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Title:

Impact of air pollution concentrations by ship emission regulation in the Seto Inland Sea, Japan

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Abstract: (Your abstract must use **Normal style** and must fit in this box. Your abstract should be no longer than 300 words. The box will 'expand' over 2 pages as you add text/diagrams into it.)

The Annex VI on "Regulations for the Prevention of Air Pollution from Ships" in MARPOL 73/78 was revised to progressively reduce air pollutant emissions. The revised Annex VI went into effect in July 2010. In this study, air pollutant emissions from ship after the effect of the revised Annex VI were estimated and the impacts of air quality were simulated. In order to estimate the ship emission from the present to 2050 in Japan, the following assumptions were applied: the life of ship is 30 years; net increase rate of shipping tonnage is 2.3%/year; the ratio of dismantled ships against total shipping tonnage is 2.2%/year; new ships are constructed by 4.5%/year. The total amounts of NOx and SOx emission around the Seto Inland Sea were expected to be decreased by 15.7% and 27.8% between the present and 2050, respectively. The WRF/CMAQ system was utilized to simulate air qualities around the Seto Inland Sea for one month (August 2008). The monthly average NO_2 and aerosol SO_4^{2-} concentrations were decreased by up to 13ppb and 2.0μg/m^3 in the land area, respectively (see Fig.1 and Fig.2). The monthly average O_3 concentration at 15JST was decreased by up to 2.3ppb (mean = 0.5ppb) in the case of only the ship emission regulation and by up to 4.8 ppb (mean = 1.6ppb) in the case of both the ship emission regulation and additional VOCs reduction in the land area (see Fig.3). The results showed that the combination of ship emission regulation and of VOCs reduction was more effective for the decreases of O_3 concentration.

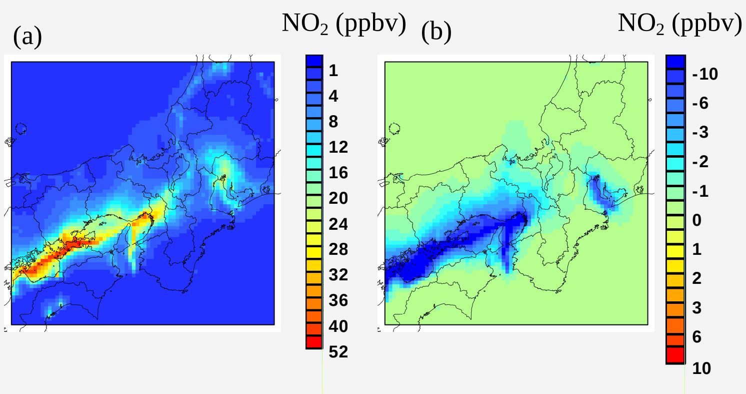

Fig.1 Spatial distributions of (a) NO_2 concentration in 2008 and (b) NO_2 concentration difference between in 2050 and in 2008.

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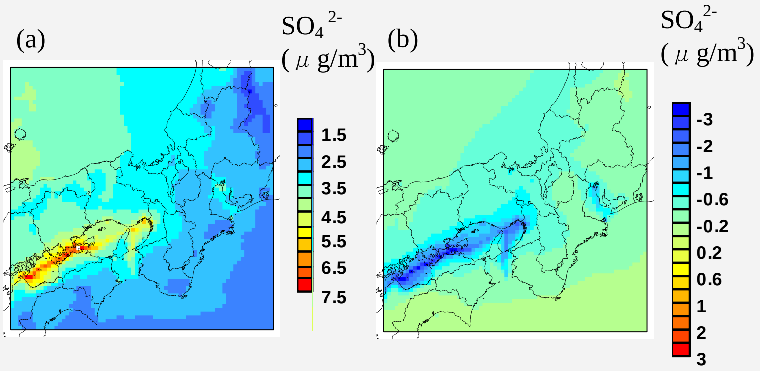

Fig.2 Spatial distributions of (a) aerosol SO_4^{2-} concentration in 2008_present and (b) aerosol SO_4^{2-} concentration difference between in 2050 and in 2008.

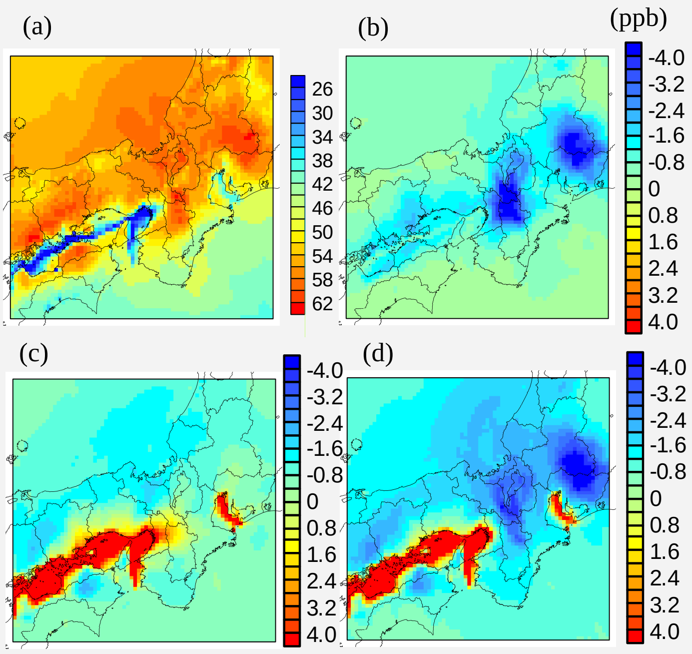

Fig.3. Spatial distributions of average O_3 concentrations at 15JST (a) O_3 concentrations in 2008, (b) the concentration differences in 2008_by VOCs reduction, (c) between in 2050 and in 2008, and (d) in 2050 by VOCs reduction