# MODIS
# Distributed Active Archive Centers (DAACs)
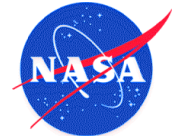## Level 1 Processing/Reprocessing
## Level 1+ Archive and Distribution

Presentation to MODIS Science Team

December 19, 2001


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Greg Scharfen (NSIDC DAAC)

John Dwyer (EDC DAAC)

# Level 1 Processing/Reprocessing: Highlights Summary

- \> 280 consecutive full days of Level 1 Collection 1 data processed
- \> 315 full days of Level 1 Collection 3 data processed
  - Full day means > 98% of data per day processed
  - Exception: Lost Level 0 data (i.e., data the DAAC did not see)
- L1 Production has been upgraded to process at 3X, seeing bursts of over 4X
- ECS Release 6A04 set us back in processing during the summer, but we have recovered well and have taken action to reduce future new release issues
- Integration of GES DAAC developed, Simple Scalable Script-Based Science Processor (S4P) into ECS demonstrates more efficient reprocessing, and now, processing
- Weekly meetings with ESDIS have lead to identifying and resolving system instabilities over time
- Weekly meeting with MODIS Technical Team address production issues that ensure data processing that maximizes data output
- Daily meeting with MODAPS to discuss processing status and plans

*Several data production metrics tools have been developed by the DAAC*
  *…allowing system behavior to become better understood*
    *…in turn, allowing production strategies to be reliably implemented that maximize output*
      *…based on priorities*

## Actual and Currently Planned Increase in Processing Capacities

|  | 12/1999 | 12/2000 | 2/2001* | 1/2002* | 12/2003 ** |
|---|---|---|---|---|---|
| Terra processing | 1.2X | 1.2X | 1.2X | 1.2X | 1.2X |
| Terra reprocessing |  | 1X | 2X | 2X | 2X |
| Aqua processing |  |  |  | 1X | 1X |
| Aqua reprocessing |  |  |  |  | 1X |
| Total Processing Capacity | 1.2X | 2.2X | 3.2X | 4.2X | 5.2X |

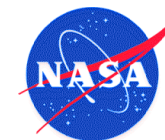*  Additional 1X installed earlier in the year than originally planned

** Additional 1X may be installed earlier in the year than planned, depending when AQUA is launched

At the GES DAAC, a rate of 1X equals processing a day of MODIS Level 1 data, in a day.

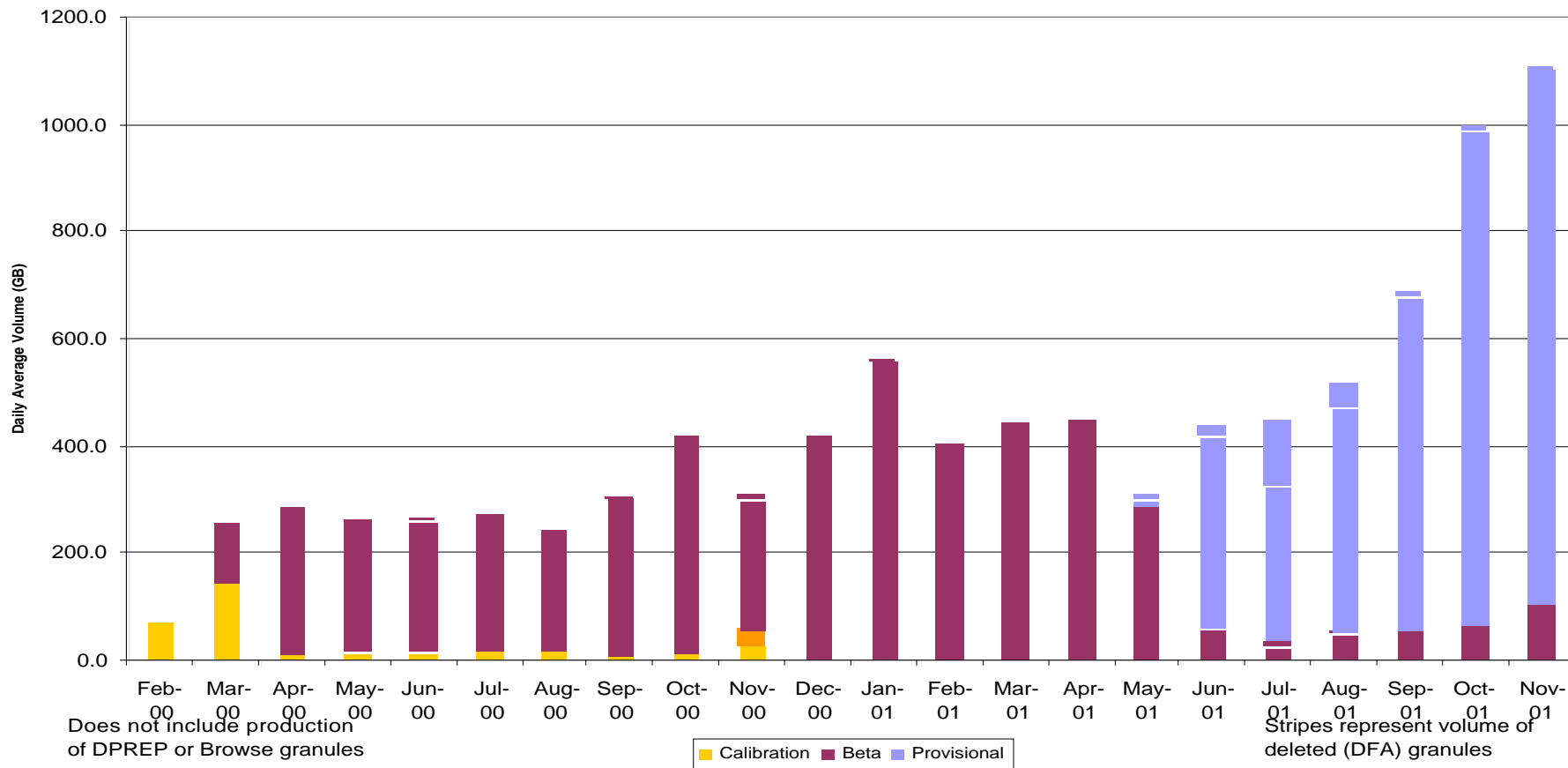GDAAC Total Performance
July-November 2001
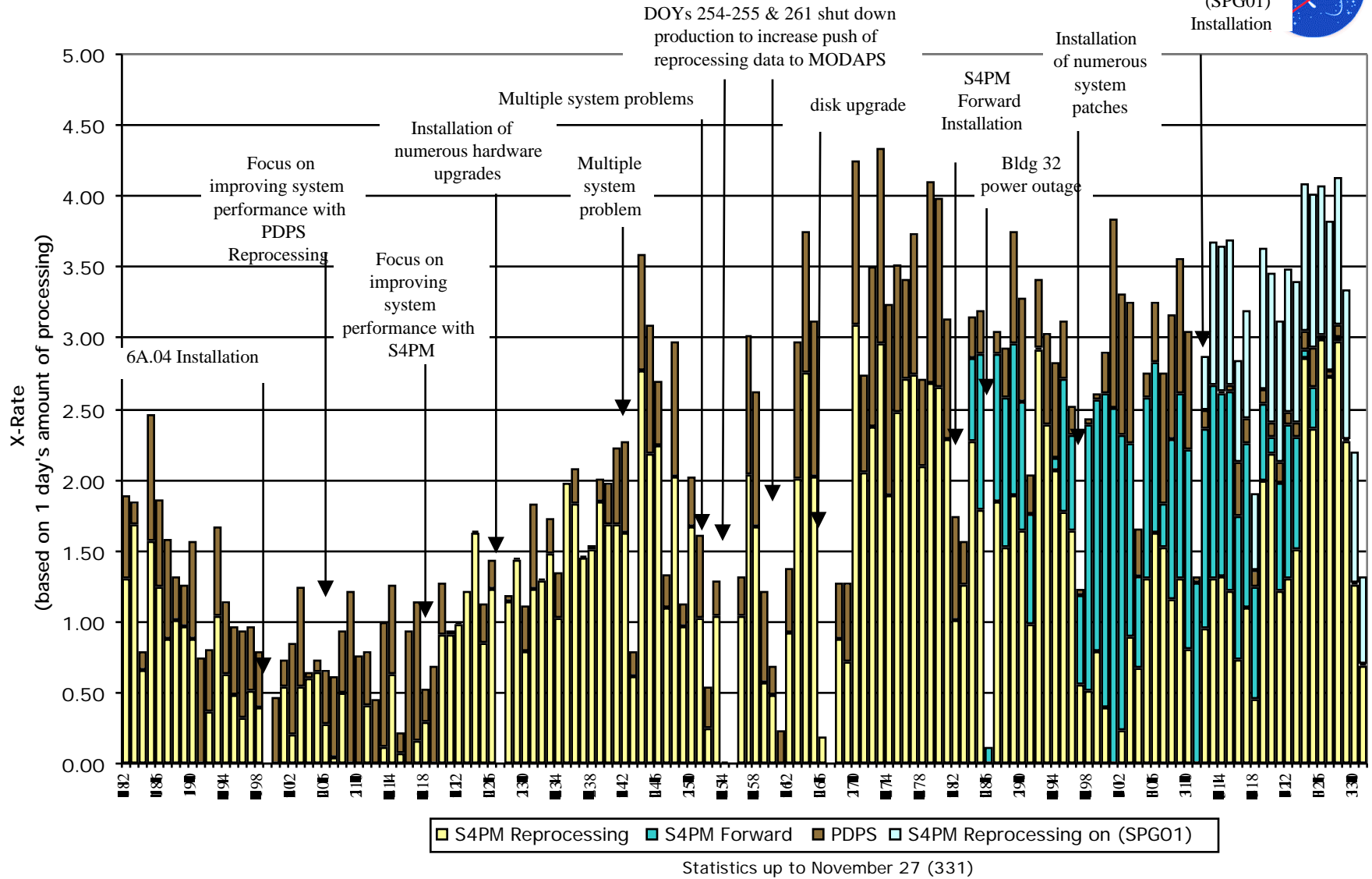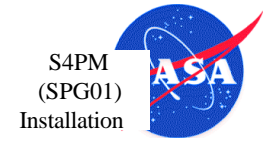
GES DAAC total performance for production, archival and ingest

# GDAAC Level 1 Production of MODIS Data Daily
## Average Volume by Month of Production

## February 2000 to November 2001



Daily Average Volume (GB)

Does not include production
of DPREP or Browse granules

■ Calibration  ■ Beta  ■ Provisional

Stripes represent volume of
deleted (DFA) granules

# Availability of MODIS Level 1B Data
## as of November 29, 2001 3:00PM

February 24, 2000 - October 30, 2000    A-Side data
October 30, 2000 - June 15, 2001    B-Side data
July 2, 2001 - Present    A-Side data
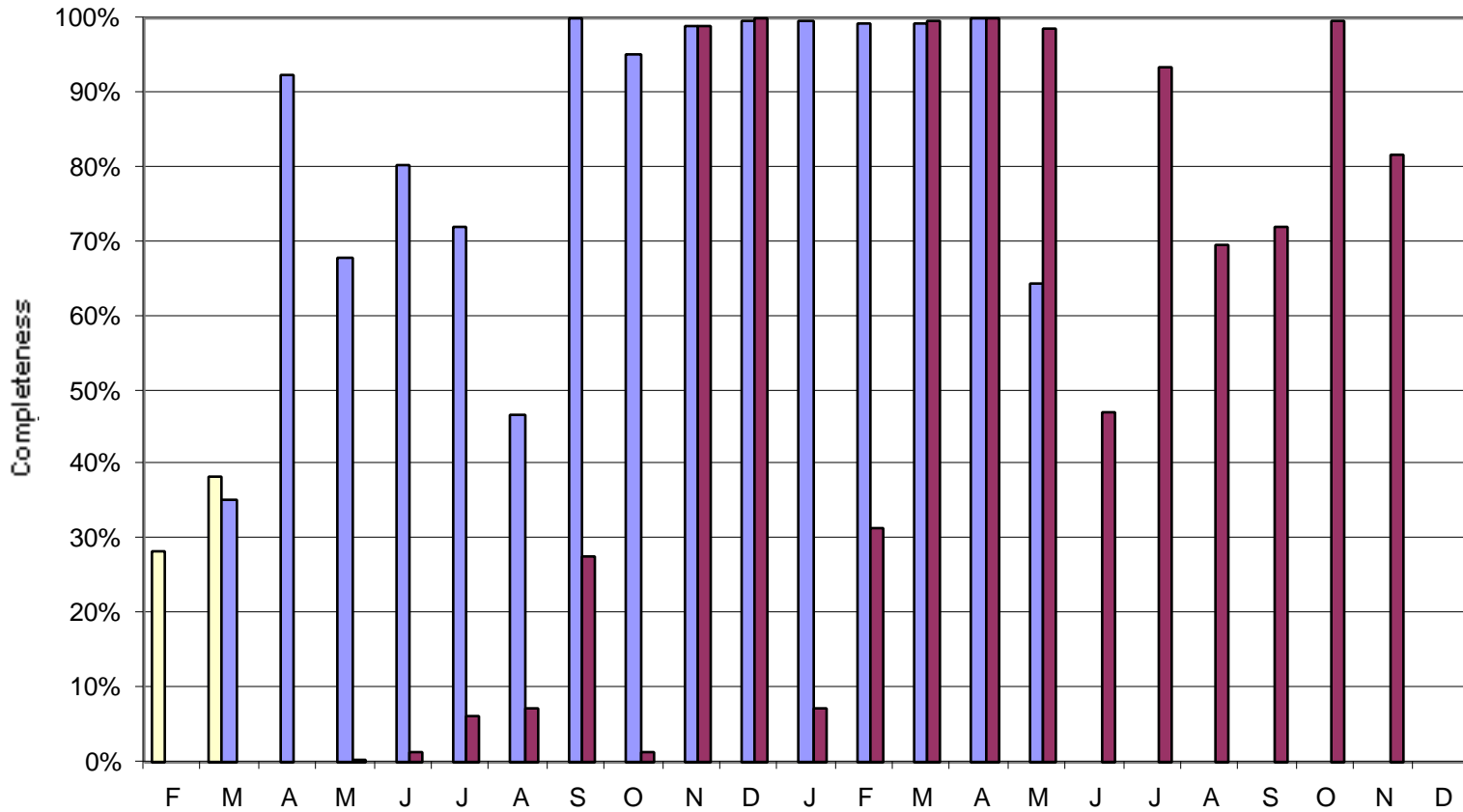


| | Feb-00 | Mar-00 | Apr-00 | May-00 | Jun-00 | Jul-00 | Aug-00 | Sep-00 | Oct-00 | Nov-00 | Dec-00 | Jan-01 | Feb-01 | Mar-01 | Apr-01 | May-01 | Jun-01 | Jul-01 | Aug-01 | Sep-01 | Oct-01 | Nov-01 | Dec-01 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ver 199 | 28.5% | 38.6% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Ver 001 | 0.0% | 35.2% | 92.6% | 67.7% | 80.4% | 71.9% | 46.8% | 99.9% | 95.3% | 98.9% | 99.6% | 99.8% | 99.1% | 99.3% | 100.0 | 64.5% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Ver 003 | 0.0% | 0.0% | 0.0% | 0.2% | 1.3% | 6.1% | 7.3% | 27.8% | 1.3% | 99.1% | 100.0 | 7.1% | 31.6% | 99.7% | 100.0 | 98.7% | 47.2% | 93.5% | 69.7% | 72.1% | 99.8% | 81.6% | 0.0% |

Note: Version 199 data is not orderable by external customers.

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**Availability of MODIS Level 2 Oceans Sea Surface Temperature as of November 29, 2001 3:00PM**
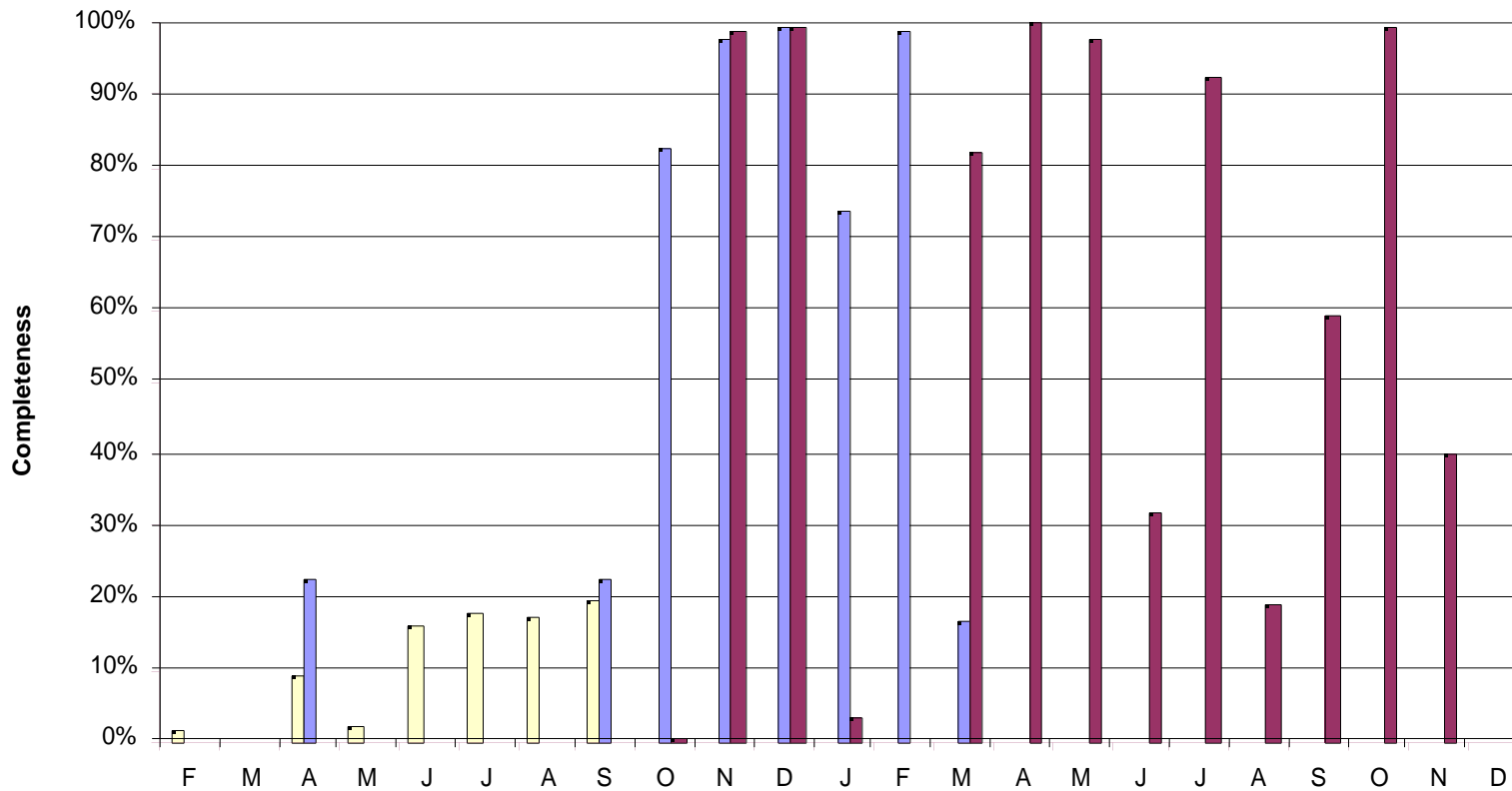
| February 24, 2000 - October 30, 2000 | A-Side data |
| October 30, 2000 - June 15, 2001 | B-Side data |
| July 2, 2001 - Present | A-Side data |



| | Feb-00 | Mar-00 | Apr-00 | May-00 | Jun-00 | Jul-00 | Aug-00 | Sep-00 | Oct-00 | Nov-00 | Dec-00 | Jan-01 | Feb-01 | Mar-01 | Apr-01 | May-01 | Jun-01 | Jul-01 | Aug-01 | Sep-01 | Oct-01 | Nov-01 | Dec-01 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ver 199 | 1.8% | 0.0% | 8.9% | 2.5% | 16.3 | 18.1 | 17.5 | 19.8 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Ver 001 | 0.0% | 0.1% | 22.8 | 0.1% | 0.1% | 0.0% | 0.0% | 22.5 | 82.7 | 97.6 | 99.4 | 74.1 | 99.1 | 16.5 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Ver 003 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.6% | 98.8 | 99.7 | 3.4% | 0.1% | 82.1 | 99.9 | 97.8 | 32.0 | 92.6 | 19.2 | 59.3 | 99.6 | 40.0 | 0.0% |

Note: Version 199 data is not orderable by external customers.

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# Availability of MODIS Level 2 Atmospheres Cloud Products
## as of November 29, 2001 3:00PM

February 24, 2000 - October 30, 2000   A-Side data
October 30, 2000 - June 15, 2001      B-Side data
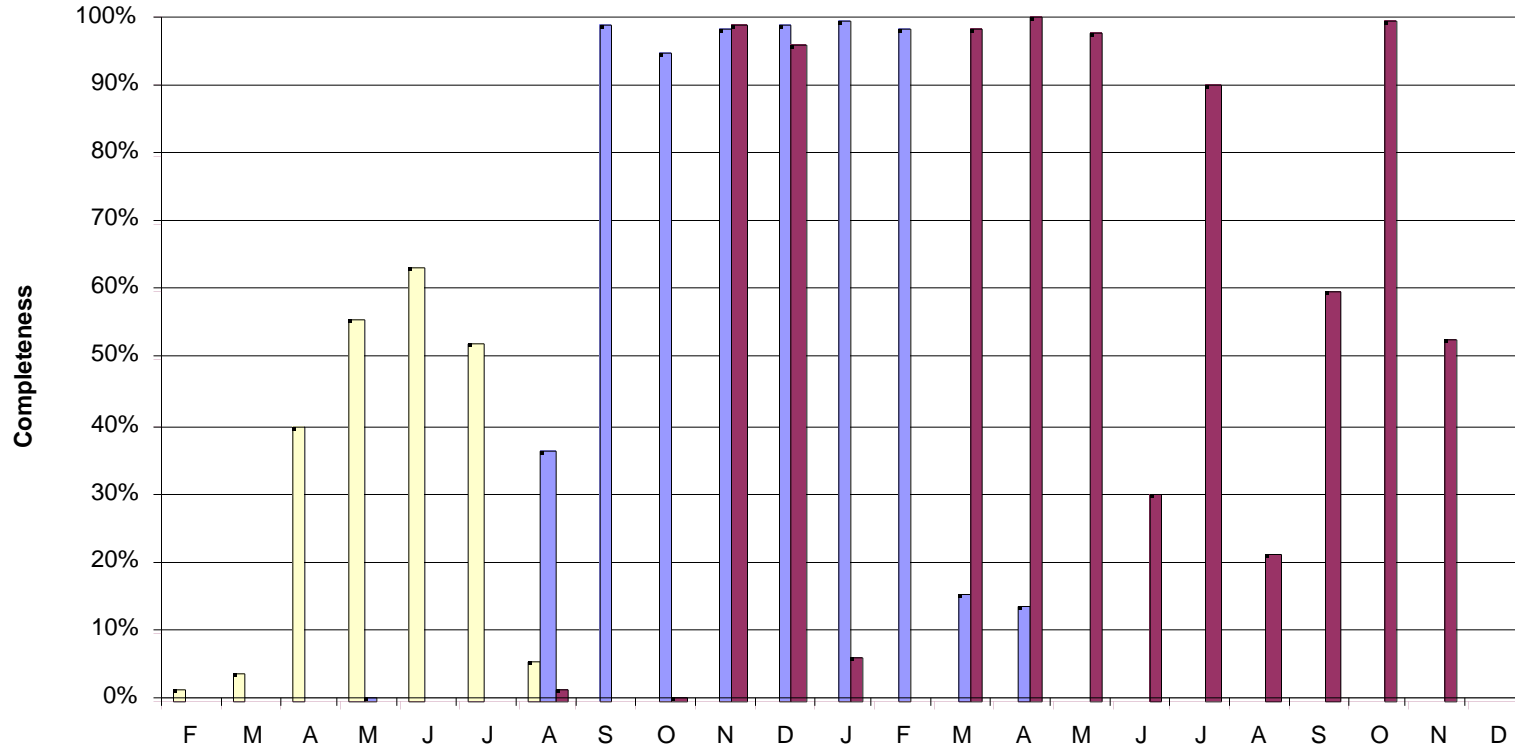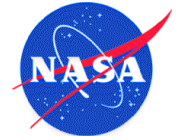July 2, 2001 - Present                A-Side data



|         | Feb-00 | Mar-00 | Apr-00 | May-00 | Jun-00 | Jul-00 | Aug-00 | Sep-00 | Oct-00 | Nov-00 | Dec-00 | Jan-01 | Feb-01 | Mar-01 | Apr-01 | May-01 | Jun-01 | Jul-01 | Aug-01 | Sep-01 | Oct-01 | Nov-01 | Dec-01 |
|---------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Ver 199 | 1.6%   | 3.9%   | 40.0   | 55.6   | 63.7   | 52.5   | 5.6%   | 0.0%   | 0.0%   | 0.0%   | 0.0%   | 0.0%   | 0.0%   | 0.0%   | 0.0%   | 0.0%   | 0.0%   | 0.0%   | 0.0%   | 0.0%   | 0.0%   | 0.0%   | 0.0%   |
| Ver 001 | 0.0%   | 0.0%   | 0.0%   | 0.2%   | 0.0%   | 0.0%   | 36.3   | 99.1   | 95.1   | 98.5   | 99.2   | 99.3   | 98.5   | 15.7   | 13.8   | 0.0%   | 0.0%   | 0.0%   | 0.0%   | 0.0%   | 0.0%   | 0.0%   | 0.0%   |
| Ver 003 | 0.0%   | 0.0%   | 0.0%   | 0.0%   | 0.0%   | 0.0%   | 1.4%   | 0.0%   | 0.6%   | 98.7   | 96.0   | 6.5%   | 0.0%   | 98.7   | 99.9   | 97.9   | 30.0   | 90.1   | 21.7   | 59.6   | 99.6   | 52.7   | 0.0%   |

Note: Version 199 data is not orderable by external customers.

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# Archive Summary at the MODIS DAACs

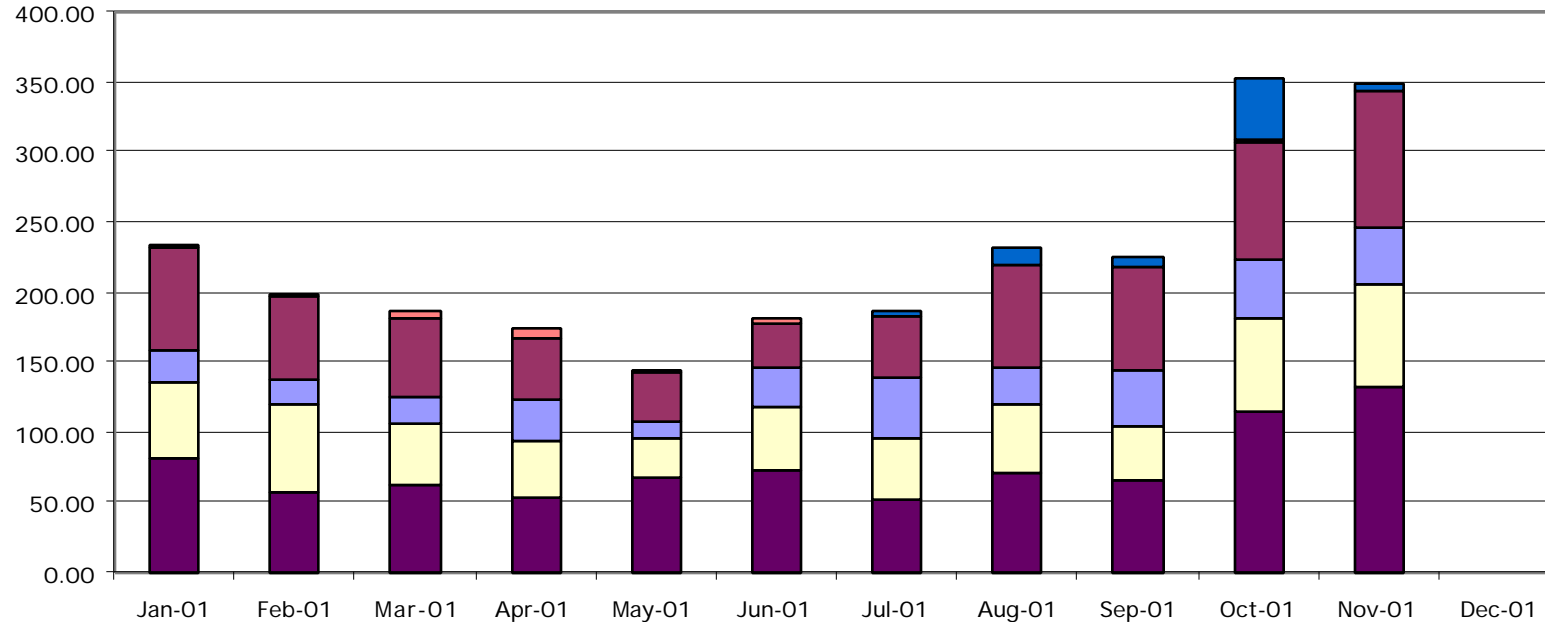|  | TB/month sustained * | Total (TB), so far |
|---|---|---|
| GSFC | 43.1 | 445.9 |
| NSIDC | 0.9 | 7.4 |
| EDC | 15.2 | 116.1 |
| TOTAL | 59.2 | <span style="color:red">>569.4</span> |

* Last three months averaged

## GDAAC Monthly Distribution Daily Averages
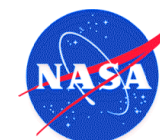## 2001
### (GB)

Statistics
starting
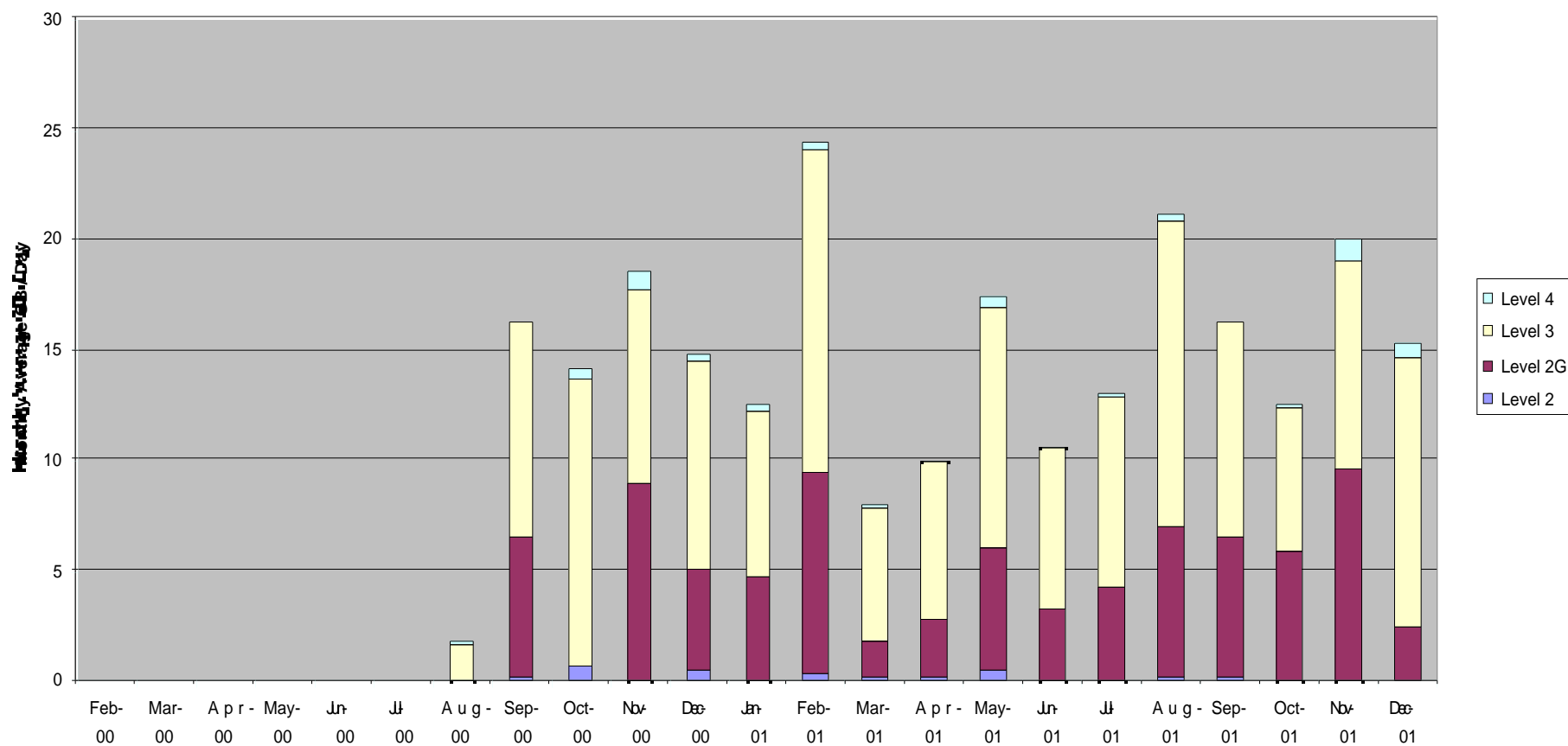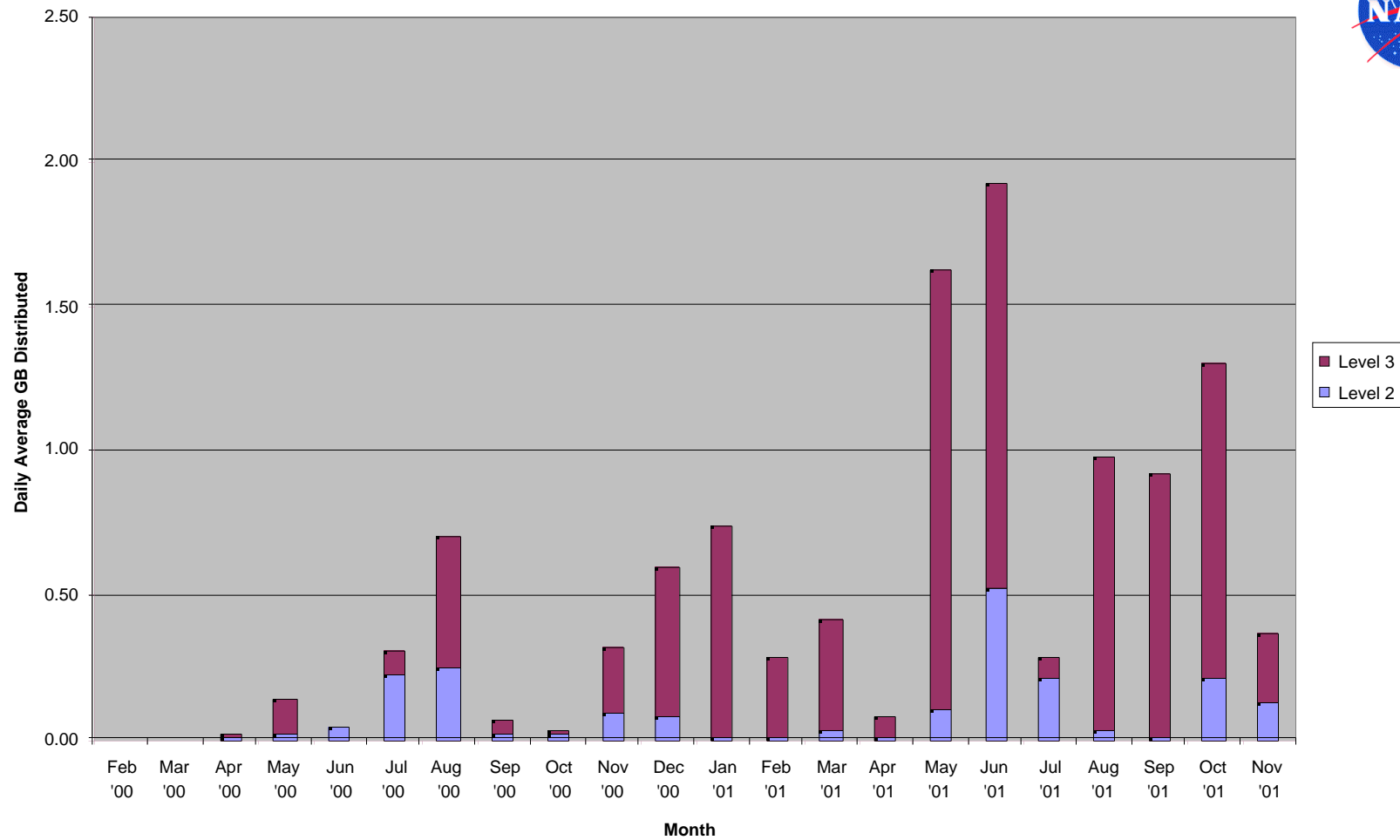DOY 023

Statistics ending
DOY 330
11/26/01

|  | Jan-01 | Feb-01 | Mar-01 | Apr-01 | May-01 | Jun-01 | Jul-01 | Aug-01 | Sep-01 | Oct-01 | Nov-01 | Dec-01 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ■ PDS | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.15 | 12.20 | 6.78 | 44.82 | 5.80 | 0.00 |
| ■ Testing | 2.42 | 3.07 | 4.33 | 6.75 | 2.83 | 3.21 | 1.08 | 0.03 | 1.40 | 1.50 | 0.06 | 0.00 |
| ■ Other | 72.25 | 57.96 | 56.75 | 44.24 | 33.98 | 31.43 | 43.92 | 72.57 | 73.22 | 84.59 | 97.77 | 0.00 |
| ■ MCST | 23.61 | 17.68 | 18.55 | 29.69 | 11.81 | 28.16 | 42.52 | 27.25 | 39.25 | 41.56 | 40.48 | 0.00 |
| □ Public | 54.02 | 62.52 | 43.90 | 40.71 | 28.54 | 45.61 | 43.46 | 48.61 | 38.09 | 65.26 | 72.23 | 0.00 |
| ■ QA | 81.76 | 58.38 | 62.85 | 53.76 | 68.36 | 72.76 | 53.14 | 71.63 | 67.16 | 115.93 | 133.10 | 0.00 |

Figure 26 GES DAAC monthly distribution averages (GB) for 2001. Monthly
distribution has increased to the MODIS team (MODAPS and calibration) in 2001,
except in the May timeframe for MCST and the June/July timeframe for all (during
reduced L1 production).

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EDAAC Distribution of MODIS Data February 2000 to December 13, 2001

Legend:
- Level 4
- Level 3
- Level 2G
- Level 2

X-axis: Feb-00, Mar-00, Apr-00, May-00, Jun-00, Jul-00, Aug-00, Sep-00, Oct-00, Nov-00, Dec-00, Jan-01, Feb-01, Mar-01, Apr-01, May-01, Jun-01, Jul-01, Aug-01, Sep-01, Oct-01, Nov-01, Dec-01

Daily Average Gigabytes of MODIS Data Distributed each Month by the NSIDC DAAC.

# NSIDC DAAC ECS MODIS User Categories
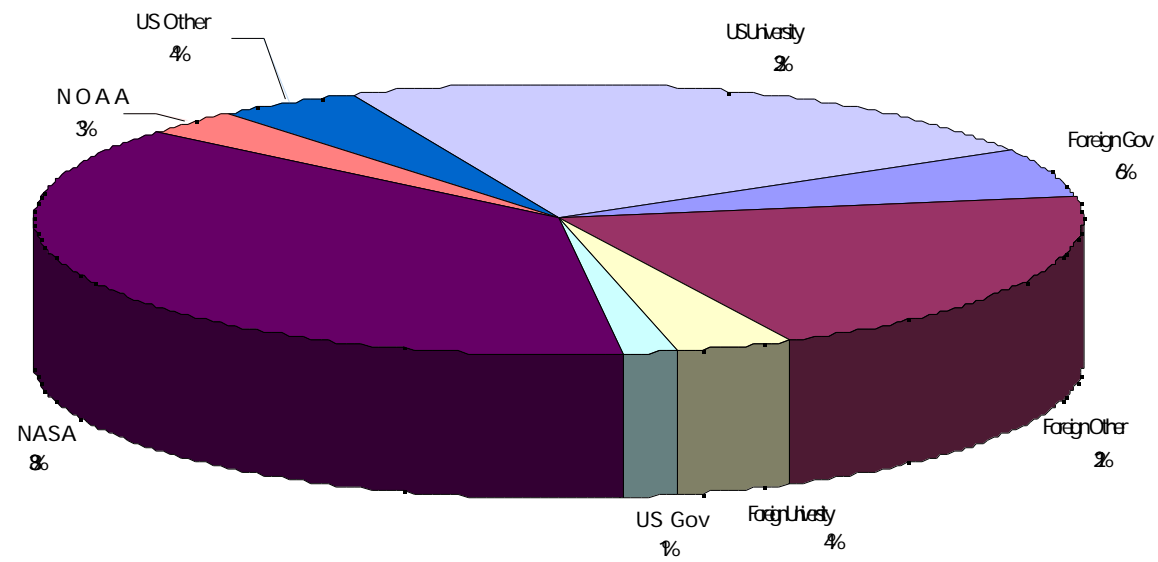
# Distribution Issues: What we are doing

The following efforts to facilitate data distribution have been undertaken at the MODIS DAACs:

- Enhancing Version 0 Web-Based Hierarchical Ordering Mechanism (WHOM) as an alternative data -ordering engine. (**PLEASE USE THESE: YOUR FEEDBACK HELPS ENSURE THAT THESE TOOLS ARE THE CORRECT ONES**)
  - Added subsetting (parameter, spatial, temporal)
  - Added on-demand subsetting
  - Output of above tools are in HDF and binary formats
- Developed subsampling PGE, also providing HDF and binary fromat outputs
- Developing in-house reprojection tools (EDC) and mosaicing enhancements (NSIDC)
- Pointing to tools developed by the MODIS Atmospheric Team including Granule Locator and GranuleVisualizer.
- Adding pointers to the GES DAAC wepage to navigate users to tools, status, and help
- Provided browse products
- Developed a data mining environment by which science algorithms that reduce data volume before transmission can be integrated.
- Implementing 'data pools', very large data staging archives, that will greatly enhance the amount of data that can be distributed in a given time period.
- Linking to research initiatives (e.g., NASA Cold Land Processes at NSIDC) and field campaigns
- Collaborating with universities by providing them data so that they can act as redistribution sites.

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# Distribution Issues:  Digging In
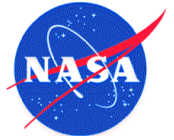
The GES DAAC has initiated a complete data ordering to data receipt analysis:

1.  Engage MODIS data users (initially, MODIS Team members and GES DAAC User Working Group members) to categorize data access/usage patterns and problems

2.  Analyze and identify, from data ordering to data receipt, the operational and functional mechanics and bottlenecks of the system, based on above data access/usage categories

3.  Prioritize (will need user input) and implement changes needed to ensure that the system allows for data access/usage at an acceptable level:
    - The GES DAAC will coordinate and resolve operational bottlenecks
    - ESDIS Project will coordinate and resolve functional bottlenecks

*This activity requires full commitment from the GES DAAC, users, and ESDIS Project to efficiently identify and remedy distribution issues*

# Use Access-Related Issues
## (Contributions from all 3 DAACs)
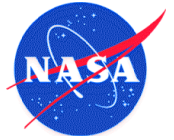
- Need high level graphical view of archive holdings (temporal and/or spatial)
- Need to formally support alternative search and order tools at all DAACs
- Need temporal, spatial and parameter subsetting capability as part of EDG
- Need more HDF-EOS tutorials and tailored display and manipulation tools and offer other formats or conversion to other formats (e.g., Geotiff, flat binary)
- Need to address data management of near-real time (bent-pipe) data
- Need to implement routine data reconciliation procedures
- Need to minimize impact of DAAC system downtime
- Need to automatically import projection information into COTS packages.
- Need to support subscription services
- Need to describe specific differences between Collection 1 and Collection 3
- Need to provide global datasets conveniently
- Need to translate QC flags (no tools)
- Need to provide global coverage of the 250m data.
- Need to match filenames as delivered with granule-id that was ordered.
- Users like the Global Browse websites, but not all that is shown has always been archived yet (EDC)

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# MODIS Data Access

Ways to Access MODIS Data
- EOS Data Gateway (EDG)
  - Access directly or via DAAC Home Pages through Links button
  - Data is sent by tape or pulled by requestor
- DAAC-specific interfaces
  - GSFC: Terra-WHOM
- Anonymous FTP
  - Access via DAAC Home Page through On-line FTP button
- Subscription
  - Data automatically pushed to requestor

# DAAC User Services

- GSFC:
  - MODIS Data Support Team.  Lead: Greg Leptoukh 301-614-5253
  - User Services Group:
    - 301-614- 5473 (ECS) or 301-614-5224 (V0)
    - daac_usg@gsfcsrvr4.gsfcmo.ecs.nasa.gov (ECS)
      daacuso@daac.gsfc.nasa.gov
    - http://daac.gsfc.nasa.gov

- NSIDC
  - MODIS Snow and Ice Product Team.  Lead: Greg Scharfen 303-492-6197
  - ECS Science Outreach Coordinator: Siri Jodha Singh Khalsa 303-492-1445
  - User Services:
    - HELP DESK - 303-492-6199
    - nsidc@kryos.colorado.edu
    - http://nsidc.org/NASA/MODIS/

- EDC DAAC
  - User Services MODIS Data Specialist:  Carolyn Gacke  605 -594-6822
  - ECS MODIS Science Data Specialist:  Calli Jenkerson  605 -594-2638
  - User Service:
    - Brenda Jones:  605 -594-6503; Toll Free  866 -573-3222 (866 LPE DAAC)
    - edc@eos.nasa.gov
    - http://edcdaac.usgs.gov

# DAAC user support for MODIS products

(slide provided by NSIDC, adapted for all DAACs)

- *Team approach*: the MODIS Product Teams includes representatives from several "resource groups" including operations, writers, user services, web technicians, systems engineering, programming and science groups
- MODIS *web pages* include:
  - documentation (metadata, catalog pages, guide documents)
  - access to browse
  - access to the EDG, WHOM
  - user tutorials: using the EDG, converting HDF-EOS data (more coming)
  - data manipulation and display tools (more coming)
- *user services* responds to questions within 24hours
- *distribution* by ftp (coming very soon:CD, DVD, DLT, 8mm)
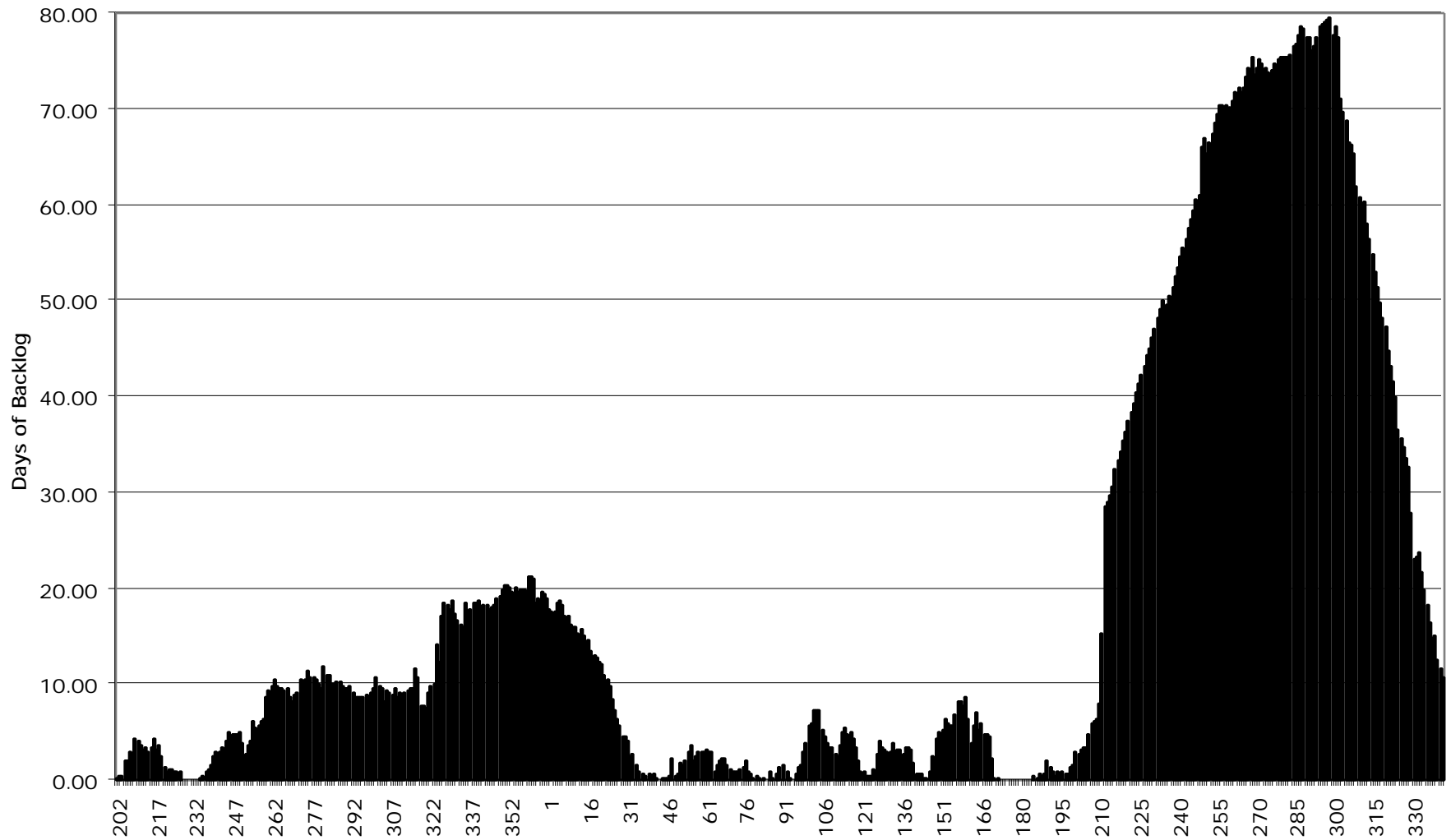- *outreach:* e.g. Conferences, papers, brochure and user surveys

# BACKUP
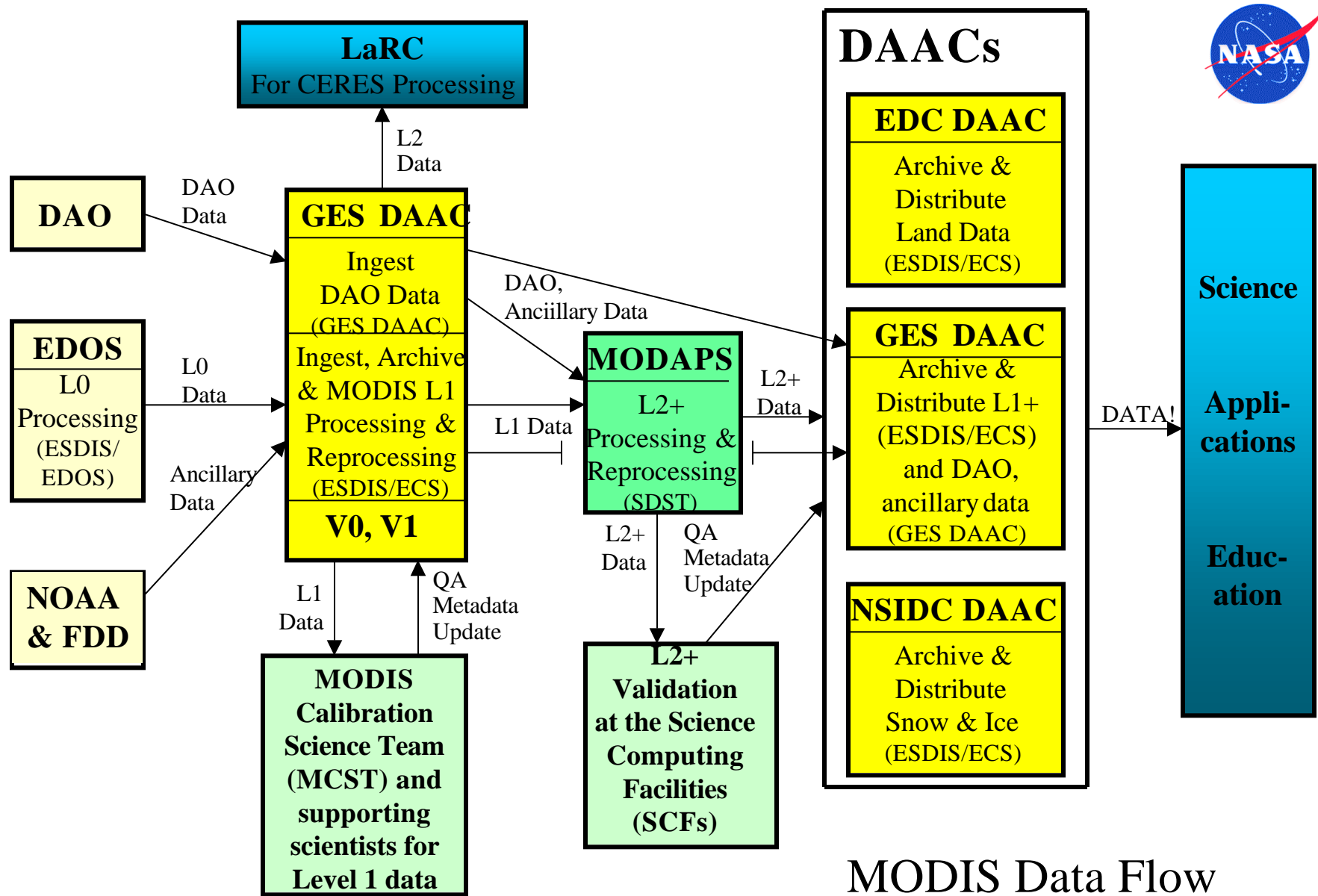
MODIS Data Flow
(Development Team in parentheses)

Backlog of Unprocessed Data
July 20, 2000 (DOY 202) - December 7, 2001 (341)

# GDAAC Archive Average Daily Volume



| | 02/00 | 03/00 | 04/00 | 05/00 | 06/00 | 07/00 | 08/00 | 09/00 | 10/00 | 11/00 | 12/00 | 01/01 | 02/01 | 03/01 | 04/01 | 05/01 | 06/01 | 07/01 | 08/01 | 09/01 | 10/01 | 11/01 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GB | 648.54 | 372.94 | 443.41 | 421.94 | 450.33 | 451.24 | 393.45 | 552.55 | 634.31 | 575.61 | 672.75 | 780.04 | 787.03 | 675.75 | 725.13 | 563.12 | 742.54 | 772.28 | 920.51 | 874.61 | 1595.09 | 1635.40 |