UK Air Pollution Forecasts

Thursday May 6th 2004

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netcen

Today's Presentation

- Some Background Information.
- Compiling Air Quality Forecasts.
- Recent Air Pollution Episodes
- Dissemination.

Forecasting Objectives

- To inform the UK public about air pollution so that they can take appropriate measures.
- To meet the requirements of European Directives on Air Pollution by ozone, sulphur dioxide and nitrogen dioxide.
- To provide Government with up-to-date scientific and policy advice.

The Current System

- 24-hour forecasts are compiled by netcen and the Met Office with the aid of forecasting models.
- Disseminated twice-daily to Teletext, Free-Phone and a Web Site.
- A national "Media Bulletin" is issued by e-mail at 5 p.m. daily.
- Long-range pollution outlooks are prepared and distributed by e-mail to the BBC, Government Departments and other "decision-makers" on Tuesdays and Fridays.

Health Effects Based Reporting

- UK based health effects expert groups have assessed the likely impact of ambient pollutant concentrations on the public.

- A 1-10 index scale has been set for each of five pollutants based on these studies.

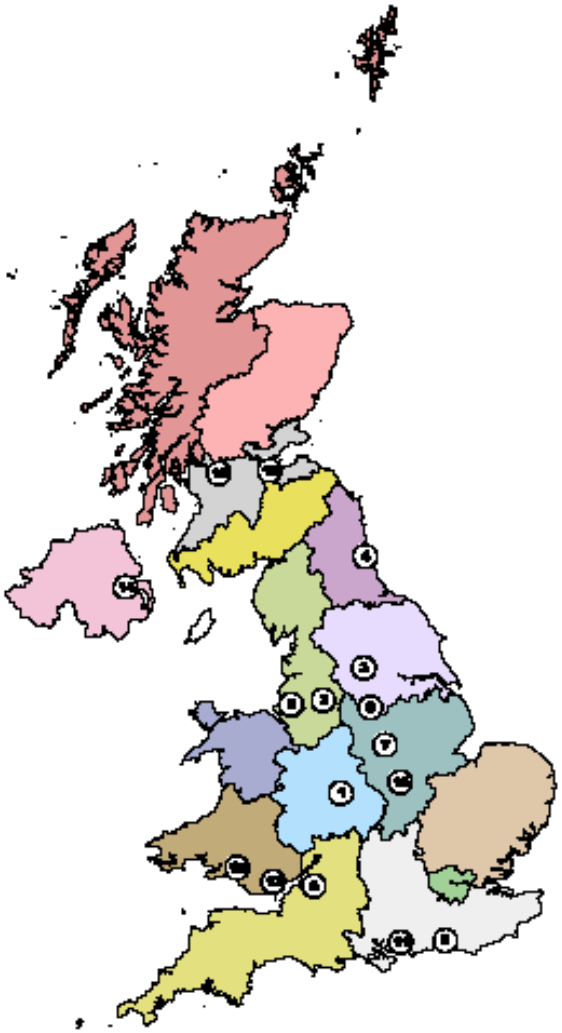
- Air Pollution Bulletins and Forecasts report the index for **worst** pollutant in each region of the UK.

The Air Pollution Index

- *When air pollution is **LOW (1-3)** effects are unlikely to be noticed even by those who are sensitive to air pollution:*
- *When air pollution is **MODERATE (4-6)** sensitive people may notice mild effects but these are unlikely to need action.*
- *When air pollution is **HIGH (7-9)** sensitive people may notice significant effects and may need to take action.*
- *When air pollution is **VERY HIGH (10)** effects on sensitive people, described for HIGH pollution, may worsen.*

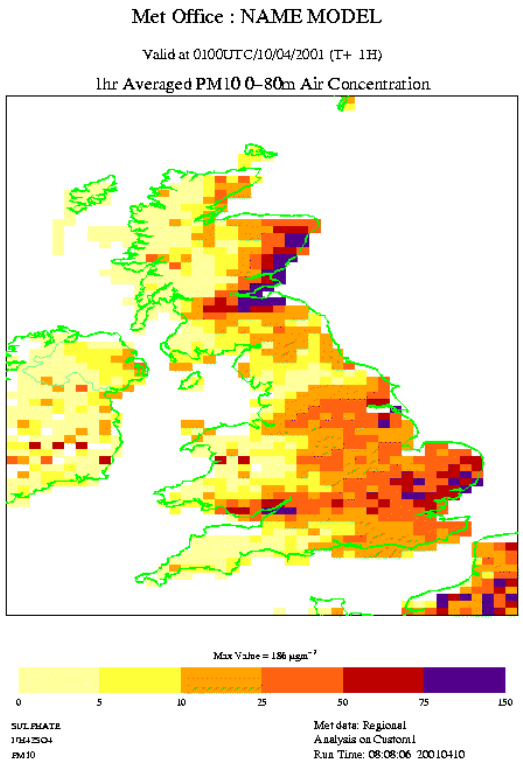
COMEAP

Zones and Agglomerations



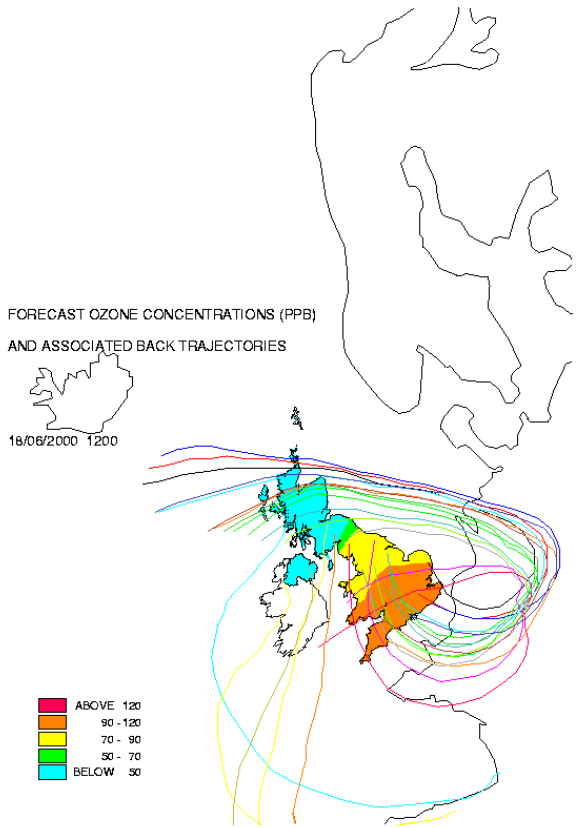
- For compliance with EC Directives the UK has been split into 16 zones and 28 agglomerations.
- Forecasts are issued for rural, urban background and roadside locations in each zone and 16 agglomerations.

How do we Compile the Forecast?



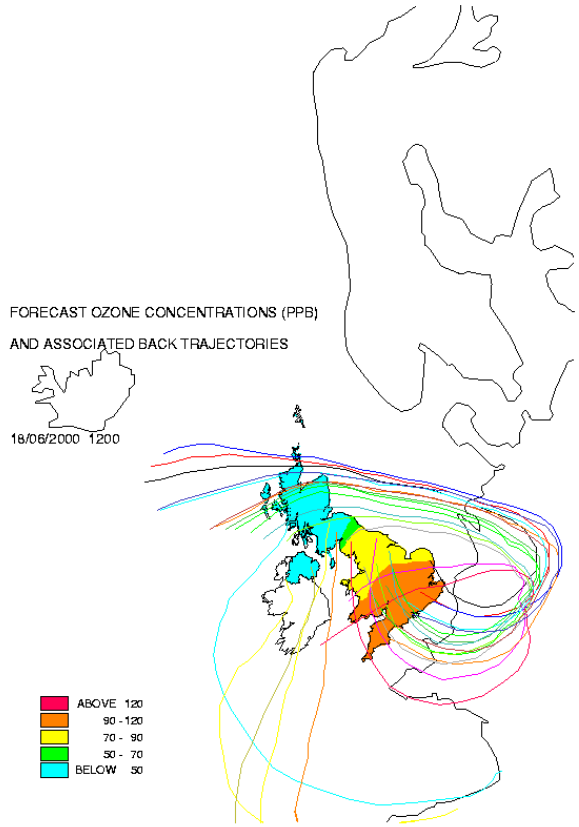
- The Met Office NAME model.

- The Ozone Trajectory model.



The Ozone Trajectory Model

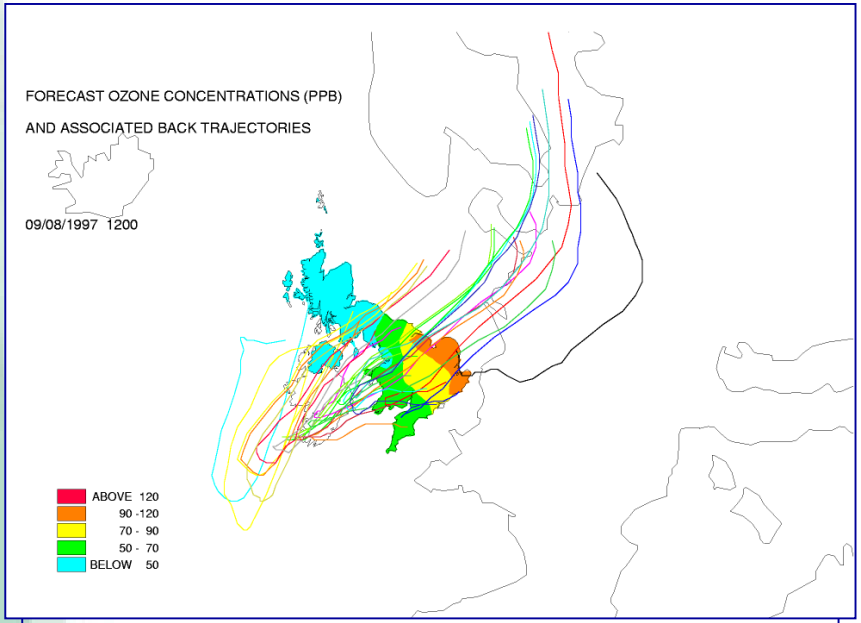
- Simplified chemistry along a forecast 96 hour trajectory:
  - since 1992.
  - with updates to the VOC emissions inventories and chemical scheme.
- Peak hourly concentration predicted at 20 sites for 1, 2 and 3 days ahead.
- Used to produce an interpolated map:
  - UK coverage
  - "Rural" Prediction.



Origins of Episodes

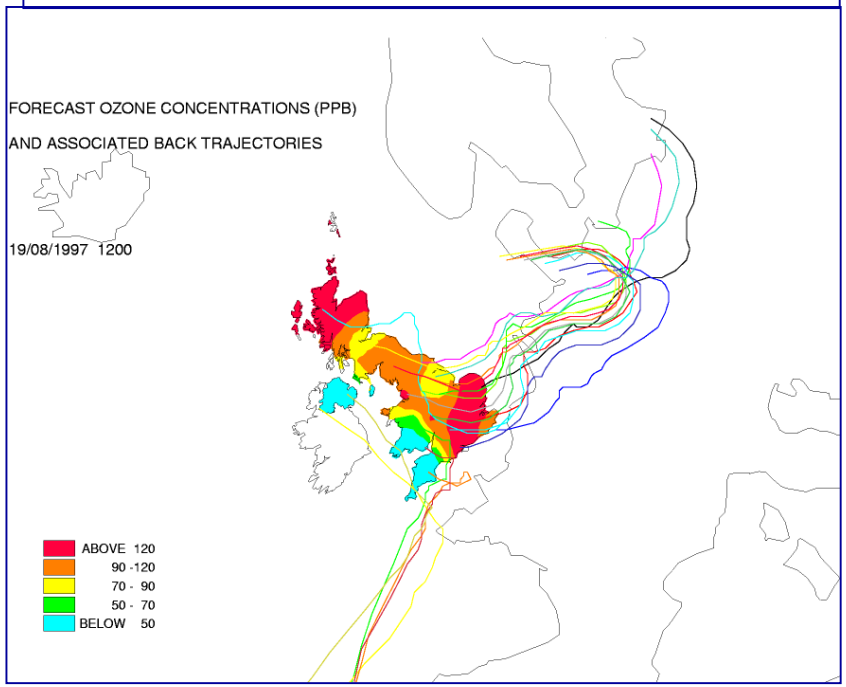
- The ozone trajectory model can be run to estimate the relative contributions of UK and European emissions to an air pollution episode.
- This is very important from a policy perspective, putting the episode into a wider European context.
- Most ozone episodes result from:
  - Hot sunny weather.
  - Light winds.
  - Often with transport of air masses from the east.

Different Episode Types



	UK + Ireland	Europe
9 August 1997	80	20

	UK + Ireland	Europe
19 August 1997	25	75

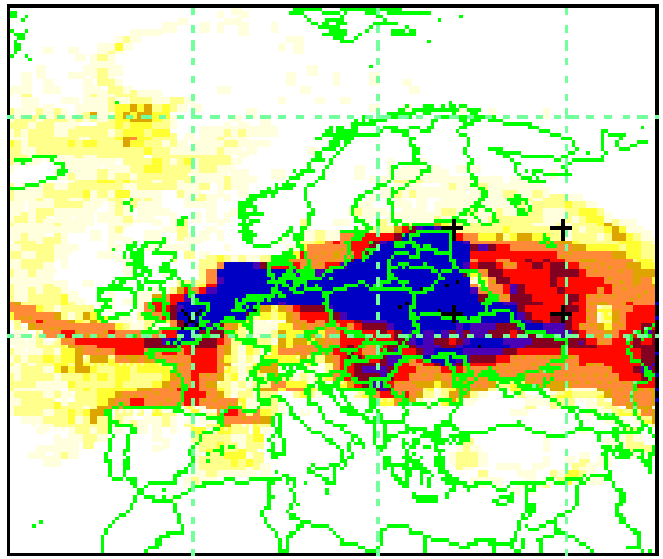


The Met Office NAME Model

- A sophisticated Lagrangian particle Dispersion Model owned by the Met Office.
- Uses UK and EMEP emissions inventories.
- Predicts background NO_x, NO_2, CO, SO_2 and PM_{10} (including secondary).
- Uses 3-D meteorology.
- Output is on a UK-grid of ~ 11km squares.

NAME in Analysis Mode

- NAME can be "run backwards" to generate air origin maps.
- Incorporates the effects of detailed 3-D wind structure and atmospheric turbulence, and amalgamates the routes of many thousands of single trajectories.



- More later on NAME from David Thomson

Weather Forecasts

- All the models take forecast meteorological parameters from the Met Office.
- The accuracy of these forecasts is crucial to model performance.
  - Is the situation stable or changing rapidly?
  - Will weather fronts arrive before or after peak traffic emissions periods?

Expert Judgement

- netcen has a team of five duty forecasters.
- All are involved in the UK's air quality monitoring programmes with a wealth of knowledge in atmospheric physics and chemistry.
- Expert judgment means assessing the accuracy of model outputs, weather forecasts and measurement data on any given day.
- Also adding information on "unusual" sources of pollution.

"Unusual" Episodes - Mainly PM_{10}

- Local construction activity, agriculture etc.
- Bonfire Night.
- Saharan Dust Storms.
- Crop or Forest Fires.
- Local Combustion Sources

Accuracy and Success Rates – UK Agglomerations

- In 2003 70% of "HIGH" episode days (Index 7 or greater) in UK agglomerations were "successfully" forecast. This means that a measured episode was correctly forecast.
- 31% of "HIGH" episode days in UK agglomerations were "accurately" forecast. This measure takes account of "HIGH" forecasts which were false alarms.
- Forecasters generally err. on the side of caution to ensure that the public are informed if an episode may occur.

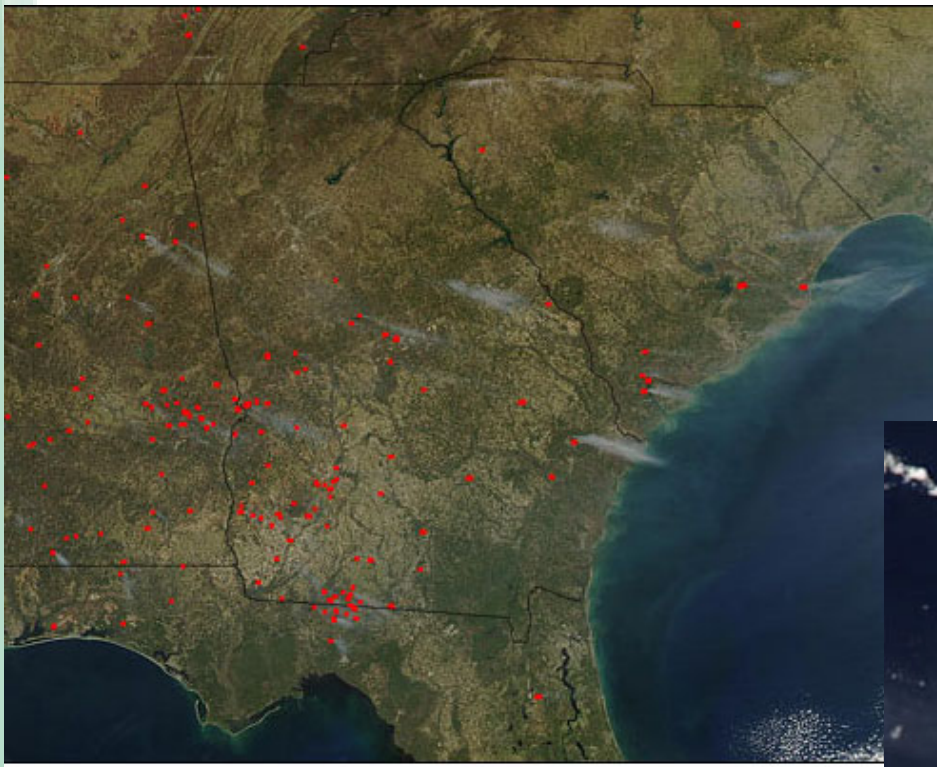
Accuracy and Success Rates – UK Zones

- In 2003 73% of "HIGH" episode days (Index 7 or greater) in UK zones were "successfully" forecast.
- 40% of "HIGH" episode days in UK zones were "accurately" forecast.
- HIGH episodes in zones are most likely to be of ground-level ozone. In agglomerations there are more PM_{10} episodes which are harder to forecast - due to many and unusual sources of this pollutant (as described earlier).

A Recent Air Pollution Episode - March 20th 2004

- Sharp increases in PM_{10} concentrations seen across much of England and Wales on this Saturday afternoon, highest in East Anglia.
- It was raining at the time and air masses were from the west!
- Possibilities:
  - Saharan Dust.
  - Fires across the Atlantic around Florida.
  - Montserrat volcanic eruption.
- NAME model runs and "black ash" observations favour the fire theory.

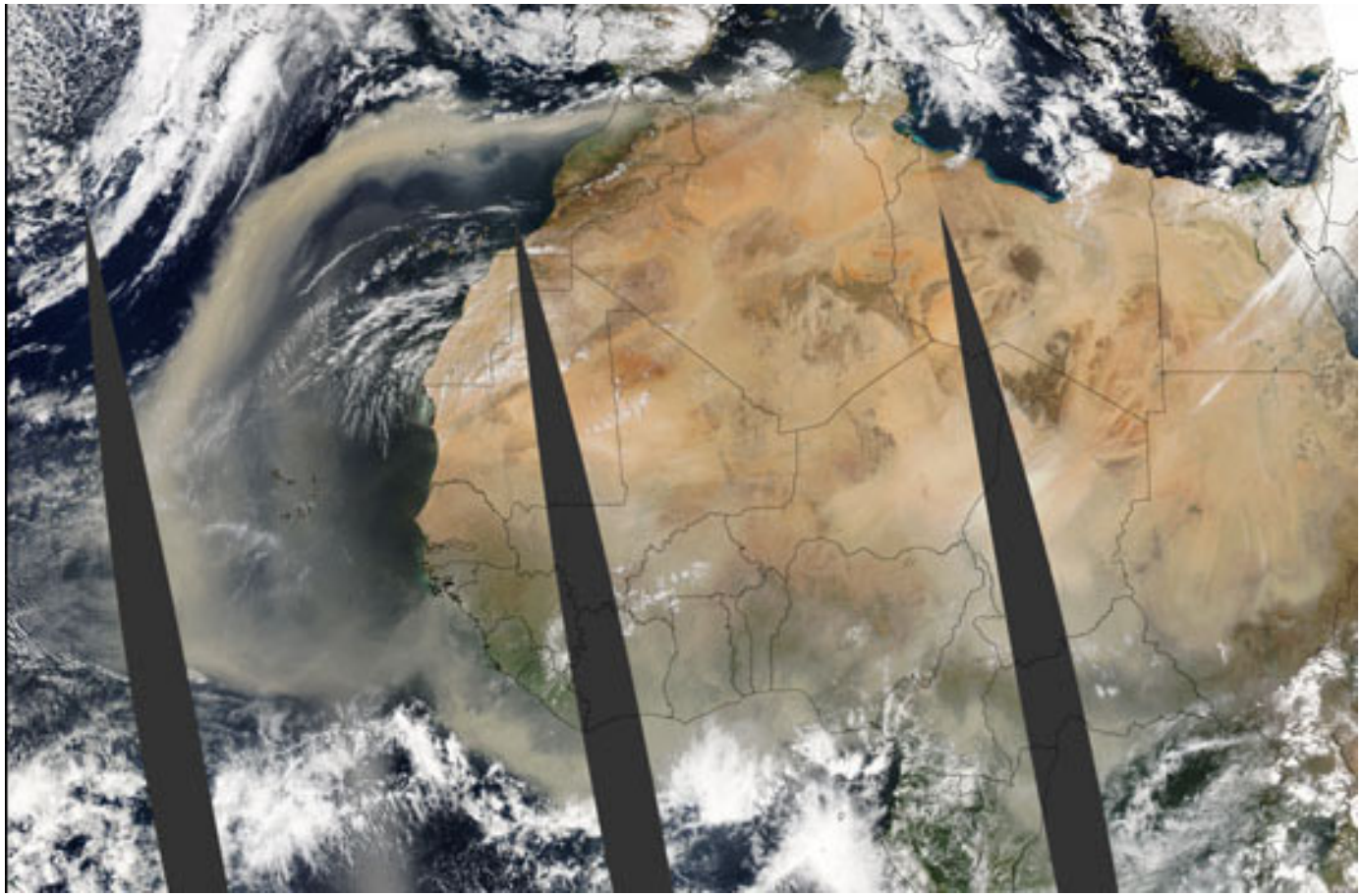
Satellite Images Identify the Possible Sources to the West of the UK



- US Fires, March 15th.

- Montserrat Volcano, March 17th.

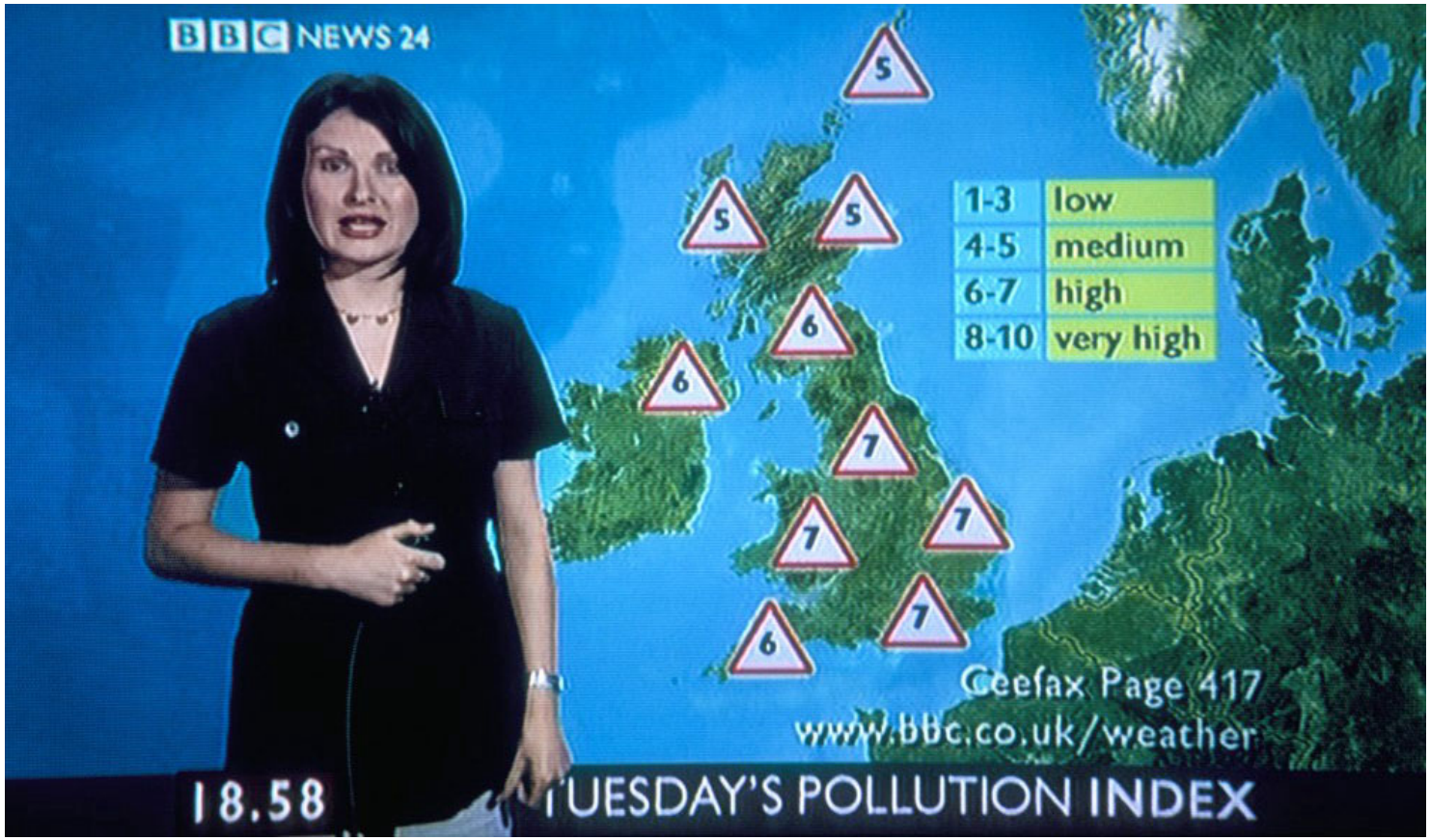
Central African Dust Storms, throughout March 2004



Summer 2003 Episodes - Press Releases and Headlines

- Defra released a number of information bulletins through their web site and the Archive News Headlines.
- There was a period of intense media and pressure group interest –
  - **'Heat brings smog danger' – Evening Standard**
  - **'Heat brings worst smog for 10 years' – The Telegraph**
  - **'Smog clouds the picture as heat-wave turns toxic' - The Times**
  - **'Smog Smashes Health Limits in Summer Scorcher' – Friends of the Earth.**
- More on the health impacts later.

Forecast Dissemination - BBC Weather



Free-Phone

- 0800 556677
- Callers are directed initially to their local region.
- Bulletins and forecasts updated hourly, pollution alerts, health effects information, brochure request.

Air Pollution

GREATER LONDON

11am Fri Apr 5th

FORECAST FOR GREATER LONDON

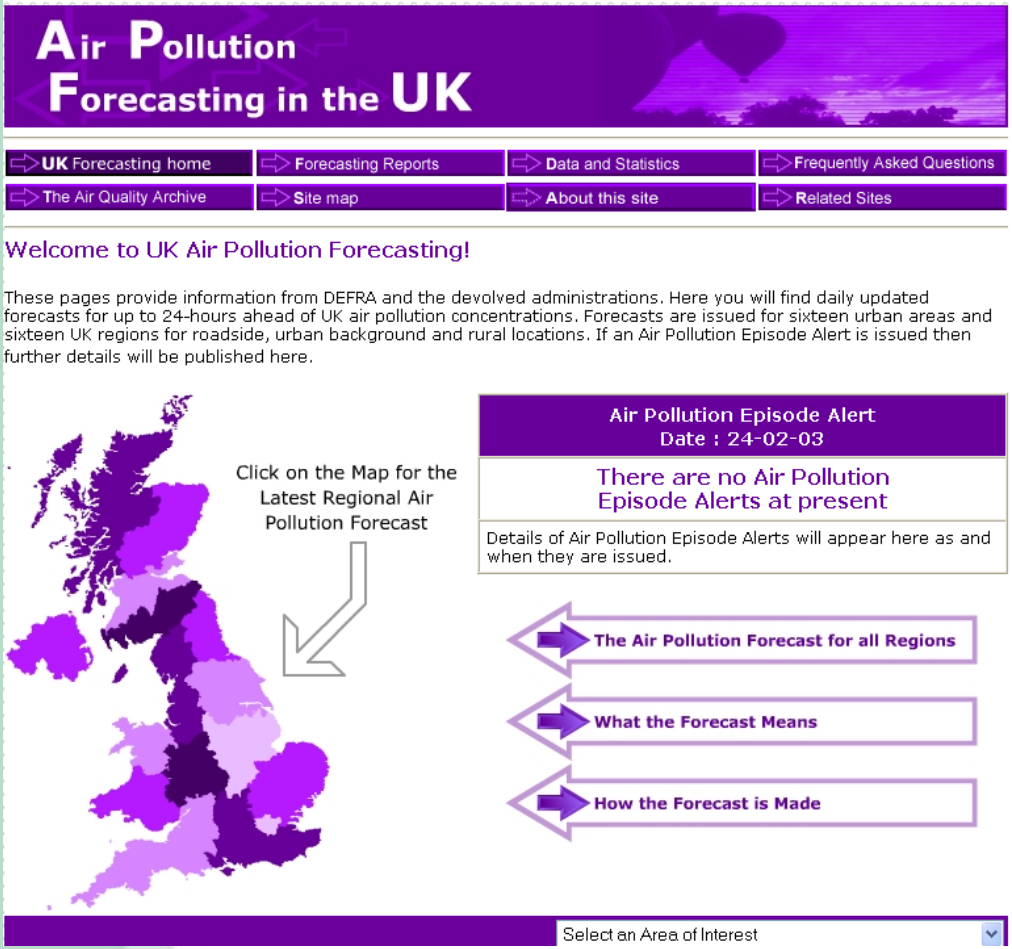
to 10am Sat Apr 6th

In London near busier roads levels will be 4 (MODERATE)

Elsewhere in London levels will be 4 (MODERATE)

Check out the Green Scene 130 C4

Air Pollution Forecasts On the World-Wide Web



www.airquality.co.uk

Air Pollution Forecast

Issued at 16:00 on 25/06/2002
This forecast is valid until 16:00 on 26/06/2002

Zone	In rural areas	In towns and cities away from busier roads	In towns and cities next to busier roads
Central Scotland	3 (Low)	3 (Low)	2 (Low)
East Midlands	3 (Low)	3 (Low)	2 (Low)
Eastern	3 (Low)	3 (Low)	2 (Low)
Greater London	n/a	3 (Low)	2 (Low)
Highland	3 (Low)	3 (Low)	2 (Low)
North East	3 (Low)	3 (Low)	3 (Low)
North East Scotland	3 (Low)	3 (Low)	2 (Low)
North Wales	3 (Low)	3 (Low)	2 (Low)
North West & Merseyside	3 (Low)	3 (Low)	3 (Low)
Northern Ireland	3 (Low)	3 (Low)	2 (Low)
Scottish Borders	3 (Low)	3 (Low)	1 (Low)
South East	3 (Low)	3 (Low)	2 (Low)
South Wales	3 (Low)	3 (Low)	3 (Low)
South West	3 (Low)	3 (Low)	2 (Low)
West Midlands	3 (Low)	3 (Low)	3 (Low)
Yorkshire & Humberside	3 (Low)	3 (Low)	2 (Low)

Forecast Dissemination
E-mail Bulletins

- Free Email service currently received by 150 + organisations including;
  - Weather Centres.
  - TV and Newspapers.
  - Government, Researchers.
- Issued daily at 5pm
  - Detailed summary of the previous 24-hours.
  - Regional forecasts for the next 24-hours.
- Drop me a note if you would like to subscribe to the service. paul.willis@aeat.co.uk.

CEEFAX and BBC Online - 5 Day Forecast

Consistency of Forecasts

- Both defra and the BBC use the 1-10 Air Pollution Index approved by COMEAP:
  - 1-3 (LOW)
  - 4-6 (MODERATE)
  - 7-9 (HIGH)
  - 10 (VERY HIGH)

- Netcen and the Met Office apply a quality control system to ensure that the regional defra forecasts agree with the values for the BBC's 230 towns and cities.

Summary

- Air Pollution Forecasts are compiled using modelling and expert judgement.
- They are widely disseminated in the UK.
- They meet statutory requirements and inform the public.
- Large numbers of people access the information, especially during episodes.
- The dissemination services and forecast accuracy are constantly being reviewed and improved.