



Influence of updating global emission inventory of black carbon on evaluation of the climate and health impact

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Black carbon (BC) is an air component of particular concern in terms of air quality and climate change. Black carbon emissions are often estimated based on the fuel data and emission factors. However, large variations in emission factors reported in the literature have led to a high uncertainty in previous inventories. Here, we develop a new global $0.1^\circ \times 0.1^\circ$ BC emission inventory for 2007 with full uncertainty analysis based on updated source and emission factor databases. Two versions of LMDz-OR-INCA models, named as INCA and INCA-zA, are run to evaluate the new emission inventory. INCA is built up based on a regular grid system with a resolution of 1.27° in latitude and 2.50° in longitude, while INCA-zA is specially zoomed to $0.51^\circ \times 0.66^\circ$ (latitude \times longitude) in Asia. By checking against field observations, we compare our inventory with ACCMIP, which is used by IPCC in the 5th assessment report, and also evaluate the influence of model resolutions. With the newly calculated BC air concentrations and the nested model, we estimate the direct radiative forcing of BC and the premature death and mortality rate induced by BC exposure with Asia emphasized. Global BC direct radiative forcing at TOA is estimated to be 0.41 W/m^2 ($0.2 - 0.8$ as inter-quartile range), which is 17% higher than that derived from the inventory adopted by IPCC-AR5 (0.34 W/m^2). The estimated premature deaths induced by inhalation exposure to anthropogenic BC (0.36 million in 2007) and the percentage of high risk population are higher than those previously estimated. Ninety percents of the global total anthropogenic PD occur in Asia with 0.18 and 0.08 million deaths in China and India, respectively.