Presenting a multi-terabyte dataset via the web

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Presentation outline

- An introduction to the BADC.
- The project stages for delivering a Live Access Server:
  1. Project design.
  2. Tools to convert the data.
  3. Designing a caching architecture.
  4. Aggregation of data files.
  5. Setting up the Live Access Server.
- Further demonstration and conclusions.

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What is the BADC?

• The NERC-designated data centre for atmospheric science.

• Over 20 TB of data.

• Serving around 5,000 users.

• Agreement with Met Office and ECMWF to distribute data.

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How people use the BADC

Get Data - Microsoft Internet Explorer provided by SST10 Office Systems

Username: astephen

Current directory: /badc/ecmwf-op/data/gridded/2.5/2002/list0201

Dataset: ECMWF Operational Analyses

- list02010100: 316980 bytes
- list02010100.dl: 1148 bytes
- list02010100.idx: 433 bytes
- list02010106: 316980 bytes
- list02010106.dl: 1148 bytes
- list02010106.idx: 433 bytes
- list02010112: 316980 bytes
- list02010112.dl: 1148 bytes
- list02010112.idx: 433 bytes
- list02010118: 316980 bytes
LAS Project Stage 1: Project Design

**ARCHIVE**
- Spectral & Gaussian Permanent GRIB
- 4 TB

**CACHE**
- 1 degree grid Virtual data Temporary GRIB
- 8 TB

**DELIVERY**
- 1 degree grid Virtual data Short-term NetCDF/plots
- 18 TB

Conversion / Caching

Aggregation / User Interface

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Introducing Climate Data Analysis Tools (CDAT):

1. Analysis, conversion, sub-setting and array operations.
2. Scriptable directly from the Python interface.
3. Interfaces to C and Fortran (Pyfort):
   • Used to integrate with ECMWF EMOS library routines.
4. Visualization and Control System.
5. Data aggregation.
6. Open-source and free.
8. GrADS/GRIB interface to GRIB.

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• Cache copy of directory structure.
• Cache algorithms written in Python.
• Control data volumes.
• Analyse and process request sizes.
• Cache of about 1 TB initially.
Climate Data Markup Language (CDML) files are created by the `cdscan` utility.

CDML contains the following sections:

- `<dataset>` - general information at the dataset level.
- `<axis>` - axis dimension information.
- `<variable>` - relating to individual variables.

3,000,000 files from one 21KB XML file!
LAS Project Stage 5: Live Access Server

Work required to configure LAS:

1. Configuring Apache webserver (RedHat Linux).
2. Configuring Tomcat Java Servlet Engine.
3. Interfacing to MySQL database.
4. Ingesting CDML files into LAS.
5. Security layer (pending).

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CDAT intercepts command and checks cache

Cache unlocked. New `cdms.open` command sent to CDAT and cache file opened.

Cache also checks if enough room and deletes oldest files if necessary.
BADC LAS Demo 1: 1 month to NetCDF

BADC Live Access Server

Datasets > ERA-40 Forecasts: Surface/single Levels (1958-2001, 1.0 deg)
Variable(s): Large-scale snowfall (in of water equivalent)

Select view:
Select output:
Select region:
Select time range:

Estimated time left: [File Download]
Download to: Transfer rate
Close this dialog

Save as:
File name: LASOutput.nc
Save as type: All Files

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ERA-40 Re-analysis Data

V-velocity (m/s)**-1

Mean 1.12676    Max 36.7089    Min -42.7208

1987/10/10 00:00:00
ERA-40 data on a regular latitude/longitude grid

This page outlines how users can access regular latitude/longitude gridded ERA-40 data.

Introduction

As stated on the parameters page, the BADC archives the ECMWF ERA-40 data in its original format (GRIB) and grid types. These are the N80 Reduced Gaussian Grid for surface data and T159 Spectral Resolution for upper air data.

The main reasons for keeping the data in these representations are (i) to maintain an archive of the original data and (ii) to keep the data in its most compressed format (both reduced gaussian and spectral resolutions are more efficient than a regular latitude/longitude grid).

However, we appreciate that many users will wish to obtain the data in a more convenient regular latitude/longitude grid and we have developed tools to make these available. For users only wishing to access a small amount of the ERA-40 data they can make use of the BADC Live Access Server (LAS) which allows sub-setting, plotting, animations and output to NetCDF format. The BADC LAS is currently under development but will be released soon.

Users wishing to access large volumes of ERA-40 data on a regular latitude/longitude grid will need to use the ERA-40 Data Selector (also currently under development). This service will allow you to submit a data request to the BADC. Our automated data converter will then convert...
Advantages of our approach:

- Multiple TB via one interface – some virtual!
- Users saved from files and formats.
- New options for sub-setting and plotting.
- Automatic monitoring of data usage.
- Caching system available for other purposes.
- Knowledge of CDAT and LAS for other projects.

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Disadvantages:

- No automatic response to massive requests.
- Limits to configurations of plots and animations.
- Caching database is slow.
- Only one dataset presented so far.
We plan to:

- Implement parallel LASes (ECMWF, UM, COAPEC).
- Implement a time algorithm to keep users informed.
- Generate user-defined LASes on-the-fly.
- Allow comparison of different datasets.
- Re-think the caching database interaction for speed.
- Look to parallelise the background file conversions.
## Useful Links

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LAS Project Overview

**ARCHIVE**
- 4 TB
- Spectral & Gaussian
- GRIB
- Permanent

**CACHE**
- 8 TB
- 1 degree grid
- Python
- EMOS
- Pyfort
- grib2ctl.pl
- gribmap
- Temporary
- GRIB

**DELIVERY**
- 18 TB
- 1 degree grid
- Short-term
- NetCDF/plots

Conversion / Caching
Aggregation / User Interface

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