Mid-Decadal Global Land Survey

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Mid-Decadal Global Land Survey (MDGLS)

Follow-on to the GeoCover orthorectified global data sets (1975, 1990, and 2000 epochs) centered on 2004-2006

- Partnership between USGS and NASA, in support of CCSP
- Support global assessments of land-cover, land-cover change, and ecosystem dynamics (disturbance, vegetation health, etc)
- Landsat-5 TM and Landsat-7 imagery, with ASTER and EO-1 ALI data as needed
Phase 1: identify all candidate scenes and ingest into the USGS archive (USGS lead)

Phase 2: Process selected data into an ortho-rectified dataset compatible with previous surveys (NASA lead)

Phase 3: Analyze data set to quantify trends in land cover and vegetation dynamics (NASA LCLUC)
Mid-Decadal Global Land Survey (MDGLS)

Phase I: Identify and Acquire L5 and L7 Data

Phase II: Process MDGLS Data

Phase III: Analyze MDGLS Dataset for Land Cover/Land Cover Change
Where do we want data?

Green = GeoCover 2000 Coverage
Red = New MDGLS Coverage
MDGLS Coverage:
• Better accounting of islands and reefs
• Inclusion of the Antarctica
• Full coverage of Arctic area in ‘ascending’ orbit

Coverage

IPY ---→

1970
1990
2000
2005

~7000 scenes
~8,200 scenes
~9,500 scenes
When do we want data?

Green = NH Summer (Jun, Jul, Aug, Sep)
Red = NH Spring (Apr, May)
Violet = NH Fall (Oct, Nov)
Yellow = NH Winter (Jan, Feb, Mar, Dec)
What data are available? Landsat-7

Green = Base \leq 1\% \text{ CC}, \text{ Fill} \leq 5\% \text{ CC} 

Yellow = Base \leq 5\% \text{ CC}, \text{ Fill} \leq 10\% \text{ CC} 

63\% of Land Area

3 month acquisition windows, 95\% fill coverage
What Data Are Available? Landsat-5
Combined Archived Coverage in EROS Archive

Green = ETM+ 5%/10% CC Fill
Yellow = TM <10% CC in EROS Archive
Red = TM = ??% CC in IC Archives

>91% of the P/R Locations Covered
STATUS: EO-1 ALI Campaign for Reefs and Small Islands

COVERING 293 L7 P/R
WITH 602 ALI IMAGES

L7 SCENE IS ACCEPTABLE WHEN ALL ALI IMAGES COVERING IT ARE ACCEPTABLE OR CLOSE

WORST RATING TO DATE FOR EACH SCENE

- ACCEPTABLE OR CLOSE
- NO GOOD
- CANX-SPECK
- MARGINAL
- NO ACQ OR ON HOLD
Status of EO-1 island acquisitions

- 293 Landsat-7 path/rows contain islands/reefs being acquired for MDGLS by EO-1 ALI
- 602 ALI scenes to cover the islands and reefs in these scenes
- If island/reef is centered, using L7, otherwise relying on EO-1.

Status of 602 ALI scenes
(as of 30 March 2007)

- Not Yet Acquired: 7%
- Acceptable: 11%
- Marginal: 8%
- Close: 5%
- Cancelled: 8%
- L7 clear: 9%
- On Hold: 7%
- Hi Lat: 8%
- Canx-Speck: 0%

Status* of 293 L7 path/rows
(as of 30 March 2007)

- Not Acq or On Hold: 50%
- Acceptable or Close: 31%
- Marginal: 8%
- No Good: 11%
- * Worst status of Multiple ALI scenes Per L7 path/row
Phase 1 Status

- Developed and implemented an MDGLS acquisition strategy
- Developed QA management tool and automated scene selection tool
- Established a network of 6 campaign stations to collect Landsat 5 data
  - 4 have provided data (Kiruna, Moscow, Irkutsk, Maspalomas)
  - 1 is under construction and will begin collections in early 2007 (Chetumal)
  - 1 is in progress (Malindi)
- Most International Cooperators have agreed to supply image data in support of the MDGLS Project
  - 6 have provided metadata to USGS
  - 6 stations have confirmed Jpeg browse – for easier inspection
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Phase II Tasks

• Establish MDGLS Product Specifications

• **Select data source and scenes** *(where multiple options are available)*

• Implement automated orthorectification at EROS

• Process selected data
  - Orthorectification
  - Gap-filling (for Landsat-7)
  - Product format

• Distribute MDGLS data

*Complete dataset available Fall 2008*
Sensor Source Selection

Recommendation:
- For cloud-free scenes (<2% CC): lean toward Landsat-7 ETM+
- Cloudier scenes (2-10% CC): lean toward Landsat-5 TM
- Humid Tropics: multiple Landsat acquisitions for compositing
- Gaps: ASTER, ALI, other

Sensor choice must be balanced against acquisition date, overall cloud cover, and acquisition date of 2000 Geocover
- Optimization algorithm developed by ARC to assist selection
Landsat-7 Gap-filling: The Good

Northern Siberia (p159r15)

EROS Gap-filling works very well in cloud free conditions
Landsat-7 Gap-filling: The Bad and the Ugly

Honduras (p18r50)

Gap-filling with cloudy scenes can introduce radiometric artifacts; small residual gaps are possible.
MDGLS Orthorectification

Need to reprocess previous GeoCover datasets in high-relief areas to maintain continuity with MDGLS
- model absolute error due to Geocover DEM choice
- reprocess locations with significant errors using SRTM

Use 2000 GeoCover chips as geodetic control, SRTM DEM for terrain correction
- L7 automated 1Gt processing available May 2007
- L5 automated 1Gt processing available Spring 2008

Geodetic accuracy relative to 2000 Geocover of 30m RMSE (or better). Maximum absolute geodetic error of 100m.
Identify: scenes with >0.5% of pixels with error > 15m
scenes with any pixel >100m error
~ 841 scenes require reprocessing
MDGLS Product Specification

- UTM / WGS-84 projection
- 14.25 / 28.5/ 57 meter resolution
- Cubic Convolution resampling (1 step)
- GeoTiff format
- Orthorectified, Gap-filled
- 30m RMSE relative to 2000 Geocover (reprocessed)
Data Processing and Distribution

Processing responsibility TBD
- EROS capability available May 2007
- USGS RFI for commercial participation

Process North America first (complete by CY07)
CY08: Process rest of globe

Release products as completed

FTP distribution of individual MDGLS scenes at no cost, with limited provision for bulk distribution of entire dataset (e.g. via hard disk transfer).
MDGLS Schedule

Image Acquisition

Phase 1 Activities

IC* Metadata Collection

Scene Selection

IC Data Collection

Phase 2 Activities

Phase 2 Planning

Product Generation

Prime Acquisition Period


*IC = International Cooperator
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Routine monitoring of global land cover conditions on 1-5 year time scales has been a documented science priority:

- US Climate Change Science Program (CCSP)
- NASA Earth Science Research Strategy
- CEOS GOFC/GOLD Program
- Global Land Program (GLP)

The MDGLS dataset offers a “pilot” opportunity to assess global rates of land cover change for 2000-2005
Community Recommendations

Meeting on Phase III Strategy – Feb 27-28, Annapolis

MDGLS critically important for LC Science and Assessments

Highest priority for global estimates of land cover change
- forest cover change, disturbance
- irrigated agriculture extent
- global standing water
- arctic hydrology (bogs, permafrost)
- urbanization
- focus on products that meet societal needs

Distributed implementation ok, but harmonization essential

Open archive would advance science utility of MDGLS
Community Recommendations (2)

FAO LCCS (Land Cover Classification Scheme) is appropriate for MDGLS, with some modification
- reduce emphasis on land use
- need comparable effort for land cover change products

Validation needs to be integrated into Phase III from the start
- work with GOFC Validation Team and CEOS CVWG
- validation of land cover change a new topic

Phase III activities represent a pathfinder for 2010 assessment, and annual assessments in LDCM era
The NASA LCLUC call opens opportunity for proposals to develop LCLUC products from both GEOCOVER & MDGLS
- Expect 3-4 selected projects, 300-400K/yr
- Anticipated starts in Mar’08

Next year an additional call to complement what’s needed based on the 2007 selections
### Mid-Decadal Global Land Survey

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The Mid-Decadal Global Land Survey (MDGLS) is a partnership between the U.S. Geological Survey (USGS) and the National Aeronautics and Space Administration (NASA), in support of the U.S. Climate Change Science Program (CCSP) and the NASA Land-cover Land-use Change (LCLUC) Program.

Characterizing trends in land cover and land use remains a key goal for Earth science. The MDGLS is assembling a global dataset of 30-meter resolution satellite imagery to support measurement of Earth’s land cover and rates of land cover change during the first decade of the 21st century.

The MDGLS builds on the existing Geocover data sets developed for the 1970s, 1990, and 2000. Some 9,000 Landsat images from the period 2004-2007 will be acquired, processed, and made available to the public via FTP download. Given the failure of the Landsat-7 ETM+ Scan Line Corrector in 2003, a combination of Landsat-7 gap-filled data and Landsat-5 data from U.S. and international ground stations will be used in the project. Additional imagery from ASTER and EO-1 ALI imagers will be included to augment the Landsat coverage. Processing will begin in early 2007 and orthorectified products will be made available for download throughout the project. The complete dataset is expected to be completed in late 2008.

We are interested in your feedback. Questions or comments may be directed to: mdglssurvey@umiacs.umd.edu