The British Atmospheric Data Centre: its scientific resources and its role in the ATMOS project

Anne De Rudder and Bryan N. Lawrence

International Conference on Modeling, Databases and Information Systems for Atmospheric Sciences MODAS
Irkutsk, 25 - 29 June 2001
Outline

• ATMOS, the framework
• BADC, what is it?
• BADC, how does it work?
• BADC, what does it do?
• BADC, what’s next?
• BADC within ATMOS
ATMOS

A scientific WWW portal for the atmospheric environment

• INTAS project (selected for funding)
• Teams: ISTP (Irkutsk); IAO, IOM, GIC (Tomsk); INM (Moscow); ESS (Gumpoldskirchen, Austria); BADC (Chilton, UK)
• Bilingual Web-based resource for support to atmospheric research and data exploitation
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• ATMOS, the framework
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• BADC, what’s next?
• BADC within ATMOS
Purpose of the BADC

- The BADC is the Natural Environment Research Council's (NERC) Designated Data Centre for the Atmospheric Sciences. It is sited at the Rutherford Appleton Laboratory (RAL), UK.

- **Mission Statement:** To Provide a high-quality archive of atmospheric data to the NERC atmospheric research community in a timely and straightforward manner, together with sufficient information about the data to permit its effective use for research purposes.
Objectives

• Long-term data archive and maintenance
• Data documentation
• Data sharing (NERC thematic programmes)
• Fetching third-party data (UKMO, ECMWF, other UK or foreign data centres)
• Data dissemination for *bona fide* research purposes
• Assistance to users regarding atmospheric data issues (trajectories, online help desk, visualisation facilities, software, links, …)
Number of users (total: 1462)

- UK: 78%
- Non UK: 22%
- Unknown: 0%

Number of non-UK users (total: 321)

- Western Europe (non UK)
- North America
- Asia
- Oceania
- Eastern Europe
- South America
- Africa
- Unknown

Who are the BADC users
BADC staff members

• Bryan Lawrence, head
• Sam Pepler, project manager
• Anne De Rudder, science support manager
• Andrew Harwood, infrastructure manager
• Jamie Kettleborough, research scientist (10%)
• Kevin Marsh, data scientist
• Anabelle Ménochet, data scientist
• Ag Stephens, data scientist
• Chris Harrold, data scientist (50%)
• + …
Outline

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Methodology

- Data are free of charge
- All data sets are available online but some have restrictions on their access
- Restricted data are distributed for _bona fide_ research purposes exclusively, on application
- Documentation available on the WWW
- Users pull across the data they want
http://www.badc.rl.ac.uk/
Query results

Searched for 'ozone' in all
Matching datasets: 31

Airborne Antarctic Ozone Experiment (AAOE-87)
Catalogue record  Dataset web page  Data directory

Airborne Arctic Stratospheric Expedition (AASE)
Catalogue record  Dataset web page  Data directory

Airborne Arctic Stratospheric Expedition II (AASE II)
Catalogue record  Dataset web page  Data directory

Airborne Southern Hemisphere Ozone Experiment (ASHOE)
Catalogue record  Dataset web page  Data directory

Total Ozone Mapping Spectrometer - CDs
Catalogue record  Dataset web page  Data directory

UGAMP Ozone Climatology
Catalogue record  Dataset web page  Data directory

Urban Regeneration and the Environment
Catalogue record  Dataset web page  Data directory

UTLS OZONE
Catalogue record  Dataset web page  Data directory

VIRTEM Validation of IASI Radiative Transfer: Experiments and Modelling
Catalogue record  Dataset web page  Data directory

Please report any problems with this page to:
BADEC support
UGAMP Ozone Climatology

Brief description

The UGAMP ozone climatology consists of a 4-dimensional dataset. These data sets include satellite observations (SEUV, SAGE II) and ground based measurements of the Service of Canada. This global climatology, covering five years input in the UGAMP models (ECMWF parametrization or 2-...
Outline

• ATMOS, the framework
• BADC, what is it?
• BADC, how does it work?
• **BADC, what does it do?**
  o Data sets
  o Services
  o Data archaeology
  o Research
• BADC, what’s next?
• BADC within ATMOS

*Did you see any омуль passing by???
Data sources

- ECMWF model output – *Restricted (UK)*
  - Operational, ERA-15 and (soon) ERA-40 reanalysis
- UK Met Office – *Restricted*
  - European synoptic stations
  - European radiosonde data
  - UK high resolution radiosonde data
  - UKMO-UARS assimilated data
  - TOVS stratospheric analysis
  - GOSTA Plus SST, sea ice & related parameters
  - Etc.
- NERC funded thematic programmes – *Restricted (validation) / public*
  - MST radar (public)
  - ACSOE (public)
  - UTLS Ozone (restricted / public)
  - URGENT (uploading – restricted)
  - Etc.
- Collaboration with other data centres – *Usually public*
  - NASA (TOMS, UARS, HALOE, GEDEX, …)
  - NDSC
  - SPARC
  - Etc.
Global Radiosonde Data (restricted)

Global Radiosonde Map

Click on the geographical area of interest on the map (e.g. North America or Antarctica) to view the radiosonde station list in the selected region.

- 1997 - present
- Vertical profiles of temperature, dew-point temperature, wind speed & direction
- 16 standard pressure levels (1000 - 10 hPa)
- Ascents conducted up to 4 times a day (0, 6, 12 & 18 h. GMT)
European Upper Air Network

Maps showing the location of upper air stations throughout Europe.

Map 1

Armenia (1), Austria (1), Azerbaijan (1), Belarus (3), Belgium (2), Bulgaria (1), Croatia (1), Cyprus (2), Czech Republic (1), Estonia (1), Denmark (3), Finland (3), France (7), Georgia (2), Germany (16), Greece (3), Hungary (2), Ireland (1), Israel (1), Italy (7), Jordan (1), Latvia (1), Lithuania (1), Netherlands (1), Norway (8), Poland (3), Portugal (2), Republic of Moldova (1), Romania (3), Russian Federation (31), Serbia (1), Slovakia (1), Spain (6), Sweden (4), Switzerland (1), Syrian Arab Republic (2), Turkey (6), Ukraine (9), United Kingdom (14)

Map 2

Iceland (1), Greenland (6)
Meteor-3 TOMS
Total ozone column (DU)

UK Met Office
Assimilated
geopotential height (km) at 100 hPa

UK Met Office
Assimilated
temperature (K) at 100 hPa

2 October 1994
GOME retrievals during March 1997. (a) Retrieved ozone concentration on the 16 km surface for 8 March 1997. (b) Height versus latitude distributions; top: retrieved field from orbit commencing 9:20 on 7 March 1997; middle: equivalent latitude derived from met Office potential vorticity along same track; bottom: “equivalent O$_3$” derived by interpolating climatological ozone zonal mean to equivalent latitude field – i.e. expected ozone based on dynamics according to Met Office. Note reasonable qualitative agreement in lower stratosphere: although GOME has relatively poor vertical resolution, it captures the horizontal structure reasonably well. 

_Courtesy of Richard Siddans and Brian Kerridge._
Urban Regeneration and the Environment (URGENT) Air Data and Software

Introduction

The NERC URGENT thematic programme was set up to integrate urban environmental research across the geological, ecological, freshwater and atmospheric sciences. It works in partnership with city authorities, industry and regulatory bodies. Deliverables from URGENT funded projects, that belong to Soil, Water, Ecology or Air Sciences, are archived at the most appropriate of the NERC data centres. In the case of Air Science projects, the data come to the BADC.

There are 13 air science projects within the URGENT Programme. The largest of these is the PUMA (Pollution in Urban Midlands Atmospheres) Consortium, which is the core of a group of five closely interrelated projects forming the PUMA Consortia. Its geographical scope is the West Midlands County (UK) and Birmingham City but its aim is to provide general insights into urban atmospheric problems.
<table>
<thead>
<tr>
<th>Year</th>
<th>Research subject</th>
<th>In situ observations/experiments</th>
<th>Technology development</th>
<th>Model development</th>
<th>Extra-academic participation</th>
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</thead>
<tbody>
<tr>
<td>1971</td>
<td>Thermal climatology of the West Midlands</td>
<td>✓</td>
<td>✓</td>
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<td>✓</td>
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<tr>
<td>1974</td>
<td>Gaseous pollutant dispersion</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>1981</td>
<td>Observation, modelling and management of urban air pollution (PUMA)</td>
<td>✓</td>
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<tr>
<td>1983</td>
<td>Organics in airborne particles</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>1996</td>
<td>Prediction of pollution from chimney emissions</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2090</td>
<td>Diode laser detection of peroxy radicals</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2222</td>
<td>Airborne particle physicochemistry and toxicity</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>2225</td>
<td>Vertical structure of the boundary layer physicochemical components</td>
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<tr>
<td>2229</td>
<td>Urban gas phase chemistry</td>
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<td></td>
<td></td>
<td>✓</td>
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<tr>
<td>2231</td>
<td>Urban meteorology</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2244</td>
<td>Sources and sinks of urban aerosols</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>2254</td>
<td>Particle size distribution of vehicular emissions</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>2602</td>
<td>Dispersion of particles in urban street canyons</td>
<td>✓</td>
<td></td>
<td></td>
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</table>
Dynamical, radiative and meteorological data

- Pressure
- Potential temperature
- Short wave radiation
- Temperature
- Horizontal wind
- Moisture
- Dew-point temperature

Photodissociation rates

- $\text{H}_2\text{O}(\text{D})$
- $\text{NO}_2$

Chemical compounds

- Inorganic molecules and neutral radicals

- Ozone
  - $\text{O}_3$
URGENT: PUMA site map

URGENT: PUMA Sites - Pritchatts Road

<table>
<thead>
<tr>
<th>Team</th>
<th>University</th>
<th>Data</th>
<th>Year</th>
<th>Date(s)</th>
<th>File name and link to archive directory</th>
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<tr>
<td>G. McGregor</td>
<td>Birmingham</td>
<td>T, p, wind, max &amp; min RH, short wave radiation</td>
<td>1999</td>
<td>13/6-12/7</td>
<td>pritch-bham met-rad 990613.na</td>
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<td>2000</td>
<td>pritch-bham met-rad 000117.na</td>
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<tr>
<td>A. Turnbull &amp;</td>
<td>Birmingham</td>
<td>T, wind, RH</td>
<td>1999</td>
<td>19/6-17/7</td>
<td>pritch-bham met 990615.na</td>
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<tr>
<td>R. Kinnersley</td>
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<td></td>
<td>1999</td>
<td>pritch-bham o3 990620.na</td>
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<td></td>
<td>1999</td>
<td>pritch-bham no 990620.na</td>
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<td>1999</td>
<td>pritch-bham co 990620.na</td>
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<td></td>
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<td></td>
<td></td>
<td>1999</td>
<td>pritch-bham pm10 990620.na</td>
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<td>M. Kochhar</td>
<td>Leicester</td>
<td>IO(D), NO2</td>
<td>1999</td>
<td>18/6-9/7</td>
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<td>2000</td>
<td>pritch-leic io(d) 000128.na</td>
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<tr>
<td>J. Lee</td>
<td>Leeds</td>
<td>IO(D)</td>
<td>1999</td>
<td>15/6-17/7</td>
<td>pritch-leeds e3-h2o io(d) 990615.na</td>
</tr>
</tbody>
</table>
5-day backward trajectories

Nice, March 1st, 2001, 6 a.m.

3, 10, 50, 200, 500, 900 hPa
NASA Ames Format for Data Exchange

Emergence and general characteristics

The NASA Ames Format for Data Exchange, often referred to as NASA Ames FDF, grow out of NASA aircraft campaigns and was first formalised at the Ames Research Center, California, during the 1987 Stratosphere Troposphere Exchange Project (STEP). Uniform rules to record data were needed to facilitate the data exchange between participants and allow shared use of a minimised amount of software to analyze and display different datasets. The issue was that the adopted data format should meet the following requirements:

- it had to be portable (readable on any machine by any programming language);
- it had to be self-describing (that is, the data had to include an attachment of all the information needed to read, understand and interpret them – thus ensuring the reader's autonomy);
- it had to be readable by humans (to retain the benefit of its self-descriptiveness).

The first and third requirements implied the adoption of a text format (namely ASCII).

Formatting your data

- NASA Ames FDF Summary is a straightforward instrument to identify the appropriate file format index and to format your data step by step. For each FDF, it includes links to detailed descriptions of the corresponding data and metadata formats;
- Makeheader is a self-explanatory Fortran program that generates NASA Ames file headers tailored to the user's needs. It does not require any knowledge of Fortran, only a Fortran compiler;
- Specific additional rules apply to some IERC thematic programmes. Please refer to:
  - NASA Ames Format for ACOSE and SOAPEX
  - NASA Ames Format for UTLS-Ozone
  - NASA Ames Format for URGENT

Checking your data files

- The NASA Ames Format checker is an interactive facility provided by BADC, that allows you to check your NASA Ames formatted files online. It is based on a program written by S. Gaines, NASA Ames Research Center;
- A checklist will be available soon.

Uploading NASA Ames files to BADC

- SOAPEX File Uploader. You need a SOAPEX account to use this online facility
- UTLS-S File Uploader. You need a UTLS-Ozone account to use this online facility
- URGENT File Uploader. You need an URGENT account to use this online facility
- Jet2000 File Uploader. You need a jet2000 account to use this online facility.
Nitrous oxide mixing ratio as a function of time along ER2 flight-track on 23 April 1993.
Upcoming Conferences and Meetings Calendar

Please let the BADC know if you would like us to advertise a meeting on this page.

Go to Year [2001] [2002] [2003] [2004] [2005] [2006] [2007]

2001
E-mail: menguc@enrg.uky.edu

E-mail: Paulette@rand.org

Jun 18 - Jun 19  12th Annual Conference of the Aerosol Society, Bath, UK.

E-mail: Ria.Lassennet@inao.fr

Irkutsk, Russia.  
E-mail: modas@iao.ru

E-mail: Doug Parker, doug@env.leeds.ac.uk

E-mail: igbp@congrex.nl

Jul 10 - Jul 18  International Association of Meteorology and Atmospheric Sciences (IAMAS) General Assembly  
Innsbruck, Austria
Research

- AMDI
- DARC
- BADC
Atmospheric models of varying complexity, including full general circulation models (GCMs), are used as tools in order to test hypotheses. The modelling work of the group is part of the UK Universities Global Atmospheric Modelling Programme (UGAMP).

Interpretation of observations of the atmosphere, particularly though not exclusively those from satellite instruments, forms a major component of the research programme. Much of the data used in this work is supplied by the British Atmospheric Data Centre (BADC), which is also based at RAL and works closely with the AMDI group.

The group’s current research is in five broad areas:

- The Interannual Variability of the Stratosphere and Mesosphere
- Ozone in the Upper Troposphere/Lower Stratosphere,
- Physical Parameterizations of Gravity Wave Processes,
- Data Assimilation, and
- Numerical Modelling

There are close links with the RAL climate dynamics group. Contact numbers and addresses for the members of the group are listed here. There is also a list of published work.

The work of the group is funded principally by the Natural Environment Research Council (NERC) with additional resources being provided by the European Commission.

Bryan Lawrence (B.N.Lawrence@rl.ac.uk), 04/01/2001
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• **BADC, what’s next?**
  o Further research development
  o Further online services
    (format issue! – converter vs common format; subsetting; visualisation; support to chemistry modelling; metadata gateway; general information; etc.)
  o Grid: integrated data/models/info system
  o ...
• BADC within ATMOS
The DataGrid Project

"DataGrid" is a project funded by European Union.

The objective is to enable next generation scientific exploration which requires intensive computation and analysis of shared large-scale databases, from hundreds of TeraBytes to PetaBytes, across widely distributed scientific virtual communities.

more info

The EU-DataGrid initiative is led by CERN, the European Organization for Nuclear Research, together with five other main partners and fifteen associated partners.
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<table>
<thead>
<tr>
<th>Activity</th>
<th>Collaborators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Development of scientific WWW-site concept &amp; supporting tools</td>
<td>IAO, GIC, ESS, INM, BADC</td>
</tr>
<tr>
<td>Databases with results of local &amp; remote measurements</td>
<td>IAO, IOM, ISTP, BADC</td>
</tr>
<tr>
<td>Models &amp; computation</td>
<td>INM, IAO, IOM, ISTP, ESS</td>
</tr>
<tr>
<td>Preparation of bilingual educational resources on atmospheric &amp; environmental sciences</td>
<td>IAO, BADC + all other partners</td>
</tr>
<tr>
<td>Development of basic site for atmospheric physics &amp; chemistry</td>
<td>IAO, INM, IOM, ISTP, GIC, ESS, BADC</td>
</tr>
<tr>
<td>Development of basic site for atmosphere &amp; environmental impact assessment</td>
<td>ESS, IOM, ISTP, GIC, INM, IAO</td>
</tr>
<tr>
<td>System integration, mirroring &amp; replication</td>
<td>ESS + all other partners</td>
</tr>
</tbody>
</table>
Russian approach  
*top-down*

General design  
Broad avenues  
Theoretical concepts

Anglo-Saxon approach  
*bottom-up*

**BADC**  
- was created to meet current demand  
- evolved as new requirements arose
http://www.badc.rl.ac.uk/

badc@rl.ac.uk

+44 (0) 1235 446432

BADC, RAL, Chilton OX11 0QX, UK