NO Emissions of the Dominant Diesel Vehicle Models in HK — Observations from On-road Remote Sensing

香港主要柴油车型的一氧化氮（NO）排放趋势—路边遥感的发现

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Background & Motivation
背景与动机

Recent remote sensing studies reported that diesel NO_x changed little or even increased despite the tightened emission standards.

近期遥感研究发现，尽管排放法规日益严格，柴油车NO_x排放变化很小或者甚至有所增加。

Previous studies usually averaged the emissions of all vehicles in the same manufacture year, regardless of the vehicle models.

前面的研究通常将所有在同一制造年份内的车的排放平均，而不考虑车型。

The real trends of individual models might have been masked as each model/manufacturer adopted different emission control technologies and retrofitted the vehicle at different time.

各个车型的真实排放趋势可能被遮盖了，因为各个车型/制造商可能采用了不同的排放控制技术，并在不同的时间升级汽车。

Background & Motivation
背景与动机

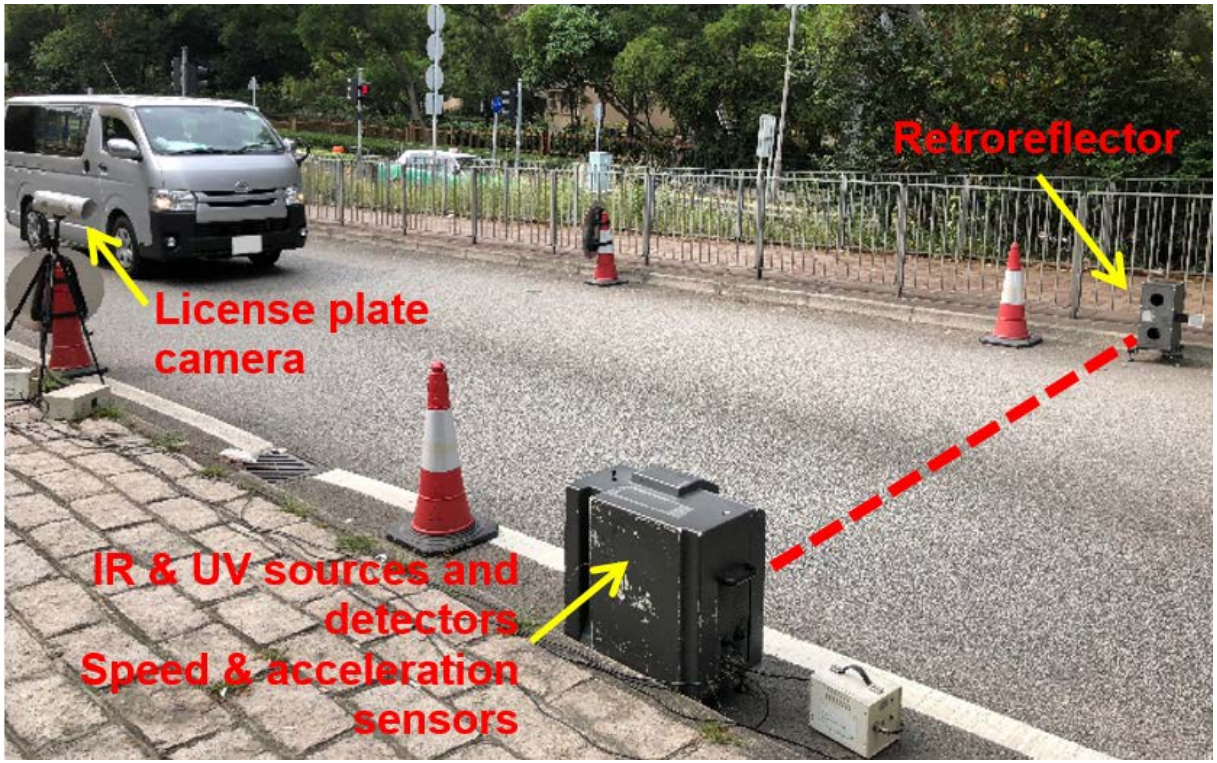
Therefore, this study aims to evaluate the NO emission trends of the dominant diesel vehicle models in Hong Kong using remote sensing technology.

因此，本研究的主要目的是使用遥感技术来评估香港主要柴油车型的一氧化氮（NO）排放趋势。

Data Collection & Treatment
数据采集与处理

Emissions data was collected by 14 sets of ETC-S420 remote sensing systems at 158 sites across Hong Kong from Apr 2014 to Apr 2017.

汽车排放数据由14套ETC-S420遥感系统在全香港158个测试地点从2014年4月至2017年4月期间获得。



Setup of a typical remote sensing measurement site in Hong Kong
香港一个典型的遥感测试地点的布置

Data Collection & Treatment
数据采集与处理

679,454 records of diesel vehicle emissions with matched licence plate number were obtained. A record was considered valid when:

获得了**679,454**个与执照号码吻合的柴油车排放数据。一个有效数据需要满足以下条件：

- measured CO_2 exhaust plume size was sufficient to determine the emission ratios (Q_P). 测量的CO_2排气量足以确定排放比(Q_P)。
- driving conditions were within the speed (< 90 km/h) and acceleration (-5 to 3 km/h/s) envelopes of the HKTET. 驾驶工况需要在HKTET的速度（<90 km/h）和加速度(-5至3 km/h/s)范围内。

363,287 (53%) records were valid (no. of licensed diesel vehicles was 138,555 in HK by Apr 2017).

363,287 (53%) 个数据为有效（截止2017年4月，香港注册的柴油车数量为138,555）。

$$EF_{NO} = \frac{30}{0.014} * \frac{Q_{NO}}{1+Q_{CO}+6Q_{HC}} \text{ [g/kg fuel]}$$

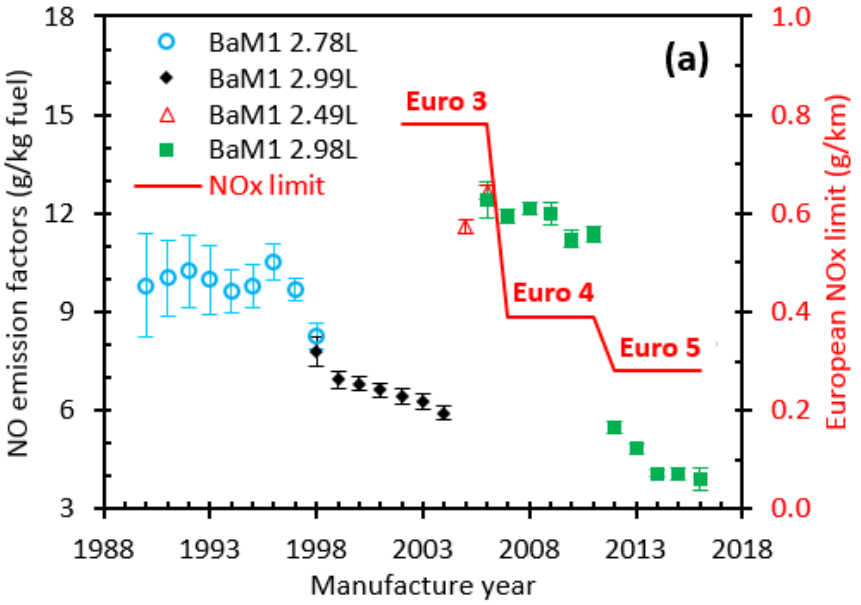
Results & Discussion
结果与讨论

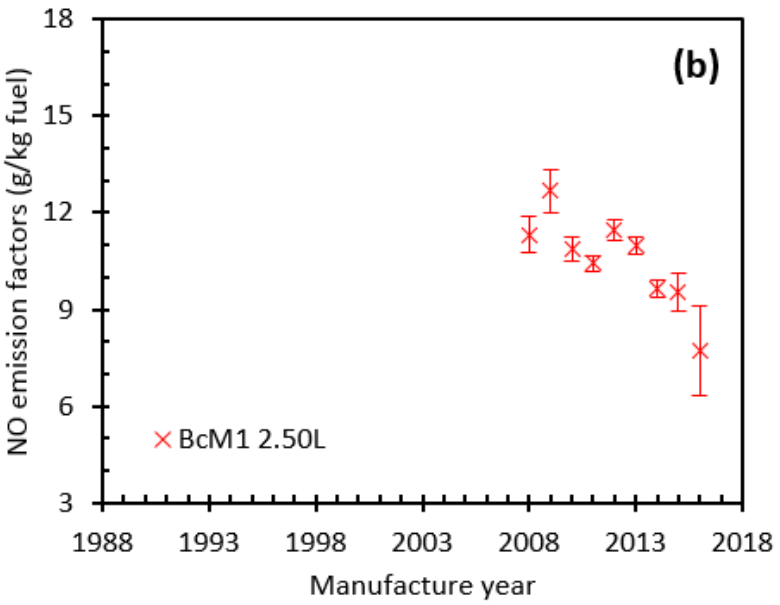
No. 序号	Vehicle model † 车型 †	Engine size (L) 引擎排量(L)	No. of records 测试数量	Manu. year 制造年份	Vehicle class ‡ 汽车类型 ‡
1	BaM1	2.98	69545	2006-2016	LGV
		2.99	19415	1998-2004	LGV
		2.49	13715	2004-2006	LGV
		2.78	5884	1989-1998	LGV
2	BaM2	4.10	43801	1997-2006	LB, PB
		4.01	30072	2006-2016	LB, PB
		3.66	3854	1993-1998	LB
3	BbM1	8.85	26613	2009-2016	PB
		10.82	8678	1997-2007	PB
		8.90	3040	2005-2009	PB
4	BcM1	2.50	21573	1985-2016	LGV
5	BdM1	5.19	13933	2006-2016	LGV, MGV
		4.75	6500	1998-2006	LGV, MGV
6	BdM2	7.79	4408	2001-2016	MGV, PB
7	BeM1	2.95	8227	2001-2012	LGV
		2.49	4063	2012-2016	LGV

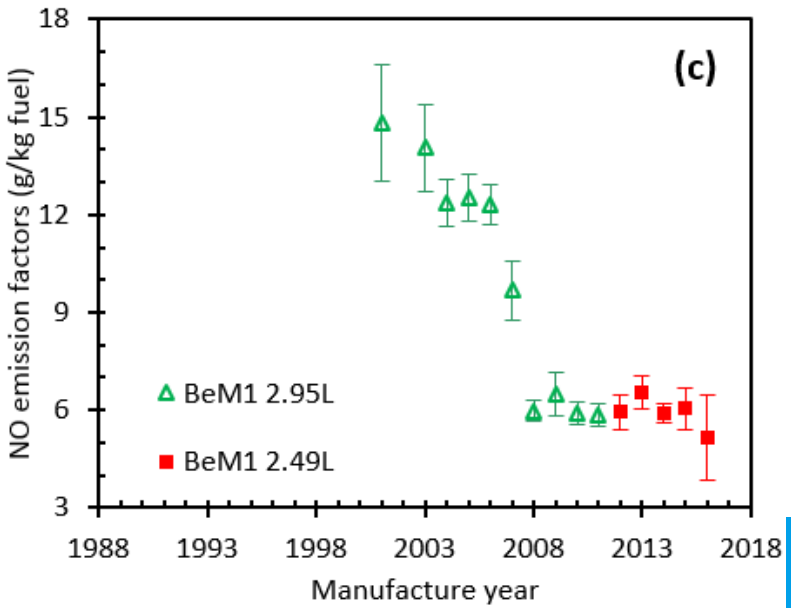
†: B'x'M'y' refers to vehicle Brand x Model y. The real brand and model names are masked out due to privacy concerns.
B'x'M'y' 表示汽车品牌 x 型号 y。基于隐私考虑，其真实品牌和型号被隐去。

‡: Abbreviations: LB, light bus; LGV, light goods vehicle; MGV, medium goods vehicle; PB, public bus.
缩写语：LB, 轻型巴士; LGV, 轻型货车; MGV, 中型货车; PB, 公共巴士。

Results & Discussion
结果与讨论





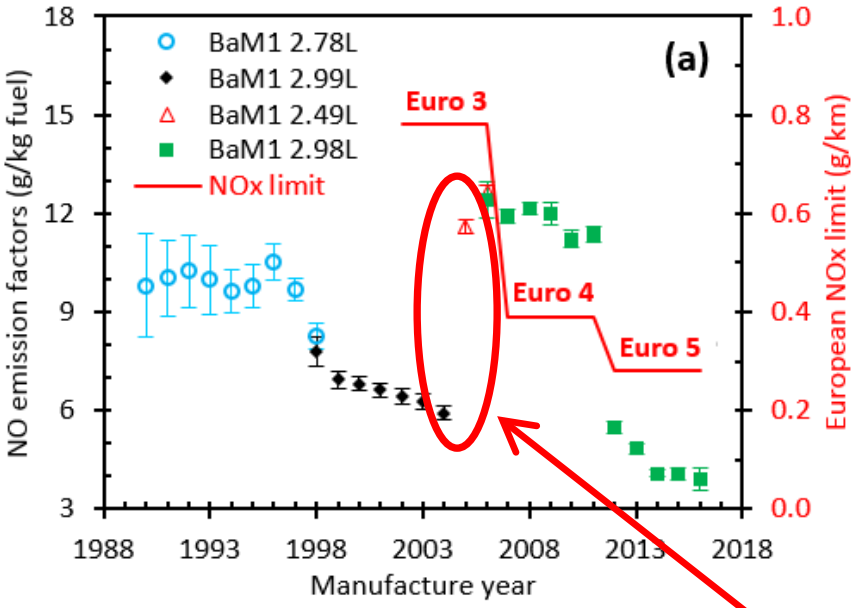


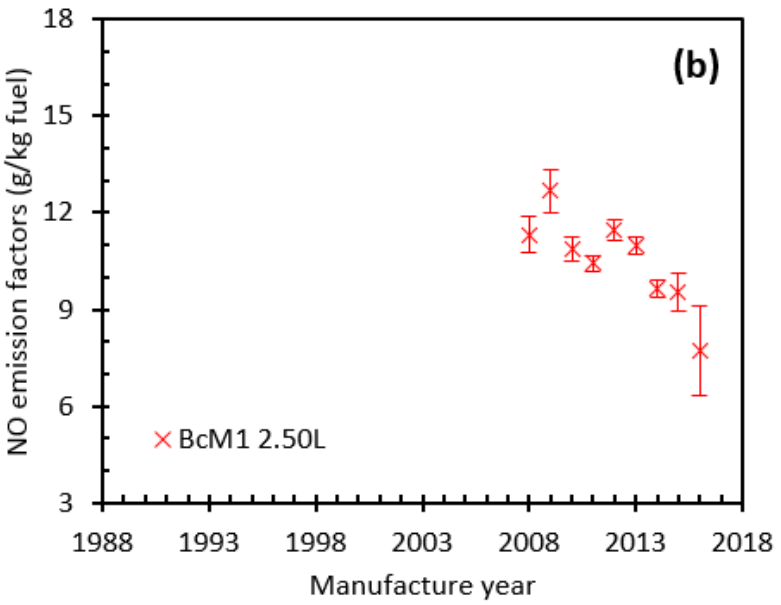
Mean NO emission factors of dominant light commercial vehicles:

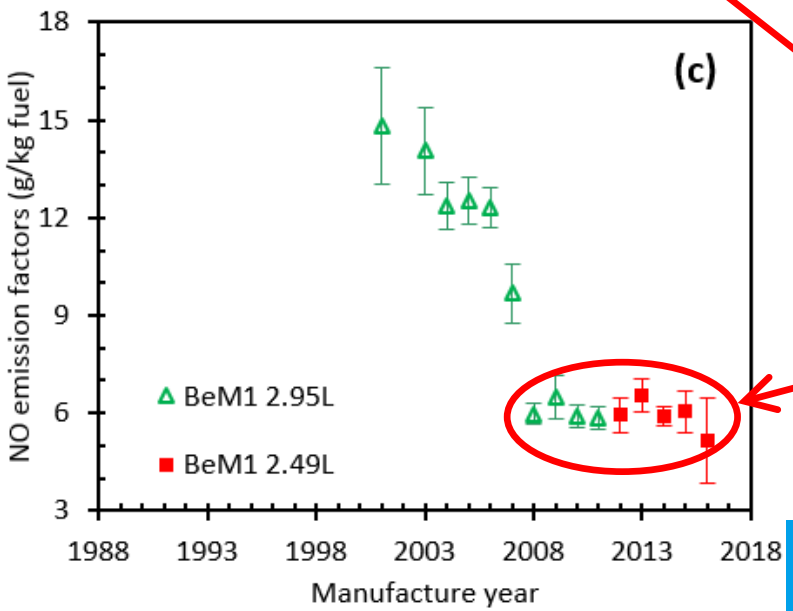
主要轻型商用车的平均NO排放因子:

(a) BaM1, (b) BcM1 and (c) BeM1

Results & Discussion
结果与讨论



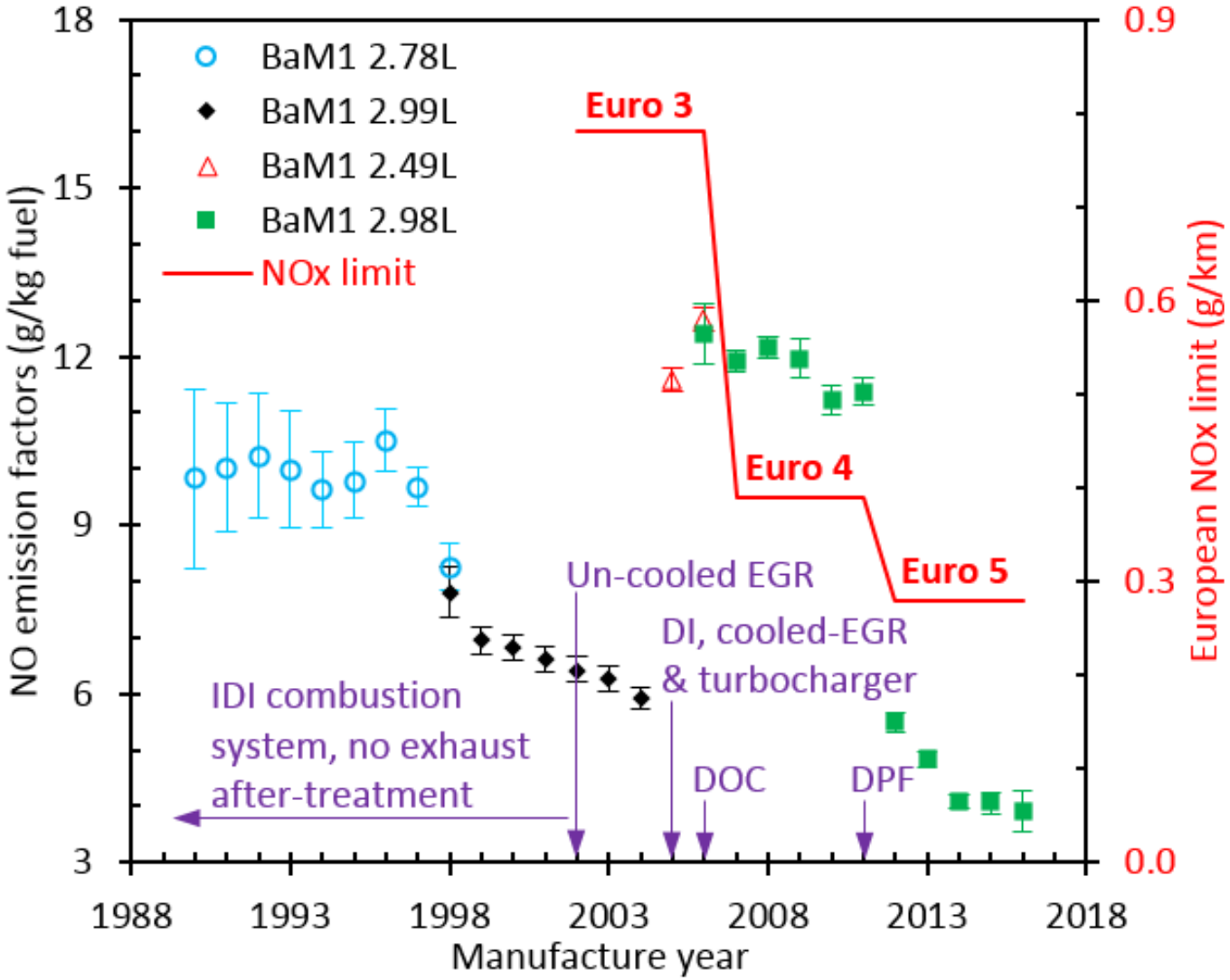




Current European standards were not very effective to reduce NO emissions of some diesel vehicle models in the real world!

在现实条件下，现有的欧洲排放法规没有很有效地降低某些车型的NO排放！

Results & Discussions
结果与讨论



Conclusions
结论

HK diesel vehicle fleet was dominated by a few models in each class.
每个类别中，香港柴油车队由少数几个车型统治。

Each diesel vehicle model showed very different NO levels and trends.
每个柴油车型的NO排放水平和趋势相差很大。

The change from IDI to DI technology increased NO greatly.
从燃油非直喷到直喷的技术变化很大地增加了NO排放。

Current European standards were not very effective to reduce real-world NO emissions of some diesel vehicle models.
在现实条件下，现有的欧洲排放法规没有很有效地降低某些车型的NO排放。

Thanks

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