Drivers, users & approaches for Smarter Air-Quality analysis

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Outline: Getting more from AQ data

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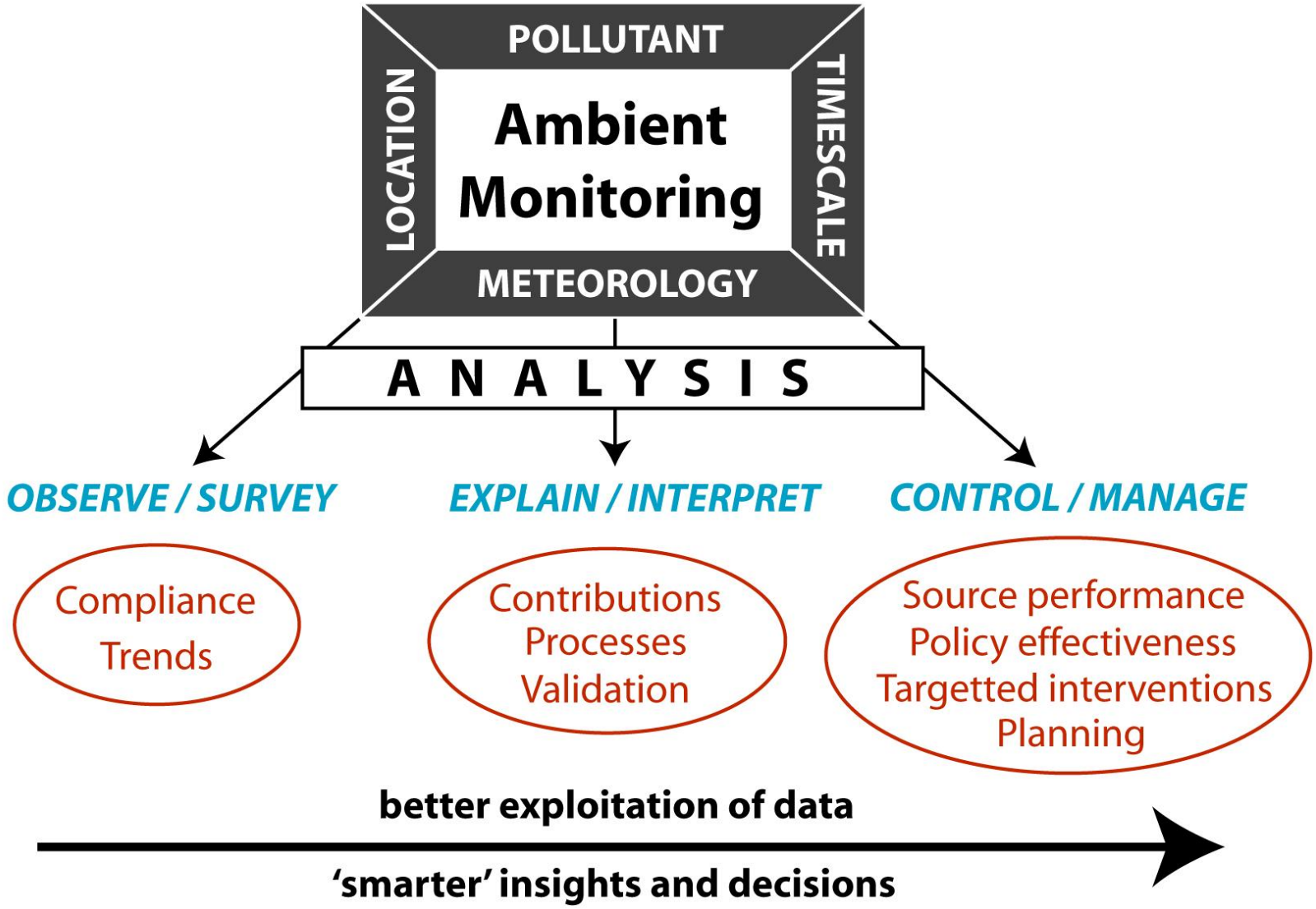
Purposes of Monitoring & Analysis



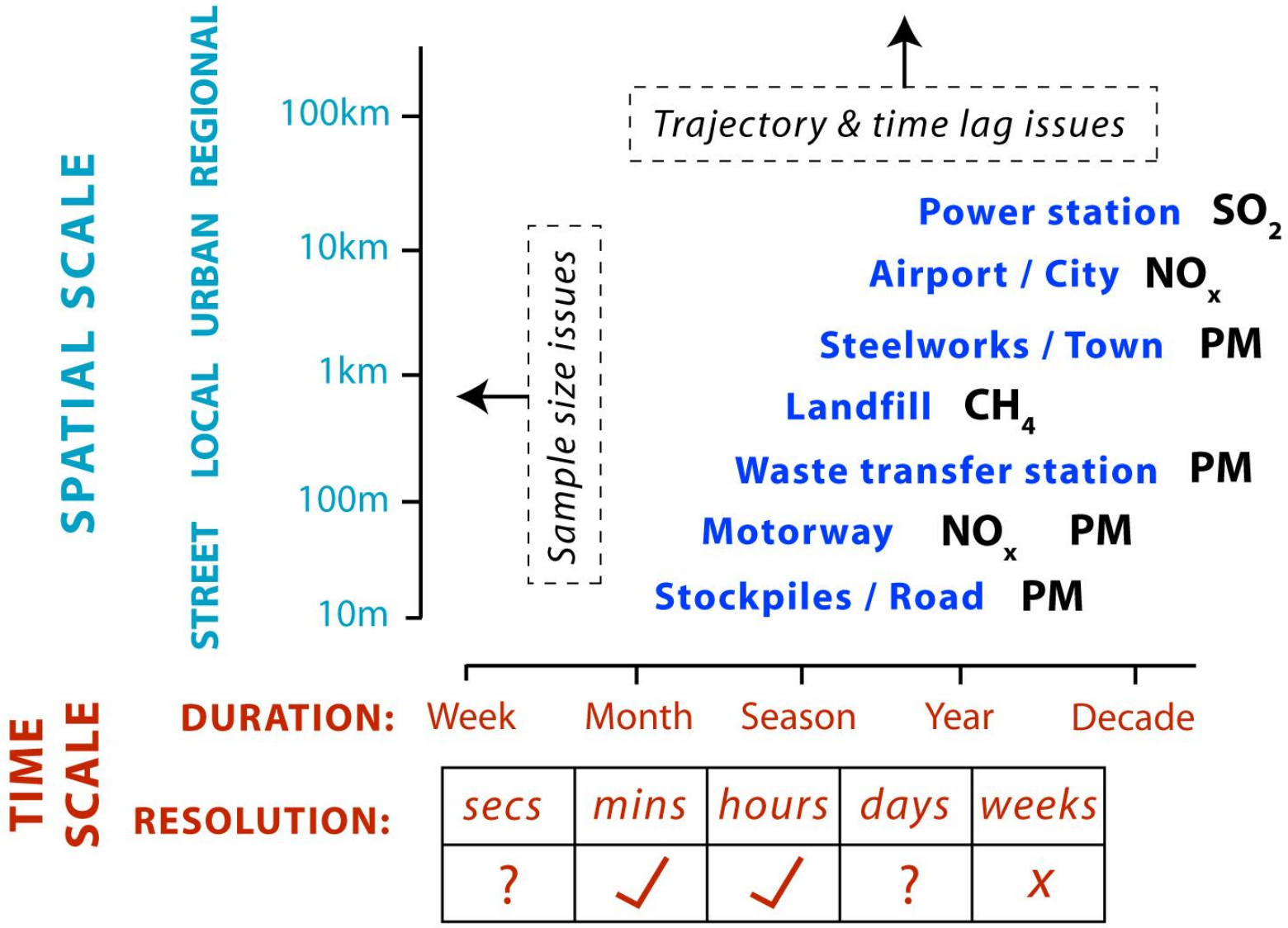
Levels of AQ Monitoring & Analysis

ASPECT	BASIC	INTERMEDIATE	CONDITIONAL ANALYSIS	ADVANCED
Pollutant	Single	Single		Multiple; Ratios
Position	Hot-spot	Wind-optimised		Source separation; triangulation
Compliance	Final	Rolling exceedances		Normalised exceedances
Background	Embedded	Embedded		Resolved w.r.t. Foreground
Plots	-	Pollution rose		Bivariate; Binomial smoothing
Trends	Annual	Rolling		CUSUM; Normalised %iles
Attribution	-	Sectors		Finger-printed contributions
Interventions	-	Annual assessment		Normalised tracking of effect
Meteorology	-	Directionally resolved		Normalised for dispersion
Modelling	-	Validation		Conditional validation
Cycles	-	-		Diurnal, rush-hour, weekly
Emissions	-	-		Fugitive; De-seasonalised
Policy & Management	Weak S:N Uncertain	Better S:N Improved		Strong S:N; Early warning; Targeting; Optimised networks

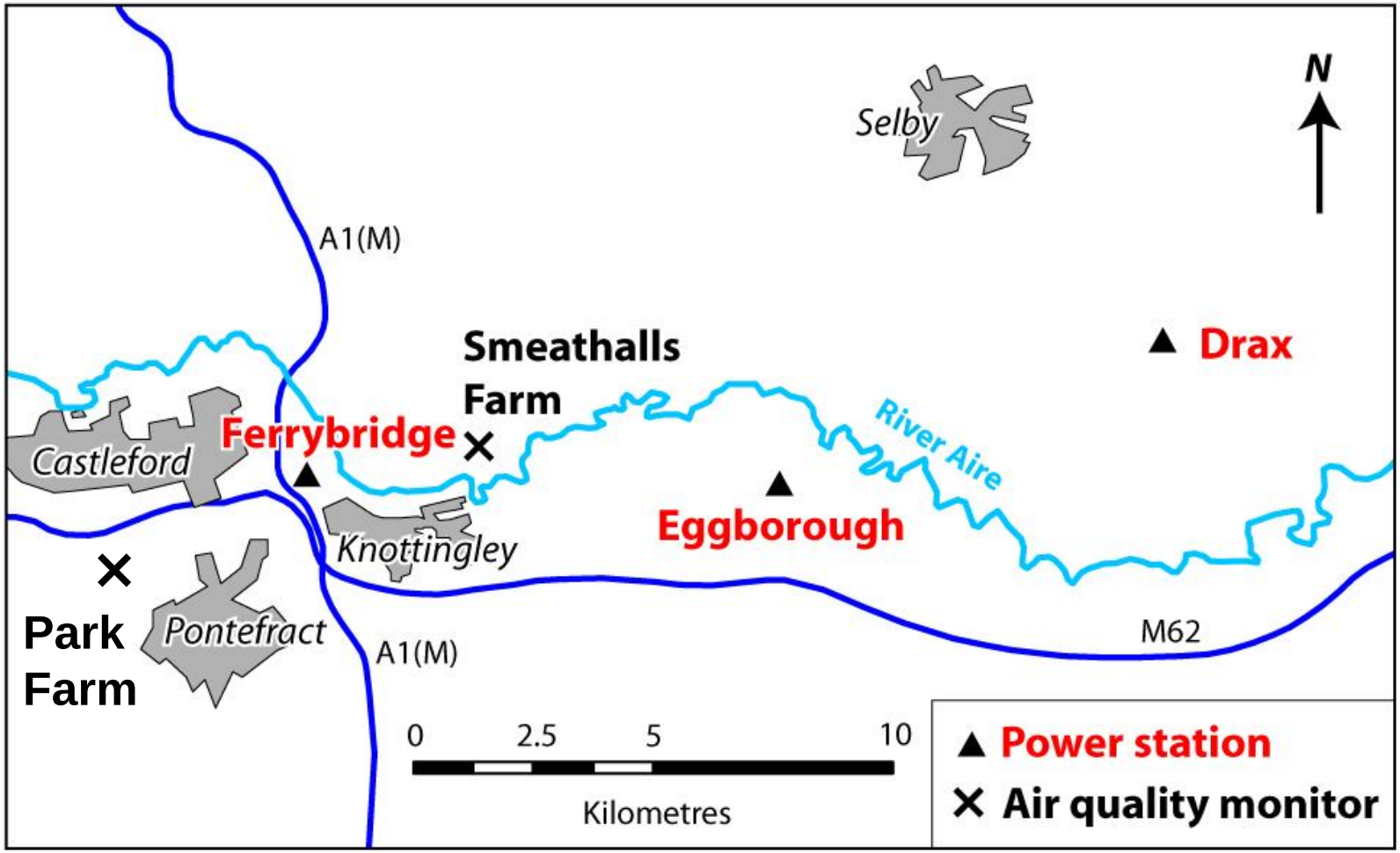
Conditional fingerprinting of sources

- **Geography**
  - direction, triangulation
- **Species**
  - pollutant type, ratio
- **Meteorology**
  - wind speed, dispersion class, soil moisture (?)
- **Activity profile**
  - diurnal e.g. rush hour
  - weekly, e.g. weekday vs. Sunday
  - seasonal, e.g. degree-days

Scales & Pollutants for Conditional Analysis



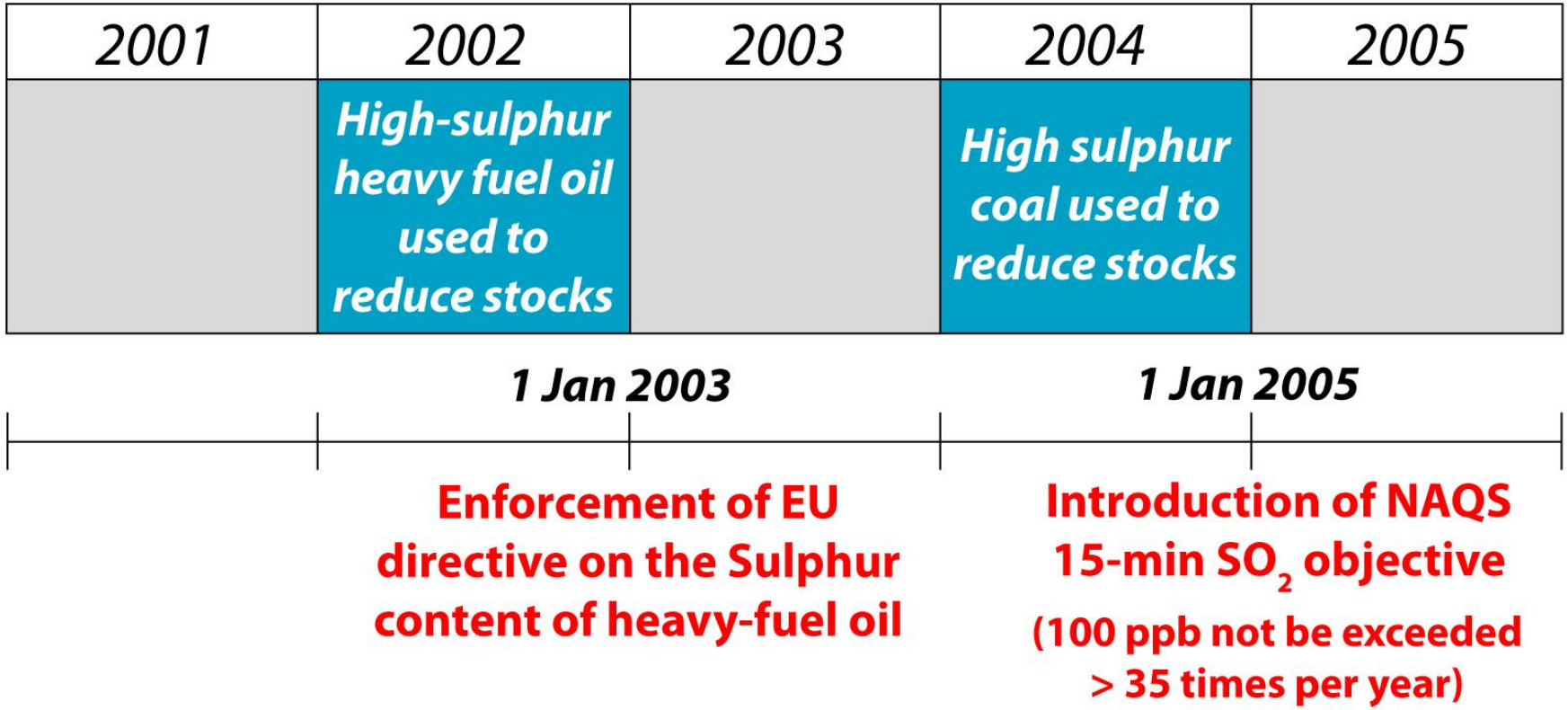
Example: Ferrybridge SO_2, Aire Valley, N. Yorks.



Example: Basic Analysis, Aire Valley SO_2

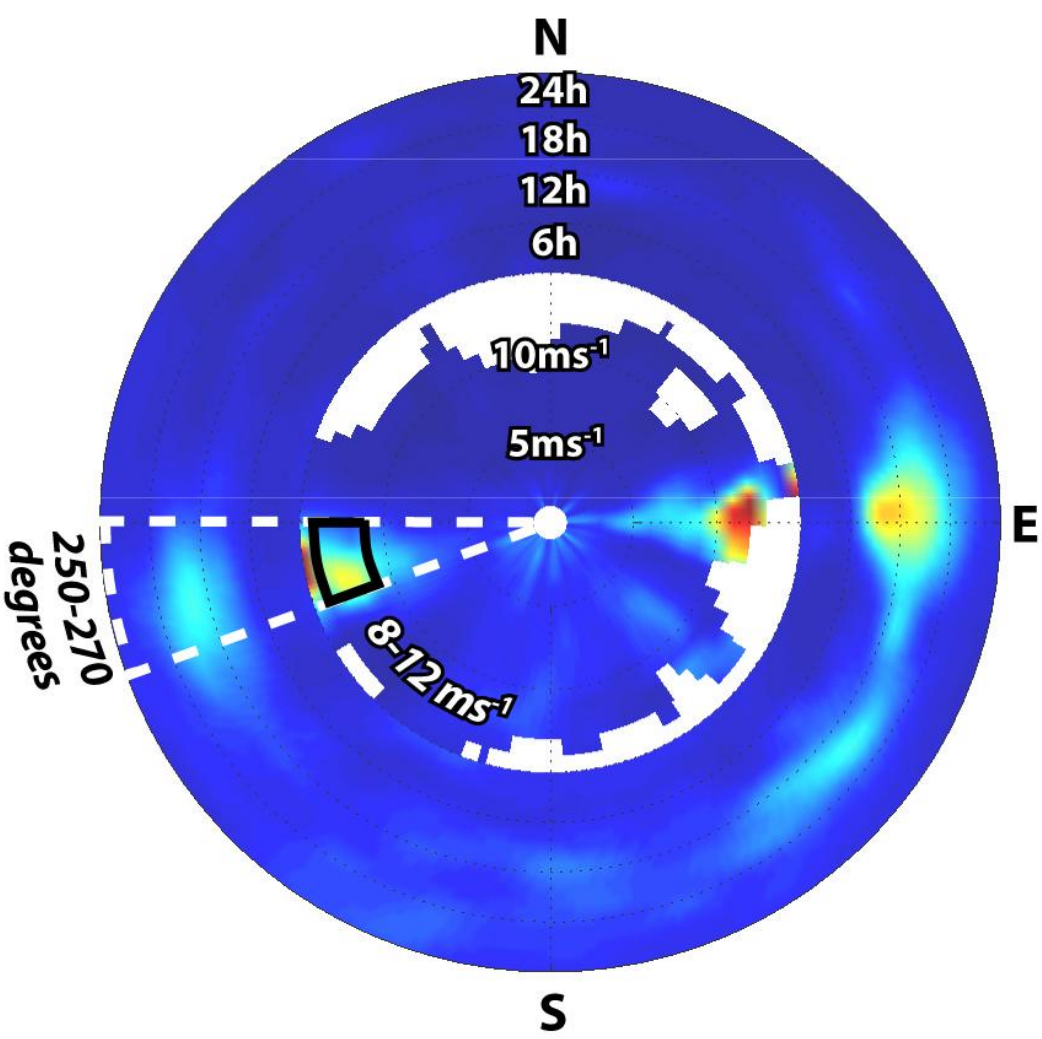
Monitor	Smeathalls Farm		West Bank	
Year	2002	2003	2002	2003
Annual mean µg/m^3	10	9	9	7
99.9 %le (15 min) µg/m^3	239	222	327	245
No 15 min >266 µg/m^3	22	20	72	26
Compliant?	Y	Y	N	Y

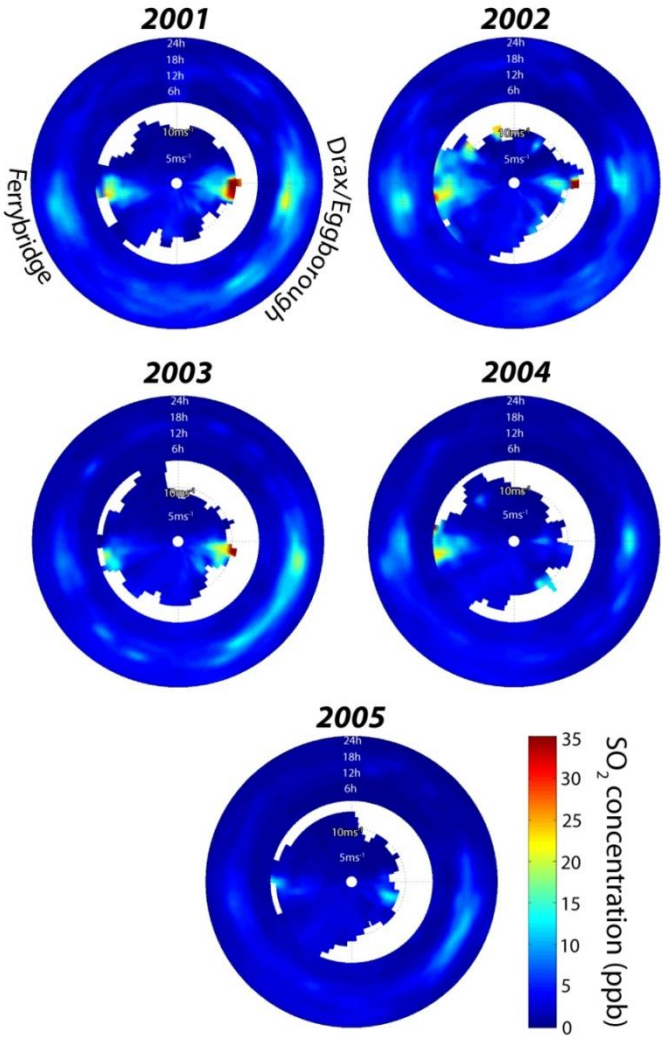
Fuel management of Ferrybridge power station:
Information from the operators



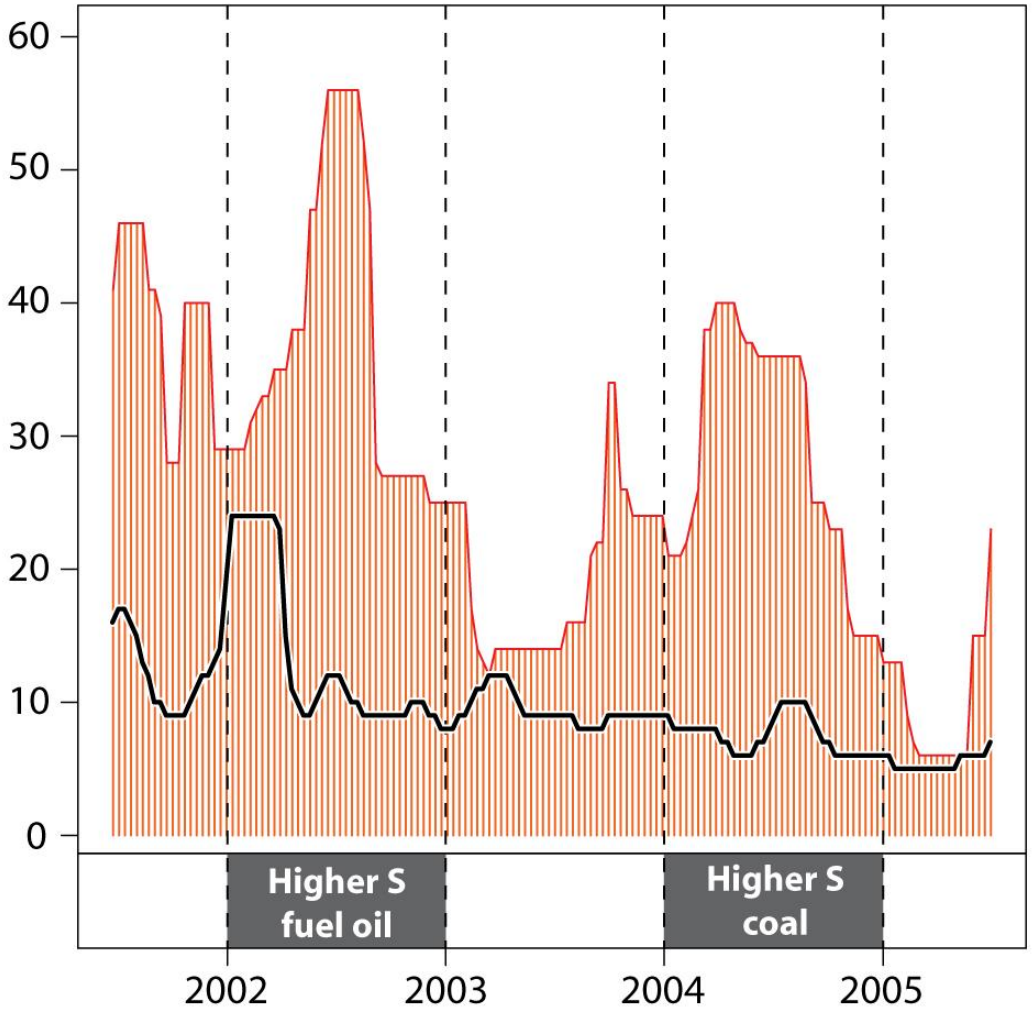
Example: Smeathalls Farm SO_2

Conditional signal 250-270 degrees; 8-12 m s^{-1}





Smeathalls Farm SO_2:
Percentile Analysis



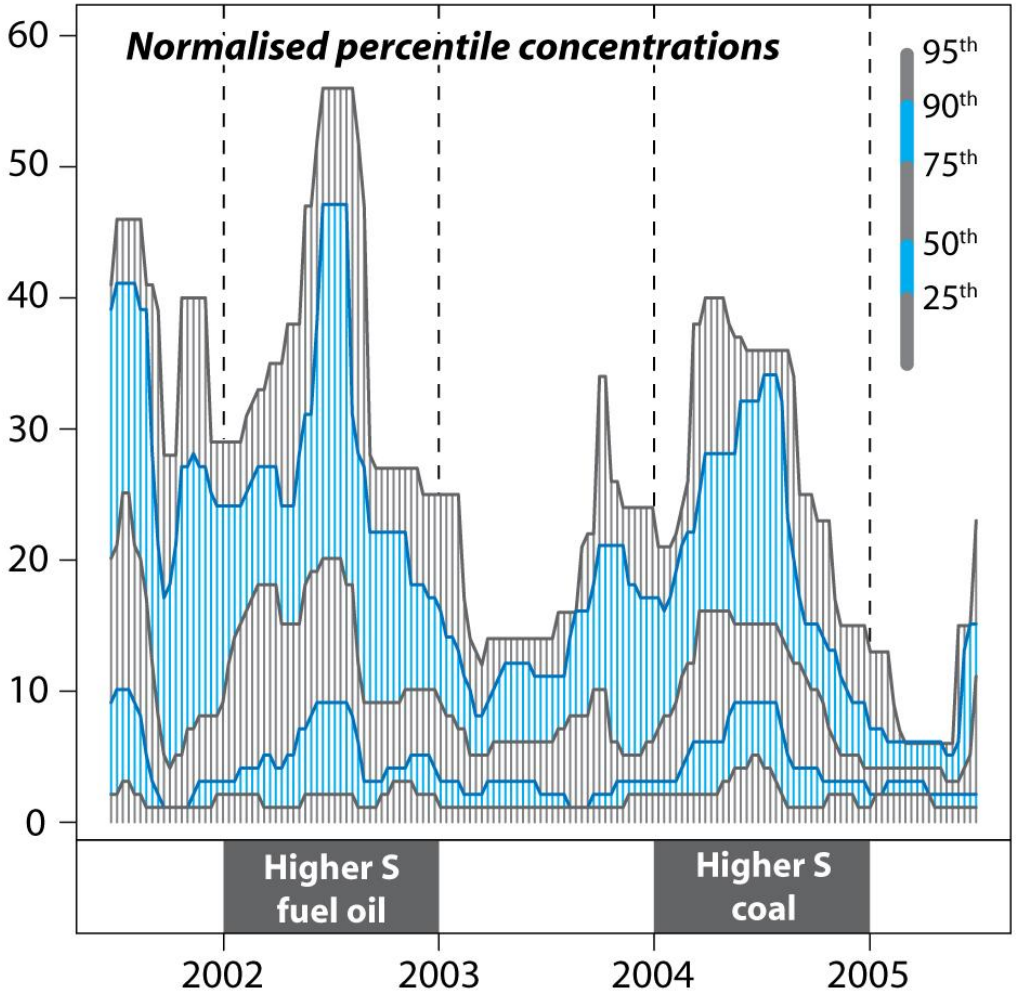
Overapping 1-year analyses:

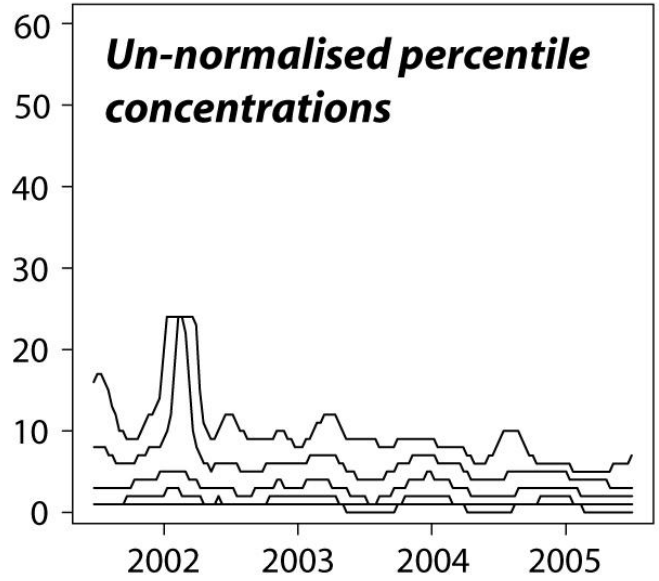
Normalised 95th percentile concentrations

Un-normalised 95th percentile concentrations

Smeathalls Farm SO_2:

Percentile Tracking (overlapping 1-year periods)

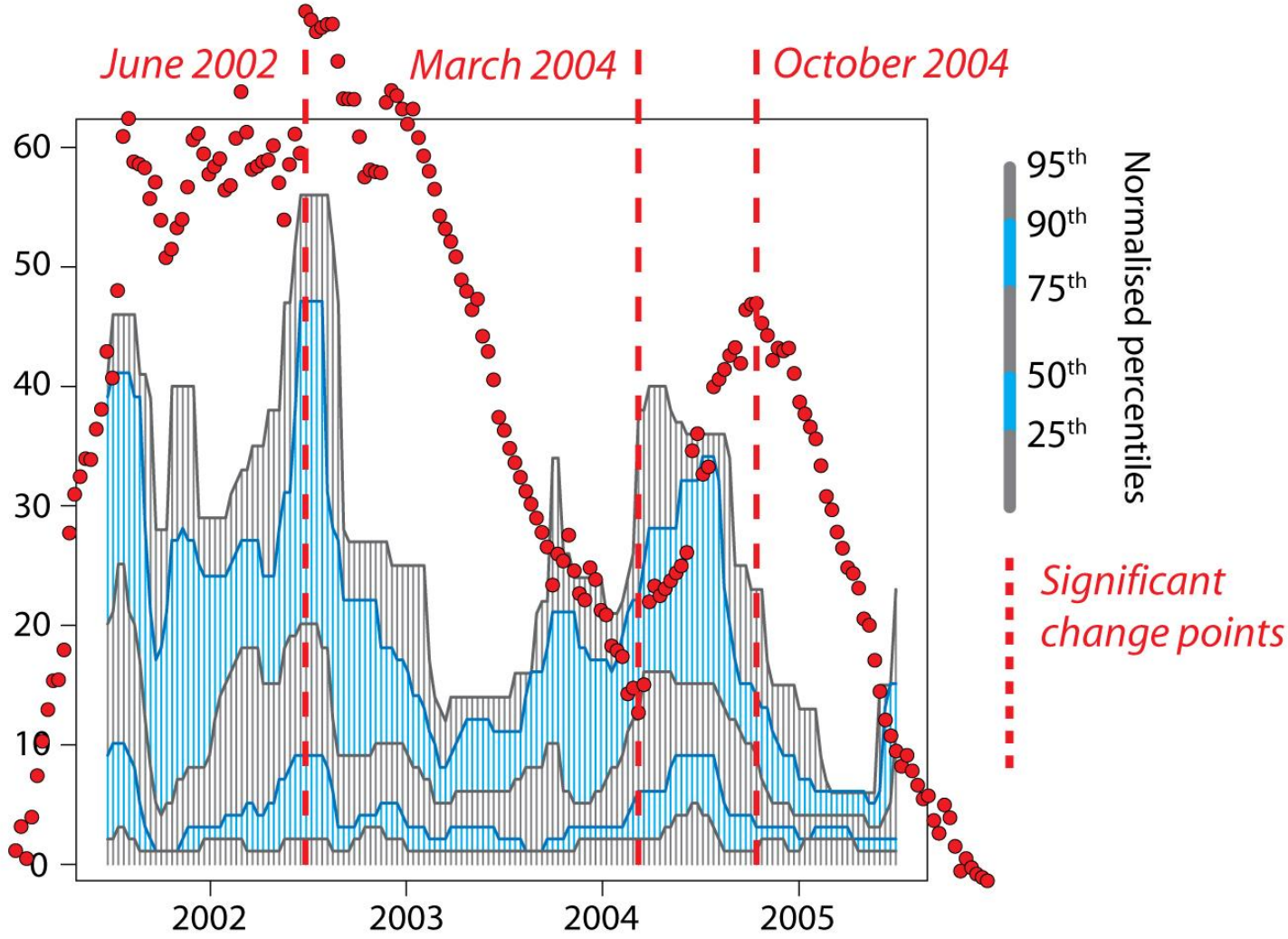




Coherent behaviour between normalised percentiles - indicates strategic management interventions

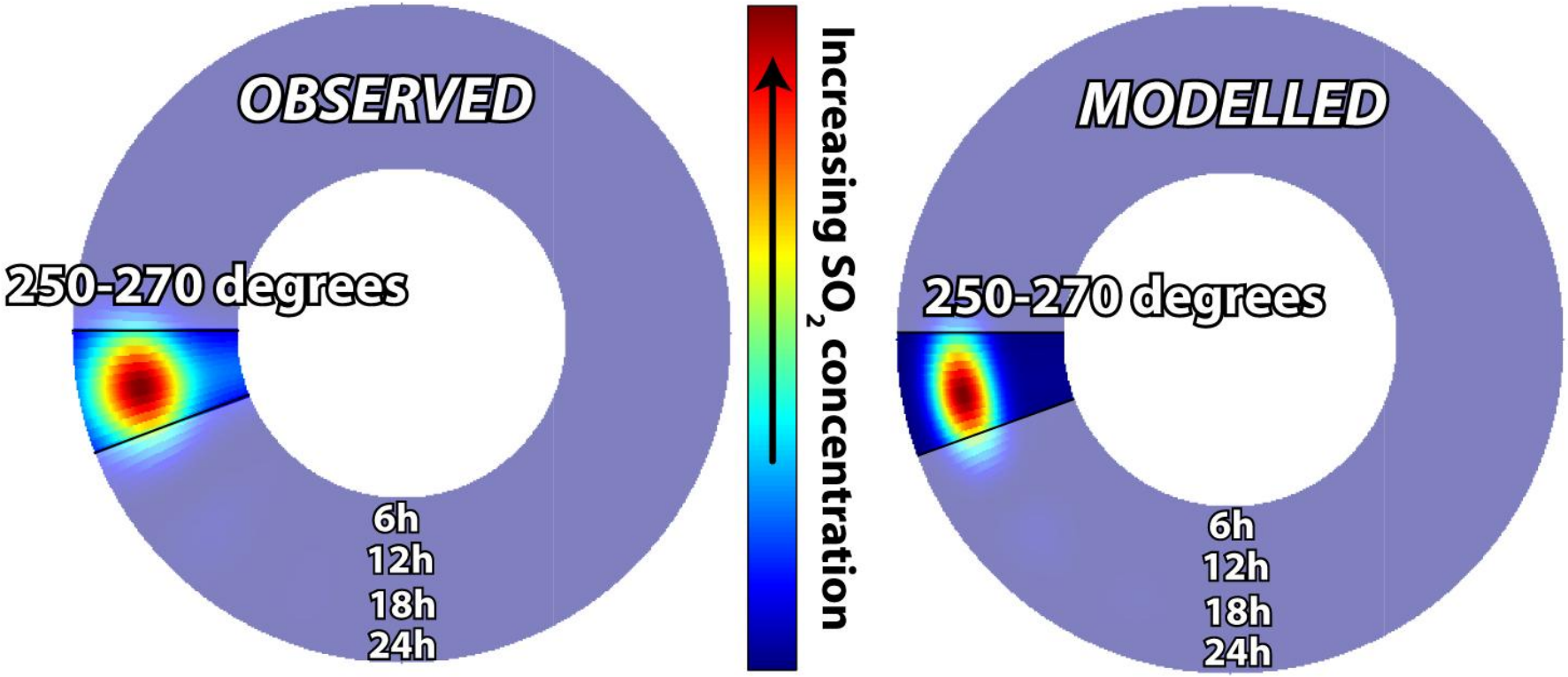
Smeathalls Farm SO_2:

Percentile Tracking & Change-Point Analysis

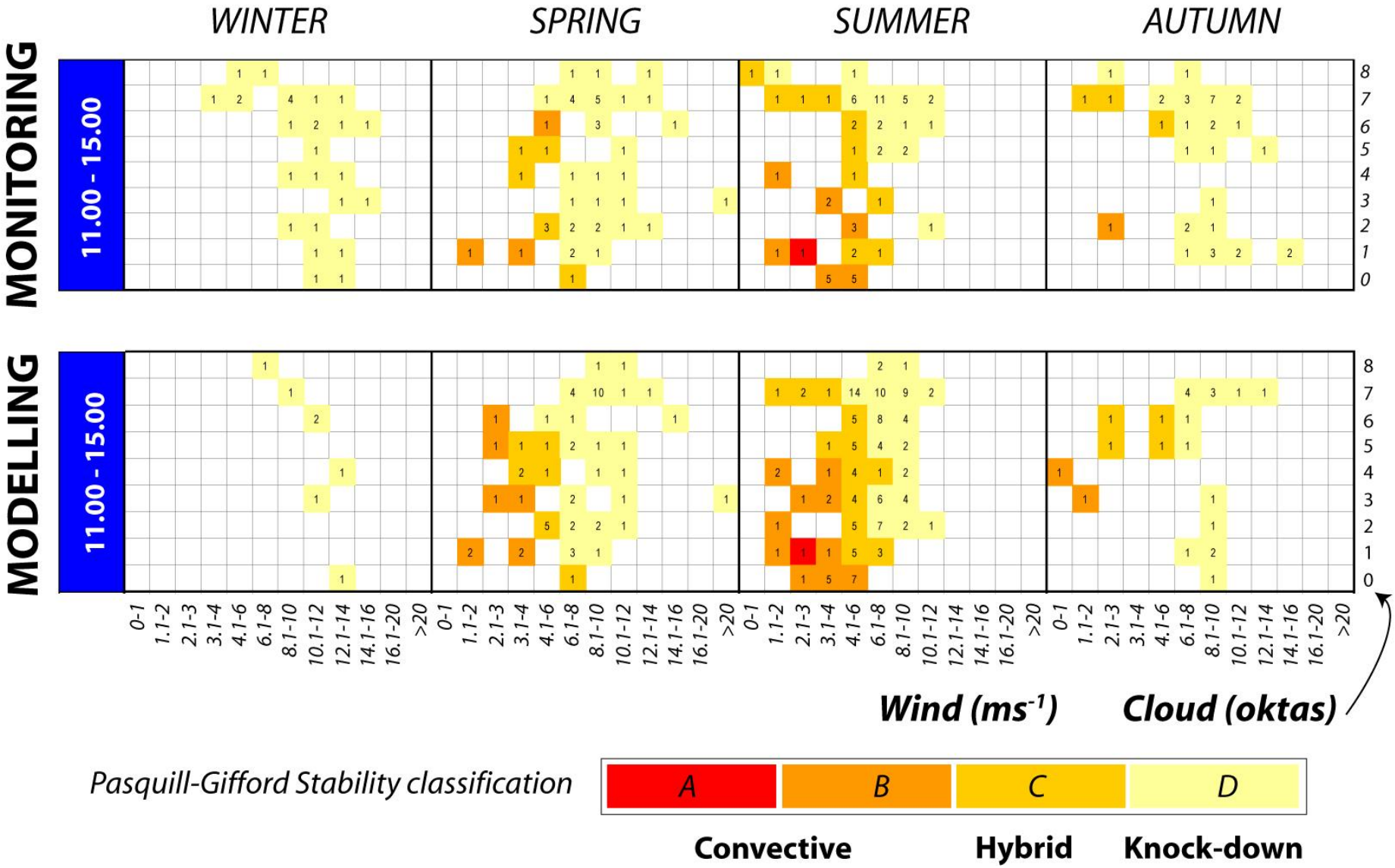


Model Verification: Ferrybridge SO_2 (2002-05)

Does the model get the ‘right answer for the right reasons?’



Comparison of top-decile dispersion climates from monitoring and modelling of Ferrybridge SO_2, 2002-05



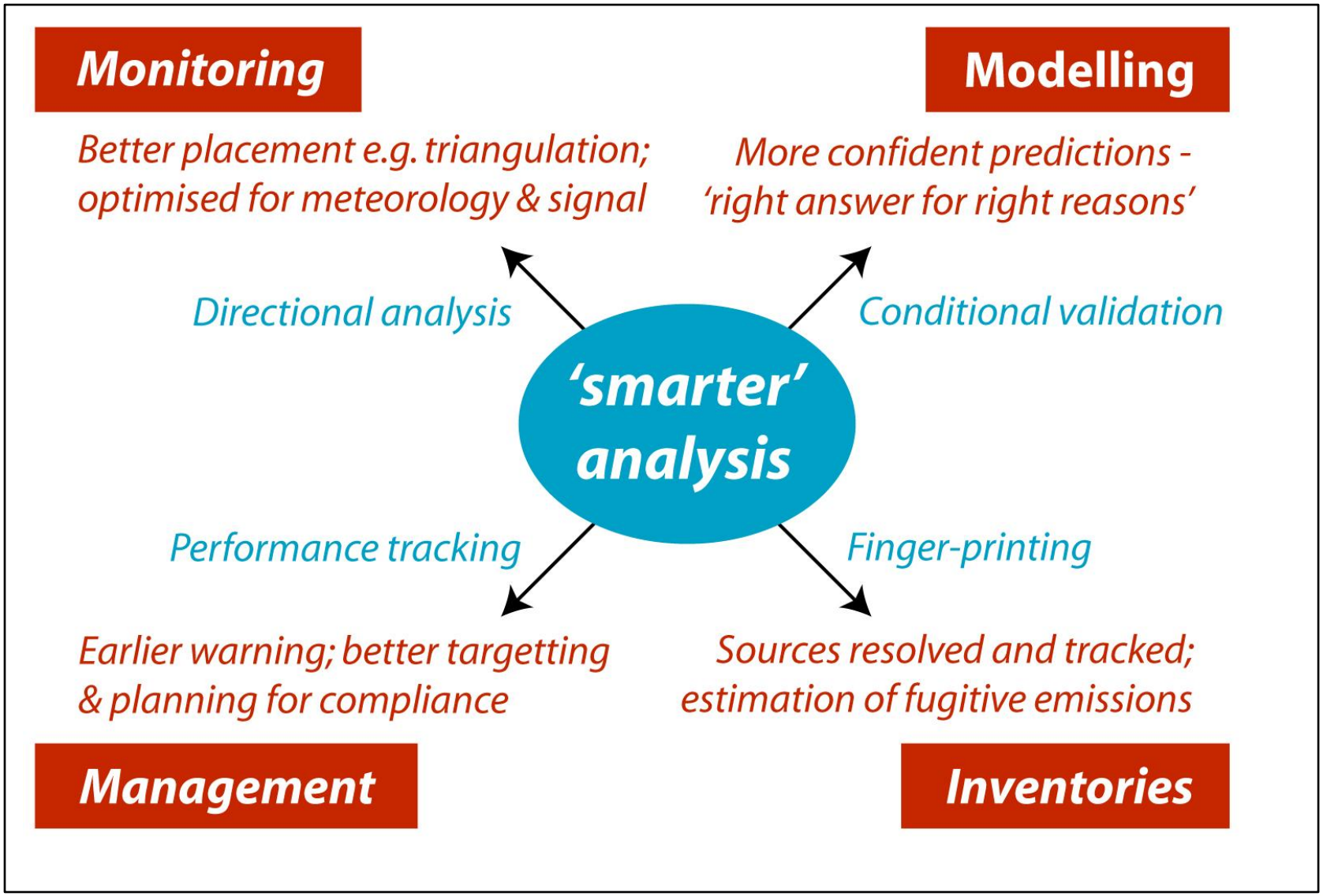
Drivers: Legislation & Issues

- **Tighter headroom/compliance** - Confirm progress
  - Explain setbacks
  - Negotiate extensions
- **Exposure reduction** - No-threshold pollutants
  - Wider impact patterns
  - Efficient coverage
- **Diffuse emitters** - Increasing % area sources
  - Fugitive impacts/controls
  - Background contributions
- **Infrastructure planning** - AQ-critical
  - Sustainable airsheds/transport
  - Source-specific performance

Requirements for ‘Smarter’ Analysis

- **Accessible & Systematic methods**
- **Shared & auditable software e.g. ‘R’**
- **Case studies showing added value**
- **Software**
  - Data inspection
  - Statistics & trends
  - Plotting & reporting
- **Cases**
  - Decision support
  - Source performance
  - Intervention & policies
- **Uptake partnership: ‘developers’ & ‘users’**
- **Smarter Networks: AQ & Meteorology**

Conclusions (1): Benefits of 'Smarter' AQ Analysis



Conclusions (2): Beneficiaries

- Policy makers - Defra; EC
- Regulators - EA; LAs
- Industries - Steel; Power
- Planners - Roads; Airports
- Env. Groups - NGOs; Residents
- Public - Health; Life Quality

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