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Monitoring endosulfan in surface soil across China

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Endosulfan, as a mixture of α- and β-endosulfan, is a cyclodiene insecticide that is still extensively used worldwide. Endosulfan was classified by the US Environmental Protection Agency as priority pollutants, and is a candidate as one of new persistent organic pollutants under the Stockholm Convention. Concentrations of endosulfan (including α-, β-isomer and their metabolite endosulfan sulfate) in Chinese surface soils are reported from 92 sites (70 for rural and 22 for urban) across China in 2005. The mean concentrations (pg/g dry weight (dw)) were in the sequence of endosulfan sulfate (363 $\pm$ 1534) $>$ β-endoslfan (105 $\pm$ 539) $>$ α-endosulfan (39 $\pm$ 252), which is consistent with persistence of these compounds in soil. The highest concentration of total endosulfan (13,203 pg/g dw) was found at an rural site in eastern China. High concentrations in some urban sites suggested the local endosulfan use in these cities, most likely on the vegetable land. Endosulfan soil residue inventories in China from 1995 to 2004 with 1/4° $\times$ 1/6° longitude and latitude resolution by using Simplified Gridded Emission and Residue Model (SGERM) have been developed in our group. The measured soil concentration data for α- and β-endosulfan at the 92 monitoring sites for 2005 were compared to their corresponding modeled concentration data for 2004 and a good consistence was found. First, one-way analysis (ANOVA) was made to address the possible difference between monitoring and modeling data for both α- and β-endosulfan respectively, and the results show that, at the 0.05 level, no significantly differences were found between them. Secondly, regression analysis between the monitoring and modeled data indicated the good correlations with R = 0.75 for β-endosulfan and a weak correlation with R = 0.19 for α-endosulfan, which is expected since β-endosulfan is much more persistent in soil than α-endosulfan, thus much smaller variation of concentrations in soil for the former than the latter. To our knowledge, this is the first national-scale study which includes both the inventories and monitoring measurements.