Atmospheric applications on Grid with a focus on GOMOS and MIPAS

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Grid Computing in Earth Sciences

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 $\rightarrow$ not sufficient for transferring all data where needed

Operational Issues Addressed by Grid

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$\Longrightarrow$ **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

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$\Longrightarrow$ **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 externals CE and SE

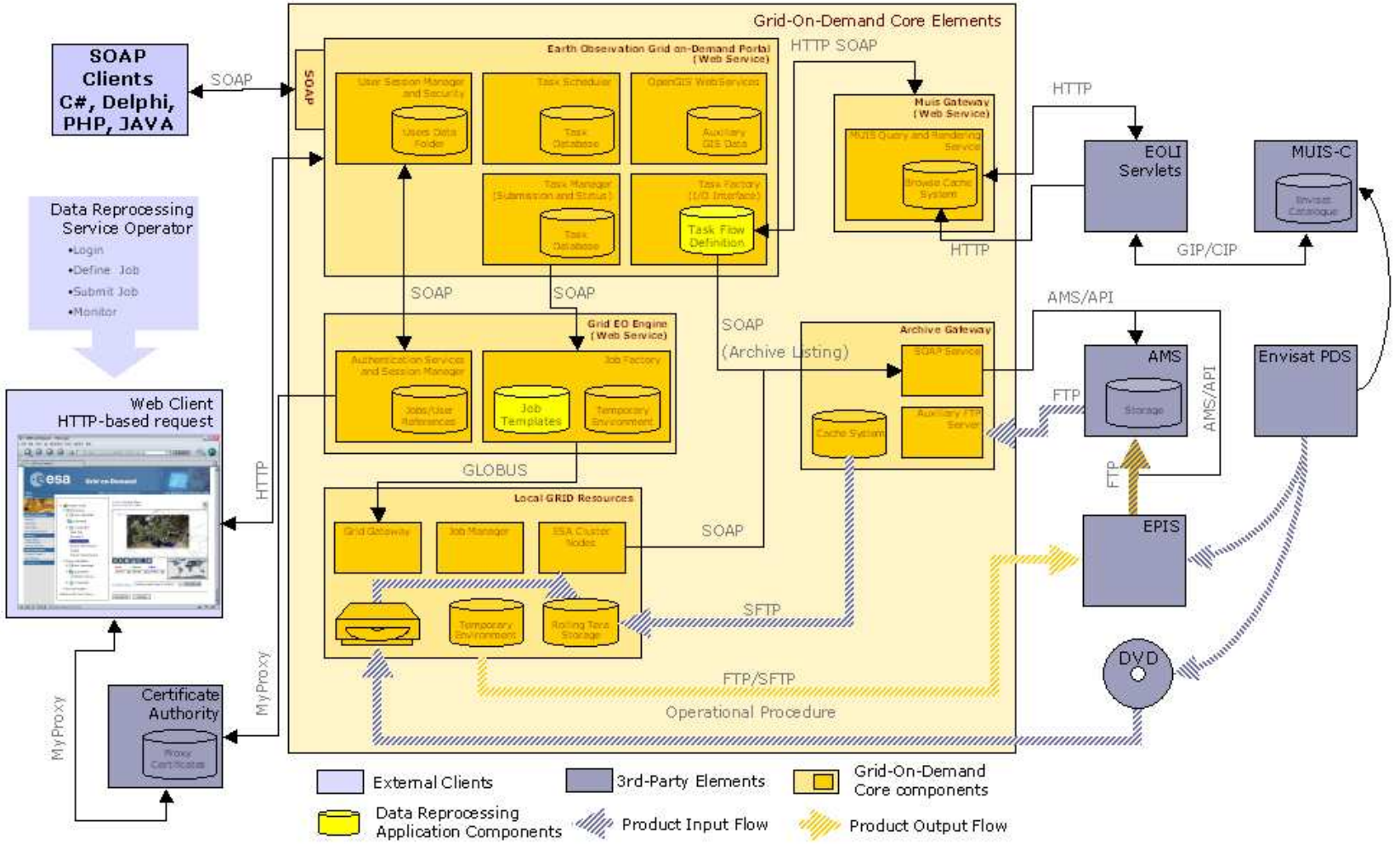
Data access

- 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



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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

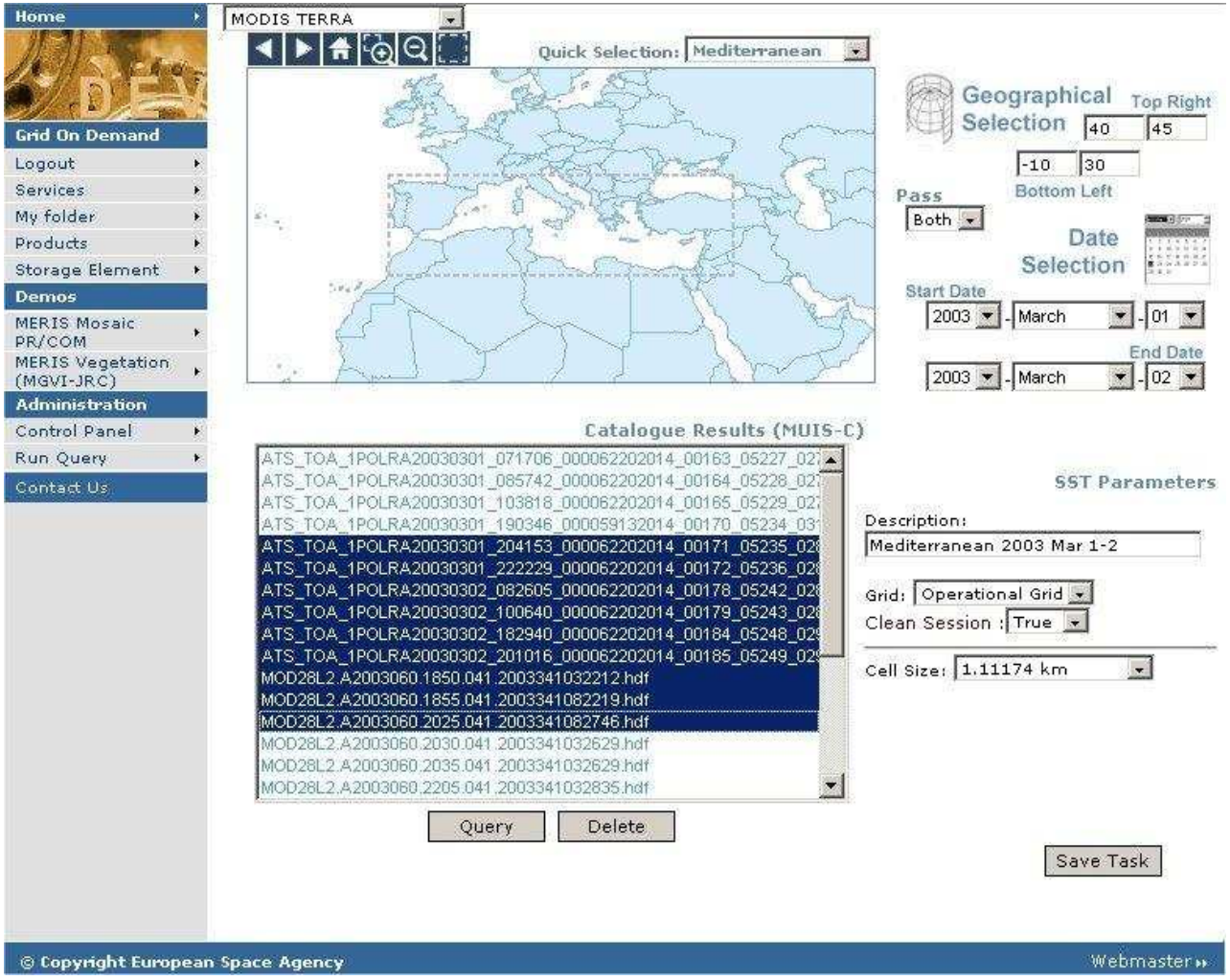
Data Online (2)

- 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)



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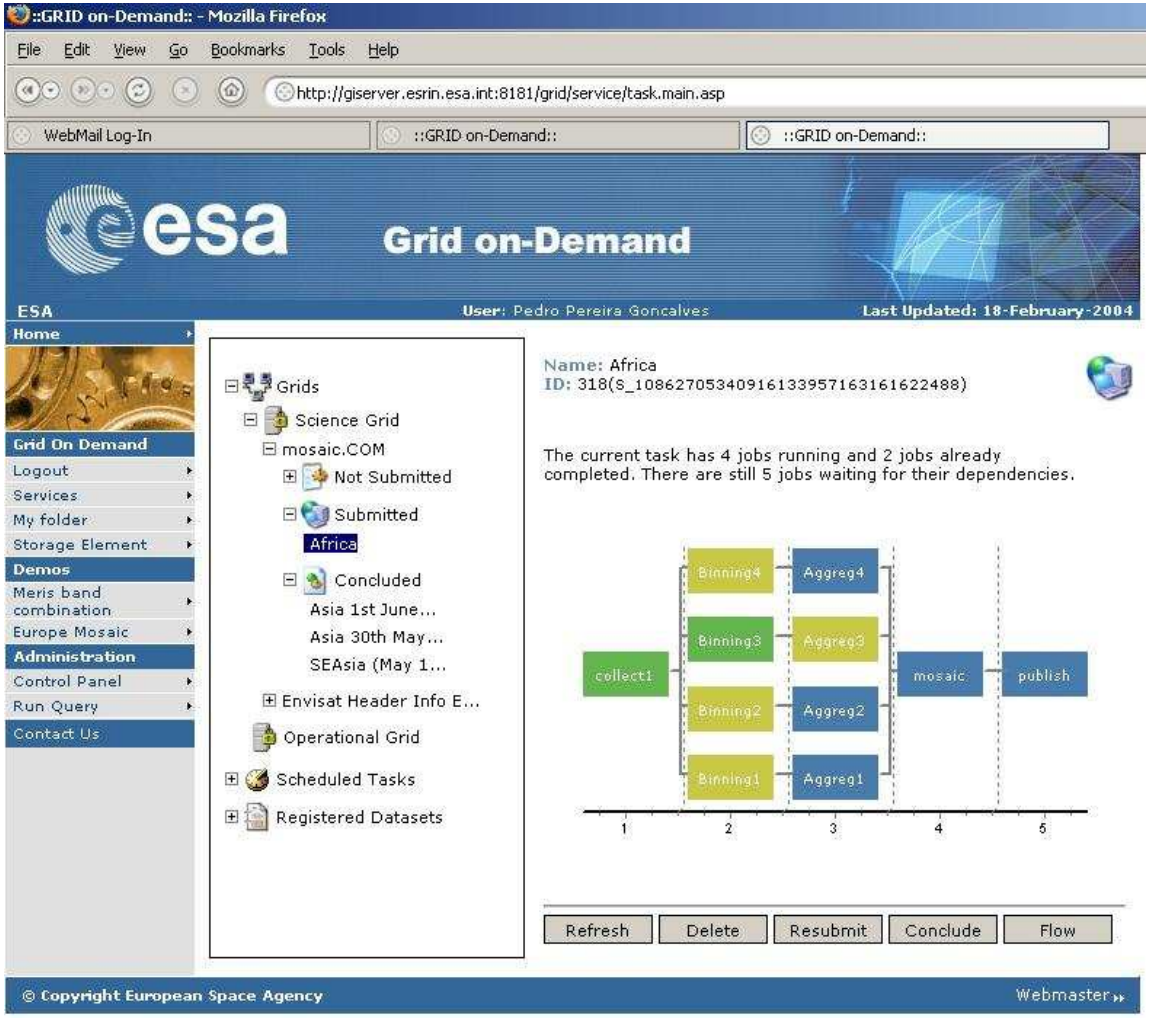
Web Portal (3)


::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::
esa
Grid on-Demand
ESA
User: Pedro Pereira Goncalves
Last Updated: 18-February-2004
Home
Grid On Demand
Logout
Services
My folder
Storage Element
Demos
Meris 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(S_108627053409161339571631616224 88)
The current task has 4 jobs running and 2 jobs already completed. There are still 5 jobs waiting for their dependencies.
Binning4
Binning3
Binning2
Binning1
Aggreg4
Aggreg3
Aggreg2
Aggreg1
collect1
mosaic
publish
1
2
3
4
5
Refresh
Delete
Resubmit
Conclude
Flow
© Copyright European Space Agency
Webmaster

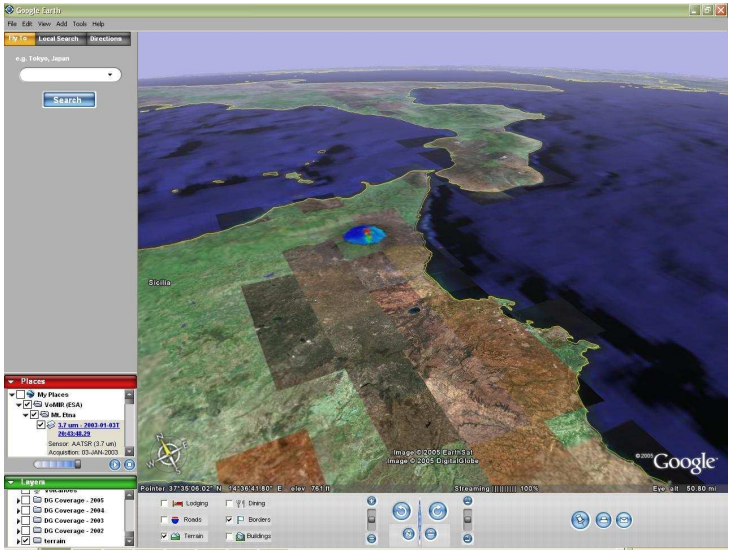
Applications (1)

- 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 $\longrightarrow$ 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 HRTP

beat2grid: Features

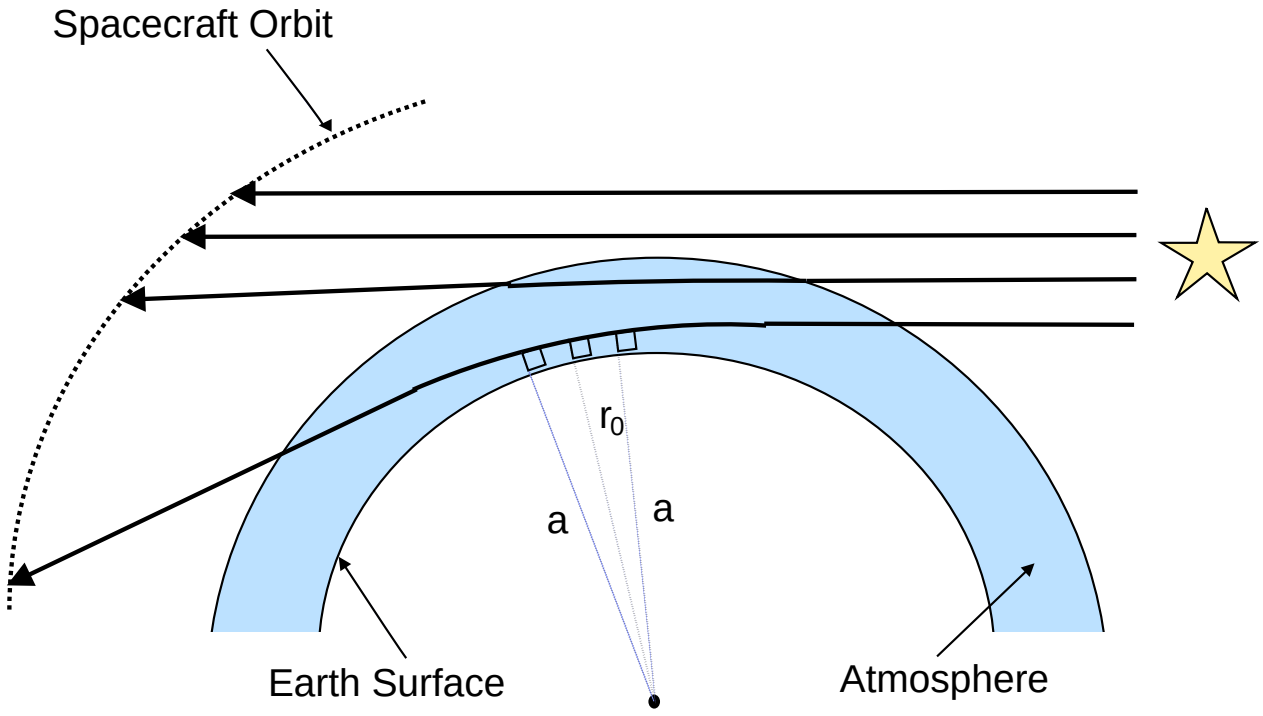
- actually supported platforms and languages
  - Linux
  - C, FORTRAN, IDL, MATLAB under discussion
- BEAT-I
  - low level access for level-0, level-1b, level-2, and auxiliary data
- BEAT-II
  - eased access to data product: e.g. `beatl2_ingest(...);`
  - import/export of several data types: ASCII, HDF4, and HDF5

beat2grid: Implemented Applications

- extraction and display of geolocation information of GOMOS products
- extraction and display of GOMOS level-2 O_3, NO_2, and NO_3 number density profiles
- extraction of MIPAS level-2 O_3 mixing ratios
- extraction of GOME products

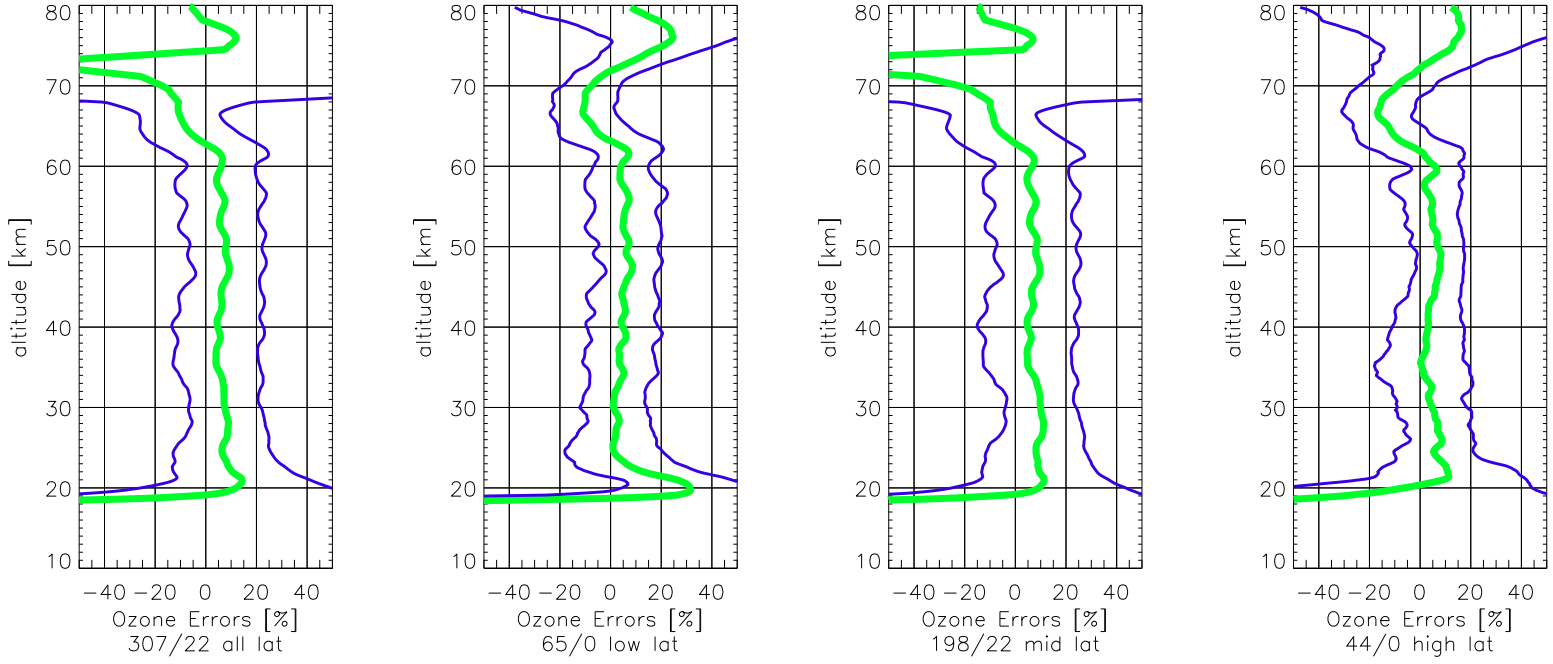
YAGOP (Yet Another GOMOS Processor): Features

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



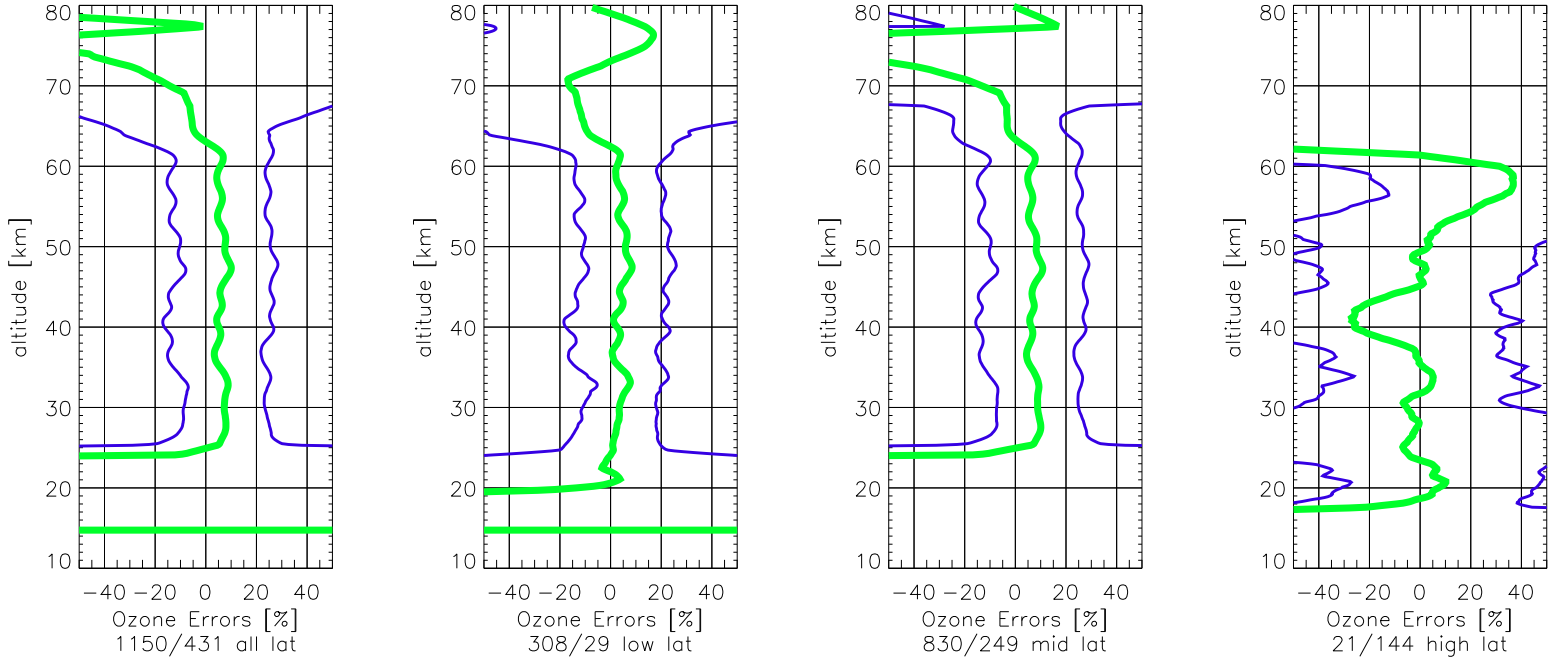
YAGOP: Ozone (1)

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



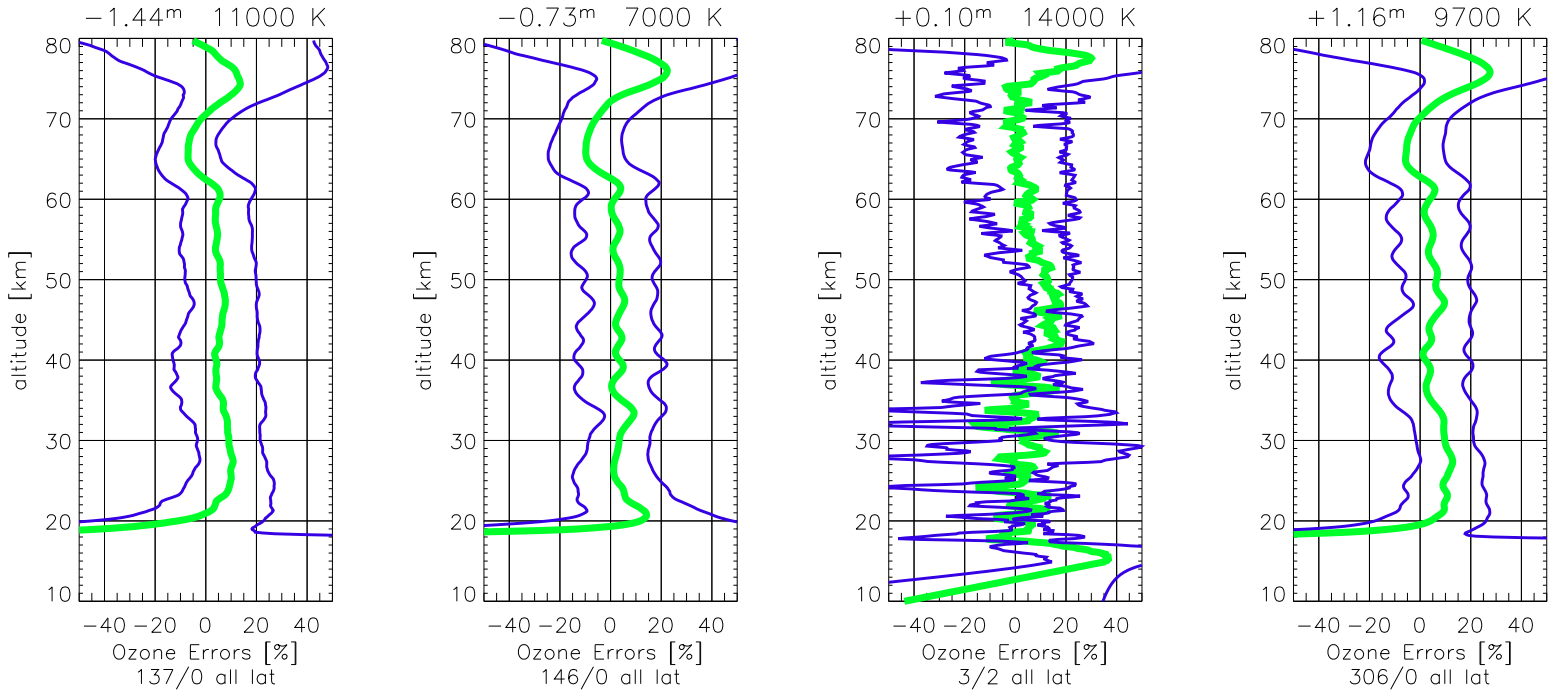
YAGOP: Ozone (2)

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

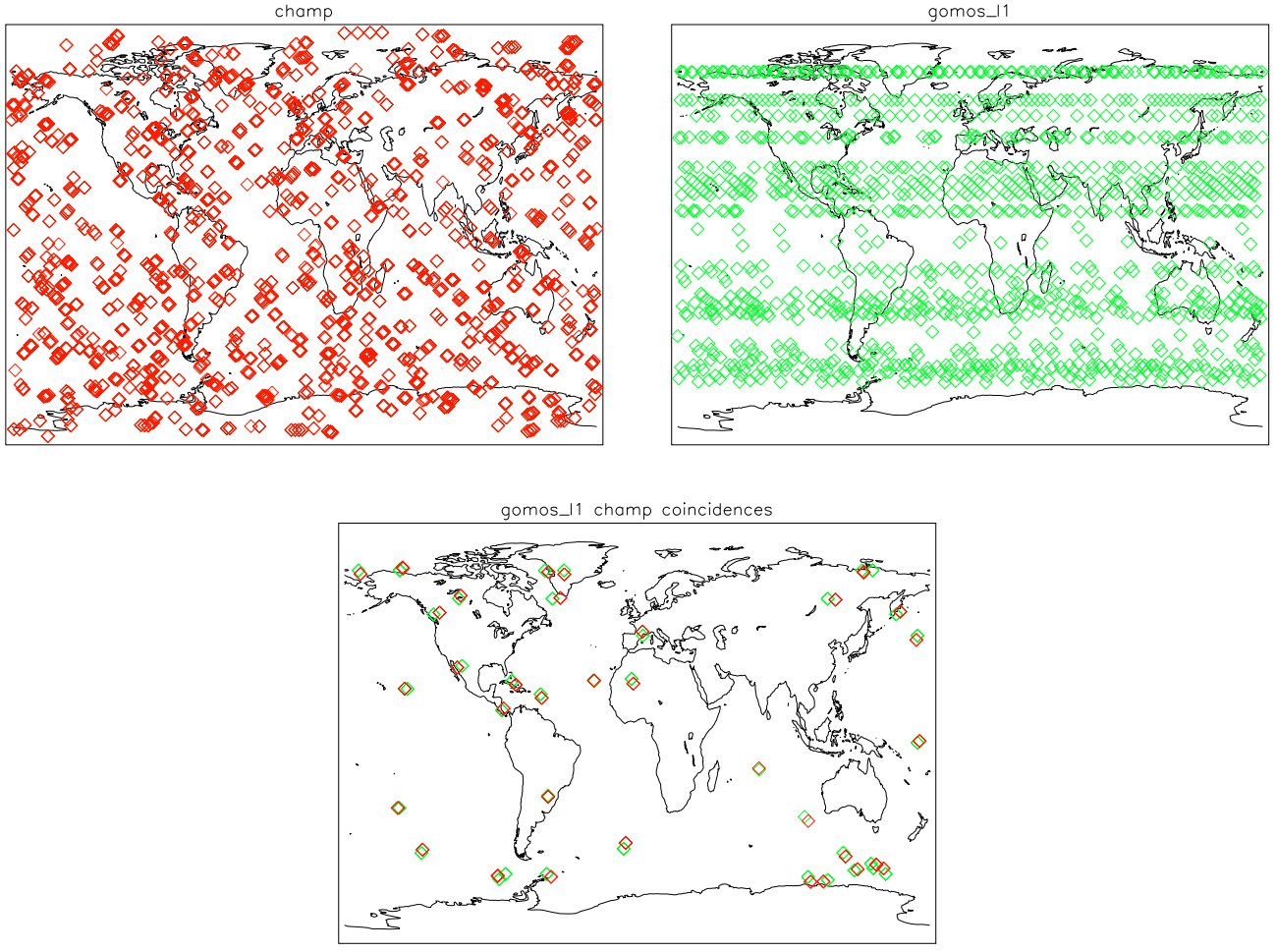


YAGOP: Ozone (3)

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

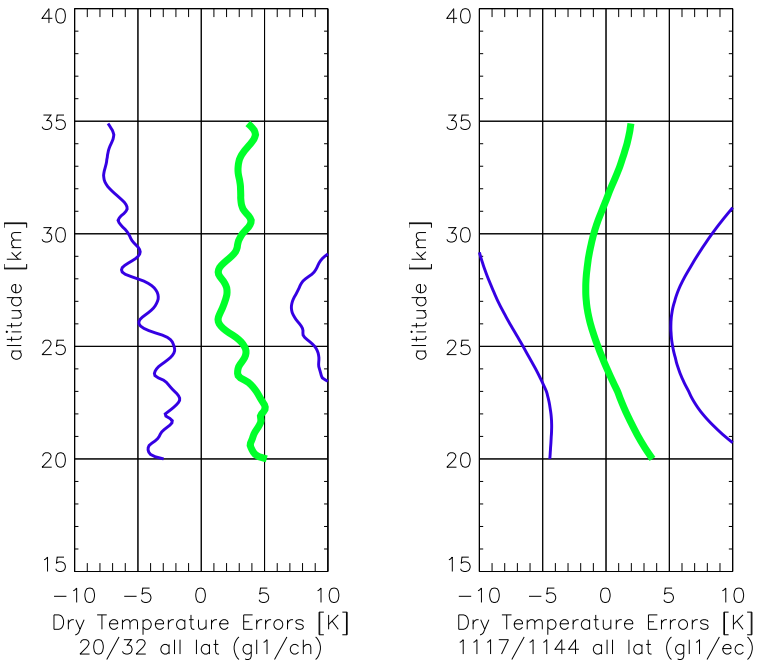


YAGOP: GOMOS – CHAMP Global Coverage Sep. 2002



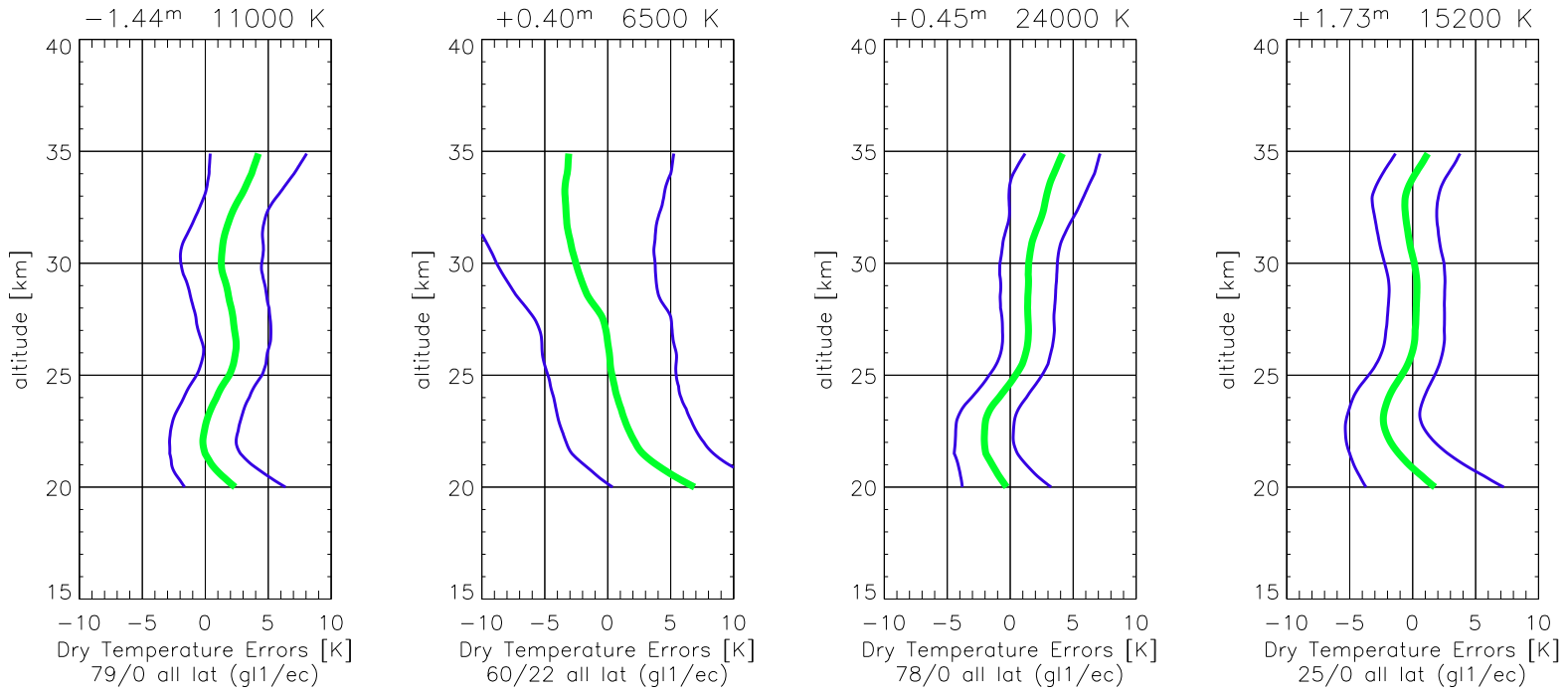
YAGOP: Temperature (1)

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
- HRTP
- 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/

http://eopi.esa.int/

Thank you

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