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HCFC-142b emissions in China: An inventory for 2000 to 2050 basing on bottom-up and top-down methods

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1-Chloro-1,1-difluoroethane (HCFC-142b) is both ozone depleting substance included in the Montreal Protocol on Substances that Deplete the Ozone Layer (Montreal Protocol) and potent greenhouse gas with high global warming potential. As one of the major HCFC-142b consumption and production countries in the world, China's control action will contribute to both mitigating climate change and protecting ozone layer. Estimating China's HCFC-142b emission is a crucial step for understanding its emission status, drawing up phasing-out plan and evaluating mitigation effect. Both the bottom-up and top-down method were adopted in this research to estimate HCFC-142b emissions from China. Results basing on different methods were compared to test the effectiveness of two methods and validate inventory's reliability.

Firstly, a national bottom-up emission inventory of HCFC-142b for China during 2000–2012 was established based on the 2006 IPCC Guidelines for National Greenhouse Gas Inventories and the Montreal Protocol, showing that in contrast to the downward trend revealed by existing results, HCFC-142b emissions kept increasing from 0.1 kt/yr in 2000 to the peak of 14.4 kt/yr in 2012.

Meanwhile a top-down emission estimation was also developed using interspecies correlation method. By correlating atmospheric mixing ratio data of HCFC-142b and reference substance HCFC-22 sampled from four representative cities (Beijing, Hangzhou, Lanzhou and Guangzhou, for northern, eastern, western and southern China, respectively), China's HCFC-142b emission in 2012 was calculated. It was 16.24(13.90-18.58) kt, equivalent to 1.06 kt ODP and 37 Tg CO_2-eq, taking up 9.78% (ODP) of total HCFCs emission in China or 30.5% of global HCFC-142b emission. This result was 12.7% higher than that in bottom-up inventory. Possible explanations were discussed. The consistency of two results lend credit to methods effectiveness and results reliability.

Finally, future HCFC-142b emission was projected to 2050. Emission might experience a continuous increase from 14.9 kt/yr to 97.2 kt/yr under business-as-usual (BAU) scenario, while a 90% reduction would be obtained by fulfilling the Montreal Protocol, namely an accumulative mitigation of 1578 kt from 2013 to 2050, equal to 103 kt ODP, and 3504 Tg CO_2 emissions. Therefore, China will contribute tremendously to the worldwide ozone protection and global warming mitigation by successfully phasing out HCFC-142b according to the Montreal Protocol schedule.