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Developing a local air quality public information service

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outline

The forecasting system - from mesoscale to local scale

PROMOTE, MACC & GAS - a digression

Turning forecasts into public information

The results - validation and user feedback

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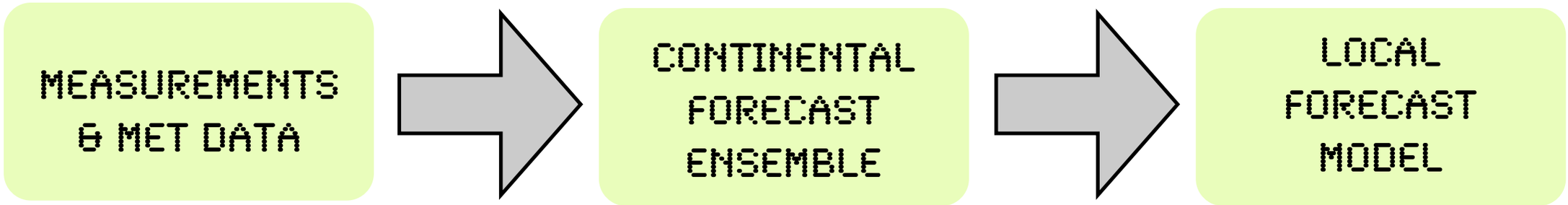
The yourair forecasting system



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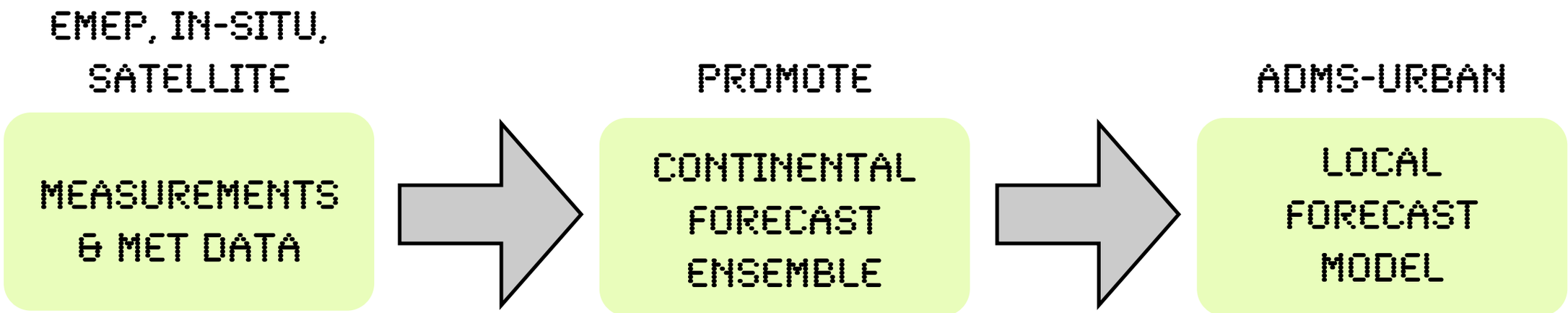
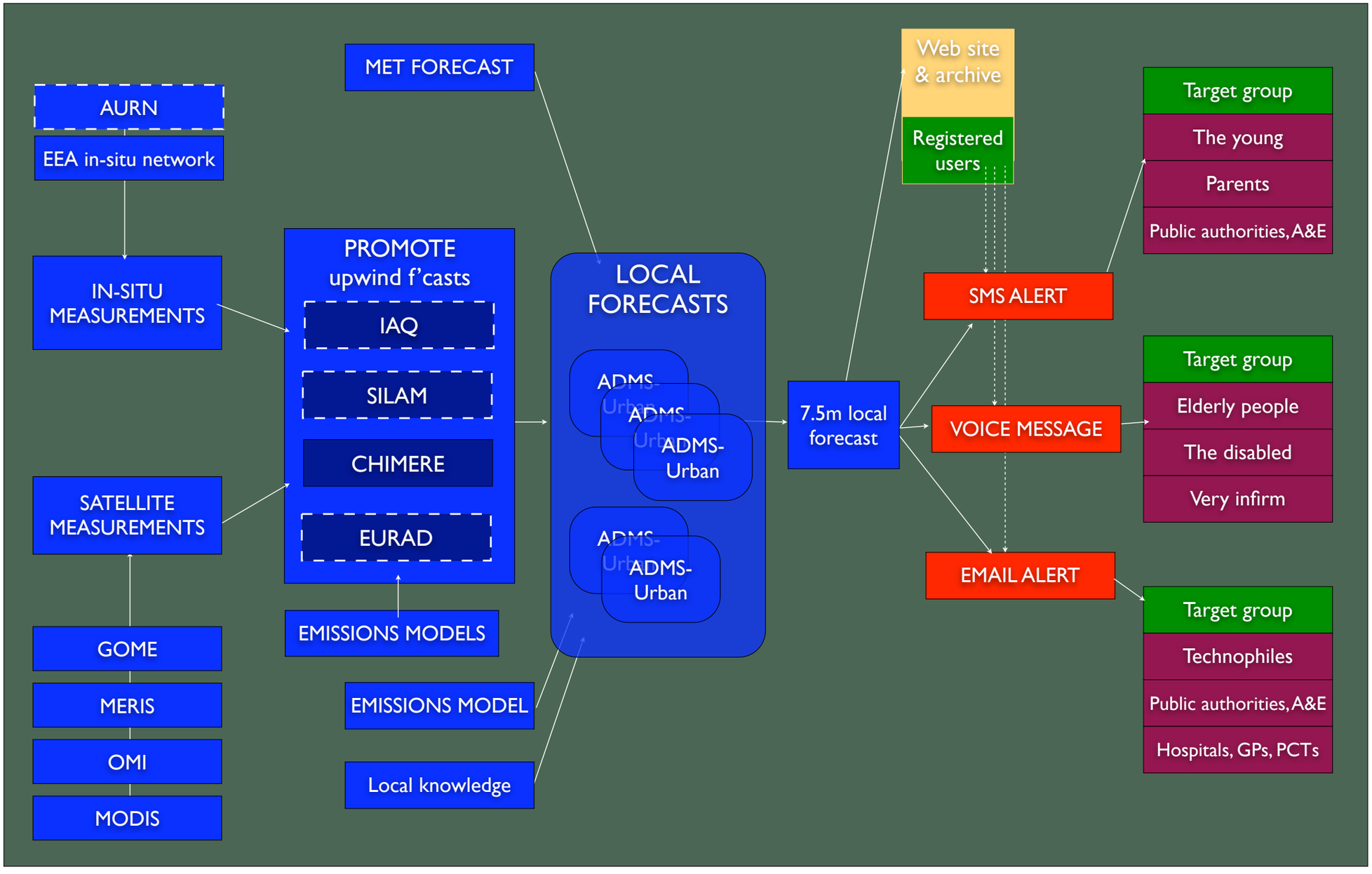
The yourair forecasting system



The yourair forecasting system



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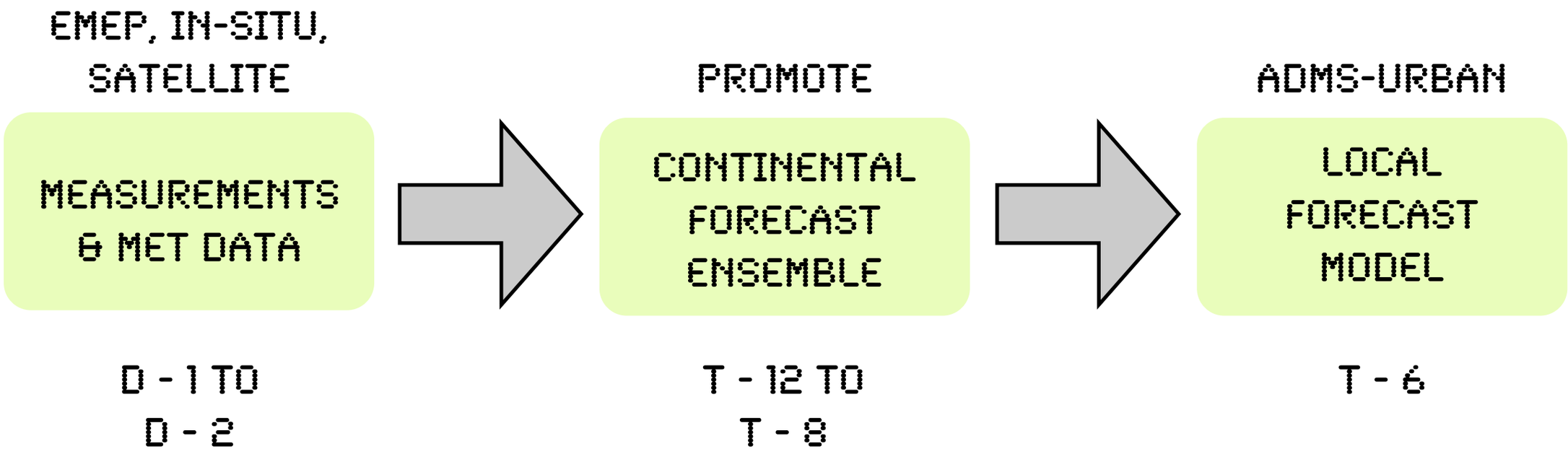
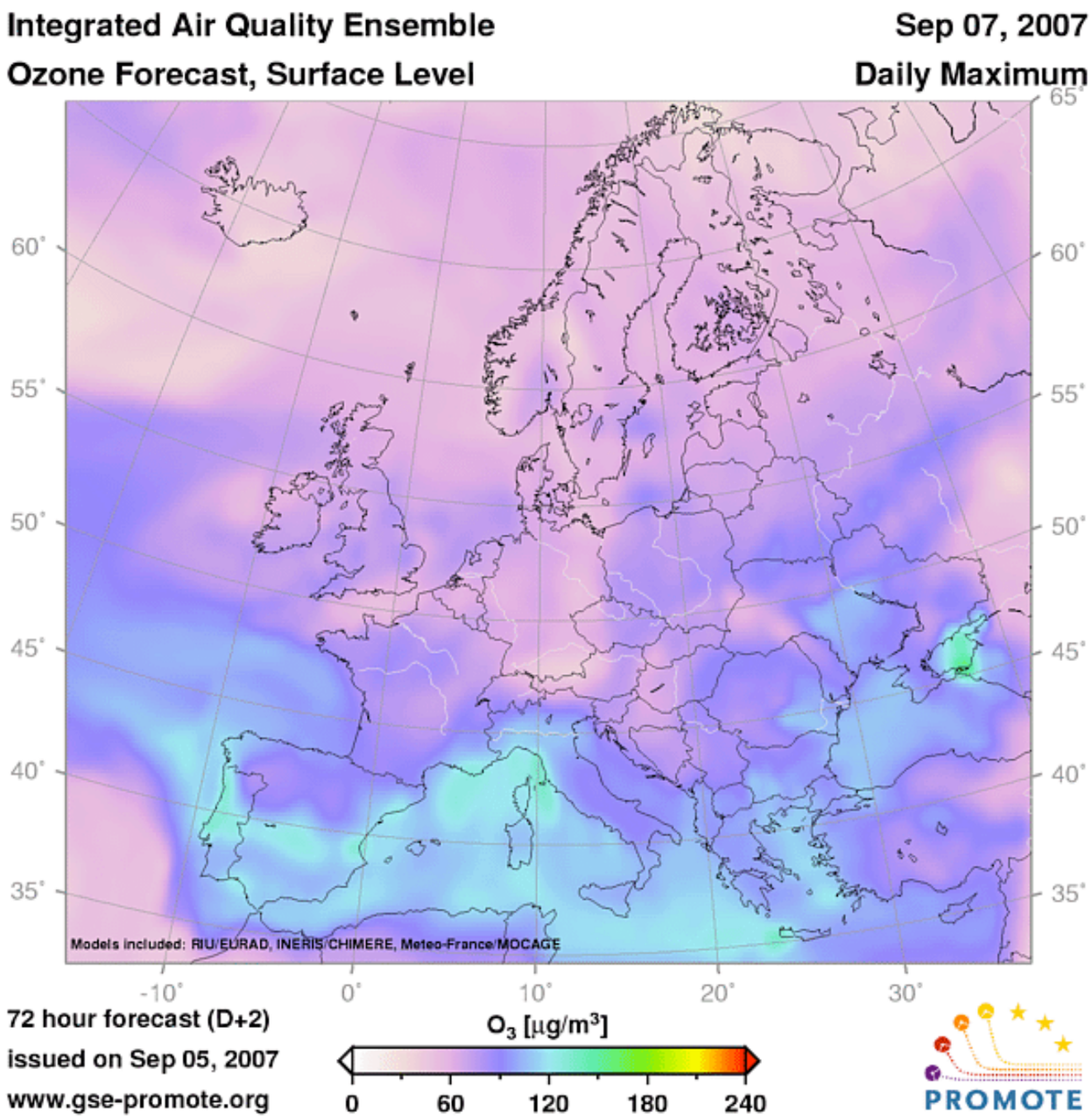
The yourair forecasting system



The yourair forecasting system



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PROMOTE, MACC, GAS - a digression

- PROMOTE - protocol monitoring for the environment 2004-2009
- ESA project to establish operational demonstration atmospheric information services as part of the joint EU-ESA GMES programme.
- Service assimilates satellite and in-situ measurements into models to generate over 40 public services, from many providers including CERC.
- Currently serves 80 millions people in 14 regions of the EU27.
- **www.gse-promote.org**
- Final goal is a atmospheric forecasting and composition service for the EU.

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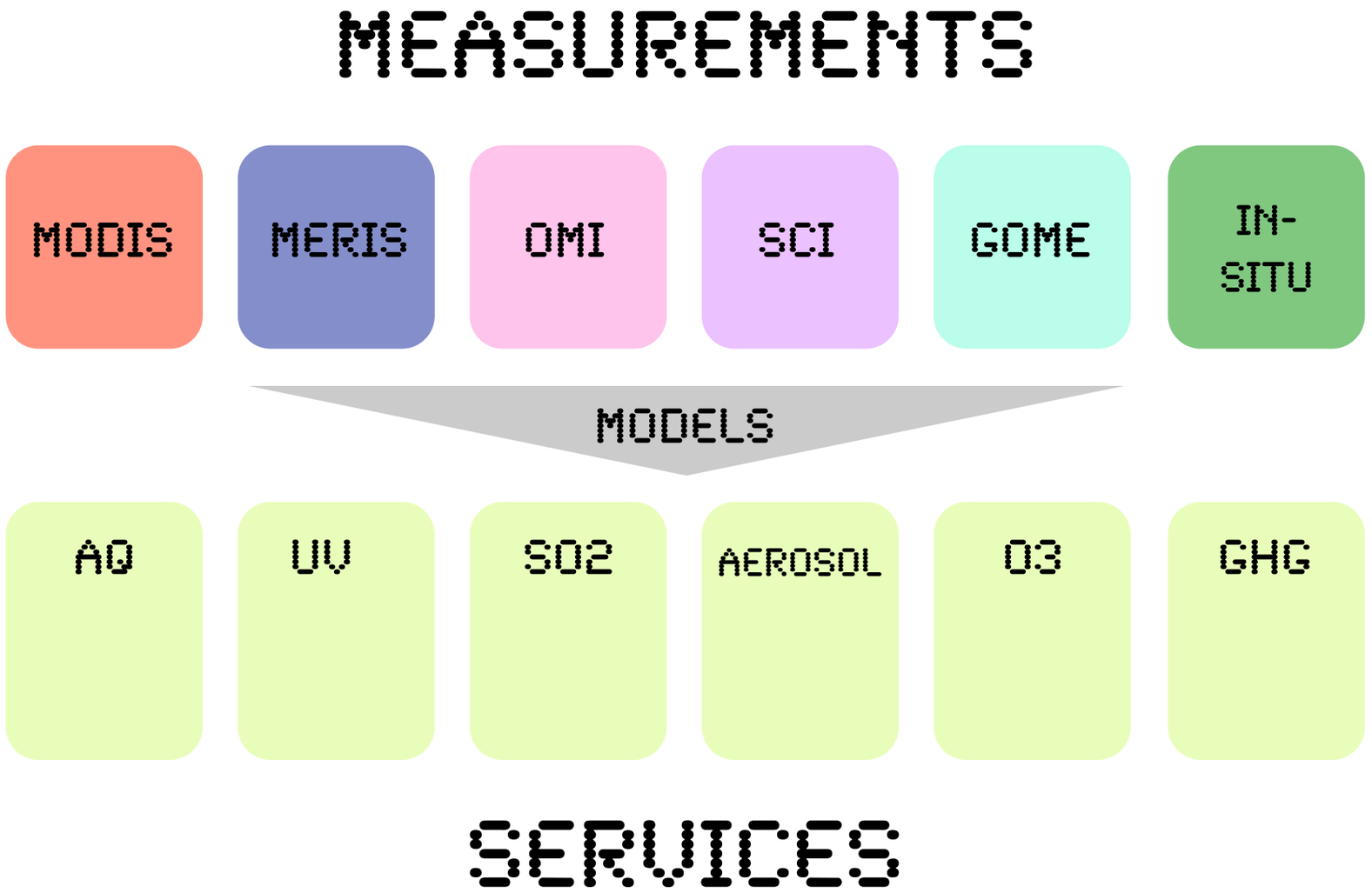
PROMOTE



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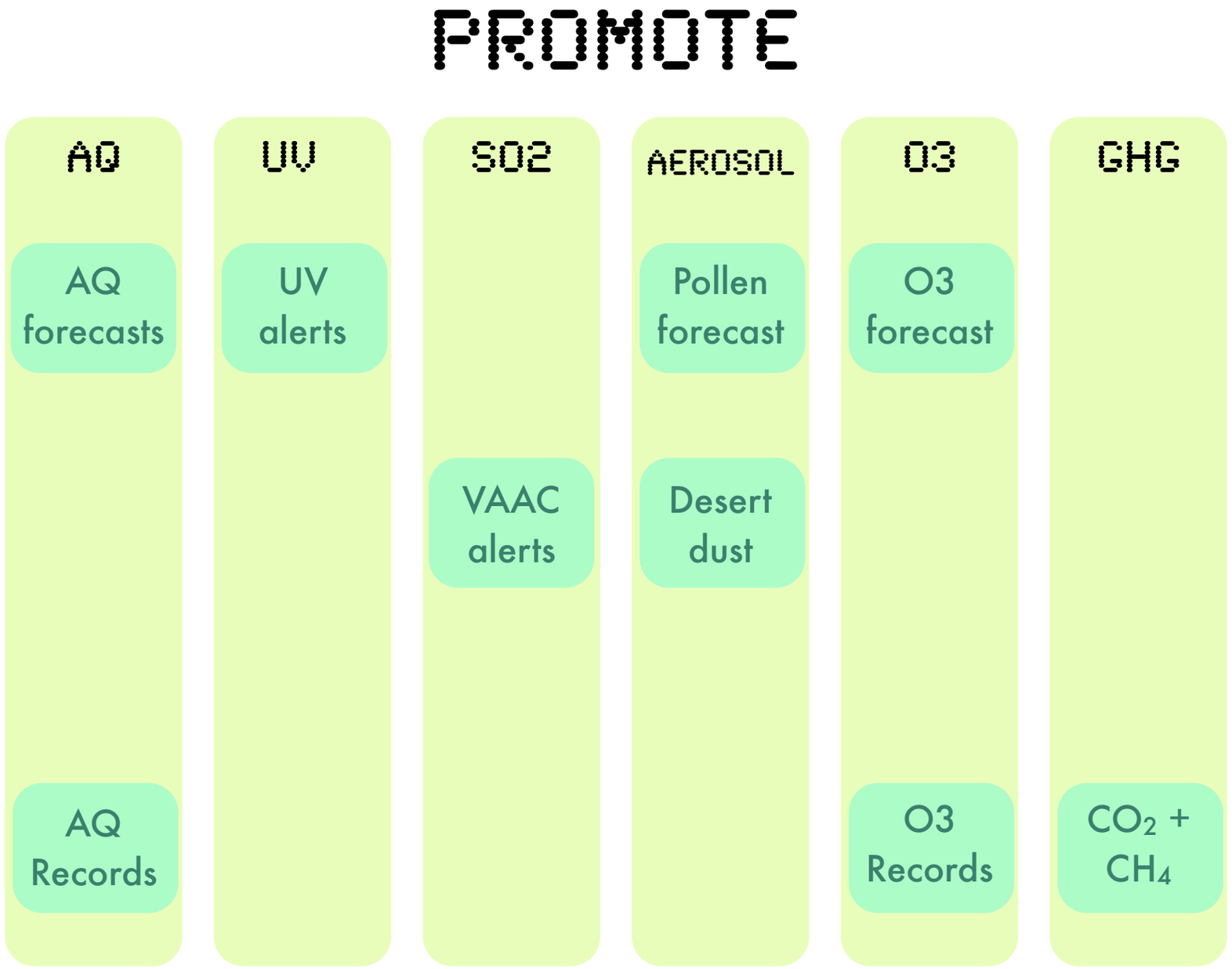
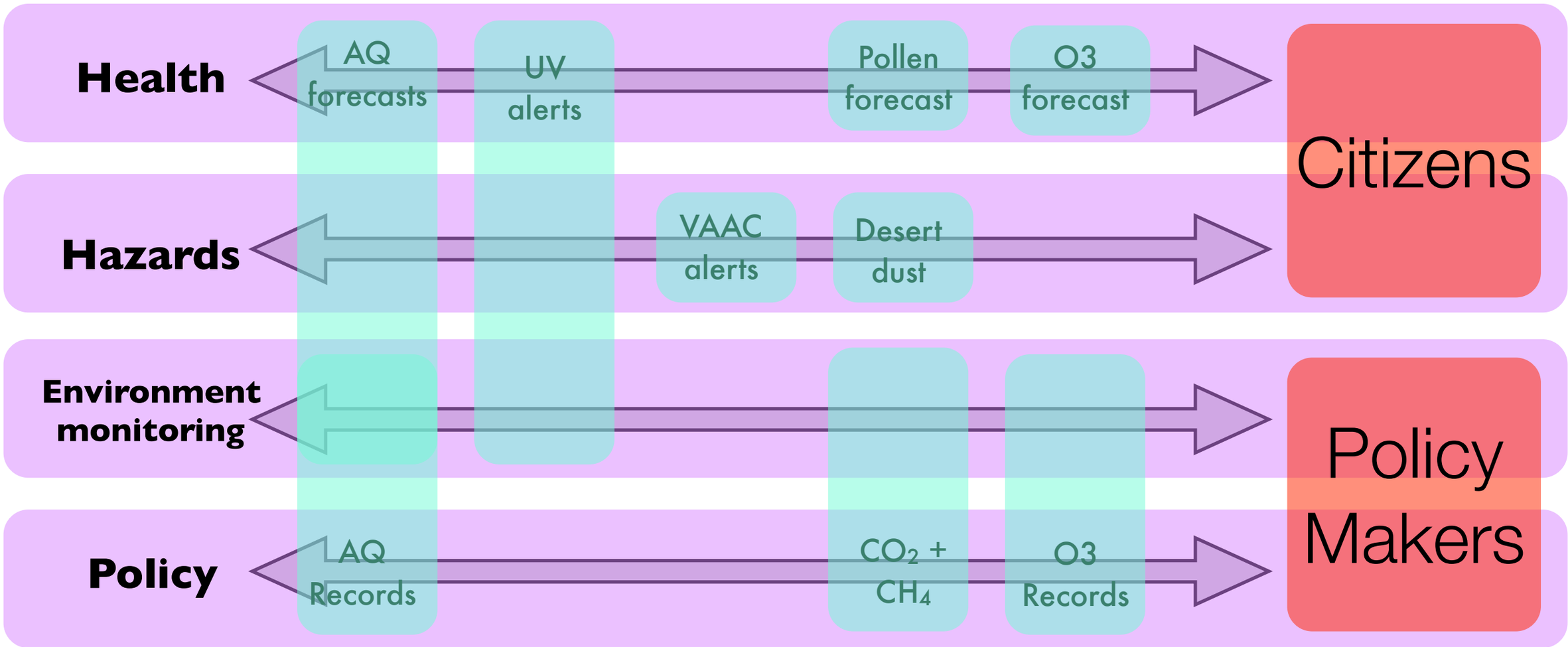
PROMOTE



USERS INCLUDE EEA (EU), UBA (OS), LUNGS (DE), ARPAS (IT)

PROMOTE



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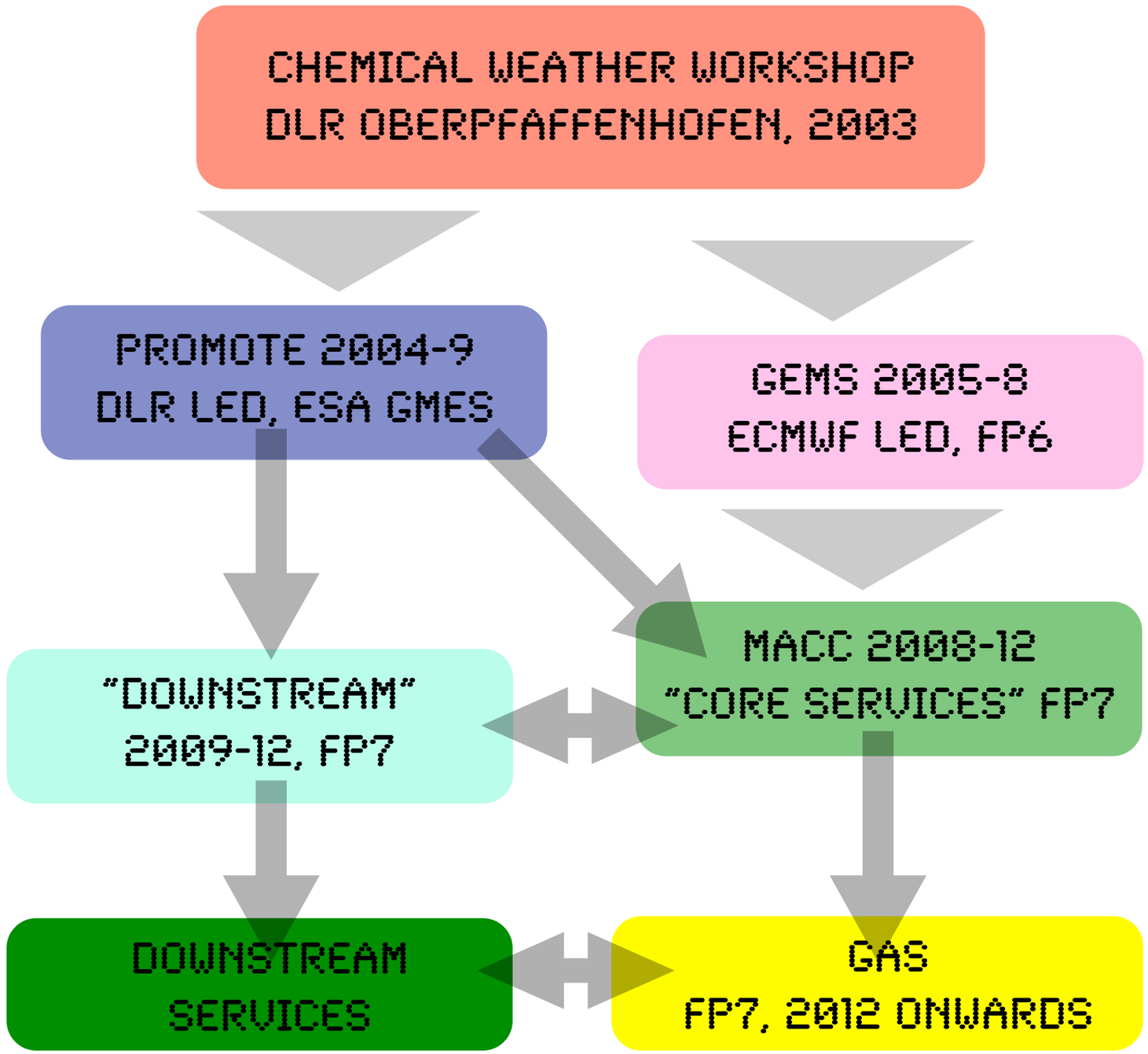
PROMOTE, MACC, GAS - the future



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The PROMOTE legacy

- PROMOTE's legacy for MACC, GAS & "downstream" is a system that's

  - An open network
    Always open to new users, services and service providers.

  - Independently validated
    Validation methodology and results are audited by Belgian Institute for Space Aeronomy.

  - User oriented
    Services demanded by users, not scientific or regulator "hobbying."

  - Many working "downstream" services, like airTEXT.

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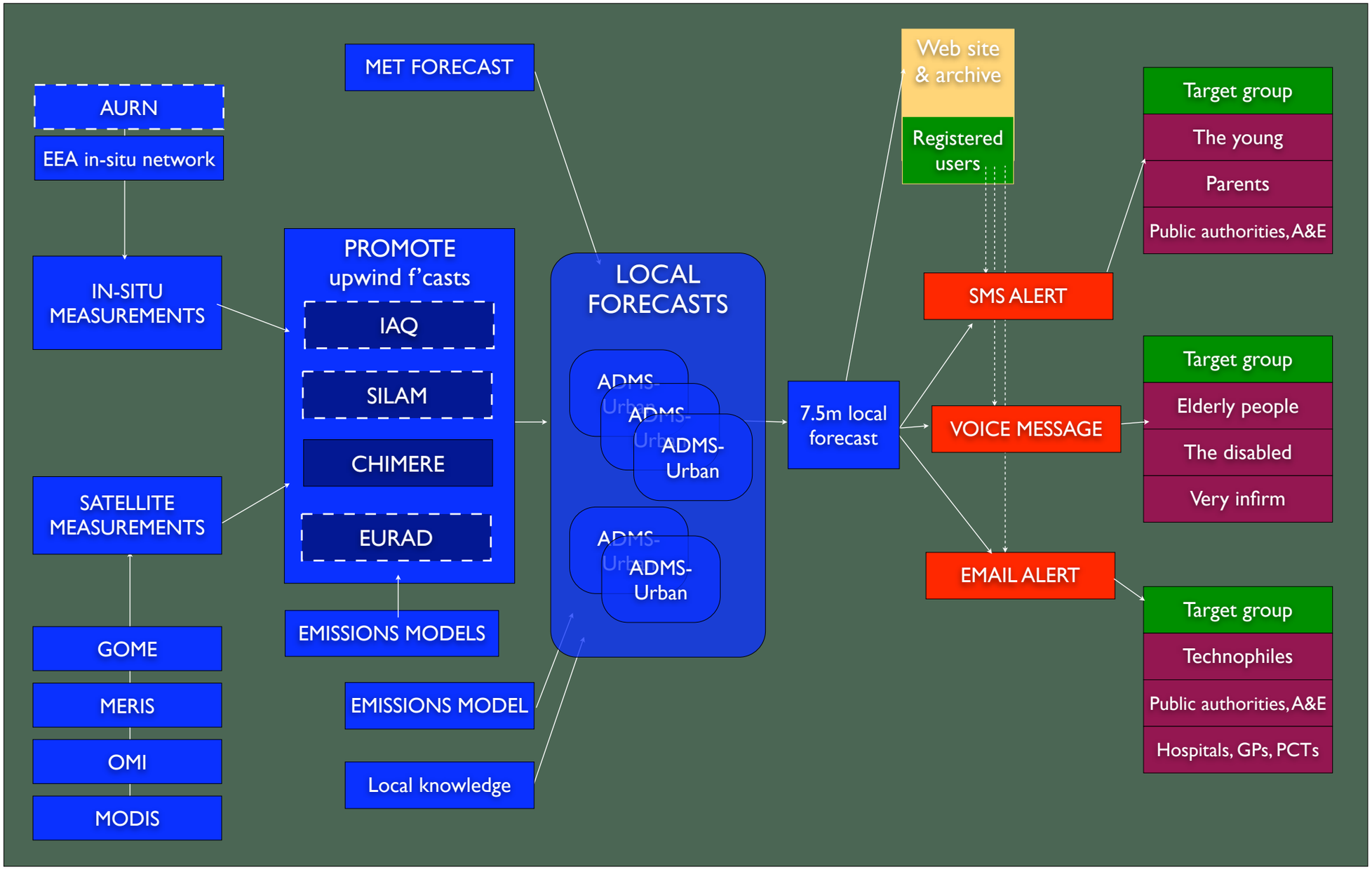
The forecasting system



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In operation - airTEXT service

- airTEXT London system is funded by PROMOTE, uses your**air** system.
- LAEI is the base emissions inventory for local modelling, with diurnal variation for weekdays, Saturday and Sunday. Some 60,000 sources are modelled.
- Forecasts issued at 7 am for today and 7 pm for tomorrow.
- Forecasts are for today (now to T+18) and tomorrow (T+6 to T+30).
- LHR met forecasts from MeteoGroup used to drive ADMS-Urban.

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In operation - airTEXT service

- NO_2, O_3 and PM_{10} forecast at variable resolution down to 5m clustered around the sources.
- Interpolated to uniform 7.5m x 7.5m resolution across 2,500 km^2 of Greater London and Slough.
- Converted to UK AQI values. Summaries generated for each London borough.
- If > 5% of the borough area has MODERATE AQ forecast, an alert is issued.

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Turning forecasts into public information

- yourair & airTEXT developed in conjunction first with LB Croydon, then with a consortium of 25 London boroughs & agencies.

- In London alone, 1000 people die earlier each year from AQ, while 300 are killed in road accidents.

- System to be specifically targeted at the most vulnerable people, going directly to them.

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Why broadcast directly?

SPECIALIST KNOWLEDGE

UNDERSTANDING OF THE HAZARD

LITTLE OR NO KNOWLEDGE

FACTS RE-INTERPRETED AS A "STORY"

USUALLY EITHER BURIED OR SENSATIONALISED

HIGH LEVEL OF CONCERN

NO UNDERSTANDING OF THE NATURE OF THE HAZARD

NO OPPORTUNITY TO INFLUENCE OUTCOMES

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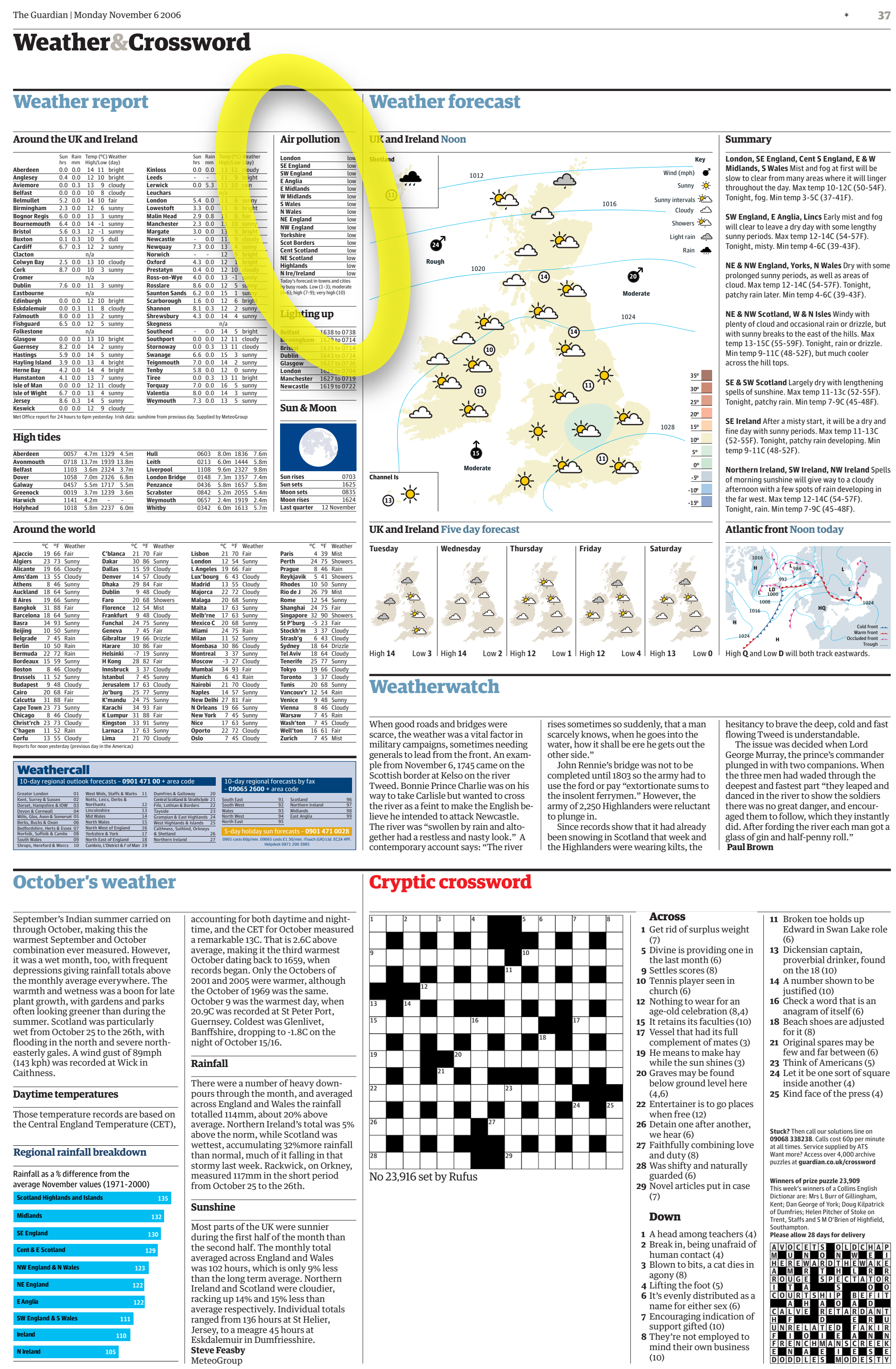
Turning forecasts into public information



The Guardian | Monday November 6 2006 • 37

Weather & Crossword

Weather report

Air pollution

London	low
SE England	low
SW England	low
E Anglia	low
E Midlands	low
W Midlands	low
S Wales	low
N Wales	low
NE England	low
NW England	low
Yorkshire	low
Scot Borders	low
Cent Scotland	low
NE Scotland	low
Highlands	low
N Ire/Ireland	low

Today's forecast in towns and cities by busy roads. Low (1-3); moderate (4-6); high (7-9); very high (10)

Lighting up

Bristol	1635 to 0714
Dublin	1643 to 0734
Glasgow	1627 to 0736
London	1625 to 0704
Manchester	1627 to 0719
Newcastle	1619 to 0722

Sun & Moon

Sun rises	0703
Sun sets	1625
Moon sets	0835
Moon rises	1624

Weather forecast

UK and Ireland Noon

Summary

London, SE England, Cent S England, E & W Midlands, S Wales Mist and fog at first will be slow to clear from many areas where it will linger throughout the day. Max temp 10-12C (50-54F). Tonight, fog. Min temp 3-5C (37-41F).

SW England, E Anglia, Lincs Early mist and fog will clear to leave a dry day with some lengthy sunny periods. Max temp 12-14C (54-57F). Tonight, misty. Min temp 4-6C (39-43F).

NE & NW England, Yorks, N Wales Dry with some prolonged sunny periods, as well as areas of cloud. Max temp 12-14C (54-57F). Tonight, patchy rain later. Min temp 4-6C (39-43F).

NE & NW Scotland, W & N Isles Windy with plenty of cloud and occasional rain or drizzle, but with sunny breaks to the east of the hills. Max temp 13-15C (55-59F). Tonight, rain or drizzle. Min temp 9-11C (48-52F), but much cooler across the hill tops.

SE & SW Scotland Largely dry with lengthening spells of sunshine. Max temp 11-13c (52-55F). Tonight, patchy rain. Min temp 7-9C (45-48F).

SE Ireland After a misty start, it will be a dry and fine day with sunny periods. Max temp 11-13C (52-55F). Tonight, patchy rain developing. Min temp 9-11C (48-52F).

Northern Ireland, SW Ireland, NW Ireland Spells of morning sunshine will give way to a cloudy afternoon with a few spots of rain developing in the far west. Max temp 12-14C (54-57F). Tonight, rain. Min temp 7-9C (45-48F).

UK and Ireland Five day forecast

Tuesday	Wednesday	Thursday	Friday	Saturday
High 14 Low 3	High 14 Low 2	High 12 Low 1	High 12 Low 4	High 13 Low 0

Atlantic front Noon today

High Q and Low D will both track eastwards.

Weatherwatch

When good roads and bridges were scarce, the weather was a vital factor in military campaigns, sometimes needing generals to lead from the front. An example from November 6, 1745 came on the Scottish border at Kelso on the river Tweed. Bonnie Prince Charlie was on his way to take Carlisle but wanted to cross the river as a feint to make the English believe he intended to attack Newcastle. The river was "swollen by rain and altogether had a restless and nasty look." A contemporary account says: "The river rises sometimes so suddenly, that a man scarcely knows, when he goes into the water, how it shall be ere he gets out the other side."

John Rennie's bridge was not to be completed until 1803 so the army had to use the ford or pay "extortionate sums to the insolent ferrymen." However, the army of 2,250 Highlanders were reluctant to plunge in.

Since records show that it had already been snowing in Scotland that week and the Highlanders were wearing kilts, the hesitancy to brave the deep, cold and fast flowing Tweed is understandable.

The issue was decided when Lord George Murray, the prince's commander plunged in with two companions. When the three men had waded through the deepest and fastest part "they leaped and danced in the river to show the soldiers there was no great danger, and encouraged them to follow, which they instantly did. After fording the river each man got a glass of gin and half-penny roll."

Paul Brown

October's weather

September's Indian summer carried on through October, making this the warmest September and October combination ever measured. However, it was a wet month, too, with frequent depressions giving rainfall totals above the monthly average everywhere. The warmth and wetness was a boon for late plant growth, with gardens and parks often looking greener than during the summer. Scotland was particularly wet from October 25 to the 26th, with flooding in the north and severe north-easterly gales. A wind gust of 89mph (143 kph) was recorded at Wick in Caithness.

Daytime temperatures

Those temperature records are based on the Central England Temperature (CET), accounting for both daytime and night-time, and the CET for October measured a remarkable 13C. That is 2.6C above average, making it the third warmest October dating back to 1659, when records began. Only the Octobers of 2001 and 2005 were warmer, although the October of 1969 was the same. October 9 was the warmest day, when 20.9C was recorded at St Peter Port, Guernsey. Coldest was Glenlivet, Banffshire, dropping to -1.8C on the night of October 15/16.

Regional rainfall breakdown

Rainfall as a % difference from the average November values (1971-2000)

Scotland Highlands and Islands	135
Midlands	132
SE England	130
Cent & E Scotland	129
NW England & N Wales	123
NE England	122
E Anglia	122
SW England & S Wales	111
Ireland	110
N Ireland	105

Rainfall

There were a number of heavy downpours through the month, and averaged across England and Wales the rainfall totalled 114mm, about 20% above average. Northern Ireland's total was 5% above the norm, while Scotland was wettest, accumulating 32%more rainfall than normal, much of it falling in that stormy last week. Rackwick, on Orkney, measured 117mm in the short period from October 25 to the 26th.

Sunshine

Most parts of the UK were sunnier during the first half of the month than the second half. The monthly total averaged across England and Wales was 102 hours, which is only 9% less than the long term average. Northern Ireland and Scotland were cloudier, racking up 14% and 15% less than average respectively. Individual totals ranged from 136 hours at St Helier, Jersey, to a meagre 45 hours at Eskdalemuir in Dumfriesshire.

Steve Feasby
MeteoGroup

Cryptic crossword

No 23,916 set by Rufus

Across

1 Get rid of surplus weight (7)
5 Divine is providing one in the last month (6)
9 Settles scores (8)
10 Tennis player seen in church (6)
11 Broken toe holds up Edward in Swan Lake role (6)
12 Nothing to wear for an age-old celebration (8,4)
13 Dickensian captain, proverbial drinker, found on the 18 (10)
14 A number shown to be justified (10)
15 It retains its faculties (10)
16 Check a word that is an anagram of itself (6)
17 Vessel that had its full complement of mates (3)
18 Beach shoes are adjusted for it (8)
19 He means to make hay while the sun shines (3)
20 Graves may be found below ground level here (4,6)
21 Original spares may be few and far between (6)
22 Entertainer is to go places when free (12)
23 Think of Americans (5)
24 Let it be one sort of square inside another (4)
25 Kind face of the press (4)
26 Detain one after another, we hear (6)
27 Faithfully combining love and duty (8)
28 Was shifty and naturally guarded (6)
29 Novel articles put in case (7)

Down

1 A head among teachers (4)
2 Break in, being unafraid of human contact (4)
3 Blown to bits, a cat dies in agony (8)
4 Lifting the foot (5)
6 It's evenly distributed as a name for either sex (6)

Stuck? Then call our solutions line on **09068 338238**. Calls cost 60p per minute at all times. Service supplied by ATS Want more? Access over 4,000 archive puzzles at **guardian.co.uk/crossword**

Winners of prize puzzle 23,909
This week's winners of a Collins English Dictionar are: Mrs L Burr of Gillingham, Kent; Dan George of York; Doug Kilpatrick of Dumfries; Helen Pitcher of Stoke on Trent, Staffs and S M O'Brien of Highfield, Southampton.
Please allow 28 days for delivery

Turning forecasts into public information

REGULATORS + FORECASTERS

YOURAIR EG AIRTEXT

PUBLIC

SPECIALIST KNOWLEDGE

UNDERSTANDING OF THE HAZARD

DIRECT MEDICAL AND EXPOSURE ADVICE

TRANSMITTED TO THE MOST VULNERABLE

TRANSMITTED BY THE MOST APPROPRIATE MEANS

HIGH LEVEL OF CONCERN TRANSLATED INTO:

IMPROVED KNOWLEDGE

CONTROL OF MEDICATION AND EXPOSURE

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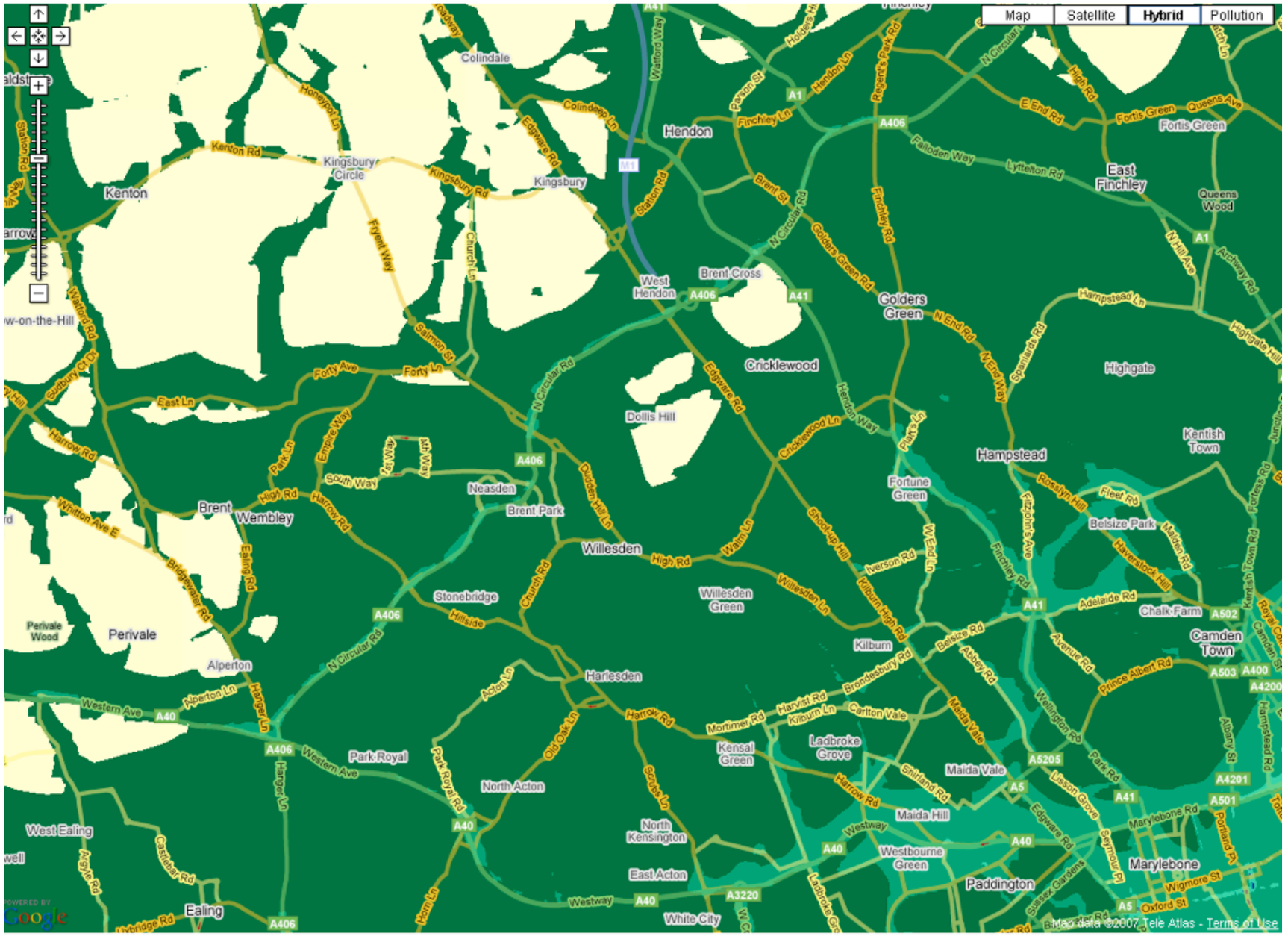

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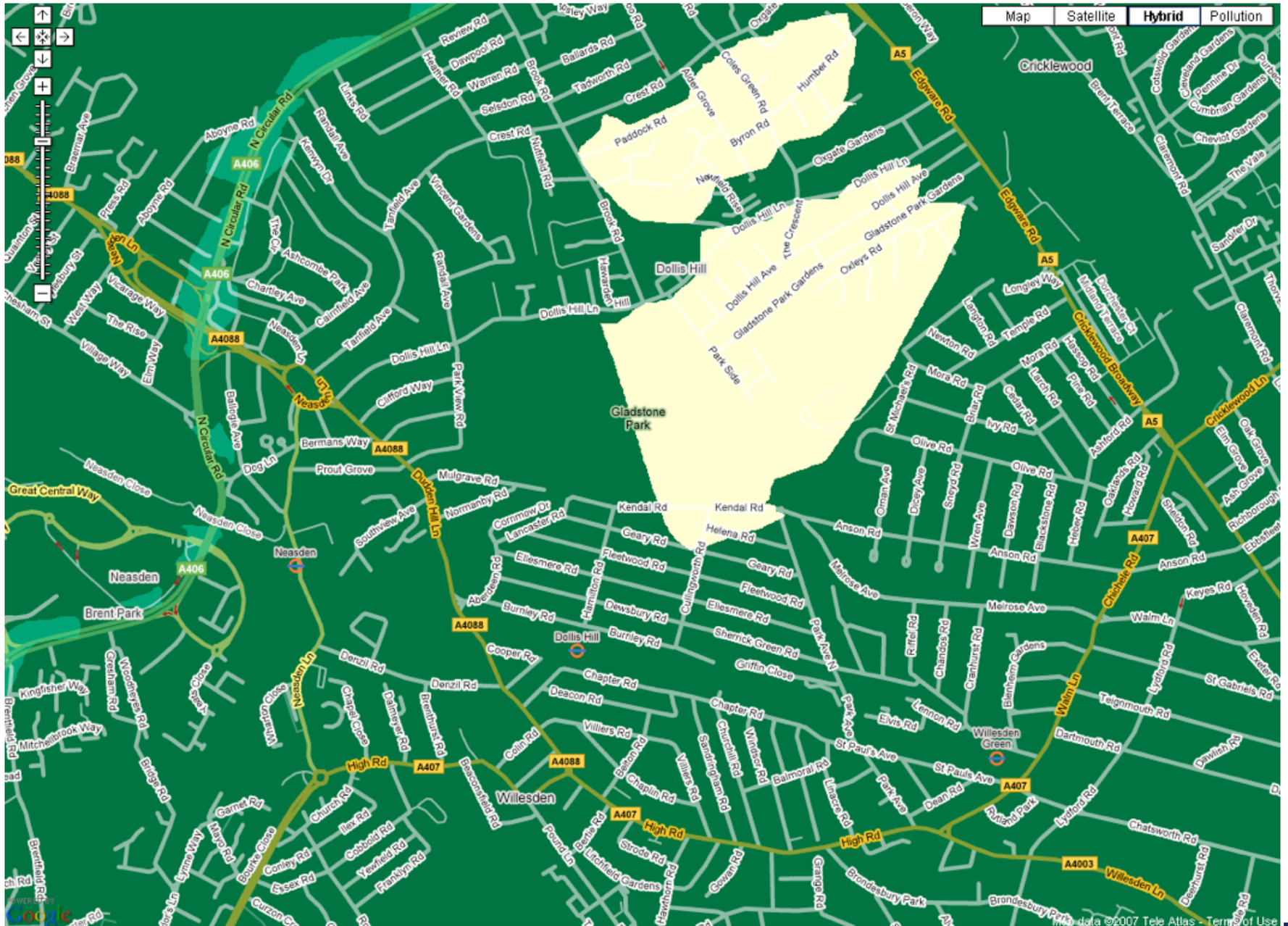

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Getting the message out

- When a moderate or higher episode is forecast, an alert is issued to subscribers.

- The alert content is based on the DoH COMEAP air quality index recommendations.

- Alerts are transmitted directly to subscribers, by voicemail, SMS or e-mail.

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Getting the message out

- sms alerts - good for parents and the young, but of limited length:

"HIGH air pollution Friday. If affected consider reducing exposure, spend less time outdoors & take reliever medication. If unwell contact your GP.

- voice alerts - good for the elderly or people with certain disabilities

"High air pollution is forecast for Friday. If affected consider reducing your exposure, spend less time outdoors and take your reliever medication. If unwell, contact your GP."

- email alerts - good for authorities, nurses, GPs.

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Results - airTEXT stage 1 in Croydon

- airTEXT stage 1 used statistical upwind calculation, not PROMOTE.

- Over period 5.5.05-28.3.07, 23 moderate alerts issued. 22 were correct, but this was a major underestimate, should have been 65.

- However, Croydon satisfied with overall approach and results. Conservative approach to alerts was preferred - main goal was testing user response.

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Results - airTEXT stage 1 in Croydon

- Some 200 users recruited, about 50% asthmatic, 25% with COPD, 20% multiple illnesses.

- Many housebound elderly people or parents of asthmatic children.

- Most potentially vulnerable to moderate air pollution.

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Results - airTEXT stage 1 in Croydon

- End of year 1, users were surveyed for their reaction to the system. 63 users responded.

- Of these:
  - 80% reported changing their behaviour on receiving an alert.
  - 97% reported being satisfied or very satisfied with the service.

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Results - airTEXT stage 1 in Croydon

"The airTEXTs help me immensely, especially as my heart and lung condition has worsened over the last 18 months and my exercise tolerance is very poor. So thank you for the continuing hard work and keeping people like myself informed."

"When I get the alerts in the evening I stay indoors next day.
I only go out two days a week."

"I think airTEXT is a great service and has helped my daughter a great deal."

"I am grateful to you all for all you do to help us."

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Results - airTEXT stage 2 in London

- Service began on 28.3.07
    - So far 1200 London subscribers from general public.
- Over April, May, June & July 2007:
    - 26 moderate alerts were issued (mainly O_3), 25 correct. Provisional measurements from 25 stations say 40 moderate episodes occurred.
    - 96% alert accuracy, but only 63% moderate forecast accuracy.
    - Combining local and mesoscale data gives a more accurate forecast.

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Results - airTEXT stage 2 in London

- Re-analyses show these underestimates are due to:

  - VOCs underestimated in initial set up. System modified in August to correct this. Re-analyses suggest 6% improvement in forecast accuracy, but reduction in alert accuracy of similar amount.

  - Assimilation of UK measurements and move from CHIMERE upwind data to IAQ will improve both upwind ozone and aerosols by 2-3%.

  - Emissions often overestimate NO - using only 3 diurnal traffic profiles is too simplistic. Improved profiles should give 2-3% improvement.

  - Model experiments suggest 75% forecast accuracy, 80% of correct alerts and a near symmetric bias are achievable.

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Summary

- Demand for an alert based AQ forecast system indicates a change in thinking from emissions reduction measures to a more sophisticated approach to exposure reduction.

- Direct alerts appear to be very effective at changing behaviour.

- This places the onus on the forecast accuracy. So far accuracy meets “acceptable” user criteria, but not “good.”

- But do we really need 7.5m resolution and what does it really mean - would 50m or 100m be more “truthful”? Also, contradictions between AQ annual standards & air quality index.

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