



City emissions: Similarities and Differences focusing on PM

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Few words on City Delta

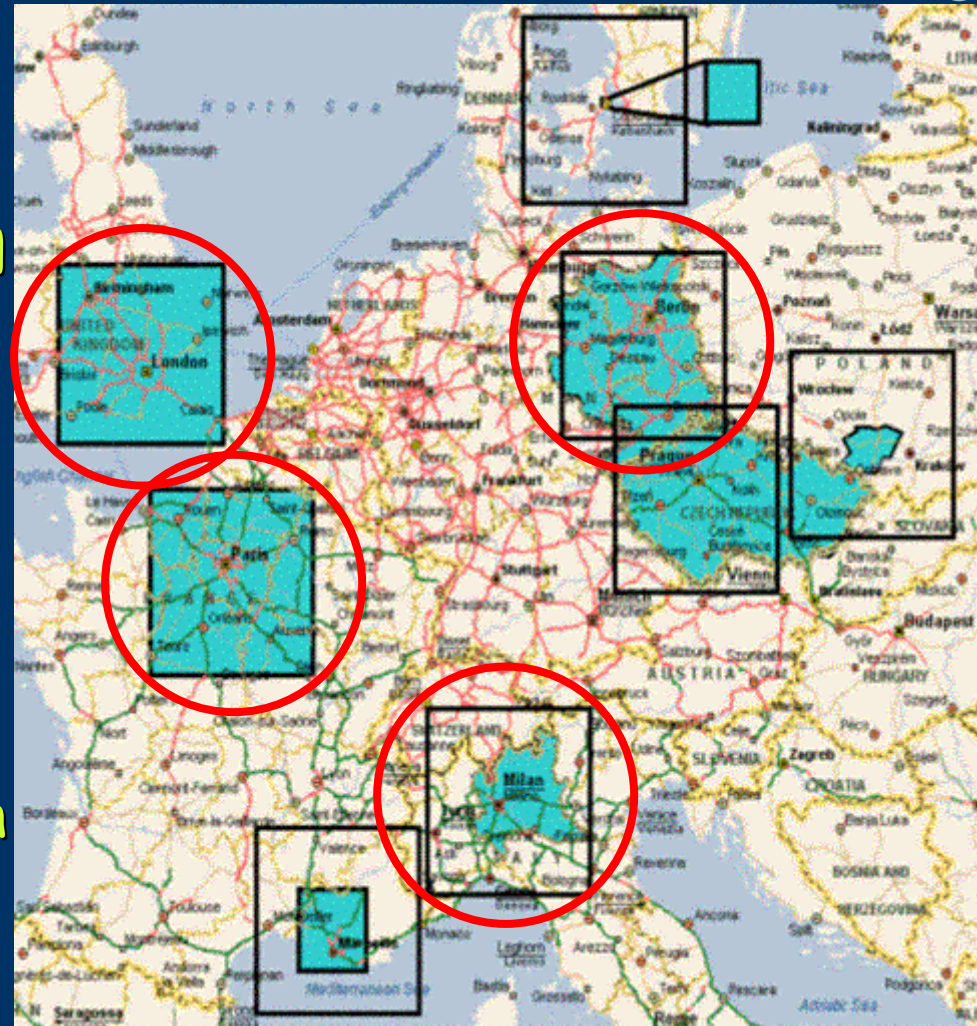
<http://rea.ei.jrc.it/netshare/thunis/citydelta/>

City Delta is an inter-comparison of long-term model responses to urban-scale emission-reduction scenarios, within the CAFE program (Clean Air for Europe) managed by JRC-IES, EMEP, IIASA and EUROTRAC. The aim is to calculate the "delta" between actual and future urban air quality levels (and their uncertainties) predicted by different dispersion models, focusing on actual and future levels of particular matter and ozone in eight European cities.

Moreover it should assist air-quality managers to quantify the air pollution contribution of regional versus local sources, to identify the most effective emission controls and provide quantitative information in relation to legal obligations, e.g. whether a certain trend in emissions will achieve air quality limit values on concentrations.

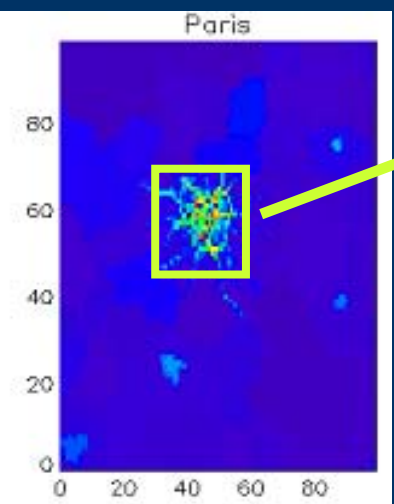
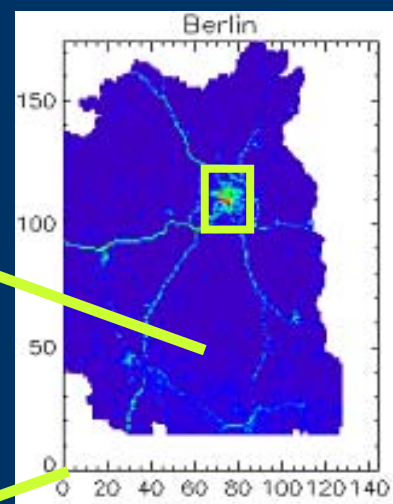
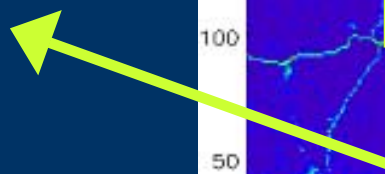
Four cities inventory comparison

Four City Delta cities:
MILAN, PARIS, BERLIN
and **LONDON** both local
(city) and national (EMEP)
emission inventories have
been compared and
analyzed focusing on PM
emissions. A special
acknowledgment is due to
all city and EMEP emission
inventory managers.

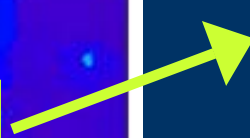


Four cities inventory domains

Local Domain

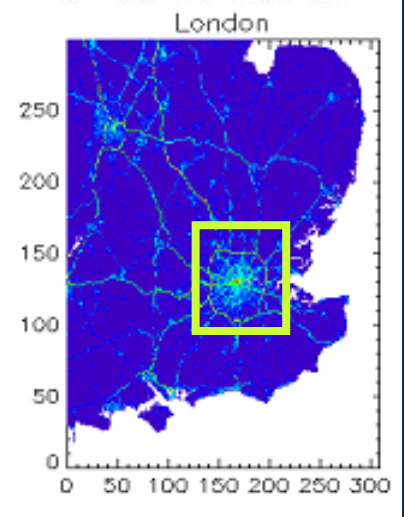
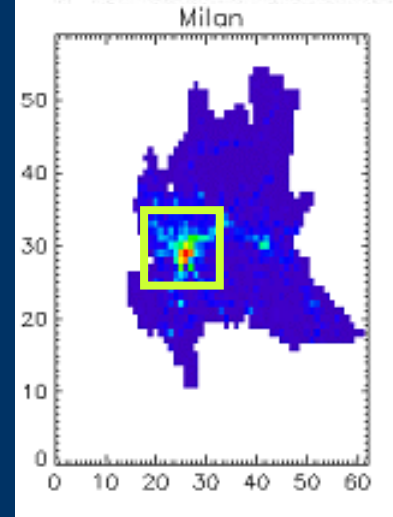


City Centre domain



NO_x
traffic
emissions

300x300 Km²
Model Domain





Four cities inventory: general information

		Milan	Berlin	London	Paris
Inventory information	Year	1997	1995 - 1999	1998	1998 (except area source, 1994)
	Gas-phase pollutant	6 (CO, NO _x , SO ₂ , NH ₃ , NMVOC, CH ₄)	5 (CO, SO ₂ , NO _x , CH ₄ , NMVOC)	5 (NO _x , NMVOC, CO, SO ₂)	6 (CO, NO _x , SO ₂ , NH ₃ , NMVOC, CH ₄)
	PM-phase pollutant	10 - 2.5	10 - 2.5	10	10 - 2.5
	Activity nomenclatures (SNAP, NAEI...)	11 SNAP sectors	5 SNAP sectors (Industrial combustion, non combustion processes, residential combustion, public power plants, road traffic, other traffic)	10 SNAP sectors (except for biogenic)	High stationary sources, low stationary sources, traffic
	Spatial dimension ¹	Regional 27.000 km ²	Regional 61.500 km ²	Squared 93.000 km ²	Squared 90.000 km ²
	Spatial resolution	5 km + point sources	2 km + point sources	1 km + point sources	3 km

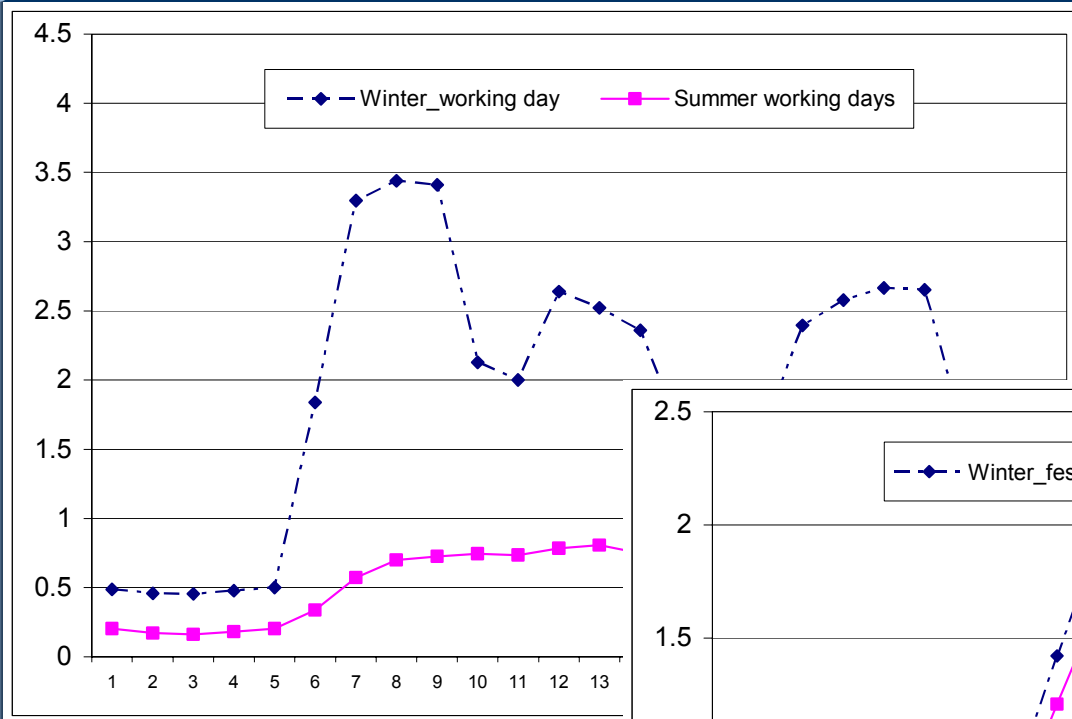


Four cities inventory: temporal disaggregation

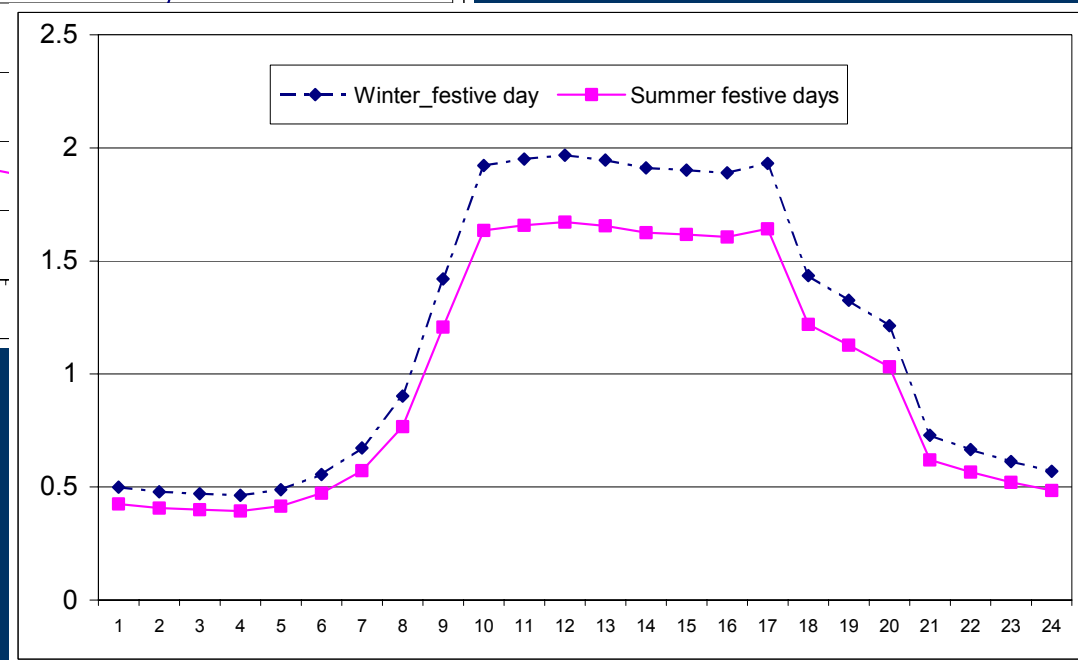
		Milan	Berlin	London	Paris
Temporal disaggregation	Number of source sector analyzed	11	11+1 activity	2 (human - biogenic)	-
	Type of variability factors analyzed (season, month, day type, pollutant, climatic class...)	4 seasons, 3 day-types, 7 pollutants, 3 climatic classes 24 hours	12 months, 7 days, 24 hours	12 months, 7 days, 24 hours, 4 pollutants	6 months, 3 day-types
	Number of theoretical independent daily profiles	2772	12	5 (4 pollutant + biogeniche)	1-
	Number of different profiles including dependent	2772	1008	420	18



Four cities inventory: temporal profiles



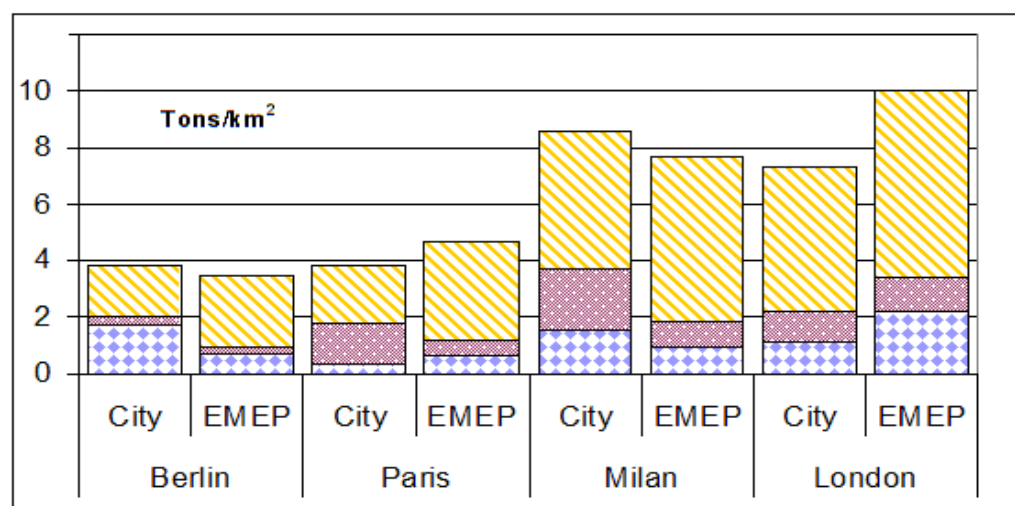
MILAN:
SNAP 2



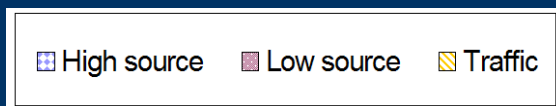
LONDON:
SNAP 2



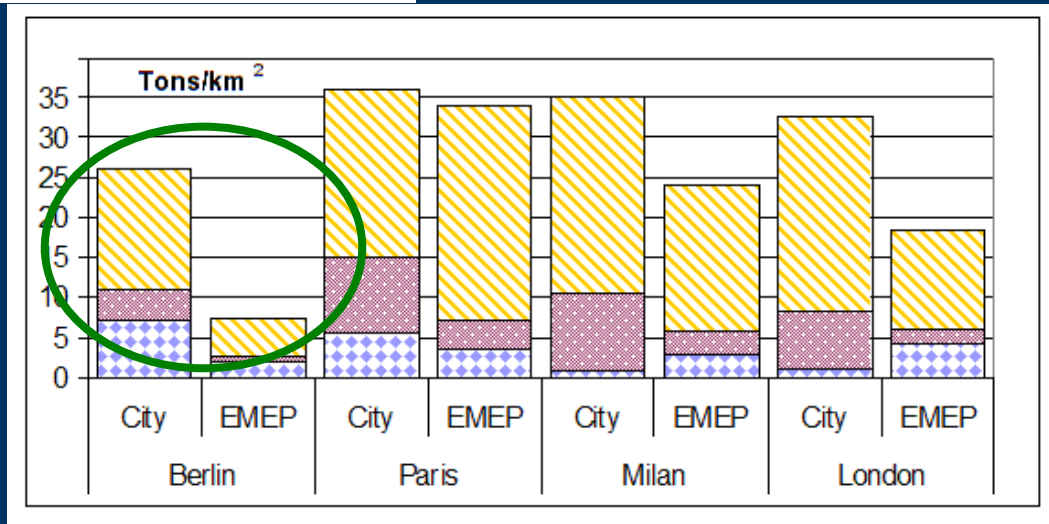
City Delta NO_x Emission Densities: City vs EMEP inventory



Emission densities
whole local domain

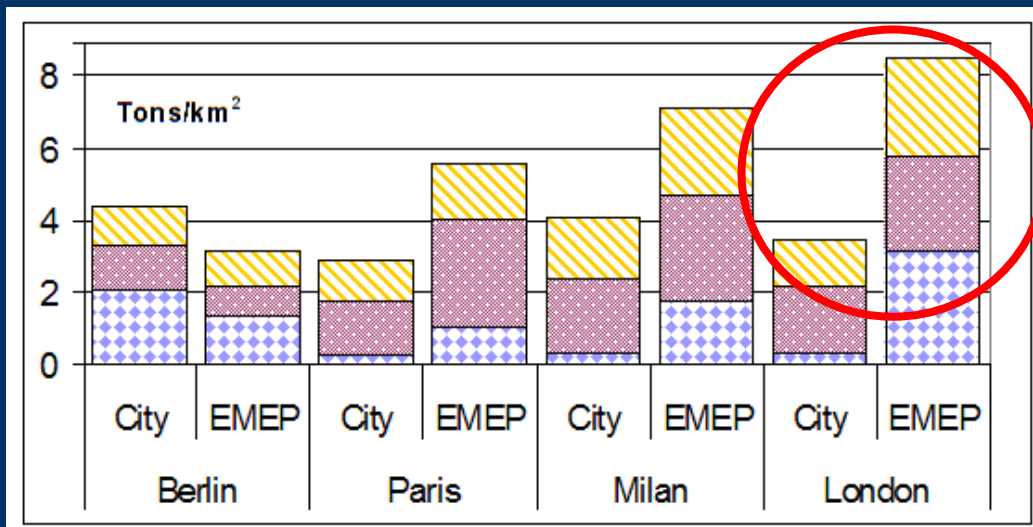


Emission densities
city centre

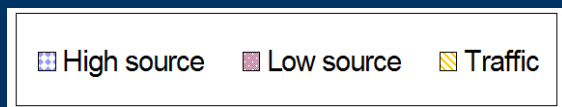




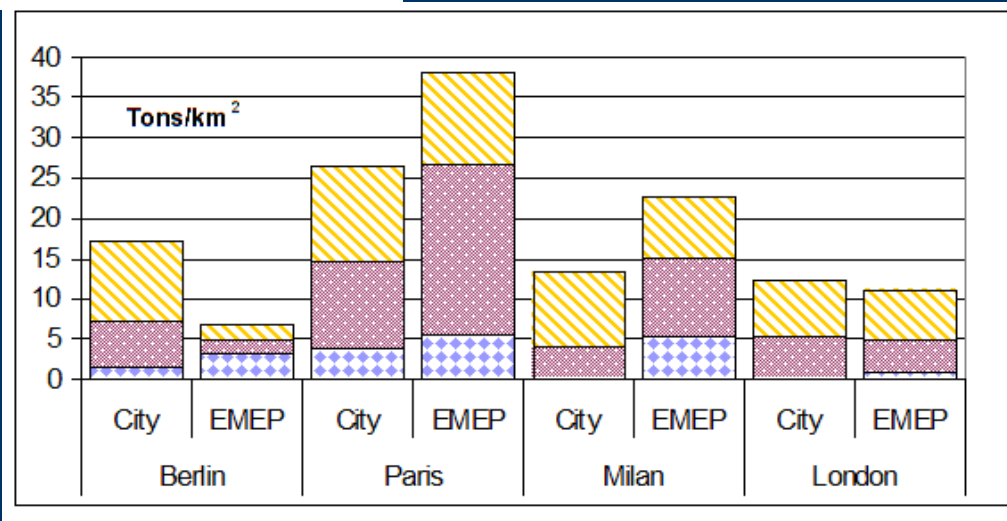
City Delta PM Emission Densities: City vs EMEP inventory



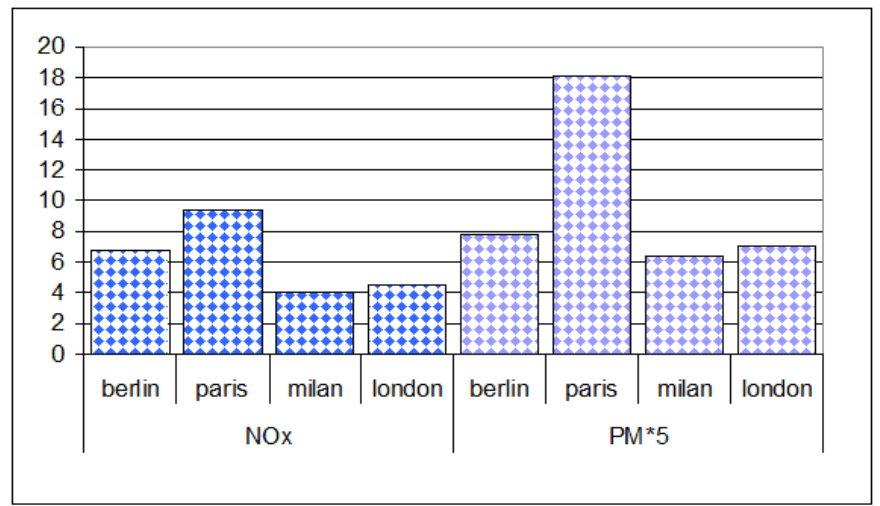
Emission densities
whole local domain



Emission densities
city centre

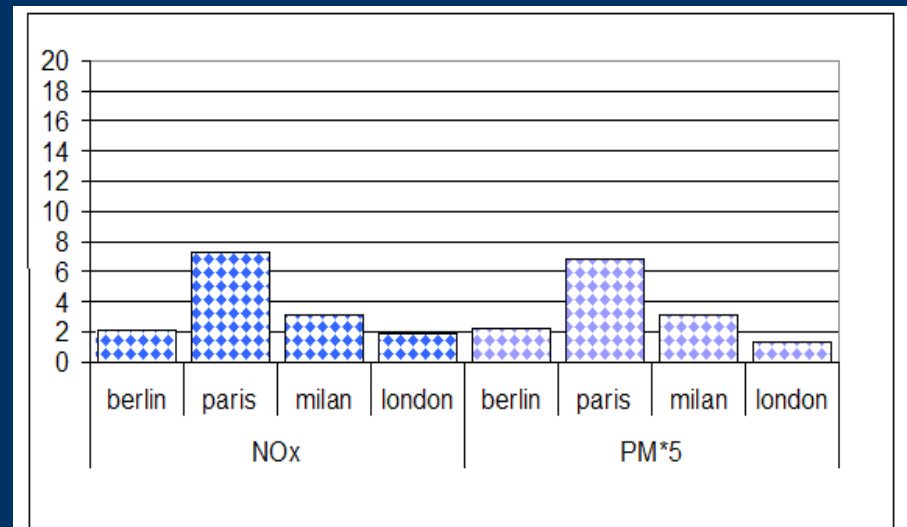


Emission density ratio: city centre/local domain



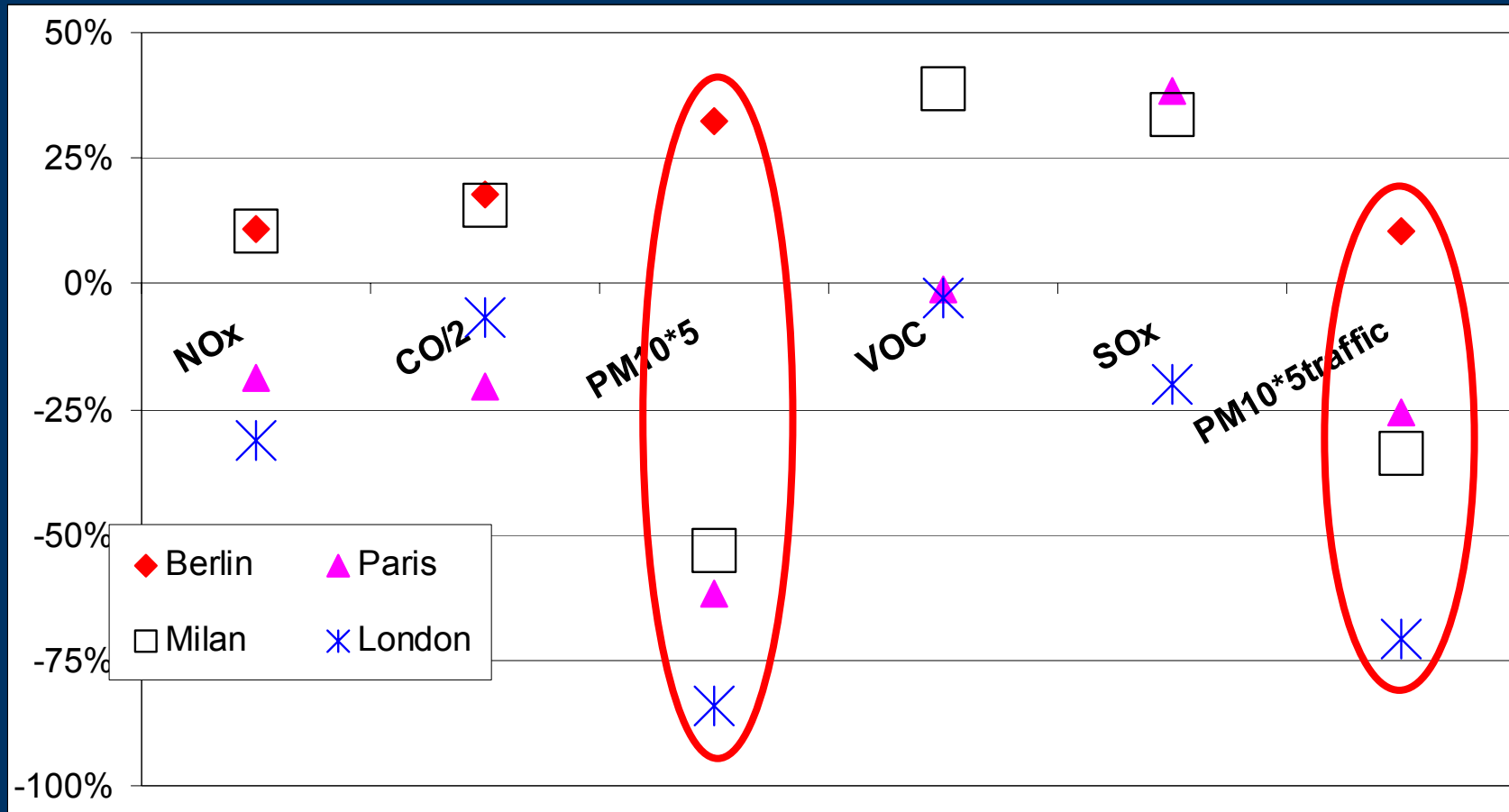
Local city centre /
whole domain
emission densities

EMEP city centre
/ whole domain
emission densities



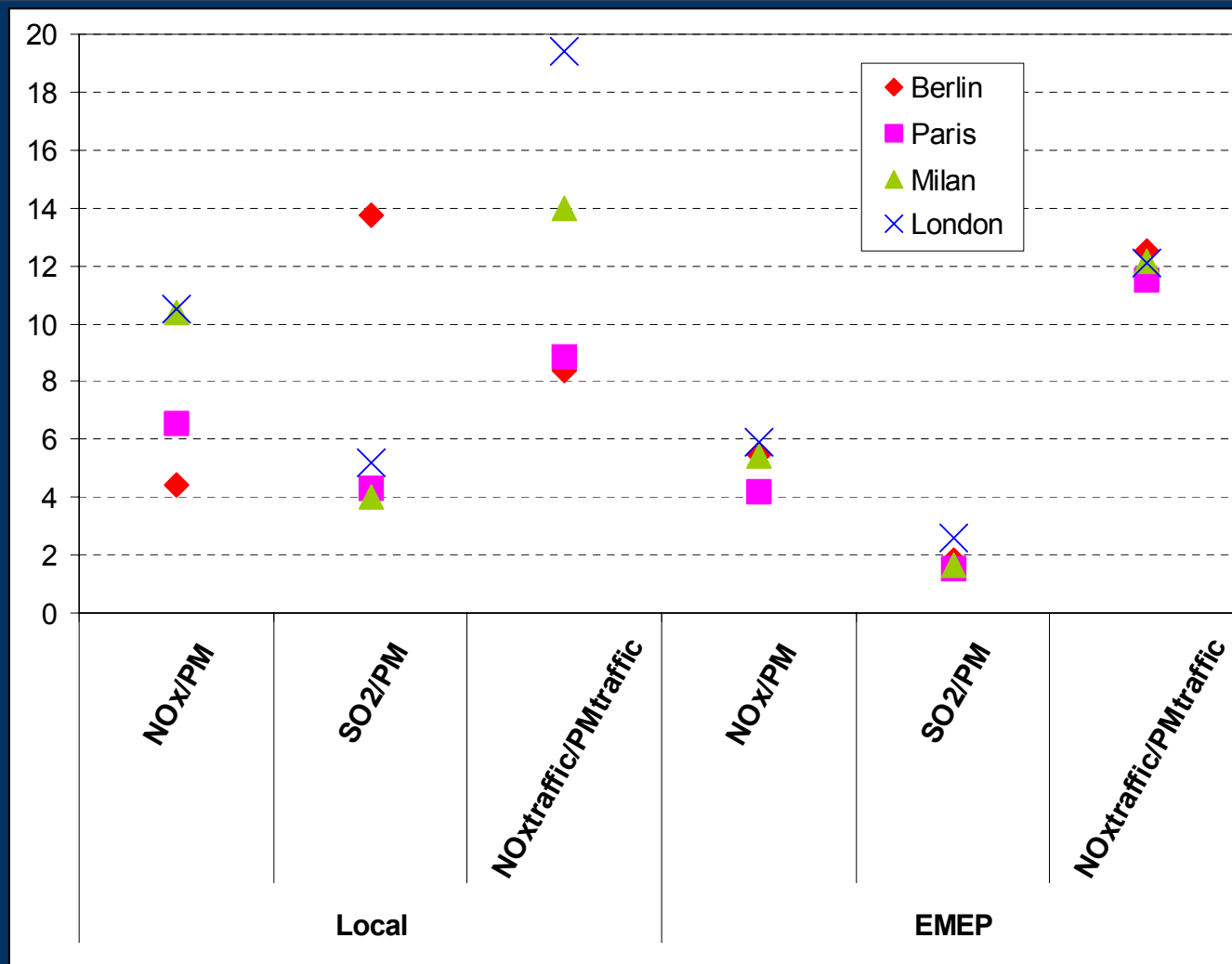


Local vs national inventory on local domain: percent difference

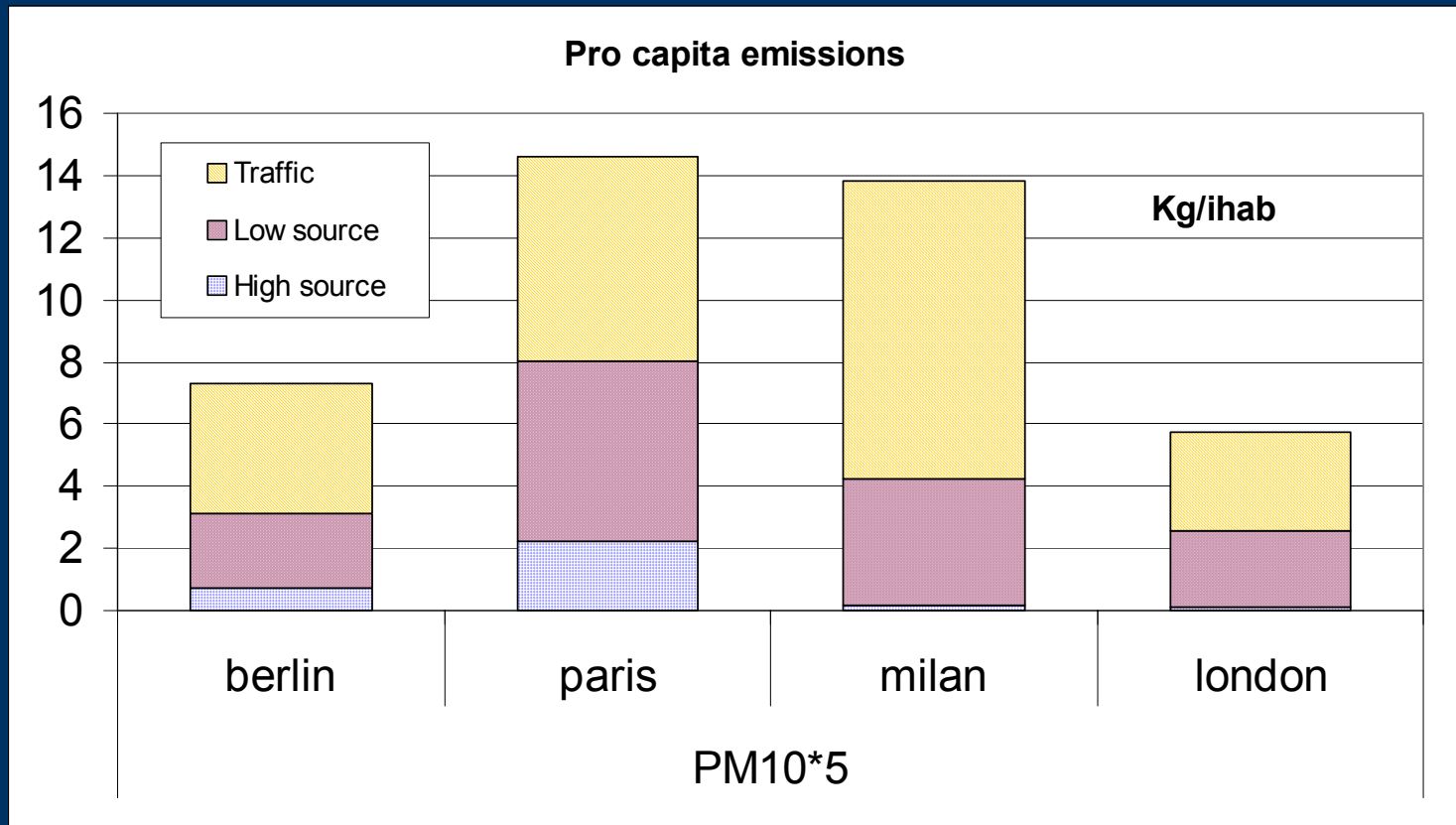




Local vs national inventory on local domain: emission ratios

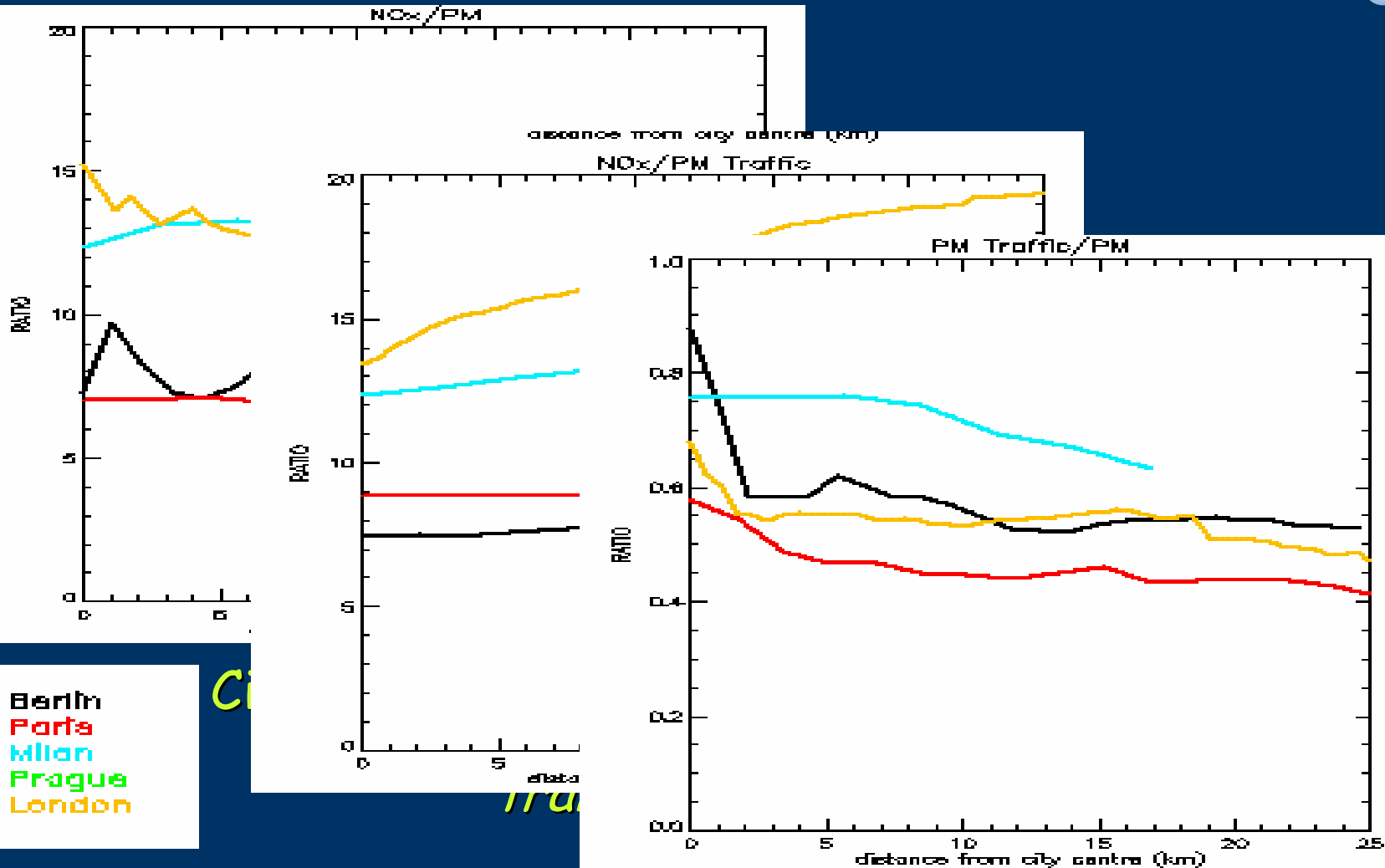


PM pro capita emissions





Emission ratios function of city centre distance



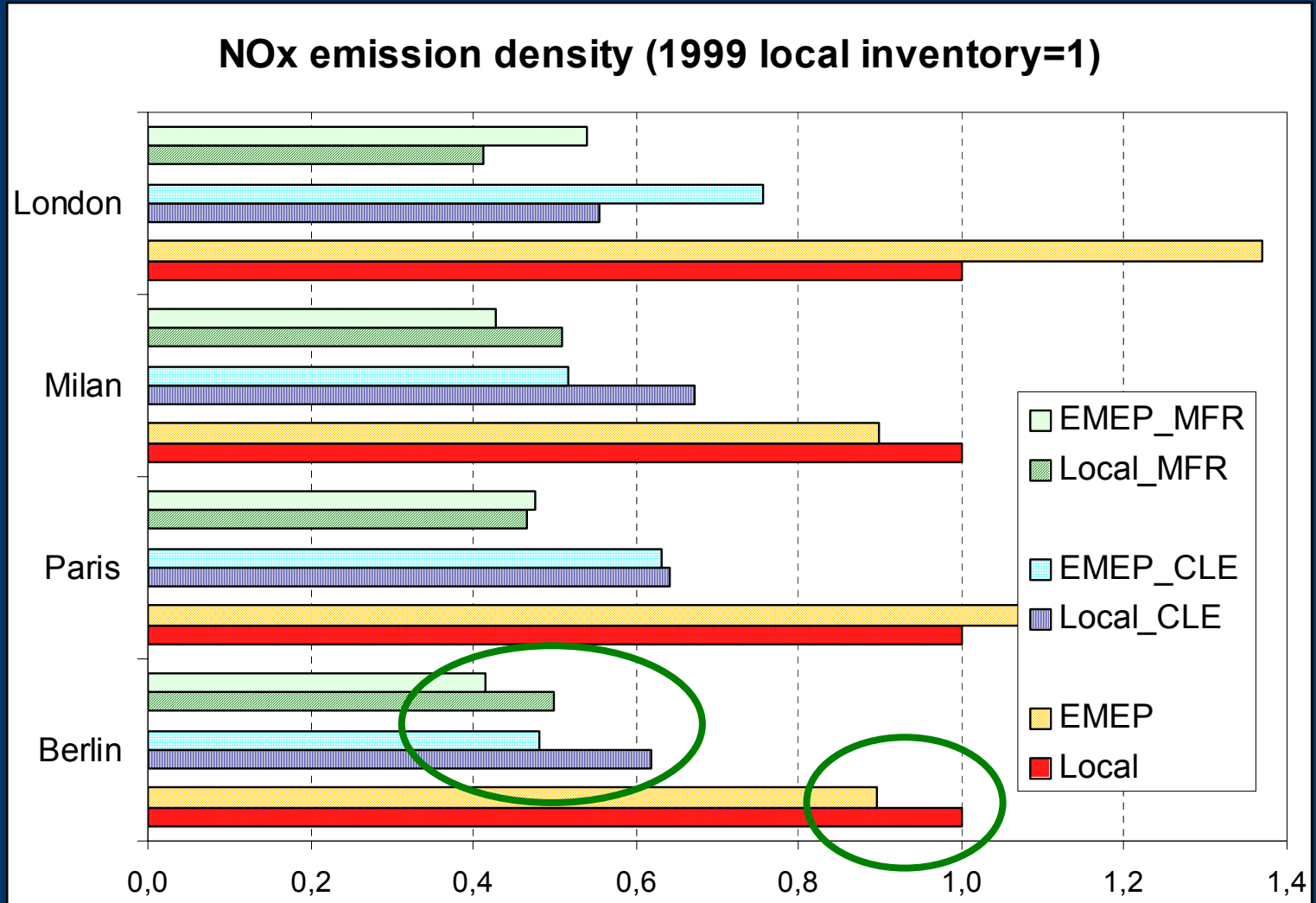
2010 emission scenarios

Emission data (both local and EMEP) have been projected in 2010 for two IIASA scenarios: the CLE (Current Legislation) and the MFR (Most Feasible Reduction) emission reduction scenarios.

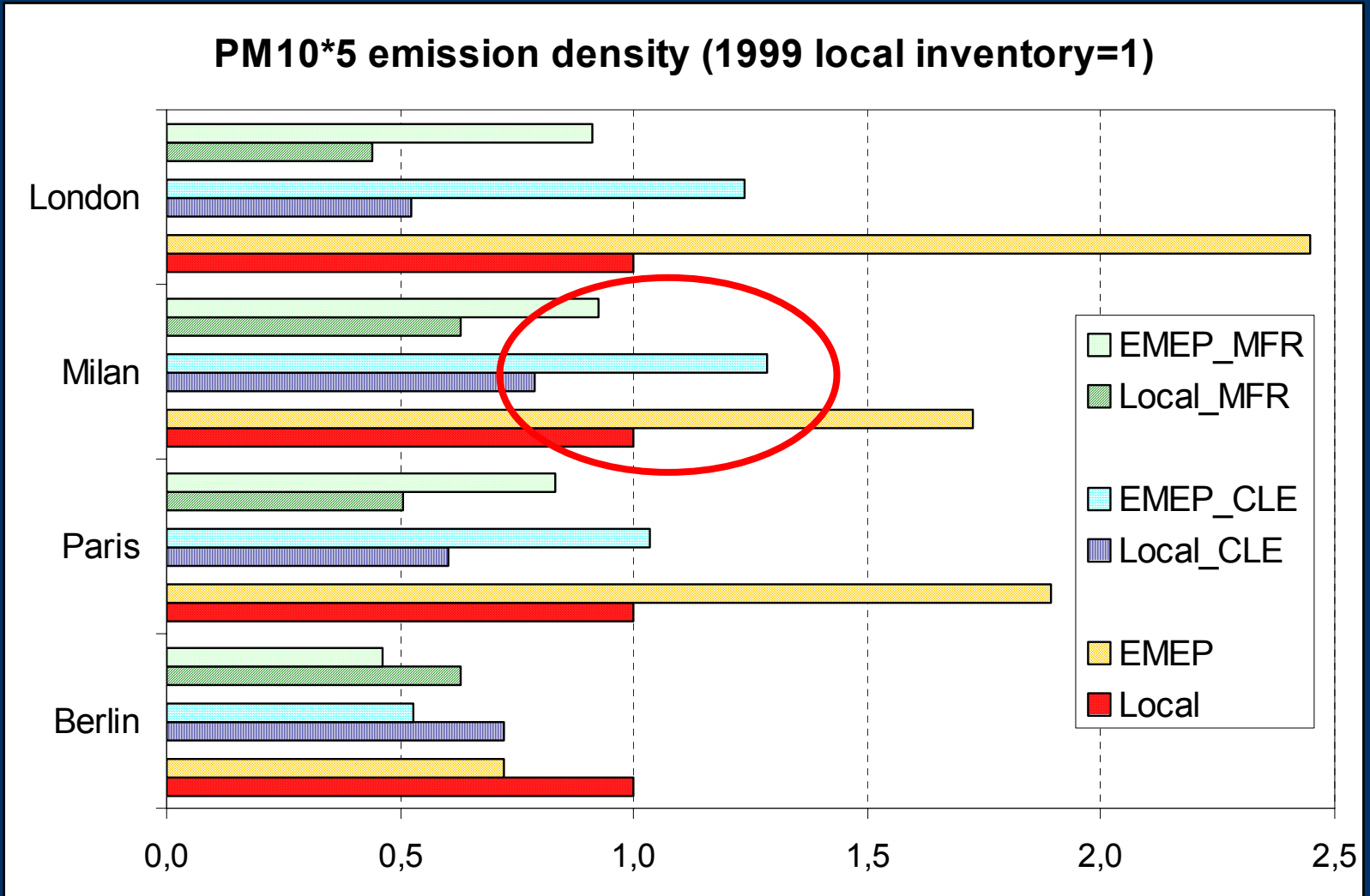
		MFR		
		Low	High	Traffic
NOx	FRAN	36	79	61
	GERM	42	43	58
	ITAL	22	74	53
	UNKI	44	77	58
PM10	FRAN	56	95	30
	GERM	58	35	17
	ITAL	44	88	19
	UNKI	74	89	22
		CLE		
		Low	High	Traffic
NOx	FRAN	6	29	58
	GERM	7	22	58
	ITAL	-9	35	51
	UNKI	6	35	55
PM10	FRAN	45	79	23
	GERM	50	24	11
	ITAL	27	44	10
	UNKI	66	64	17

%
reduction

City 2010 emission scenarios: NOx



City 2010 emission scenarios: PM



Conclusions

1. A set of rough indicators (e.g. emission density, pro capita emission, emission ratios ..) could be used as a first check for an emission inventory.
2. Local inventories gives more information (QA/QC?) on a resolution lower than the regional one: a major effort in their validation/integration should be done
3. While NO_x, and other gas pollutants (with a major uncertainty for VOC) emission estimates uncertainty could be roughly thought to be around 20-30%, PM estimates seems to be still higher than 50%. This uncertainty could significantly affect the evaluation of PM reduction policy efficacy.