determine their exact orbits.

By knowing *where* the each satellite is, and then determining where it *should* be, the team can decide which orbital maneuvers are necessary to correct each satellite's position. Two basic maneuvers are delta-Velocity (ΔV) and delta-Inclination (ΔI).

Landsat 5 orbits the Earth at an altitude of 705 km (438 miles). Even with this distance, there is still sufficient atmosphere to induce a drag force on the spacecraft, which takes energy away from the orbit, reduces the spacecraft's velocity, lowers its altitude, and, as a result, shortens the orbit period. An orbit that is too low or too high will cause the ground track of the satellite to drift off course. The orbital path is corrected by firing thrusters (located on the back of the spacecraft) that increase the satellite's velocity, raise its orbit, and restore the orbital period (and ground track) to specification. In effect, the energy removed by drag is replaced using thrust generated during the ΔV maneuver.

Landsat 5's orbit is also affected by the gravity of the Earth, Moon, and even the Sun. These forces influence the satellite's orbital plane, or inclination. Inclination plays a key role in maintaining Landsat's Sun-synchronous orbit, by controlling the orbit's procession as the Earth orbits the Sun. The ΔI maneuver, while complicated and done infrequently because considerable planning and fuel is required, is necessary to help Landsat 5 maintain the 10:00 a.m. equatorial crossing time. Once complete, the satellite maintains a constant angle between the Sun and the Earth throughout the year. This results in consistent illumination of the ground during imaging, which is a key requirement in multi-temporal land cover and land use studies.

A number of scenes that I have requested to be processed have been rejected, and I have been told they cannot be processed. Why is this, and will they ever be made available?

In order to generate a Landsat product, a number of processing steps must occur. If any of the vital information used for data processing (e.g., definitive ephemeris data) is corrupted or lost during data downlink, geometric processing cannot occur.

Because of the large number of data requests in our automated systems at this time, an image is removed from the archive when it cannot be processed. As the number of data requests decreases, some of the rejected images may be investigated, and if a solution can be found, they will be reprocessed and made available to download.

I have downloaded an image and received a .tgz file. How do I open it?

Landsat images files are tarred and g-zip compressed. To view the individual band files and ancillary data files, the data must be untarred and unzipped using file extraction software (e.g., WinZip).

Landsat Science Team Spotlight - Dr. Darrel Williams, NASA Goddard Space Flight Center

Figure 1. Dr. Darrel Williams, Landsat Project Scientist, NASA Goddard Space Flight Center, Greenbelt, MD.

Dr. Darrel Williams has been with NASA at Goddard Space Flight Center since 1975. He has served as Assistant Project Scientist for Landsat 4 and Landsat 5, and is the current Project Scientist for Landsat 7.

Williams's primary focus on the Landsat Science Team is to enhance and modify the current Long Term Acquisition Plan (LTAP) with co-investigator Dr. Samuel Goward. Ensuring successful continuation of a global archive after the launch of the next Landsat mission is the objective of their work.

Williams received his PhD in Physical Geography from the University of Maryland, College Park in 1989, and attained bachelor's and master's degrees in Forest Science from Pennsylvania State University in 1973 and 1974, respectively.

Throughout his career Williams has been actively involved in remote sensing research, with the majority of his work involved in the development of enhanced techniques for assessing forest ecosystems worldwide.

Dr. Williams has received the NASA Medal for Outstanding Leadership (1997), NASA's Exceptional Service Medal (2000), and in 1999, he received the "Aviation Week and Space Technology 1999 Laurels Award" for outstanding achievement in the field of Space, in recognition of his science leadership role for the highly successful Landsat 7 mission.

Special Recognition – Dr. Thomas Loveland Receives Prestigious Award

(USGS Press Release: http://www.usgs.gov/newsroom/article.asp?ID=2191&from=rss)

Figure 2. Dr. Thomas Loveland, U.S. Geological Survey

Dr. Thomas Loveland, Senior Scientist at the U.S. Geological Survey (USGS) Earth Resources Observation and Science (EROS) Center has been named a 2009 Fellow for the American Society for Remote Sensing and Photogrammetry. Annually, one or two professionals are awarded the fellowship for exceptional service in advancing science and the mapping sciences.

Since 1979, Dr. Loveland has pursued research at the USGS EROS Center in the field of satellite remote sensing to map and monitor land cover and land use. During the past three years, he worked to establish the USGS-South Dakota State University (SDSU) Geographic Information Science (GIS) Center of Excellence where he is currently Co-Director. As an adjunct faculty member at SDSU, Loveland has taught many courses and advised numerous graduate students.

Dr. Loveland was among the first investigators to create continental and global-scale land cover data sets derived from remotely sensed imagery. Crossing geographic scales again, he presently heads a USGS research team charged with developing a contemporary land cover history of the U.S. based on small sample blocks of remotely sensed data that are systematically verified in the field.

In addition, Dr. Loveland leads the Landsat Continuity Mission Science Team, a group of scientists and engineers responsible for offering advice and recommendations to the USGS and NASA on issues critical to the successful launch of the next Landsat satellite. A member of the editorial board for the Journal of Land Use Sciences, he has served in leadership roles in a number of national and international science organizations including the American Society of Photogrammetry and Remote Sensing, the U.S. Climate Change Science Program, and the International Geosphere-Biosphere Programme. He is a past member of the NASA National Polar-orbiting Operational Environmental Satellite System (NPOESS) Preparatory Project science team. He has authored or co-authored over 90 scientific papers, delivered at well over 60 national and international meetings. He has received career achievement awards from the USGS, the Department of the Interior, American Society of Photogrammetry and Remote Sensing, and the Association of American Geographers.

Dr. Loveland holds bachelor's and master's degrees in Geography from South Dakota State University and a PhD in Geography from the University of California-Santa Barbara. He and his wife, Cam, reside in Sioux Falls, South Dakota.

Tips and Tricks – What can you do with Landsat's Panchromatic Band?

Landsat's Panchromatic Band (Band 8) is collected at 15-meter resolution and can be used to sharpen a composite 30-meter image.

Pan sharpening is a technique that merges high-resolution panchromatic data with medium-resolution multispectral data to create a multispectral image with higher resolution features.

This document (http://landsat.usgs.gov/panchromatic_image_sharpening.php) provides step-by-step instructions using two software packages to successfully perform the image sharpening.

Meetings & Conferences

The Landsat Technical Working Group (LTWG#18) meeting was held in Maspalomas, Spain, February 9 –13, 2009. The meeting was jointly organized by the USGS and NASA and was hosted by the European Space Agency (ESA) and Spanish Space Agency Instituto Nacional de Técnica Aeroespacial (INTA). Participants from 11 countries, including members of the USGS Landsat and Landsat Data Continuity Mission (LDCM) Projects, represented 14 international ground stations and discussed a wide range of technical topics. (Read More)
(http://landsat.usgs.gov/documents/LandsatUseage.pdf 648 KB)

Association of American Geographers (AAG) 2009 Annual Meeting
March 22 – 27, 2009
Las Vegas, NV

"Advancing Geography in Partnership with You"

The Association of American Geographers (AAG) is a scientific and educational society founded in 1904. Its 10,000 members share interests in the theory, methods, and practice of geography and geographic education.

EROS Authors in Recent Publications

Chander, G., Markham, B.L., and Helder, D.L., 2009, Summary of current radiometric calibration coefficients for Landsat MSS, TM, ETM+, and EO-1 ALI sensors: Remote Sensing of Environment, v. 113, no. 5, p. 893-903.
http://dx.doi.org/10.1016/j.rse.2009.01.007
http://landsat.usgs.gov/documents/Landsat_Calibration_Summary_RSE.pdf

Reed, B.C., Budde, M.E., Spencer, P., and Miller, A.E. , in press, Integration of MODIS-derived metrics to assess interannual variability in snowpack, lake ice, and NDVI in southwest Alaska: Remote Sensing of Environment.
http://dx.doi.org/10.1016/j.rse.2008.07.020

Jacques, C.N., Jenks, J.A., and Klaver, R.W., 2009, Seasonal movements and home-range use by female pronghorns in sagebrush-steppe communities of western South Dakota: Journal of Mammalogy, v. 90, no. 2, p. 433-441.
http://dx.doi.org/10.1644/07-MAMM-A-395.1

Svancara, L.K., Scott, J.M., Loveland, T.R., and Pidgorna, A.B., In Press, Assessing the landscape context and conversion risk of protected areas using satellite data products: Remote Sensing of Environment.
http://dx.doi.org/10.1016/j.rse.2008.11.015

Napton, D.E., Auch, R.F., Headley, R., and Taylor, J.L., In Press, Land changes and their driving forces in the Southeastern United States: Regional Environmental Change, p. 1-17.
http://www.springerlink.com/content/x2k502355w7879u8/fulltext.pdf

United Nations Environment Programme, 2009, Kenya–atlas of our changing environment: Nairobi, Kenya, United Nations Environment Programme, 374 p.
http://www.unep.org/dewa/africa/kenyaatlas/

Xian, G., Homer, C.G., and Fry, J.A., In Press, Updating the 2001 National Land Cover Database land cover classification to 2006 by using Landsat imagery change detection methods: Remote Sensing of Environment.
http://dx.doi.org/10.1016/j.rse.2009.02.004

Huang, C., Goward, S.N., Schleeweis, K., Thomas, N., Masek, J.G., and Zhu, Z., In Press, Dynamics of national forests assessed using the Landsat record–case studies in eastern United States: Remote Sensing of Environment.
http://dx.doi.org/10.1016/j.rse.2008.06.016

Tennessee Valley Authority Kingston Fossil Plant
Landsat 5 TM: November 20, 2008 (http://landsat.usgs.gov/images/about/LT5_19-35_11-20-08_cropped.tif 26.0 MB) and December 22, 2008 (http://landsat.usgs.gov/images/about/LT5_19-35_12-22-08_cropped.tif 25.7 MB)
On Monday, December 22, a dike at a containment area failed at the Kingston Fossil Plant, releasing approximately 5.4 million cubic yards of coal fly ash. The slurry mix of ash and water spread over a half square mile adjacent to the plant.

These Landsat 5 Thematic Mapper images, acquired November 20 and December 22, 2008, give a view of the area from space. The changes in the color of the water indicate the location of the sediment.

Recovery and cleanup efforts continue at the plant, which is located on the Emory River portion of the Watts Bar Reservoir in eastern Tennessee.

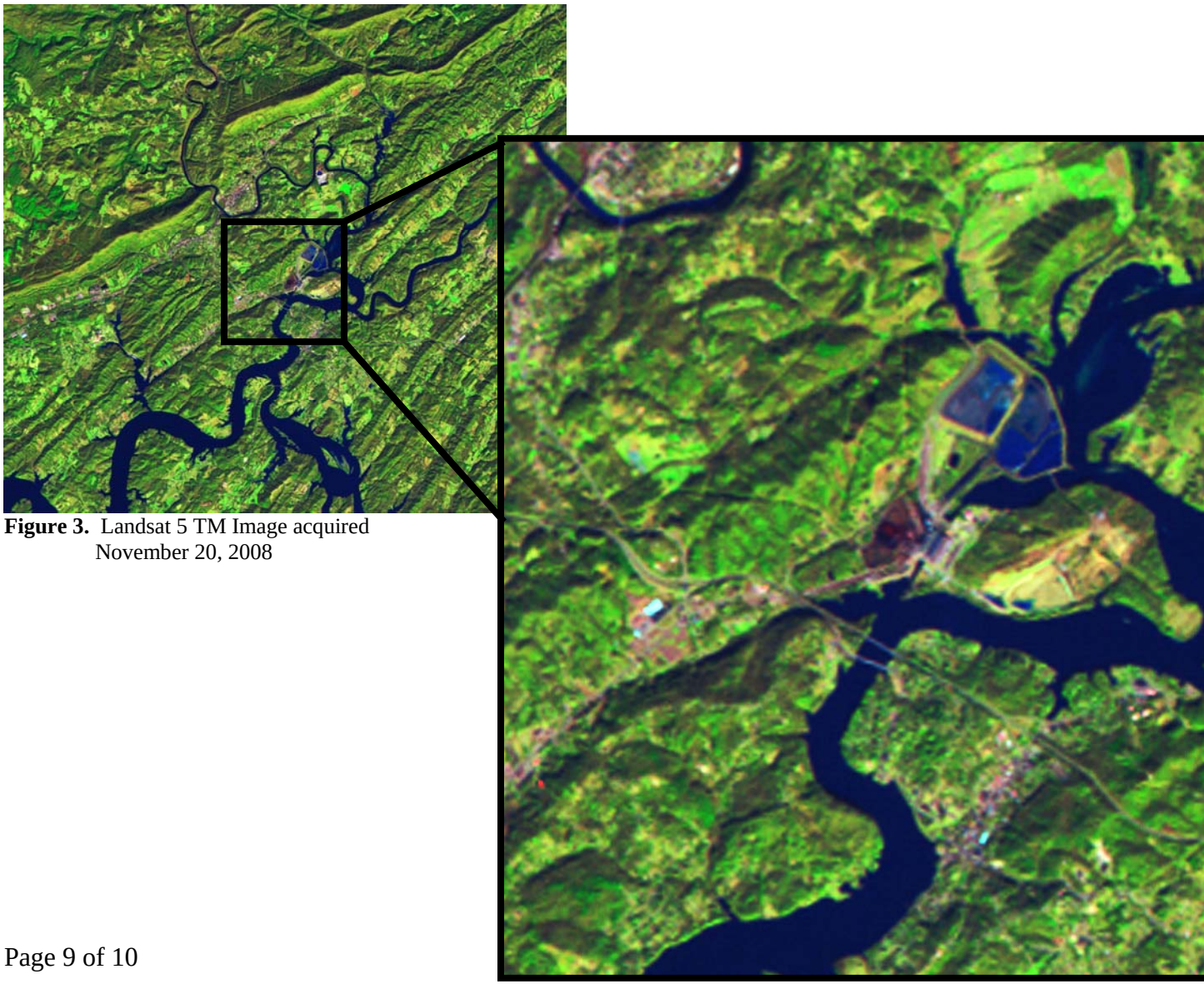

Figure 3. Landsat 5 TM Image acquired November 20, 2008

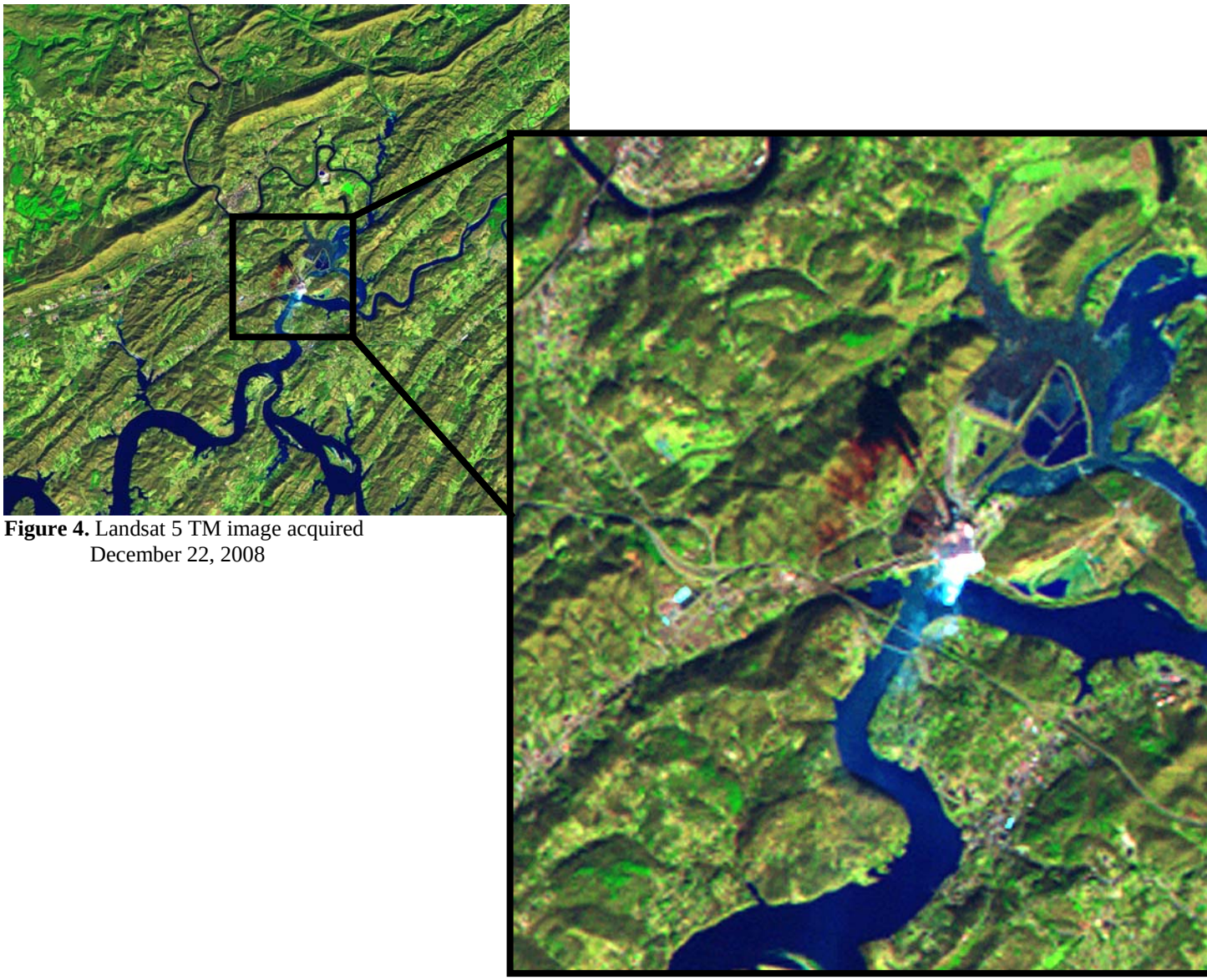

Figure 4. Landsat 5 TM image acquired December 22, 2008