

## Supplementary Information

# Real-world measurement and mechanical-analysis-based-verification of NO<sub>x</sub> and CO<sub>2</sub> emissions from in-use heavy-duty vehicle

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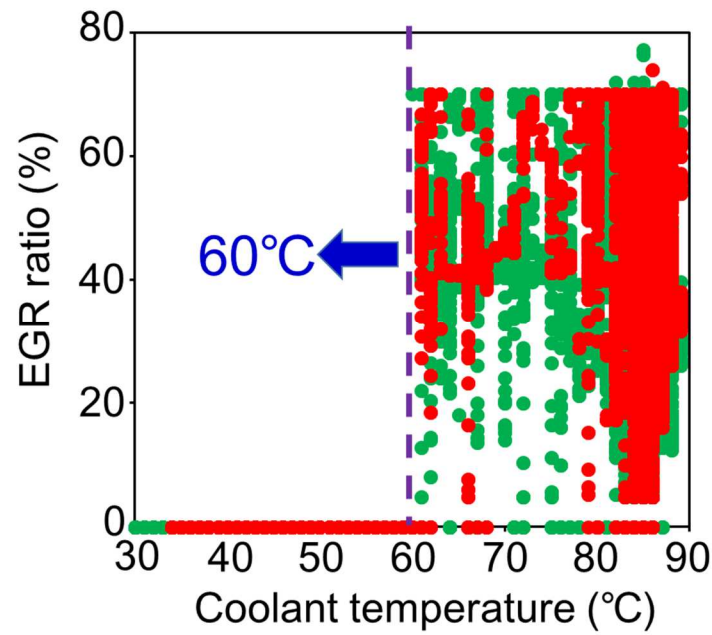
**Text S1** *Japanese regulation regarding heavy-duty vehicles (2016)*

Table S1. Japanese regulation regarding heavy-duty vehicles (2016) with the WHVC mode.

Brand-new vehicles are required to meet both the average and the maximum regulation values.

Component	Regulation (average, g/kWh)	Regulation (max, g/kWh)
Carbon monoxide (CO)	2.22	2.95
Non-methane hydrocarbon (NMHC)	0.17	0.23
Nitrogen oxides (NO <sub>x</sub> )	0.4	0.7
Particulate matter (PM)	0.01	0.013

8 **Text S2** *Relationship between EGR and coolant and ambient temperatures*

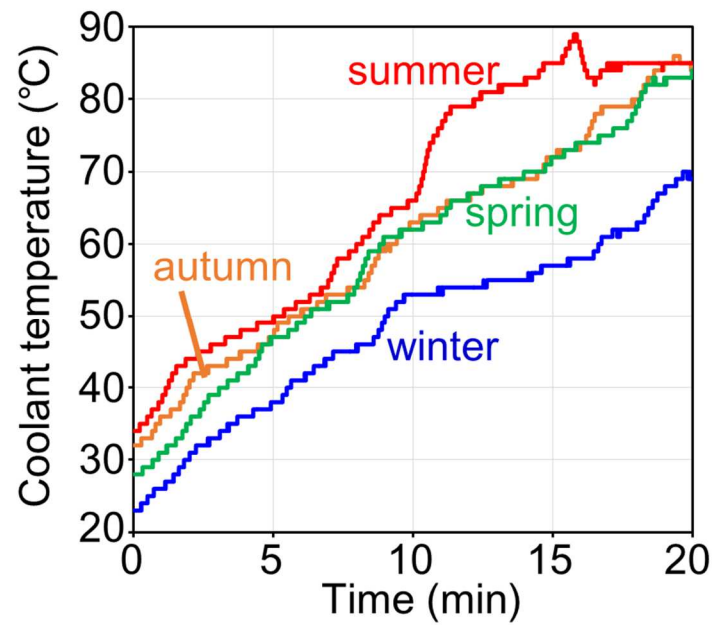


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10 Figure S1: Relationship between EGR ratio and engine coolant temperature. The green and

11 red plots correspond to measurements obtained in spring and summer, respectively.

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14 Figure S2: Time profile of engine coolant temperature in four seasons, measured through real-

15 world driving.

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**Text S3 Relationship between urea-SCR and catalysis and ambient temperatures**

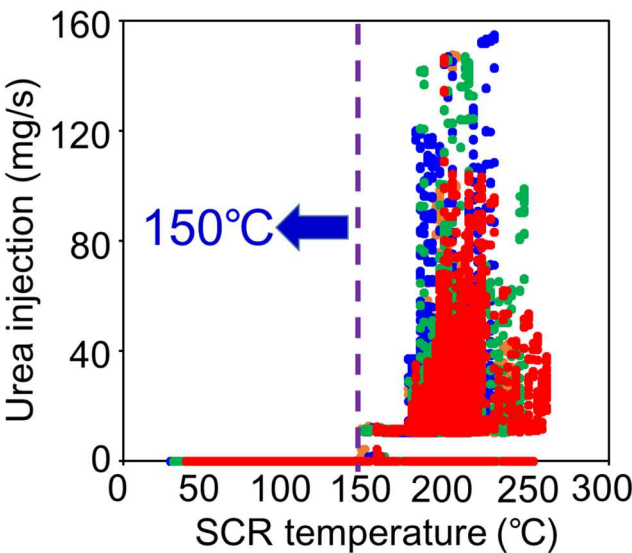


Figure S3: Relationship between the amount of urea injection and urea-SCR surface temperature (■: autumn, ■: winter, ■: spring, ■: summer).

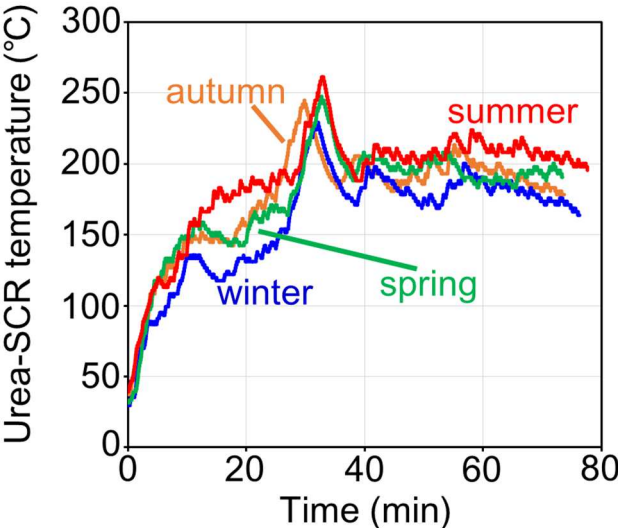
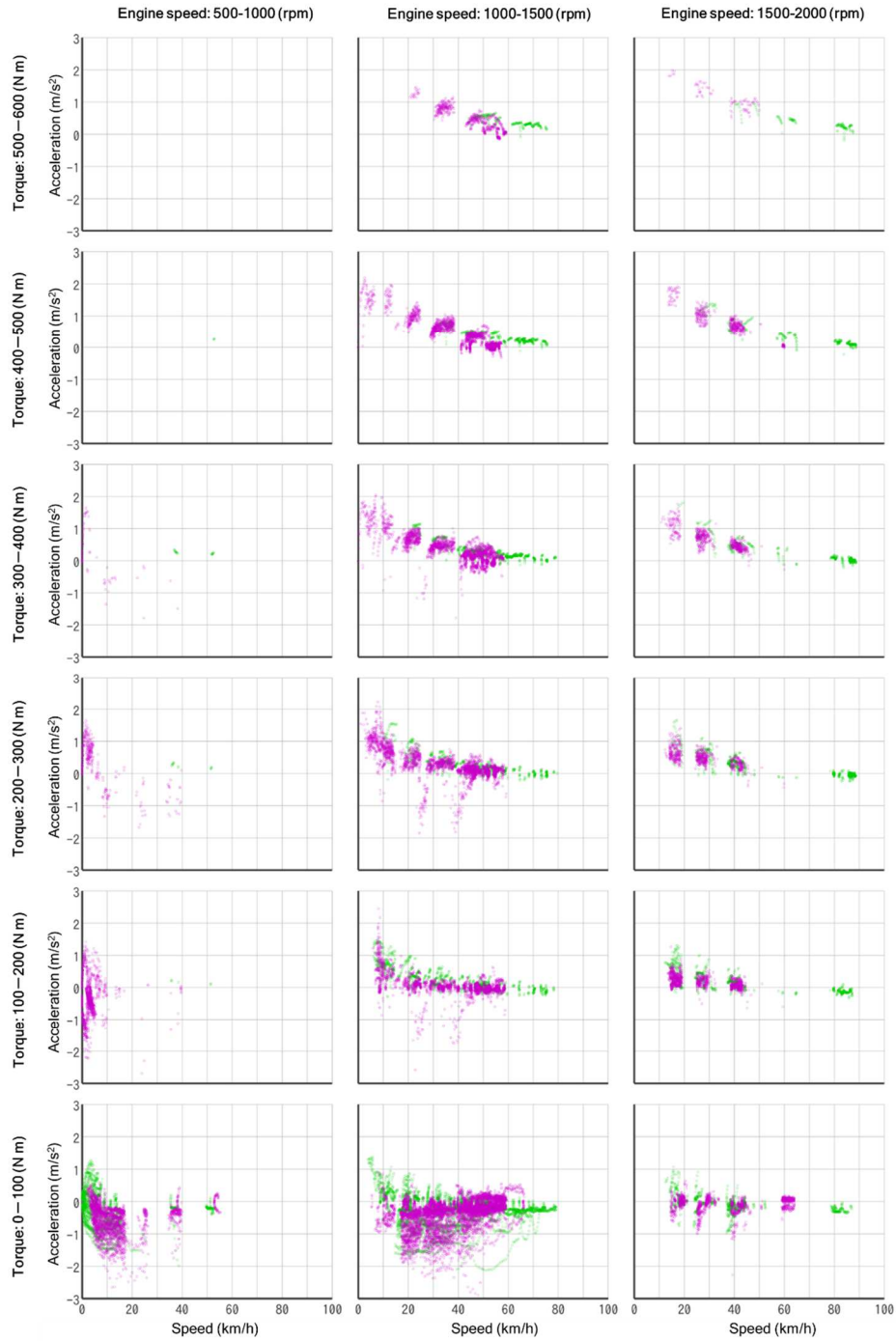


Figure S4: Time profile of SCR surface temperature in four seasons, measured through real-world driving.

27 **Text S4** *Vehicle speed and acceleration distribution obtained through PEMS*  
28 *and WHVC*



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30 Figure S5: Distribution of vehicle speed and acceleration determined via PEMS (●) results  
31 and WHVC (●) divided into three engine-rotation and six engine-torque ranges.

**Text S5** *Additional information pertaining to the chassis dynamometer experiment*

Table S2: Gaseous pollutants measured in chassis dynamometer tests (g/km).

Mode	Month, Year	CO	THC	NO <sub>x</sub>	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O
WHVC (cold)	Nov 2018	0.032	0.001	0.396	473.8	0.001	0.035
	Jan 2019	0.032	0.002	0.349	465.1	0.001	0.030
	Jun 2019	0.023	0.001	0.377	466.9	0.001	0.034
	Aug 2019	0.016	0.000	0.352	463.1	0.001	0.027
WHVC (hot)	Nov 2018	0.016	0.000	0.018	434.9	0.001	0.036
	Jan 2019	0.006	0.000	0.008	438.5	0.001	0.039
	Jun 2019	0.007	0.000	0.028	442.6	0.001	0.044
	Aug 2019	0.007	0.000	0.020	440.1	0.001	0.040