

Atmospheric applications on Grid with a focus on GOMOS and MIPAS

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1

Grid Computing in Earth Sciences

1

Grid Computing in Earth Sciences

2

The Atmosphere on Grid

1

Grid Computing in Earth Sciences

2

The Atmosphere on Grid

3

Grid and Beyond

1

Grid Computing in Earth Sciences

2

The Atmosphere on Grid

3

Grid and Beyond

4

Summary & Outlook

Grid Computing in Earth Sciences

Grid Introduction (1)

- geographically dispersed (distributed) network of computers
- accessing and handling resources (computing, data, tools, ...)



Grid Introduction (2)

- comfortable and open platform
- facilitates accessibility and interoperability
- provides seamless and scalable access to wide-area distributed resources
- common standardized infrastructure built on top of localized infrastructures
- anything one computer can do, a pool of computers can do faster and better
- . . . nobody needs to know where the electricity comes from, or how it is transmitted, it is just there to be used. . .

Operational Issues Addressed by Grid

- data are acquired and archived at distributed sites
- generation of high level global products need access to multi-source data
- increasing demand for global data products (also in NRT) as for GMES related projects
- present network solves some problems → not sufficient for transferring all data where needed

Operational Issues Addressed by Grid

- data are acquired and archived at distributed sites
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⇒ **move processors to data** in a flexible and controlled way

Application Community Issues

- EO science applications increasingly need to work across multiple geographical and administrative domains
- access data at different sites
- processing using different algorithms running on different machines
- storage of results on different devices
- distribute to different end users
- barriers by non-standard interfaces

Application Community Issues

- EO science applications increasingly need to work across multiple geographical and administrative domains
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- barriers by non-standard interfaces

⇒ **collaborative platform** with common access to data, tools, and computing resources to host applications controlled by users

Grid on-Demand: System Infrastructure

Computing and Storage Elements (CE, SE)

- ~200 working nodes; ~70 TB (continuously growing)
- operational: GLOBUS 2.4, Science: LCG 2.6
- link to external CE and SE

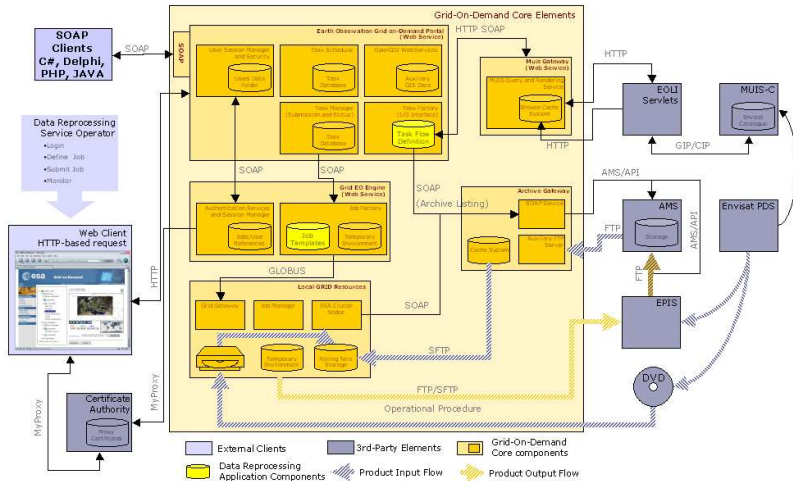
Data access

- e.g. Envisat NRT rolling archive
- access to other external data providers

Network & Security

- GIGAbit LAN in ESRIN, ...
- user certification ESACERT

Grid on-Demand: System Infrastructure



Data Online (1)

- MERIS L2: 2003 – to date
- MERIS L3
- MERIS FR (samples)
- AATSR L1: 2003 – to date
- AATSR L2: last 6 months
- ASAR GM: Feb 2004 – to date
- ASAR HRes and MRes: 2005
- MSG SEVIRI: last 6 months
- AVHRR, SeaWiFS, MODIS: under discussion at CNR

Data Online (2)

- GOME L1: 1996 – 2003 (more is coming)
- GOMOS: June 2003 – April 2004 (full data coverage soon)
- MIPAS (status: downloading)
- SCIAMACHY (status: pending)

Web Portal (1)

- selection of a set of algorithms
- temporal/spatial selection of products
- job selection, launching, and live status
- visualization via your own routines (command line)
- visualization in Web Map and Google Earth
- access to products and documentation

Web Portal (2)

The screenshot displays the MODIS Terra web portal interface. On the left is a navigation menu with links: Home, Grid On Demand, Logout, Services, My folder, Products, Storage Element, Demos, MERIS Mosaic, PRI/COM, MERIS Vegetation (MGVI-JRC), Administration, Control Panel, Run Query, and Contact Us. The main area features a map of the Mediterranean region with a 'Quick Selection: Mediterranean' dropdown. To the right of the map are controls for 'Geographical Selection' (Top Right: 40, 45; Bottom Left: -10, 30), 'Pass' (Both), 'Date Selection' (Start Date: 2003, March, 01; End Date: 2003, March, 02), and 'SST Parameters' (Description: Mediterranean 2003 Mar 1-2, Grid: Operational Grid, Clean Session: True, Cell Size: 1.11174 km). Below the map is a 'Catalogue Results (MUIS-C)' list showing various data files, including ATS_TOA_1POLRA and MOD28L2_A files. At the bottom of the results list are 'Query' and 'Delete' buttons. A 'Save Task' button is located at the bottom right of the interface.

Home

MODIS TERRA

Quick Selection: Mediterranean

Geographical Selection

Top Right: 40 45

Bottom Left: -10 30

Pass: Both

Date Selection

Start Date: 2003 March 01

End Date: 2003 March 02

SST Parameters

Description: Mediterranean 2003 Mar 1-2

Grid: Operational Grid

Clean Session: True

Cell Size: 1.11174 km

Save Task

Catalogue Results (MUIS-C)

ATS_TOA_1POLRA20030301_071706_000062202014_00169_05227_02

ATS_TOA_1POLRA20030301_085742_000062202014_00164_05228_02

ATS_TOA_1POLRA20030301_103818_000062202014_00165_05229_02

ATS_TOA_1POLRA20030301_190346_000059132014_00170_05234_03

ATS_TOA_1POLRA20030301_204153_000062202014_00171_05235_02

ATS_TOA_1POLRA20030301_222229_000062202014_00172_05236_02

ATS_TOA_1POLRA20030302_062606_000062202014_00178_05242_02

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ATS_TOA_1POLRA20030302_182840_000062202014_00184_05248_02

ATS_TOA_1POLRA20030302_201016_000062202014_00185_05249_02

MOD28L2_A2003060_1850_041_2003341032212 hdf

MOD28L2_A2003060_1855_041_2003341032219 hdf

MOD28L2_A2003060_2025_041_2003341032746 hdf

MOD28L2_A2003060_2030_041_2003341032829 hdf

MOD28L2_A2003060_2035_041_2003341032829 hdf

MOD28L2_A2003060_2205_041_2003341032835 hdf

Query Delete

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Webmaster

Web Portal (3)

esr GRID on-Demand: - Mozilla Firefox

File Edit View Go Bookmarks Tools Help

http://giserver.esrin.esa.int:8181/grid/service/task.main.asp

WebMail Log-In :GRID on-Demand:: :GRID on-Demand::

esr Grid on-Demand

ESA User: Pedro Pereira Goncalves Last Updated: 10 February 2004

Home

Grid On Demand

Logout

Services

My Folder

Storage Element

Demos

Here's band combination

Europe Mosaic

Administration

Control Panel

Run Query

Contact Us

Grids

- Science Grid
 - mosaic.COM
 - Not Submitted
 - Submitted
 - Africa
 - Concluded
 - Asia 1st June...
 - Asia 30th May...
 - SEAsia (May 1...
 - Envisat Header Info E...
 - Operational Grid
 - Scheduled Tasks
 - Registered Datasets

Name: Africa
ID: 318(9_10862705340916133957163161622488)

The current task has 4 jobs running and 2 jobs already completed. There are still 5 jobs waiting for their dependencies.

collect1

Binning4

Binning3

Binning2

Binning1

Aggreg4

Aggreg3

Aggreg2

Aggreg1

mosaic

publish

1 2 3 4 5

Refresh Delete Resubmit Conclude Flow

© Copyright European Space Agency Webmaster

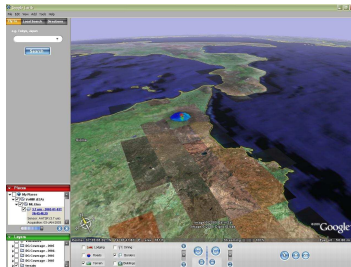
Applications (1)

- Global MERIS L3 layers, NRT MERIS L3 ocean/atmosphere
- Using BEAM toolbox
- NRT MERIS L3 vegetation (MGVI)



Applications (2)

- NRT Antarctica ASAR GM mapping
- multitemporal analysis: systematic flood monitoring
- VOMIR-Volcano monitoring by IR (with Kings College)
- (1 volcano, 3 years of data in dispersed storages → 1 hour processing in 20 CPU)



The Atmosphere on Grid

Envisat and ERS-2 Atmospheric Instruments

- GOMOS (Global Ozone Monitoring by Occultation of Stars)
- MIPAS (Michelson Interferometer for Passive Atmospheric Sounding)
- SCIAMACHY (SCanning Imaging Absorption SpectroMeter for Atmospheric CHartographY)
- GOME (Global Ozone Monitoring Experiment)

Actual and Future Projects

- beat2grid
- YAGOP (Yet Another GOMOS Processor)
- MIPAS reprocessing with GMTR
- var2grid: 3-DVAR data assimilation (DMI)
- GOME processing
- radiosondes from IPSL
- GOMOS H RTP

beat2grid: Features

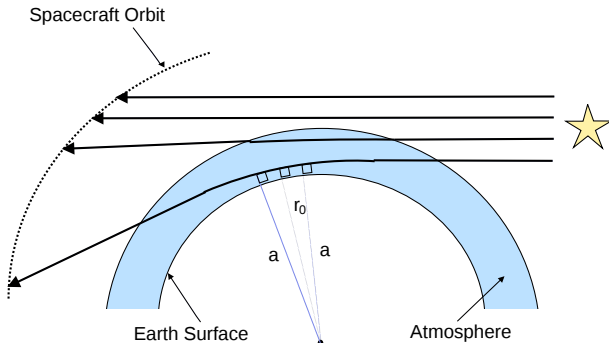
- actually supported platforms and languages
 - Linux
 - C, FORTRAN, IDL, MATLAB under discussion
- BEAT-I
 - low level access for level-0, level-1b, level-2, and auxiliary data
- BEAT-II
 - eased access to data product: e.g. `beat12_ingest(...)`;
 - import/export of several data types: ASCII, HDF4, and HDF5

beat2grid: Implemented Applications

- extraction and display of geolocation information of GOMOS products
- extraction and display of GOMOS level-2 O₃, NO₂, and NO₃ number density profiles
- extraction of MIPAS level-2 O₃ mixing ratios
- extraction of GOME products

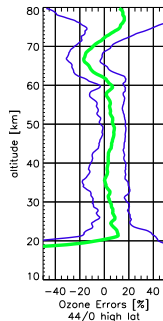
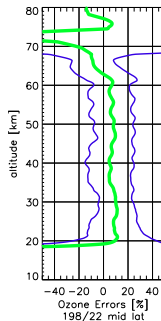
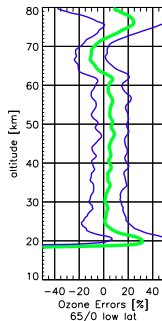
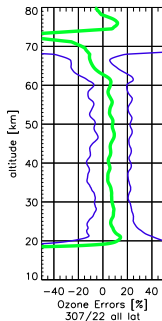
YAGOP (Yet Another GOMOS Processor): Features

- level-2 processing for ozone, NO_2 , and T
- comparison with ECMWF and CHAMP (future: MIPAS)



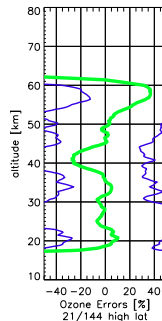
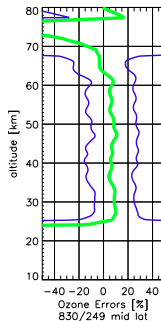
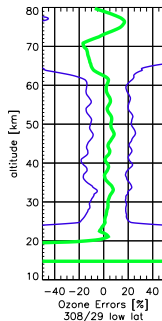
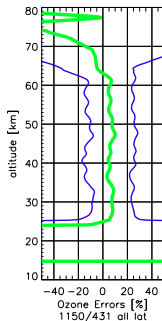
YAGOP: Ozone (1)

Comparison with op. GOMOS product (Sep. 2002): all stars



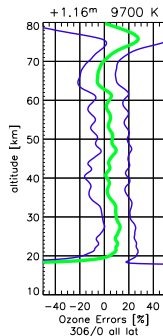
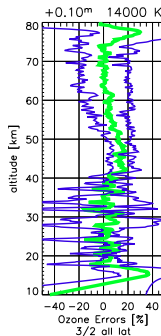
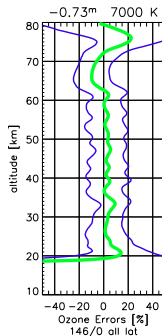
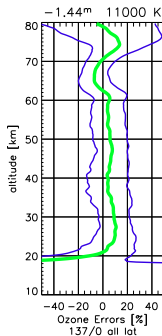
YAGOP: Ozone (2)

Comparison with op. GOMOS product (Sep. 2003): all stars

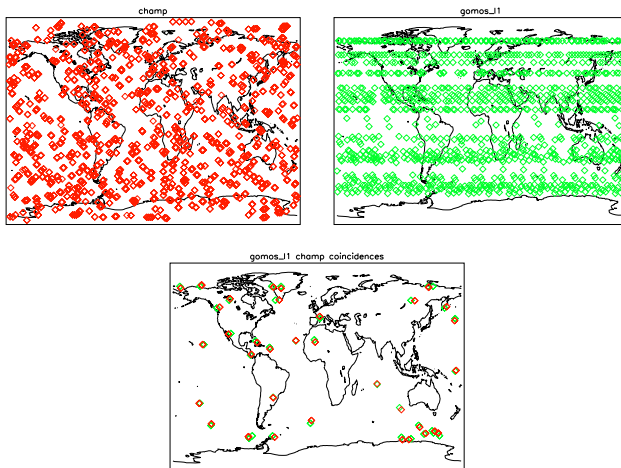


YAGOP: Ozone (3)

Comparison with op. GOMOS product (Sep. 2003): selected stars

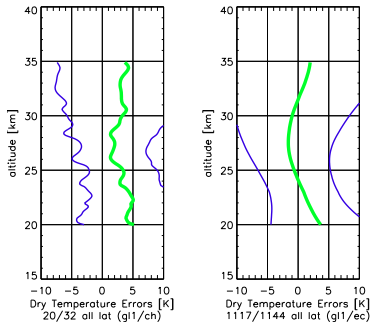


YAGOP: GOMOS – CHAMP Global Coverage Sep. 2002



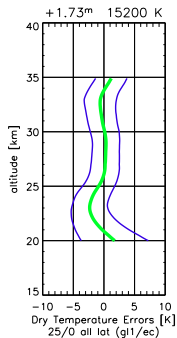
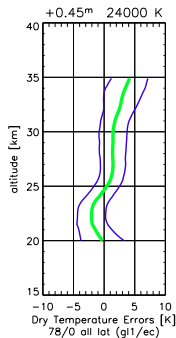
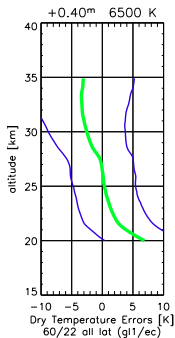
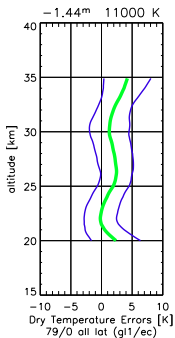
YAGOP: Temperature (1)

Comparison with CHAMP and ECMWF(Sep. 2002): all stars



YAGOP: Temperature (2)

Comparison with ECMWF (Sep. 2002): selected stars



Grid and Beyond

What comes next?

- The Voice (THEmatic Vertical Organizations and Implementation of Collaborative Environments)
 - open agriculture services (forests and vineyards)
 - GMES open architecture for urban areas
 - e-calibration - validation for the ozone community
 - integration of science and operational ocean community
- Diligent (A Digital Library Infrastructure on Grid ENabled Technologies)
 - collection of functions and services: storage, discovery, retrieval, and conservation of data
 - meeting points of a large number of disciplines including data management, info retrieval, library sciences, doc. management, info systems, the web, image processing, human-computer interaction

What comes next?

- BrainBridges

- started in March 2005
- defines road map for e-collaboration initiative in FP7
- builds on results from "The Voice"

- Medical Imaging

- New Phase Unwrapping methods as used in MRI
- PU similar to SAR processing

Summary & Outlook

Grid Technological Aspects

- interoperability on open platforms
- collaborative platform
- moving processors to data
- common access to data, tools, and computing resources
- anything one computer can do, a pool of computers can do faster and better

Grid Activities: Now and Future

- beat2grid: GOME, GOMOS, MIPAS, and SCIAMACHY
- YAGOP
- H RTP
- MIPAS reprocessing with GMTR algorithm
- MERIS and AATSR
- radiosondes from IPSL
- var2grid: 3-DVAR data assimilation (DMI)
- Metop/IASI, Metop/GRAS processors and validation with AATSR and SCIAMACHY

EO Grid Processing-on-Demand (1)

1. Call for proposals mid 2006

Main Objectives

- promote the access to atmospheric data available at ESA
- offering online access to ESA standard products with attached computing infrastructure and tools to assist the generation of "scientific added value products"
- promote the development of earth science applications requiring high data and processing resources (data fusion, modelling, data mining, ...)
- foster new partnerships between ESA and partners in earth science research, algorithm development and validation, and operational deployments of value-added applications

EO Grid Processing-on-Demand (2)

Principle

- put large processing resources close to the archives
- integrate reusable common tools and functions for accessing the data and catalogues
- bring the user's algorithms to the data

Terms and Conditions

- use the data provided for Cat-1 only within the project team and only for the purpose described in the project proposal
- for widely publishing the project results in scientific publications or presentations use citation: "*[mission or instrument]* Data provided by European Space Agency"

EO Grid Processing-on-Demand (3)

<http://eopi.esa.int/>

The screenshot shows the ESA Earth Observation Principal Investigator Portal (EOPi) website. The header features the ESA logo and the text "Earth Observation Principal Investigator Portal". The main navigation bar includes links for "11-May-2006 UT", "Principal Investigator", "Evaluator", "Correspondent", and "Contact us". The left sidebar contains a list of links: "Exploitation Results & News", "Results", "News", "Search", "Focus on PI", "Round table", "AO Submission", "Cat-1 & Open AOs", "Previous AOs", "Update & Reporting Services", "About this site", "ESA Data Policy", "FAQ", "Related Links", and "How to get ESA data". The main content area is divided into several sections. The "Results" section displays three images: a satellite image of a coastal area, a satellite image of a coastal area, and a satellite image of a coastal area. The "News" section displays three articles: "New Insights in Basin and Range Geodynamics", "The Earth's Breath", and "Study of intertidal flats using ERS SAR". The "Open AOs" section displays two articles: "CAT-1" and "IPM". The "Focus on PI" section displays a photo of Dr. Yuri Falko. The "News" section displays a photo of a person. The "Search" section displays a world map. The footer includes the ESA logo and the text "© Copyright ESA".

<http://eopi.esa.int/>

esa Earth Observation Principal Investigator Portal

11-May-2006 UT

Principal Investigator **Evaluator** **Correspondent** **Contact us**

Exploitation Results & News

Results

News

Search

Focus on PI

Round table

AO Submission

Cat-1 & Open AOs

Previous AOs

Update & Reporting

Services

About this site

ESA Data Policy

FAQ

Related Links

How to get ESA data

Results

Ischia deformations measured from space

JERS-1 and ERS-1 comparison for sea-ice monitoring

InSAR Provides New Information about Iranian Earthquakes

Update / Report

login

password

GO

Open AOs

CAT-1

Category-1

IPM

Third Party Missions

Focus on PI **News** **Search**

Dr. Yuri Falko

Atmospheric Science Conference, [ESA-ESRIN, 8-12 May 2006]

3rd MSG Workshop [Helsinki (Finland), 15 June 2006]

Main search

Living Planet

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Thank you