Air Pollution Forecasting: Ozone episode report (August 2002)

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Introduction.

From Wednesday 14th to Sunday 18th August 2002, national air monitoring networks recorded an ozone pollution episode in the south east of the UK. Levels were elevated over much of South East England, London, the East Midlands and the North East but were particularly high in East Anglia. Although much of the UK was measuring MODERATE levels at the time, the HIGH band was only breached in the Eastern zone at four sites.

This report discusses the extent and duration of the episode and identifies some of the causal factors involved. As the final data for the period of the event has yet to be ratified all statistics and charts are based on the provisional data used in the forecasting process.

Changing concentrations and weather over time.

- Weather conditions during the event were warm and sunny. However, wind direction is likely to have been the significant causal factor. Air mass back trajectories are illustrated in Figures 2-7 (pages 5 to 7) at the end of this report and show how the increasing concentrations of ozone in the south east are linked to the changing wind direction.

- The weather on Tuesday 13th August was dominated by moderate to strong westerly winds influencing the whole of the UK, as shown in Figure 2. These winds brought in clean Atlantic air masses from the sea.

- On 14th August winds continued south westerly but were lighter, as show in Figure 3. This diagram illustrates that Eastern and South East zones and Greater London Urban Area are forecast by the model to experience higher concentrations of ozone. Air masses influencing the east of England travelled over the rest of the country picking up ozone precursors along the way, resulting in increased ozone concentrations.

- By Thursday 15th August, northern and western regions of the UK were being influenced by moderate westerly winds bringing clean air masses. Southern and eastern regions at this time were being fed by light southerly continental winds. Typically these continental air masses contain an abundance of ozone precursors from European industrial areas.

- The south east continued to be fed by south easterly air into Friday and winds at this time were almost calm, leading to poor dispersion conditions.

- By Saturday 17th August, most of the air masses reaching the UK were southerly and bringing air from the continent. Air masses affecting south easterly regions had now passed over heavy industrial areas of Germany and the Netherlands in the south east before reaching the UK. This coincides with the highest concentrations of the episode which were measured at four sites in the Eastern zone on this day. Figure 1 (page 3) shows the changing hourly average concentrations during the event at the four sites which entered the HIGH band. The additional site at Strath Vaich in the Highlands of Scotland has been included in the chart. This illustrates how sites being fed by Atlantic rather than continental winds did not record elevated levels even if they were rural sites and experienced warm temperatures and unbroken sunshine.

Table 1 – changing UK ozone concentrations over time.

Date	Number of sites in MODERATE band	Number of sites in HIGH band	Maximum hourly mean (ppb)
14/08/02	6	-----	82
15/08/02	21	-----	71
16/08/02	13	-----	75
17/08/02	48	4	136
18/08/02	14	-----	68

- Table 1, above, lists the number of sites in the MODERATE and HIGH bands from 14th to 18th August and the maximum hourly concentration for each day. This shows how concentrations built up over several days to culminate in HIGH concentrations being recorded on 17th August. Of the 4 sites which measured HIGH concentrations, St. Osyth (near Clacton in Essex) measured the highest concentrations of 136 ppb. A further 46 sites measured concentrations in the MODERATE band during the period.

Summary.

- The areas affected by the episode were south eastern regions of the UK, particularly the Eastern zone and the South East zone, both of which recorded levels above 90 ppb (into the HIGH band)

- The episode culminated on Thursday 17th August with 4 sites recording HIGH levels and 48 sites measuring MODERATE levels.

- Long periods of sunshine and warm temperatures were experienced across most of the UK at the time. However, the significant causal factor appears to have been wind direction which dictated the abundance of ozone precusors contained in air masses affecting different parts of the UK.

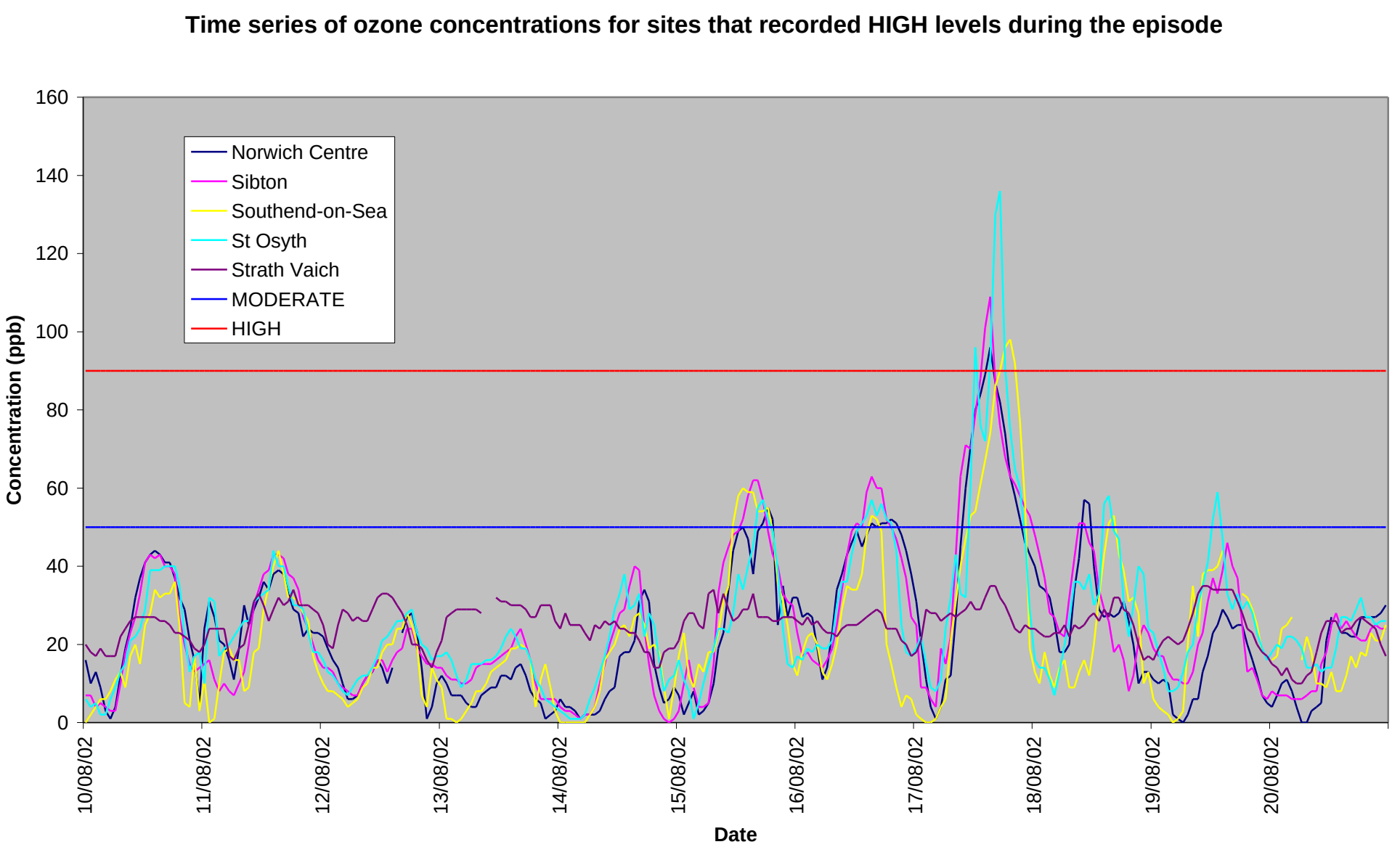

Figure 1 – Time series chart of concentrations over time (ppb) at sites which entered the HIGH band

Table 2 – UK ozone concentrations at sites measuring MODERATE or HIGH levels during the event.

Site	Number of days of MODERATE pollution	Number of days of HIGH pollution	Maximum hourly mean (ppb)
St Osyth	4	1	136
Southend-on-Sea	4	1	98
Sibton	4	1	109
Norwich Centre	4	1	96
Rochester	4	-----	86
Bottesford	4	-----	89
Wicken Fen	4	-----	78
Thurrock	4	-----	70
London Teddington	4	-----	69
London Westminster	4	-----	73
London Eltham	3	-----	65
London Bexley	3	-----	69
Weybourne	3	-----	76
London Brent	3	-----	67
Harwell	3	-----	66
London Haringey	3	-----	64
High Muffles	2	-----	81
London N. Kensington	2	-----	66
Redcar	2	-----	76
Middlesbrough	2	-----	71
Reading	2	-----	59
Sandwell West Bromwich	2	-----	82
London Wandsworth	2	-----	59
Aston Hill	2	-----	54
London Hackney	2	-----	60
Bristol Centre	2	-----	61
Coventry Memorial Park	1	-----	74
Leicester Centre	1	-----	68
Wigan Leigh	1	-----	75
Wolverhampton Centre	1	-----	58
Birmingham East	1	-----	60
Ladybower	1	-----	66
Leamington Spa	1	-----	61
Rotherham Centre	1	-----	57
Barnsley Gawber	1	-----	60
Birmingham Centre	1	-----	59
Bolton	1	-----	63
Glazebury	1	-----	59
Leeds Centre	1	-----	60
London Southwark	1	-----	59
Salford Eccles	1	-----	59
Nottingham Centre	1	-----	57
Preston	1	-----	58
Bradford Centre	1	-----	58
London Bloomsbury	1	-----	59
Sheffield Centre	1	-----	60
Stoke-on-Trent Centre	1	-----	54
London Hillingdon	1	-----	56
Newcastle Centre	1	-----	53
Lullington Heath	1	-----	54

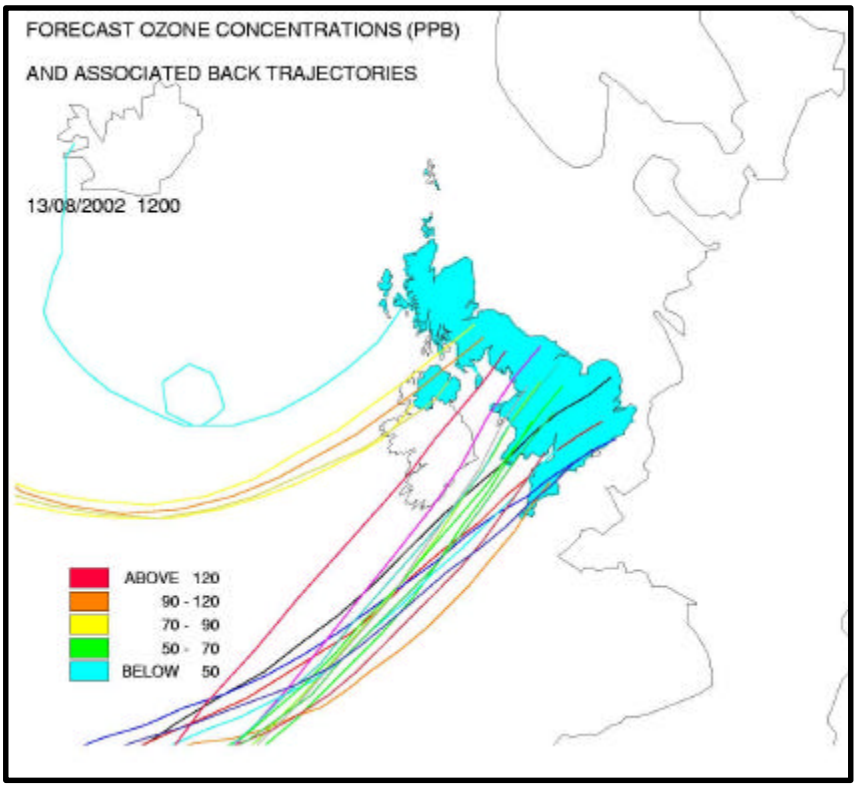

Fig. 2 – air mass back trajectory for UK, 13th August 2002

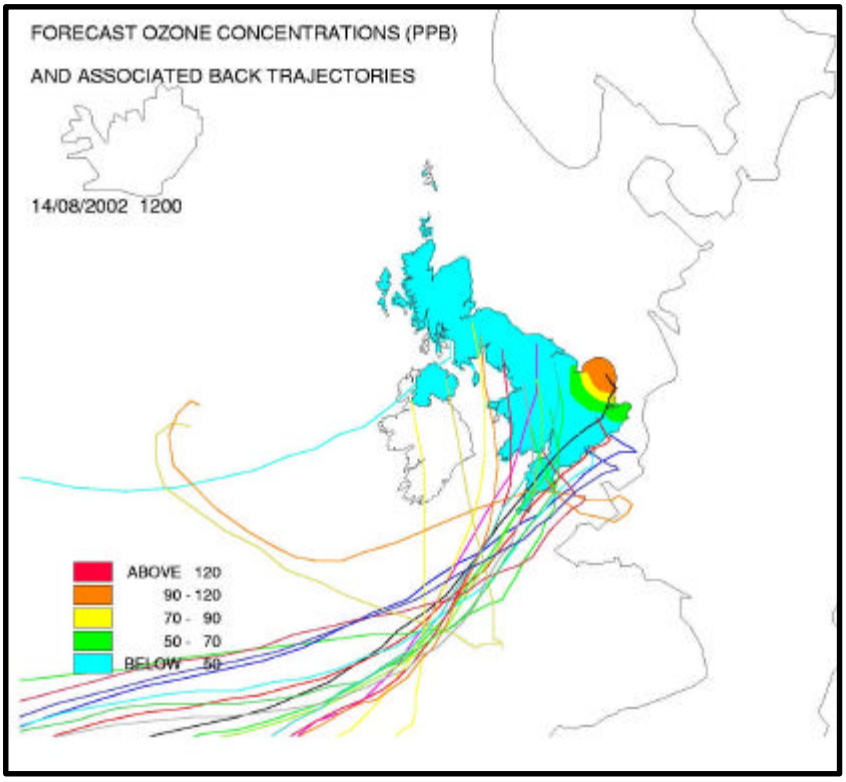

Fig. 3 – air mass back trajectory for UK, 14th August 2002

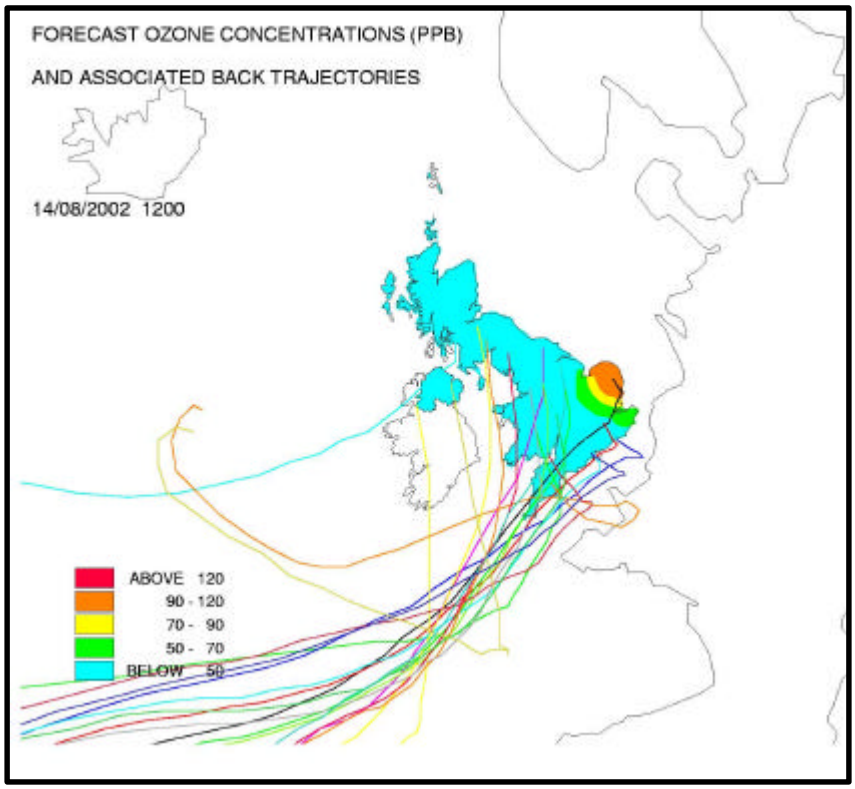

Fig. 4 – air mass back trajectory for UK, 15th August 2002

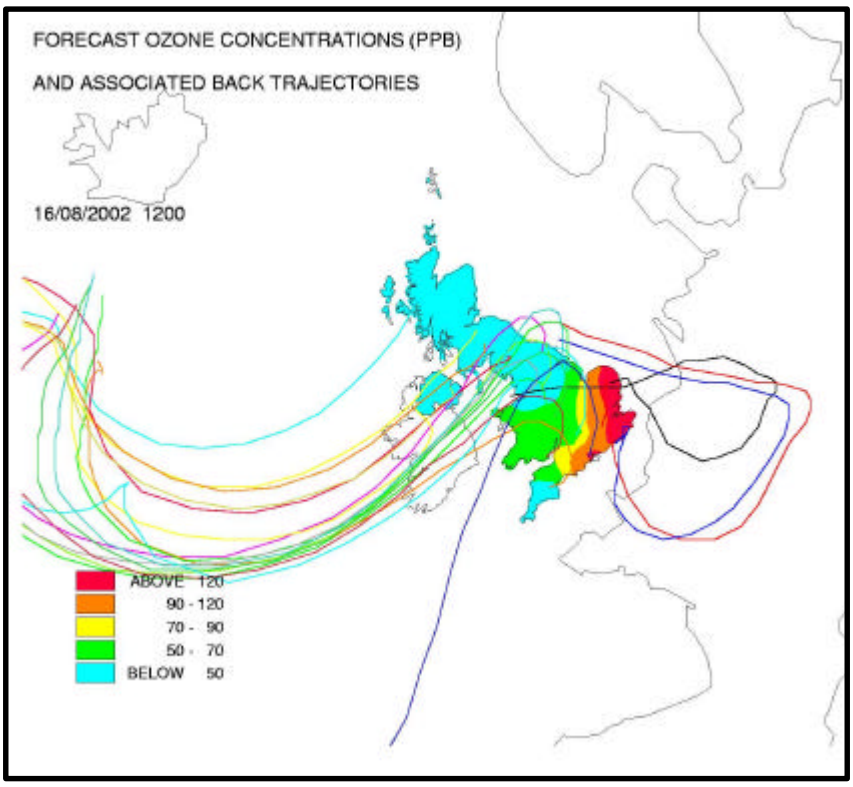

Fig. 5 – air mass back trajectory for UK, 16th August 2002

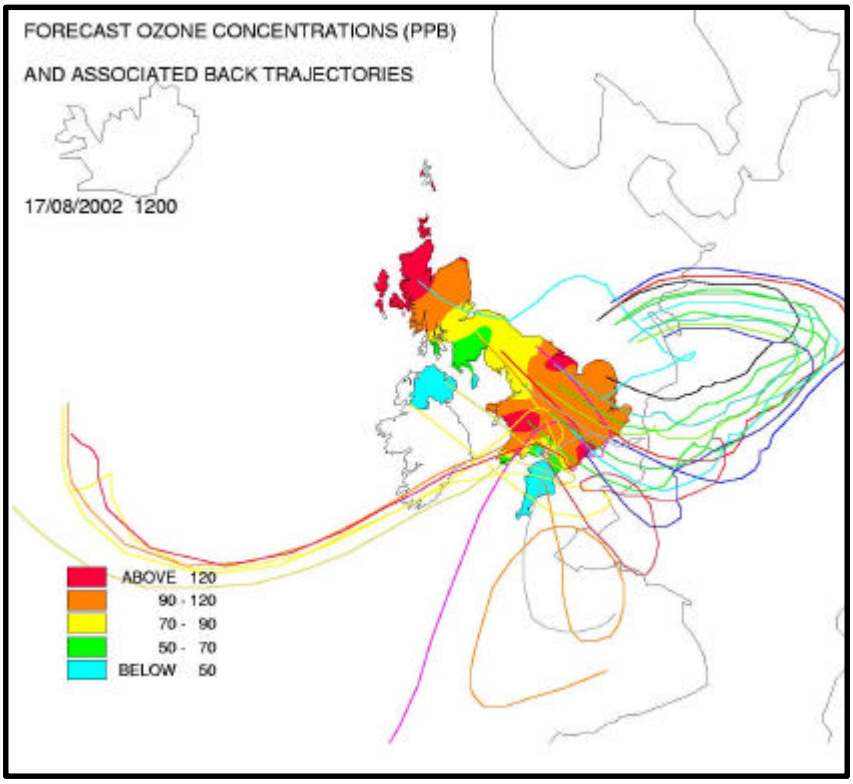

Fig. 6 – air mass back trajectory for UK, 17th August 2002

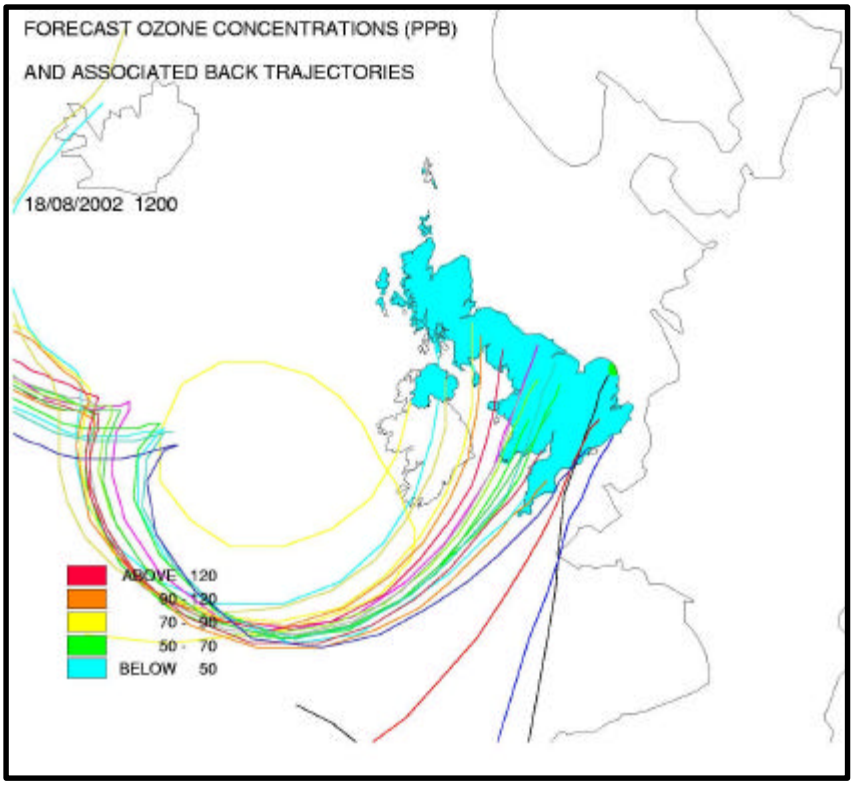

Fig. 7 – air mass back trajectory for UK, 18th August 2002