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Impact analysis of local atmospheric dynamics to pollution transport and dispersion in urbanized coastal zone*

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*International Conference and Early Career Scientists School on Environmental Observations, Modeling and Information Systems , Irkutsk , June 24 - July 2, 2012

Plan of the talk

- Region of Dunkirk
- Measurement campaign BTEX 2006
- Numerical model set-up
- Simulations with different resolutions
- Backward trajectories
- Prespectives and conclusions

Campaign BTEX 2006

Volatile organic compounds (VOC) :

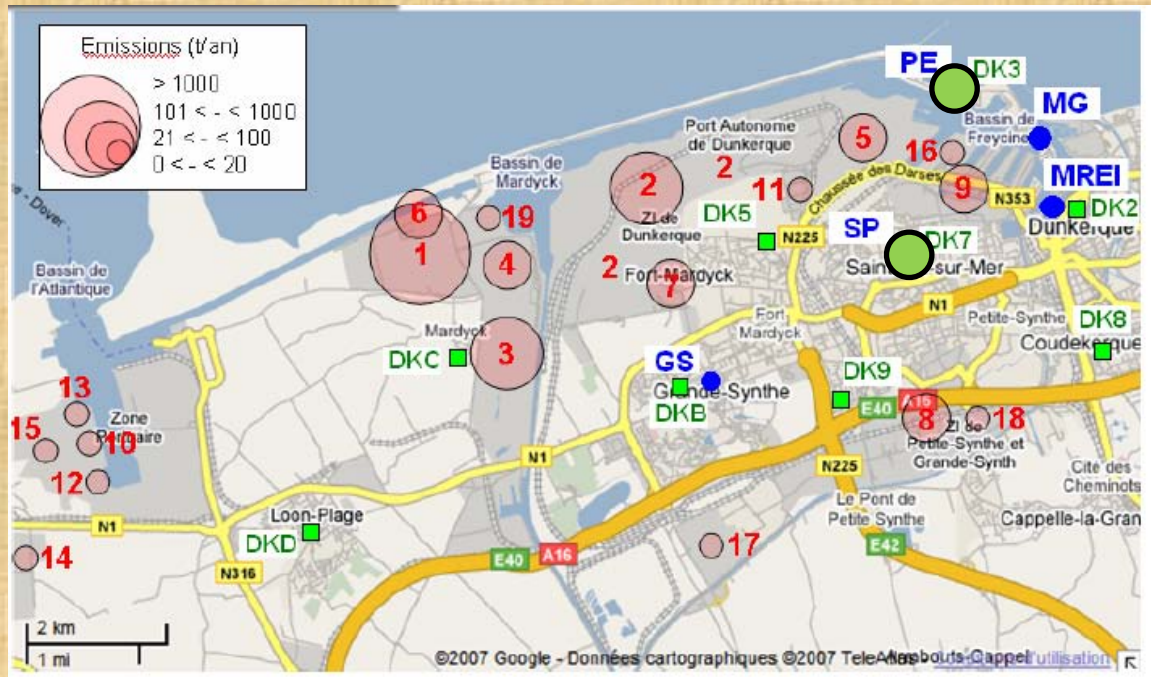
- benzene
- toluene
- ethylbenzine
- m/p xylene
- o xylene

Measurements:

- at 5 stations
- each 15 min
- from February till October

Principal sources:

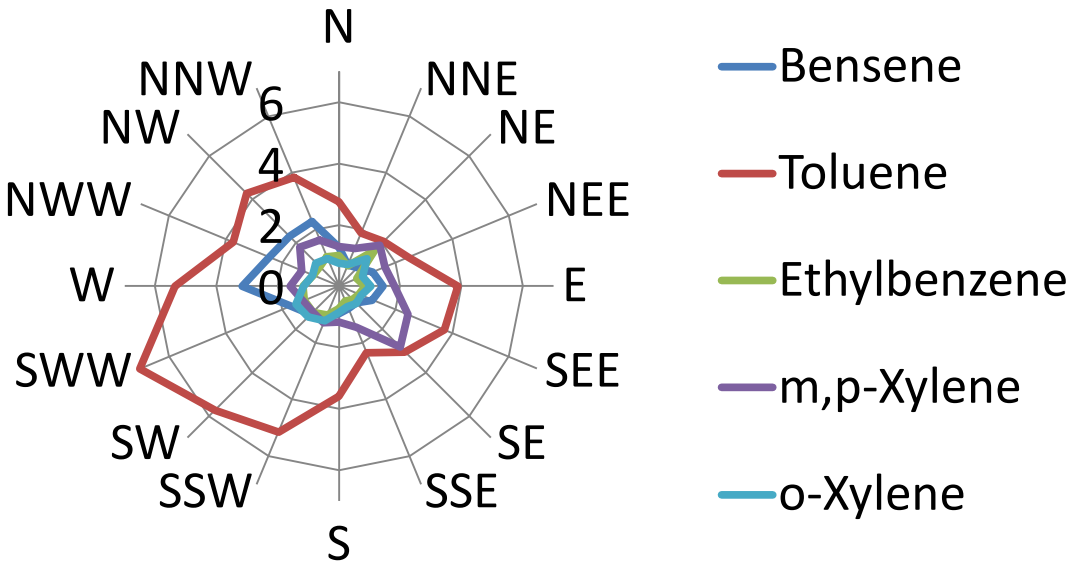
- Industry – 36%
- Transport – 32%
- Residential - 20 %
- Energy production - 7%
- Agriculture – 5%



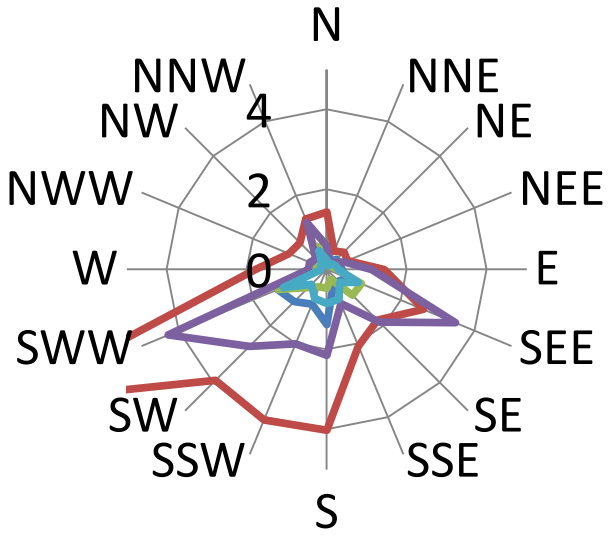
Characterization of air mass

- age - by concentration ratio, e.g. C(Bz)/C(Tl)
- signature of an industry (also by ratio)
- localization - by simultaneous peaks of pollution
- pollution + windrose:

St Pol



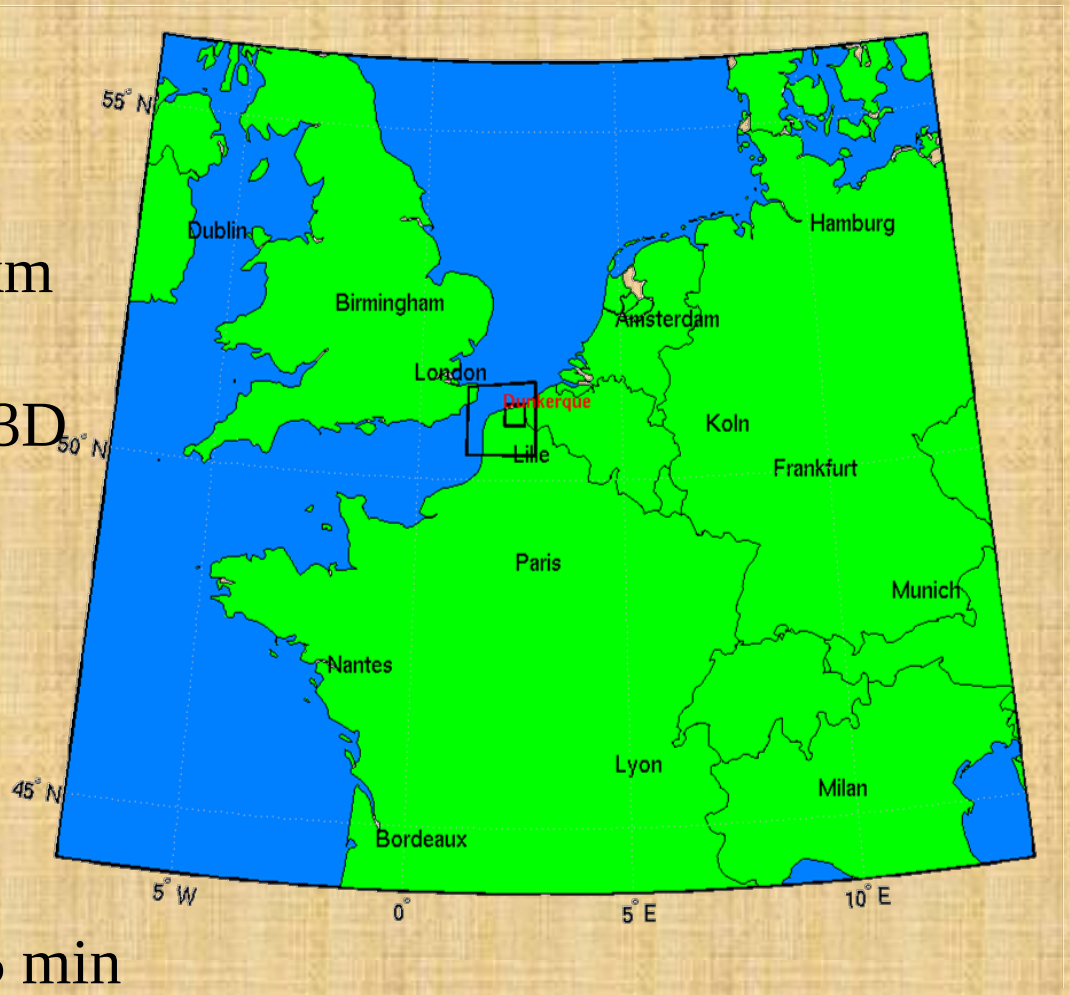
Port Est



Numerical model set-up

MESO-NH non-hydrostatic model
3 included models –
•Model 1 1500x1500km, 10km
•Model 2 120x120km, 2 km
•Model 3 35x35km, 0.5 km, 3D turbulence scheme
•Z: 70 levels up to 12 km.

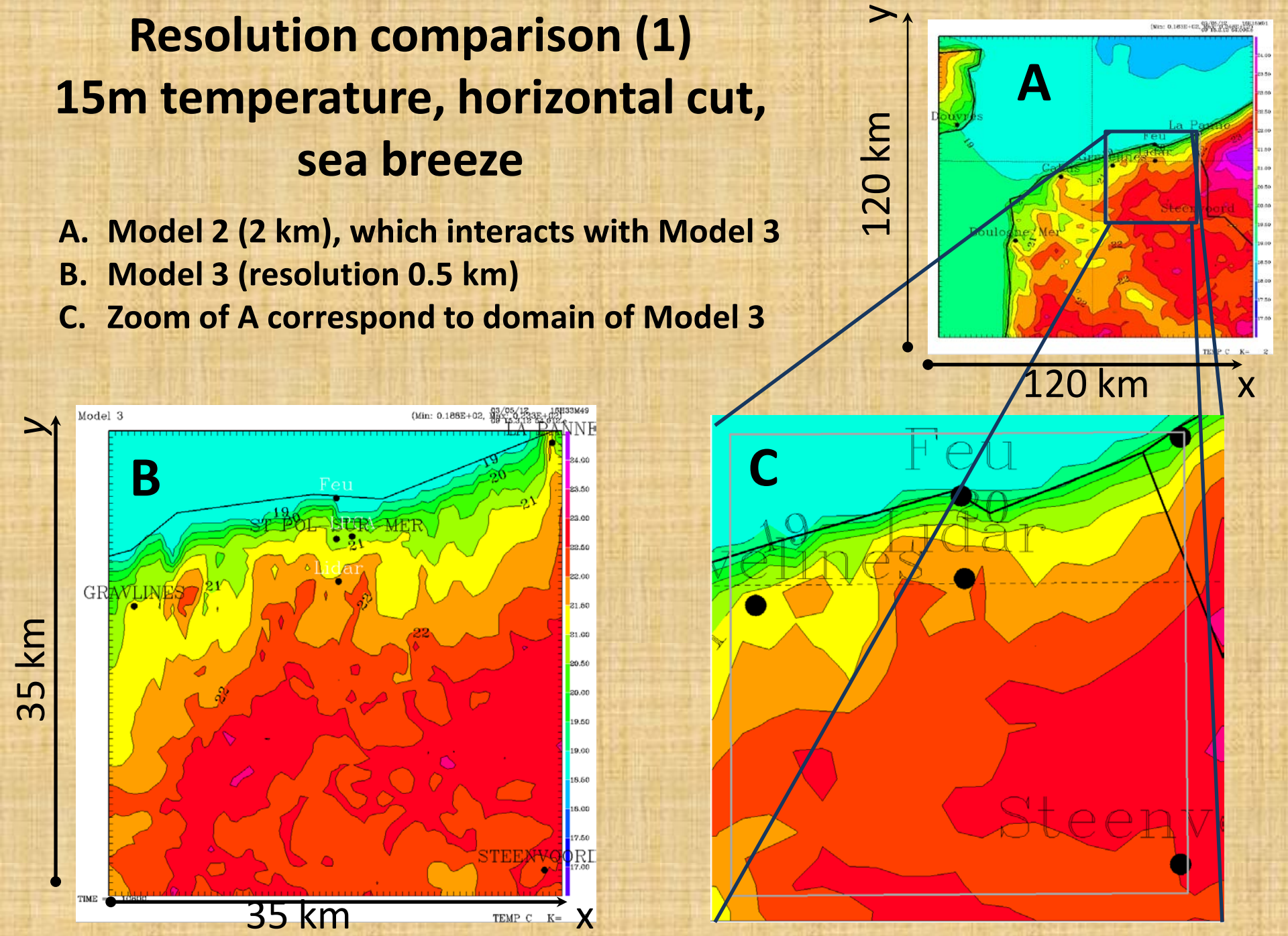
SURFEX surface scheme**,** resolution 0.5 km in Europe



Two week period in June, 15 min

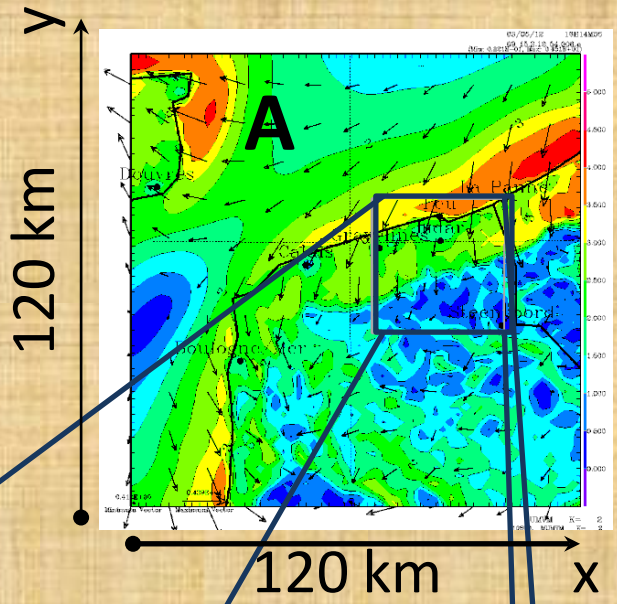
Resolution comparison (1)
15m temperature, horizontal cut, sea breeze

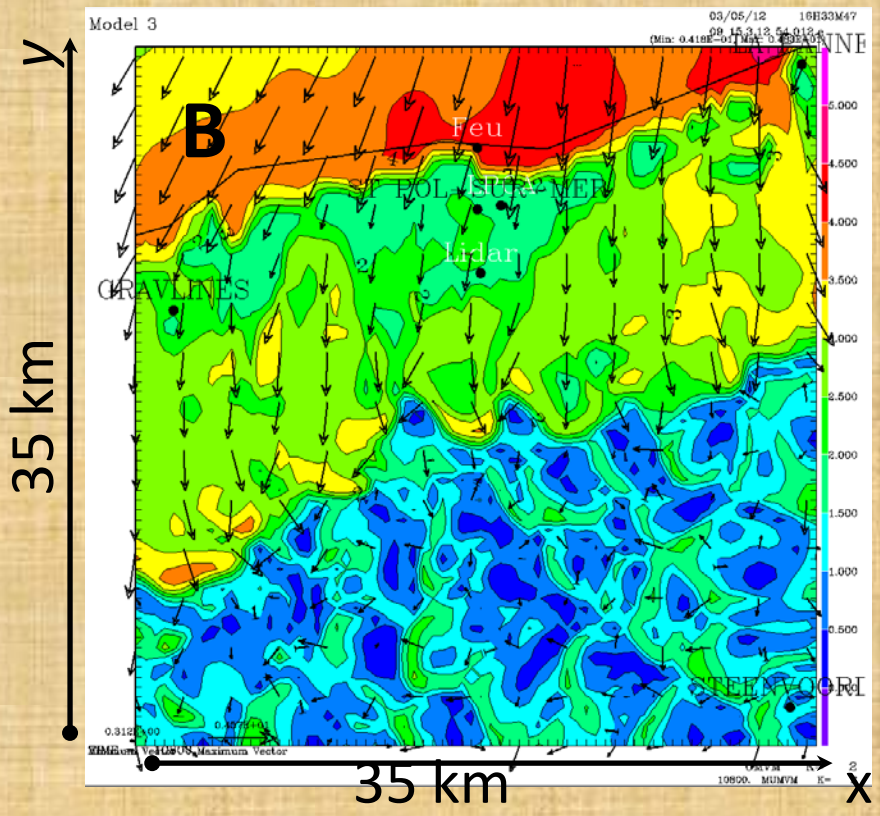
A. Model 2 (2 km), which interacts with Model 3
B. Model 3 (resolution 0.5 km)
C. Zoom of A correspond to domain of Model 3

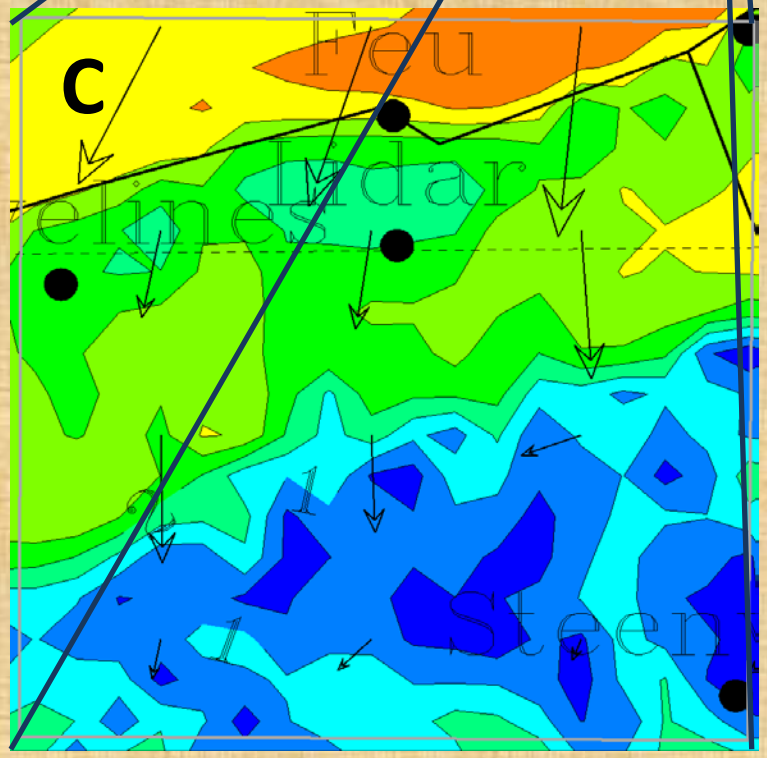


Resolution comparison (2)
15m wind speed, horizontal cut, sea breeze

A. Model 2 (2 km), which interacts with Model 3
B. Model 3 (resolution 0.5 km)
C. Zoom of A correspond to domain of Model 3

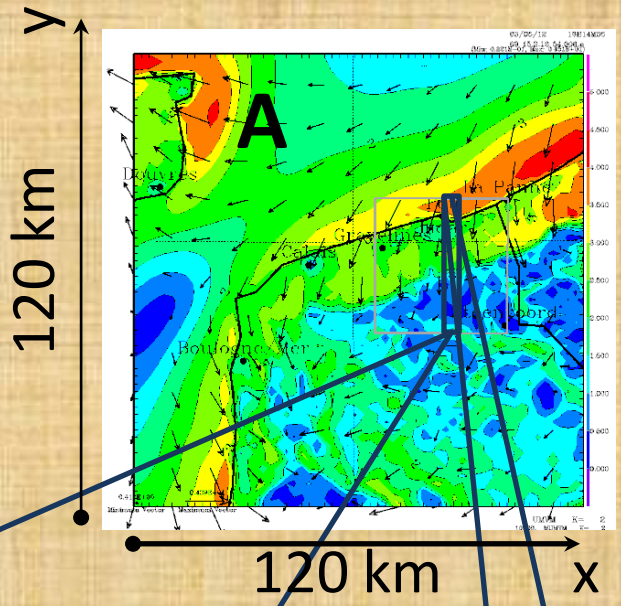


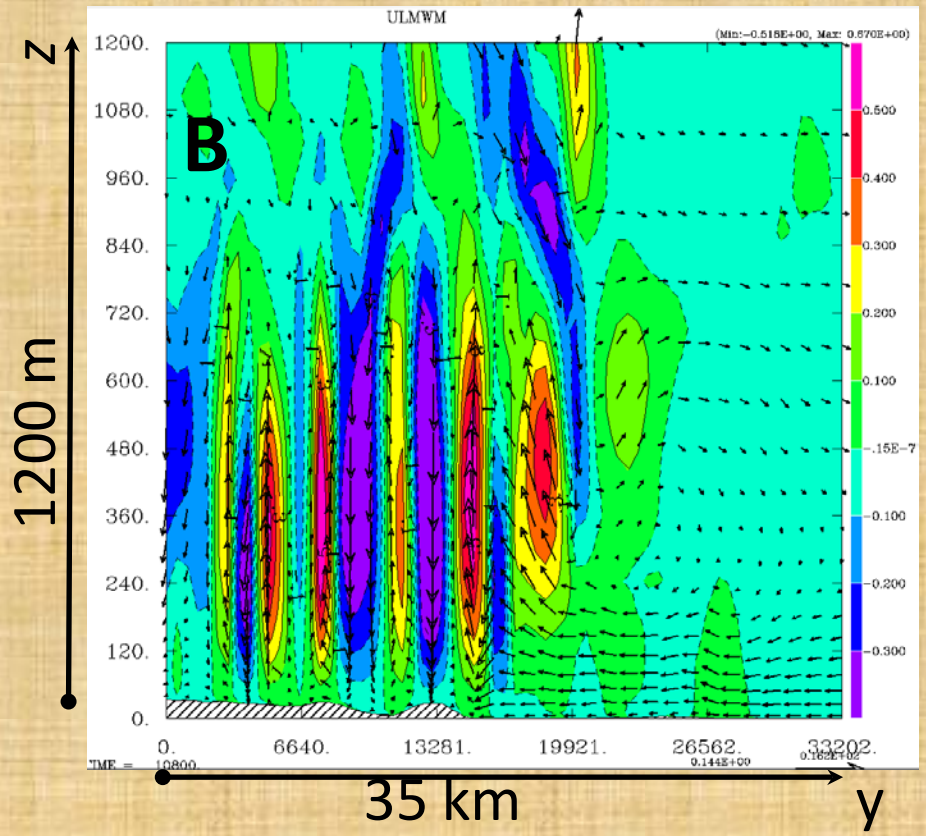


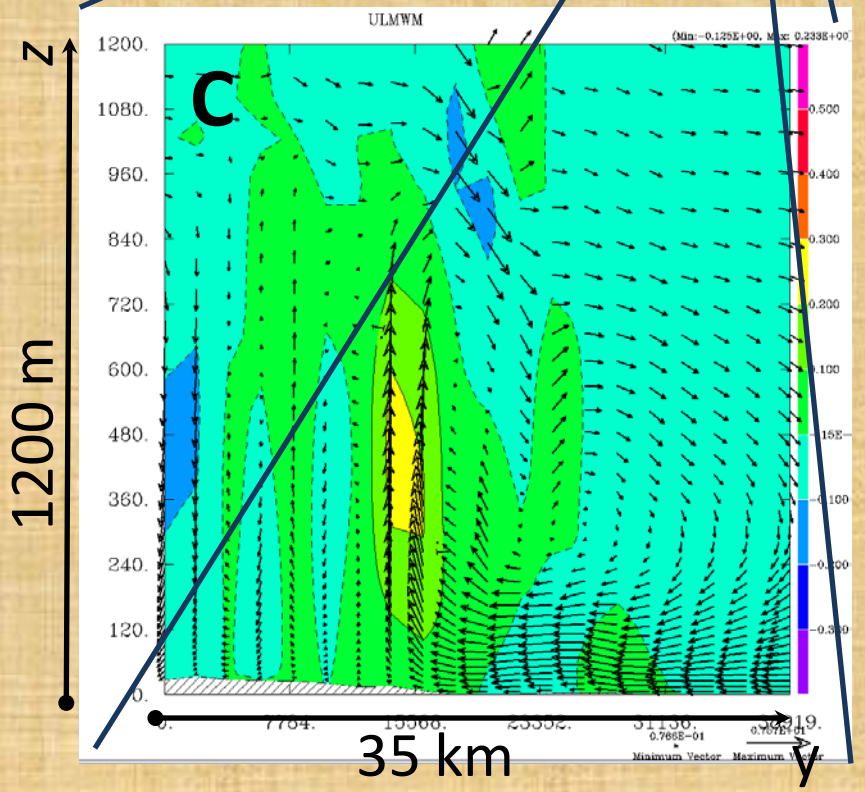


Resolution comparison (3) wind speed, vertical YZ cut (B, C) , sea breeze

A. Model 2 (2 km), which interacts with Model 3 (horizontal cut, 15 m)
B. Model 3 (resolution 0.5 km)
C. Zoom of A correspond to domain of Model 3



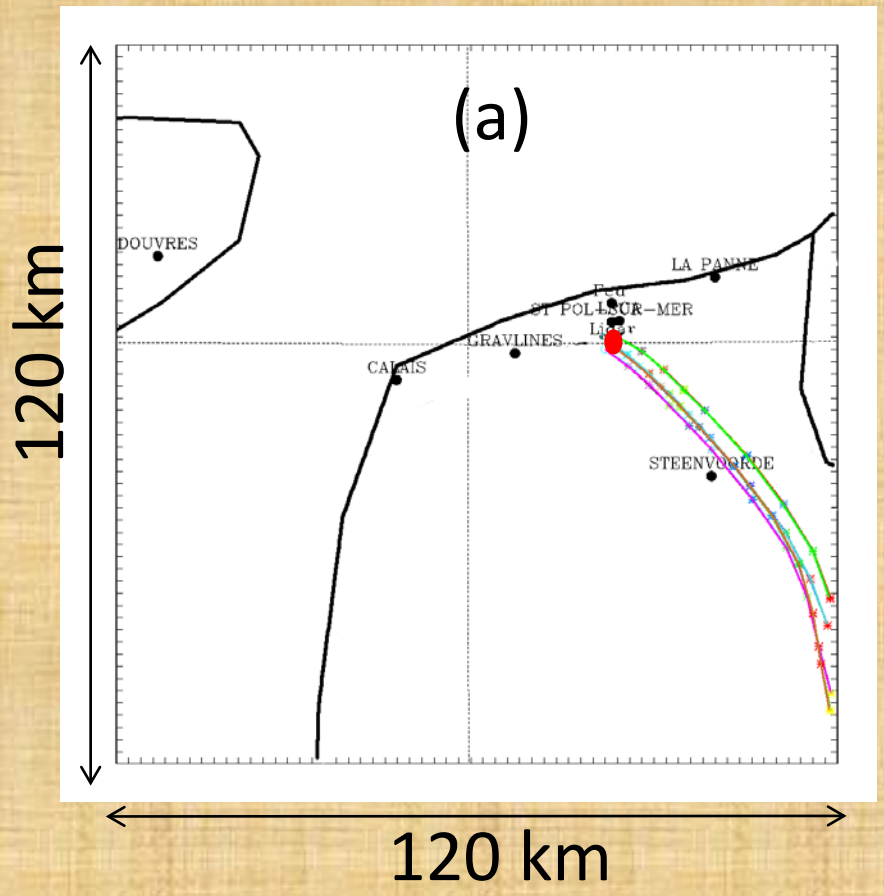


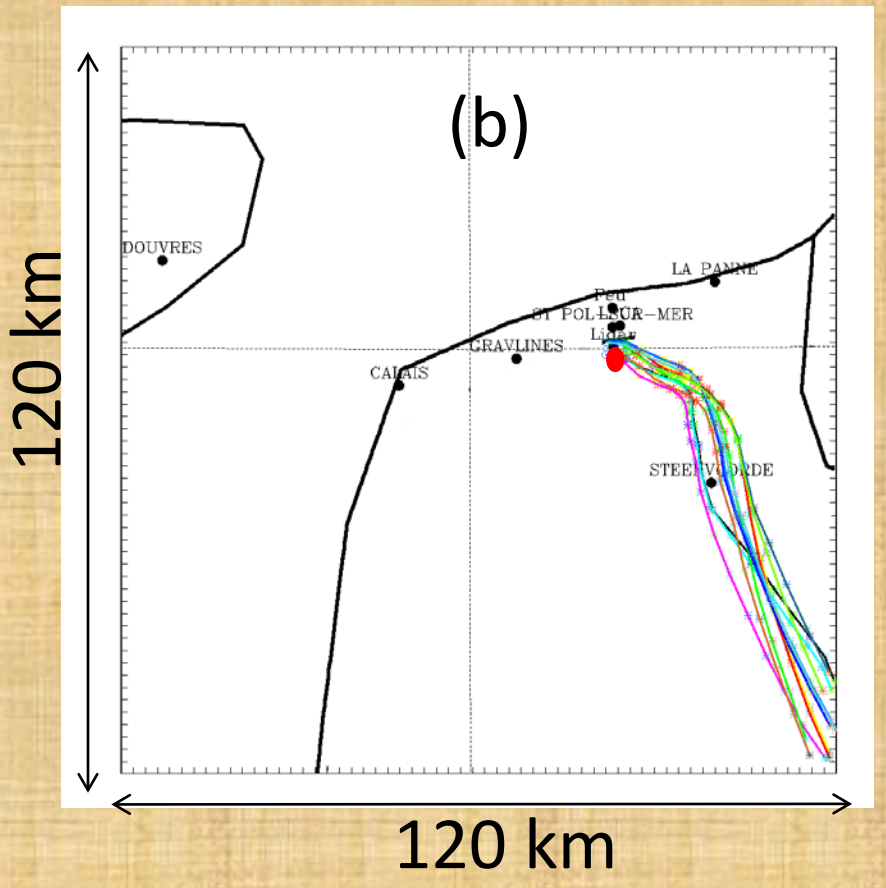


Backward trajectories in horizontal (XY) plane

(a) 9 June 12:00 - low pollution

(b) 13 June 6:00 - high pollution

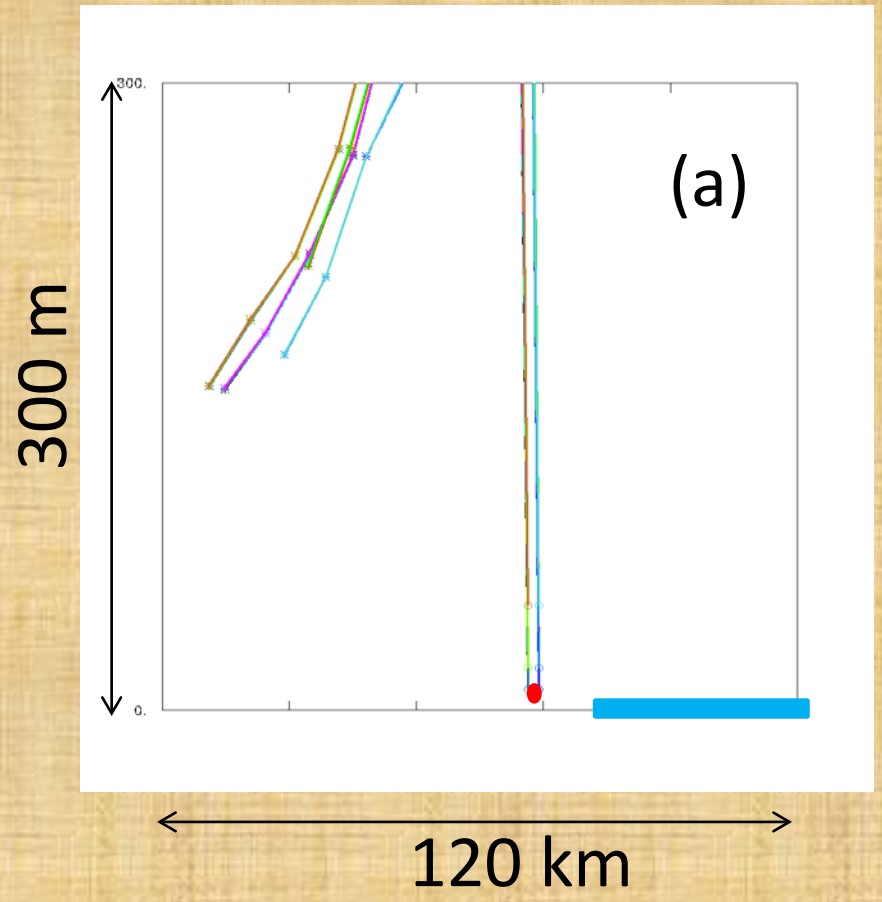


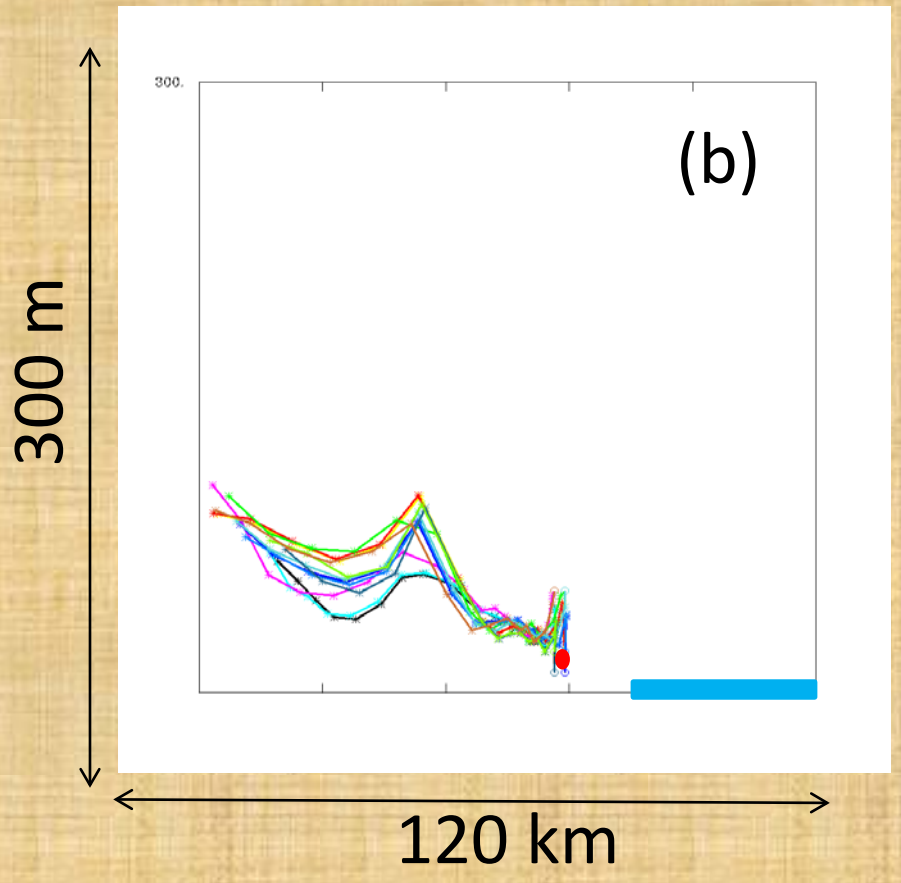


Backward trajectories in vertical (YZ) plane

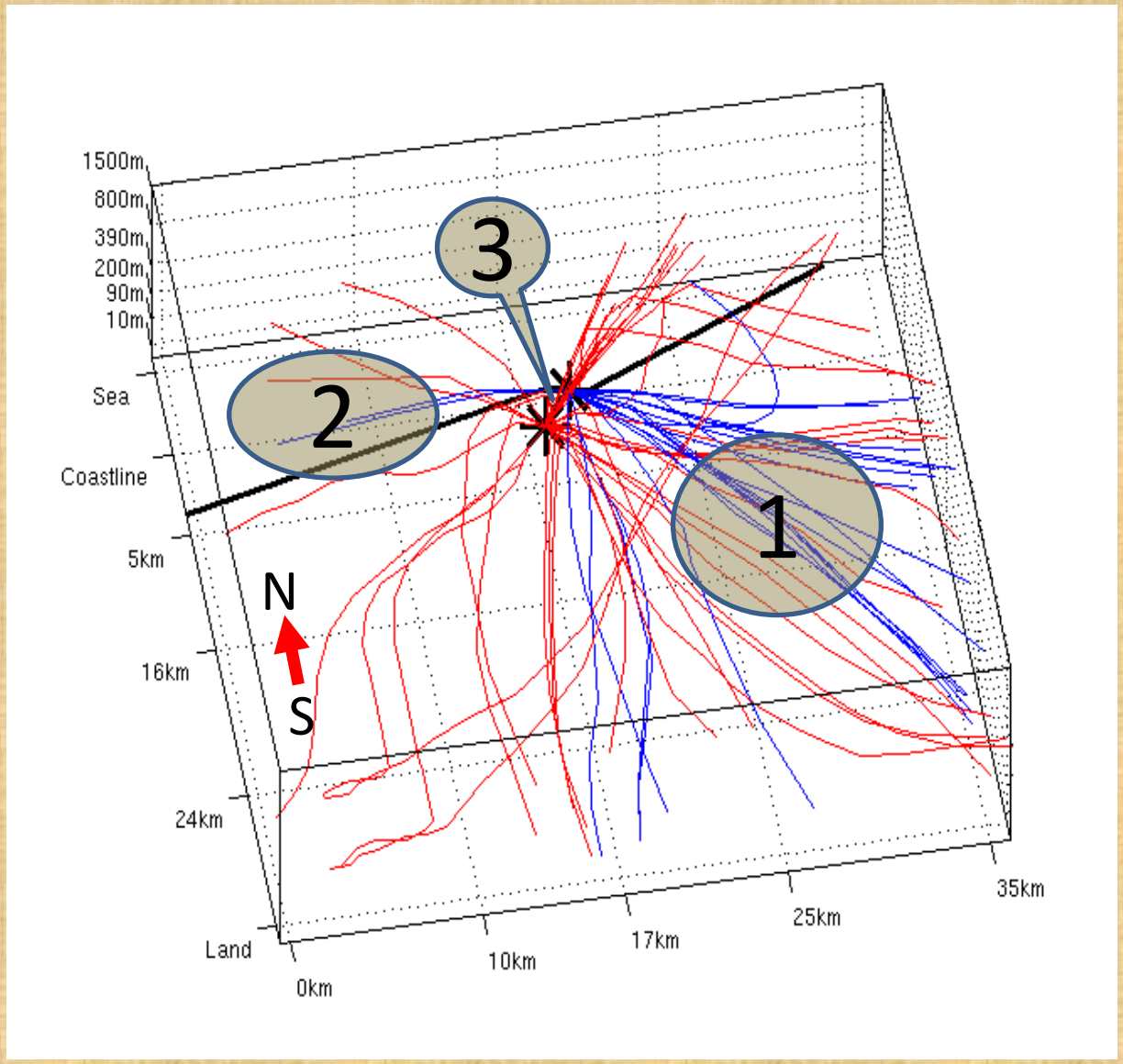
(a) 9 June 12:00 - low pollution

(b) 13 June 6:00 - high pollution





Backward trajectories, C(o-Xylene) > 2 µg/m^{-3}



1. Transport pollution[(a)]
2. Industrial pollution[(a)]
3. Port pollution[(b)]

a. « Non-local » pollution

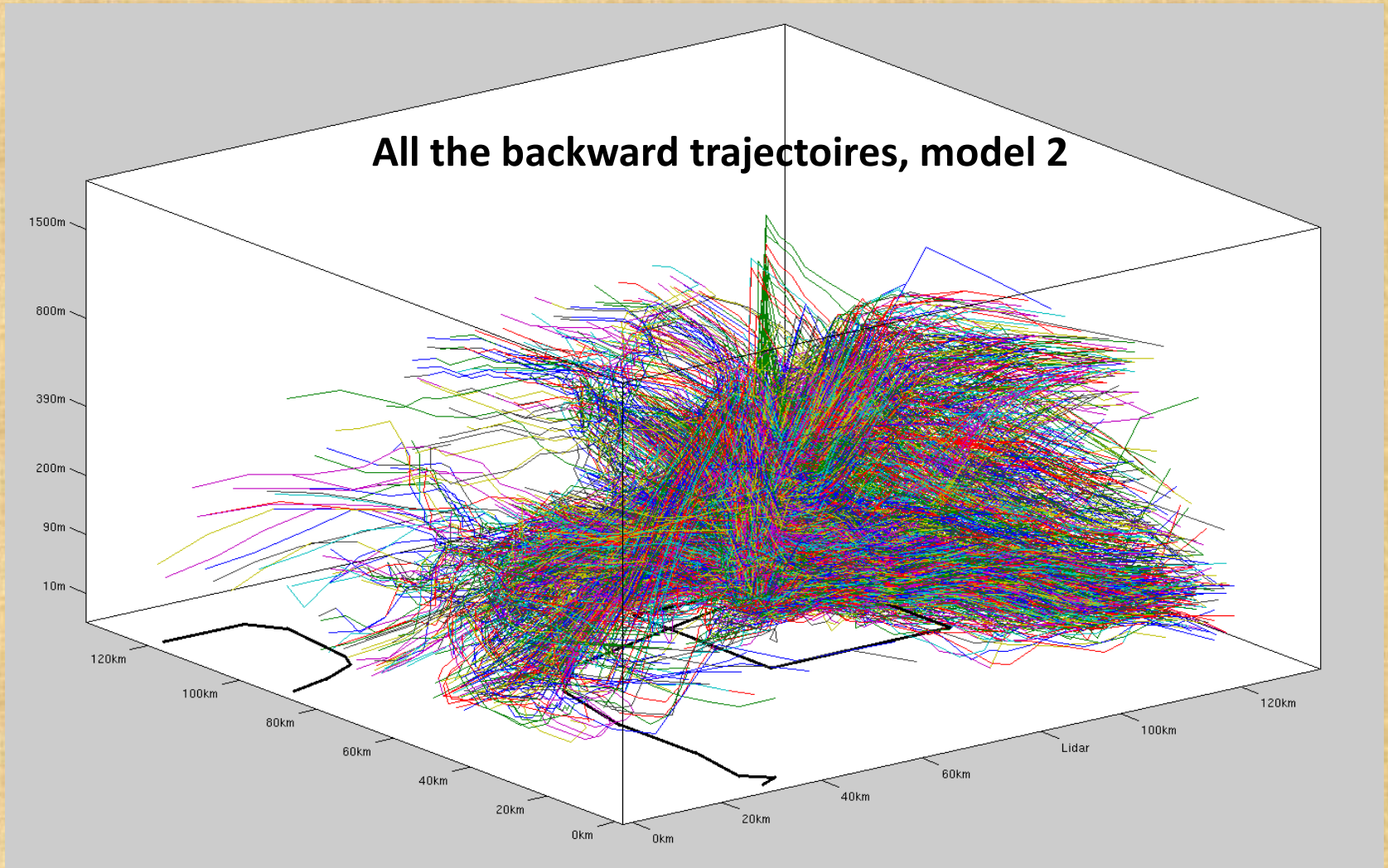
b. « Local » pollution

Conclusions

- COV measurements are coupled with model backward terajectorys
- Fine resolution is important
- Key role of local atmospheric dynamics (sea and offshore breezes)

Perspectives

- Cluster analysis
- Map of regional pollution
- Additional chemical tracers



Thank you for your attention!..)

Trajectoires and centroids (k-means)