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Data mining: Use of historical Cabauw SF6 experiments

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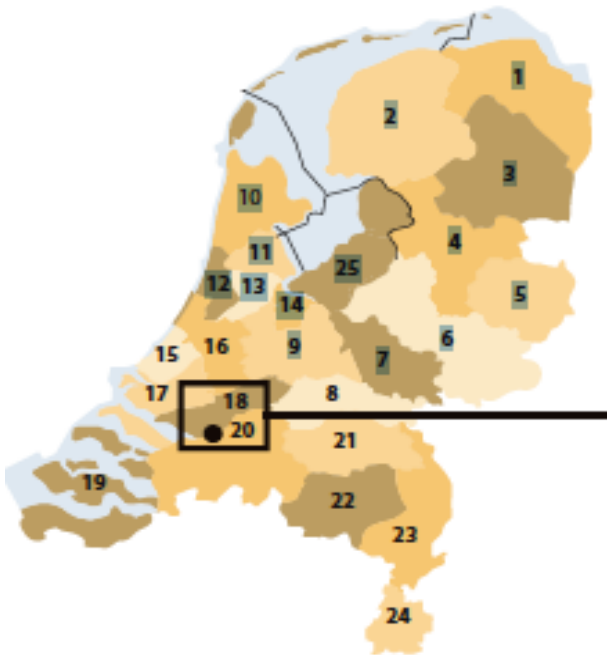
1. Why - Data mining Cabauw SF6 experiments
2. Method - establish confidence in observations
3. Method – compare with met.model
4. Conclusions

Trigger – Chemical accident near Rotterdam



Fire at chemical plant at Moerdijk januari 2011

- Effected area 0-80km
- Different governmental parties; cities, firebrigades, police, health, safety boards, ...
- Communication (and harmonisation) necessary



Trigger – long range; strong shear



The fire at chemical plant

- Effected area 0-80km
- Strong wind shear
- gap between short- and long-range models

→ Need for

- **A medium range dispersion forecast**
- **dynamically driven by high resolution weather forecast**



TNO (Nils Rosmuller, Hans Boot), RIVM (Eelke Kooi) and KNMI (Gertie Geertsema) investigated the options and specifications.

Trigger – validation necessary



Looking for validation sets at jsirwin.com website:

SF6 tracer experiments at Cabauw

For this purpose ideal:

- in the centre of the Netherlands
- Cabauw-Rotterdam: 35km



Data mining – Historical Cabauw SF6 experiments -- gertie (KNMI)

Confidence – Cabauw experiment overview



Investigation of usefulness and extension of observations showed:

- Extensive number of runs
- Experiments cover different weather regimes
- Two relevant release heights (80 and 200m)
- The data are still significant since the environment has hardly changed
- Concentration measurements at 3-5 km from the source



Confidence – data mining possible?



Is it possible to use the data? The data is not yet digitalized. Some data is difficult to read. But a pilot showed that it is possible to recover most of the information.

8.1
7.9
7.6
7.9

8.1
7.9
7.6
7.8 ?

RUN 1 (28 April 1977). Table 3

		time in GMT						
height in m	U	10.30	11.00	11.30	12.00	12.30	13.00	
		11.00	11.30	12.00	12.30	13.00	13.30	
200		7.5	8.3	7.8	7.4	7.8	8.1	
160		7.5	8.3	8.0	7.5	7.8	7.9	
120		7.3	8.1	8.0	7.4	7.6	7.6	
80		---	7.8	7.6	6.9	7.0	7.9	
40		6.8	7.5	7.2	6.5	6.4	6.1	
20		6.0	6.7	6.3	5.7	5.5	5.0	
10		5.6	6.2	5.8	5.2	5.0	4.5	
5		5.3	5.8	5.4	4.8	4.5	4.2	
1.5		4.1	4.7	4.3	3.9	3.5	3.3	

```
Terminal — bash
# run 1 (28 April 1977) Table 3 Time in GMT
#
# first row:      mdi      h[m]
# volgende rijen: hh:mm [GMT] ff[m/s]
99  200 160 120 80 40 20 10 5 1.5
10:30 7.5 7.5 7.3 99. 6.8 6.0 5.6 5.3 4.1
11:00 8.3 8.3 8.1 7.8 7.5 6.7 6.2 5.8 4.7
11:30 7.8 8.0 8.0 7.6 7.2 6.3 5.8 5.4 4.3
12:00 7.4 7.5 7.4 6.9 6.5 5.7 5.2 4.8 3.9
12:30 7.8 7.8 7.6 7.0 6.4 5.5 5.0 4.5 3.5
13:00 8.1 7.9 7.6 7.8 6.1 5.0 4.5 4.2 3.3
```

Compare obs and meteorological model



For the first experiment (called Run 1 in the original document) we¹ have reconstructed the weather situation using the mesoscale numerical weather prediction model Harmonie².

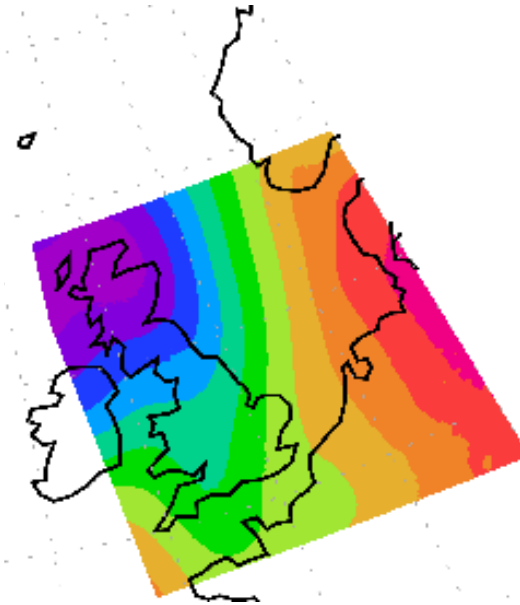
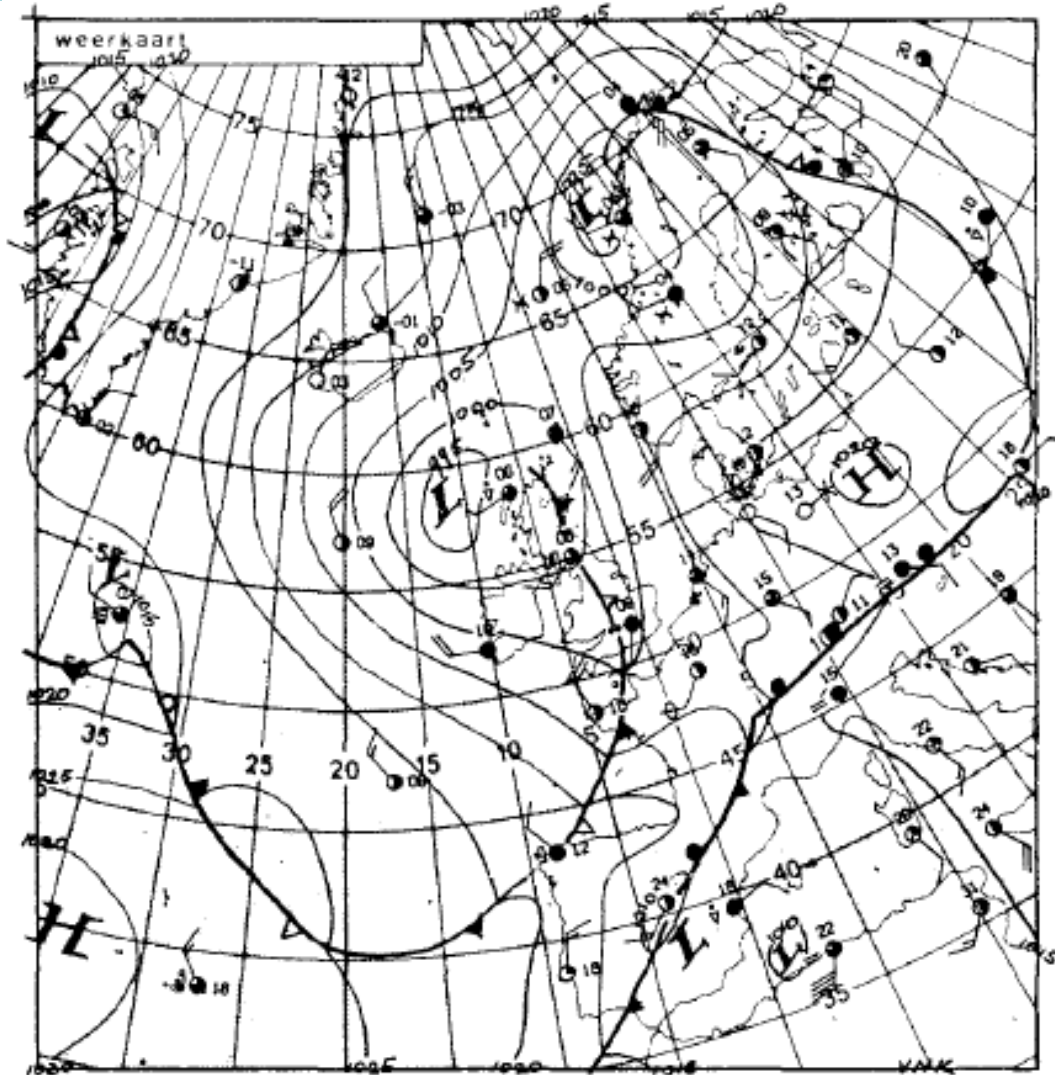
run 1 characteristics:

- 28 April 1977
- @10:47 GMT
 - Ps 1010.8 hPa
 - Humidity 53%
- @12:52 GMT
 - Ps 1009.0 hPa
 - Humidity 53%
- Windspeed: 5-8m/s
- Winddir: 140-160 deg
- Temp: 10-13 Celsius

¹ Gertie Geertsema & Henk van den Brink (KNMI)

² more information on Harmonie see website hirlam.org

Compare – obs and met.model



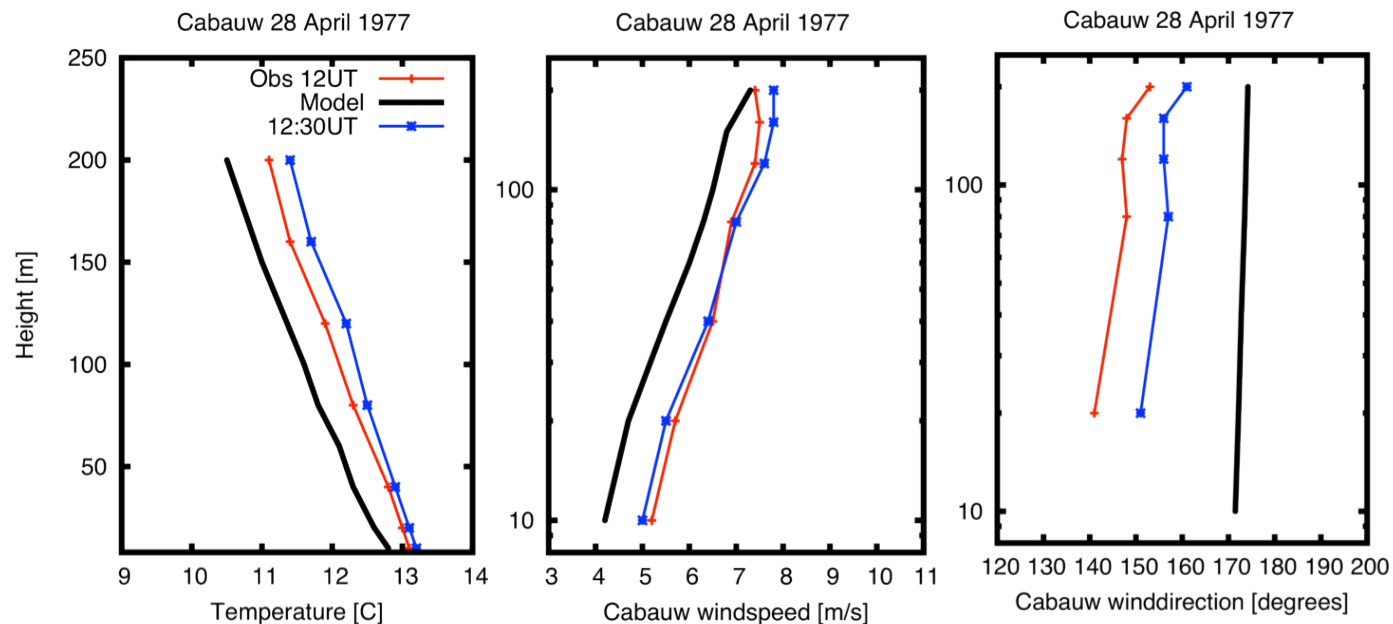
Left the original weather chart,
Right surface pressure as
reconstructed using Harmonie

Compare – obs and met.model



- Comparison model versus observations shows
- Temperature : underestimation appr .5-1 degree
 - Windspeed: underestimation appr .5-1 m/s
 - winddirection is off by appr 20-30 degrees

But as can be seen in slide 7 the temporal variation is large. Therefore it can be concluded that these are promising results.



Conclusion Cabauw SF6 1977-1978



- It is interesting to “refurbish” historical tracer experiments
- Cabauw SF6 is a well documented experiment
- SF6 is a greenhouse gas, use should be avoided if possible
- Reconstruction of weather using mesoscale model Harmonie is tested for run1 and shows promising results.