Supplement of Atmos. Chem. Phys., 15, 6637–6649, 2015
http://www.atmos-chem-phys.net/15/6637/2015/
doi:10.5194/acp-15-6637-2015-supplement


Atmospheric Chemistry and Physics Open Access

*Supplement of*

# Estimating $NH_3$ emissions from agricultural fertilizer application in China using the bi-directional CMAQ model coupled to an agro-ecosystem model

**X. Fu et al.**

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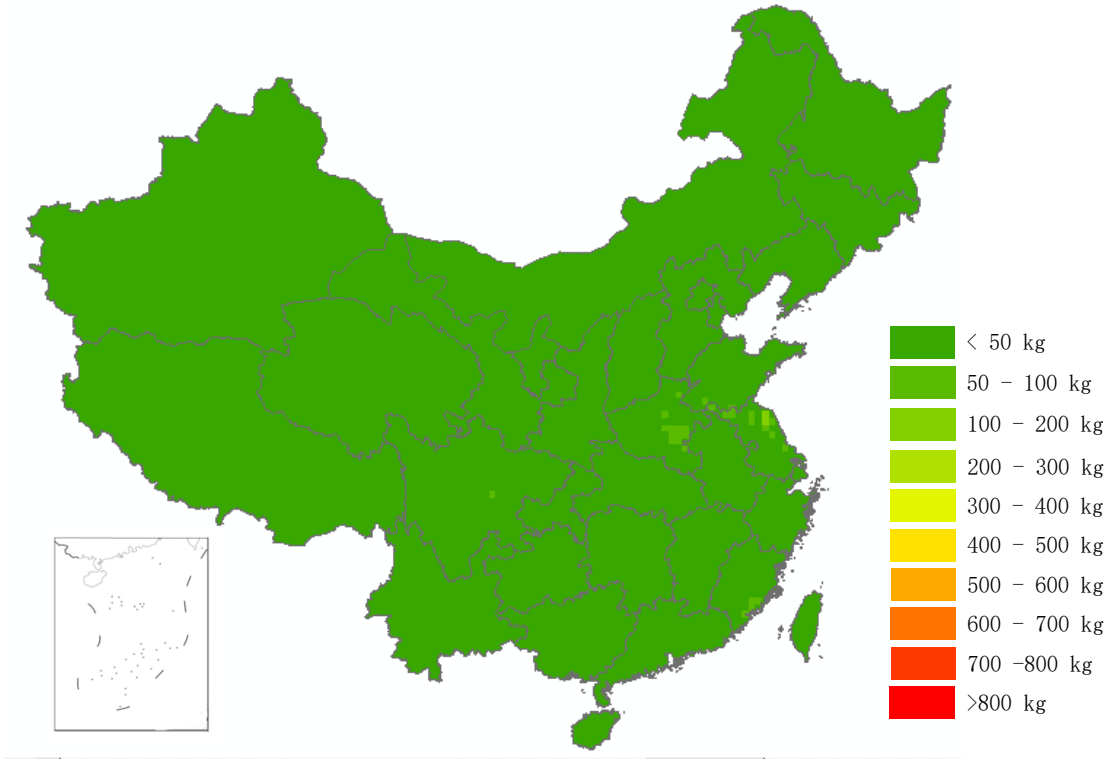
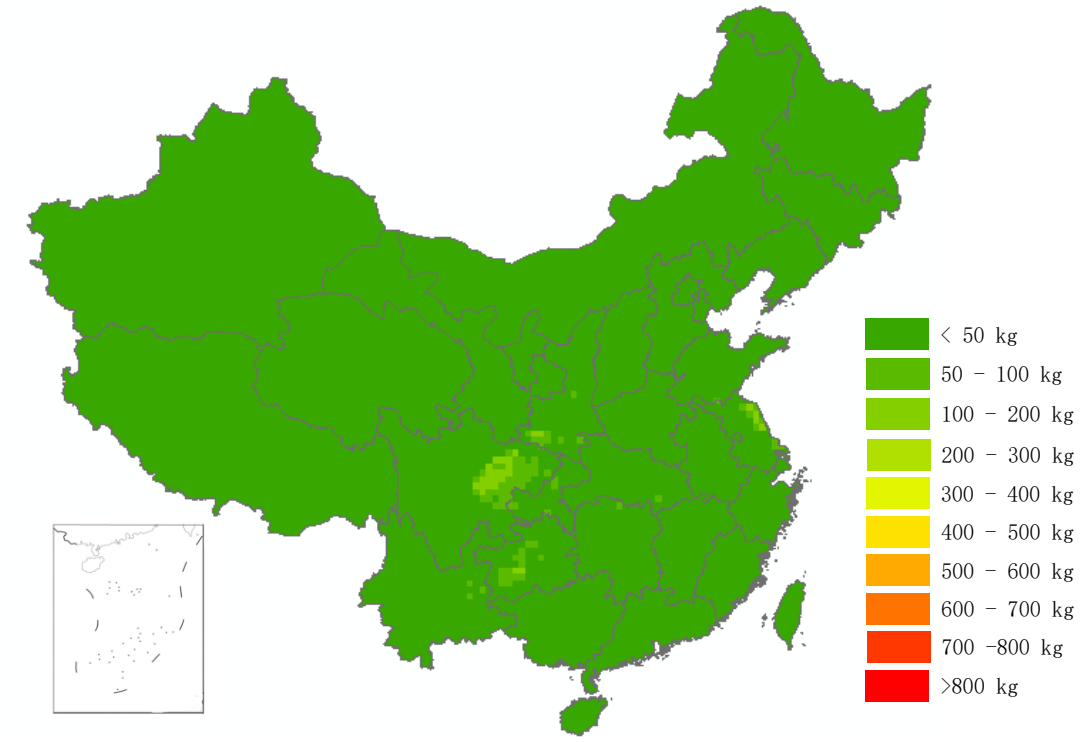
## 1 The spatial distribution of NH3 emissions from N fertilizer use for each month

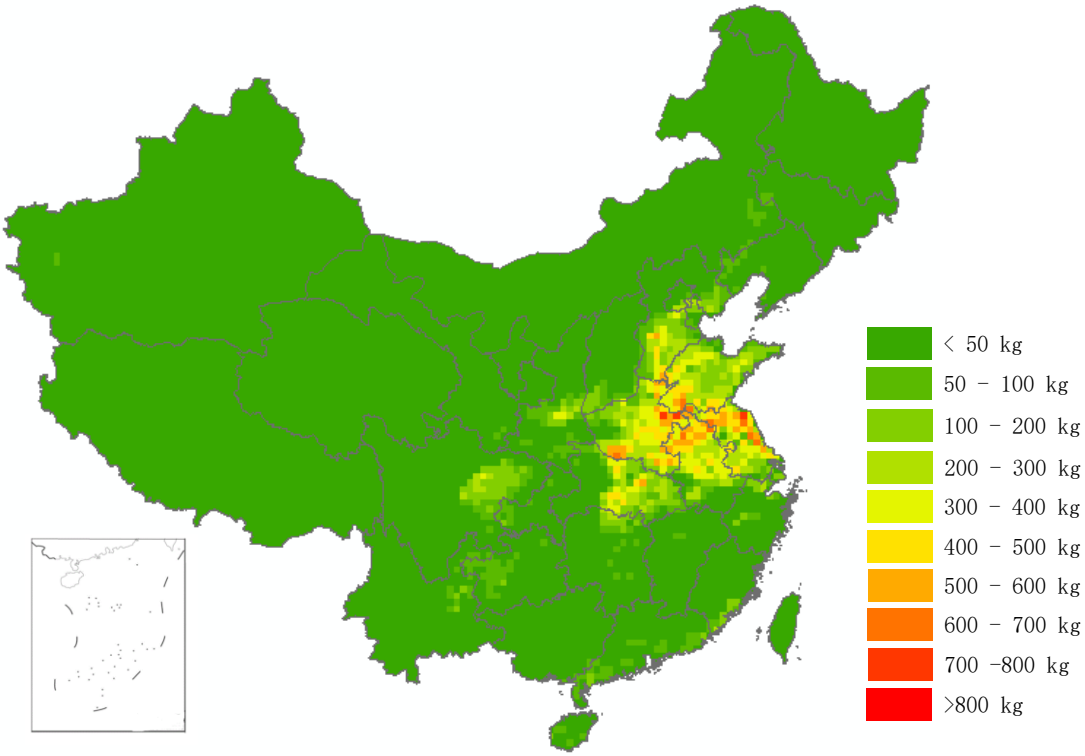
(a) January



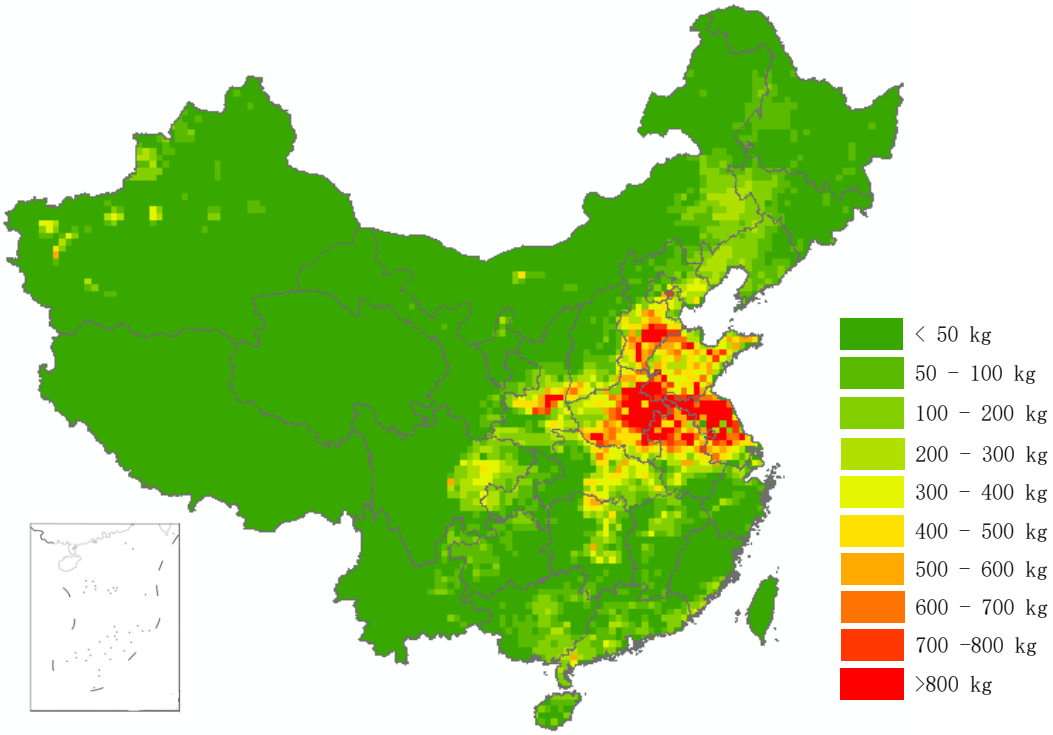

(b) February



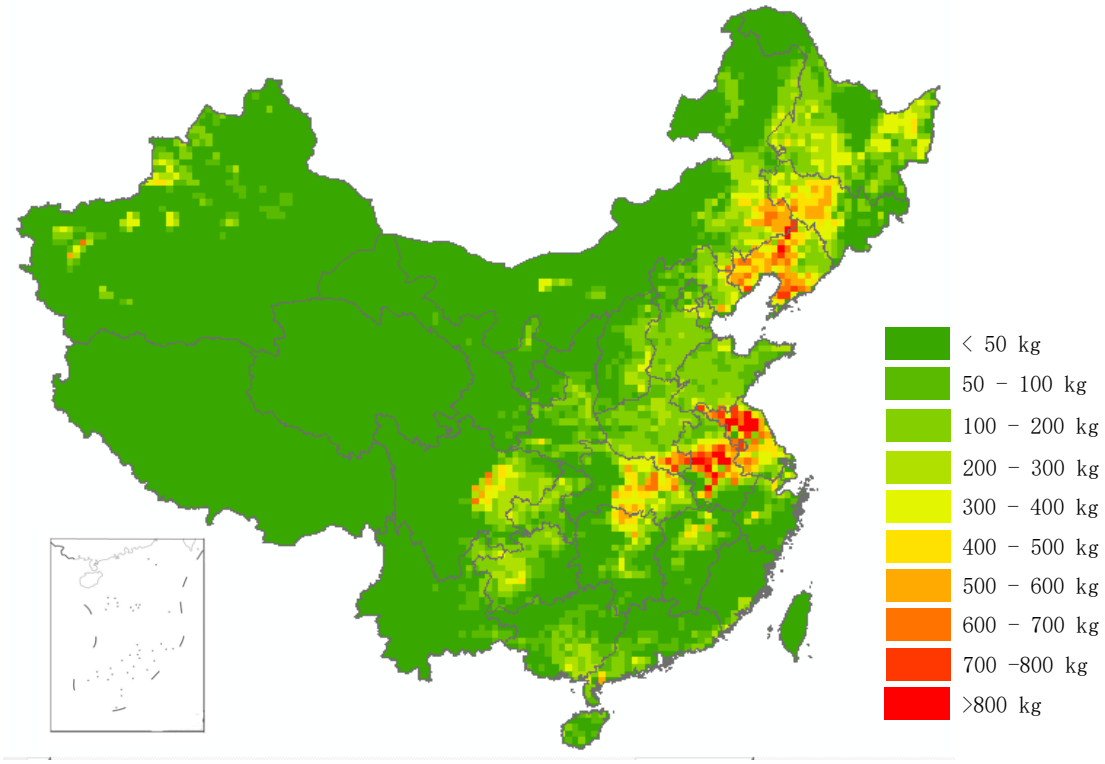
(c) March



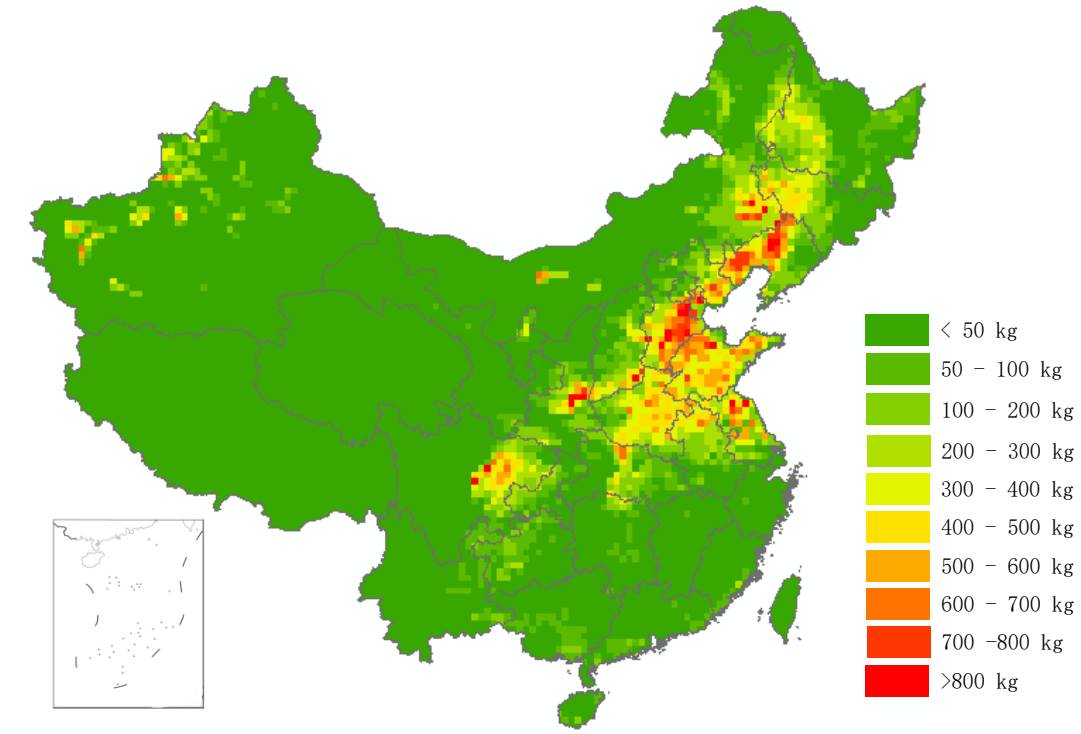

(d) April



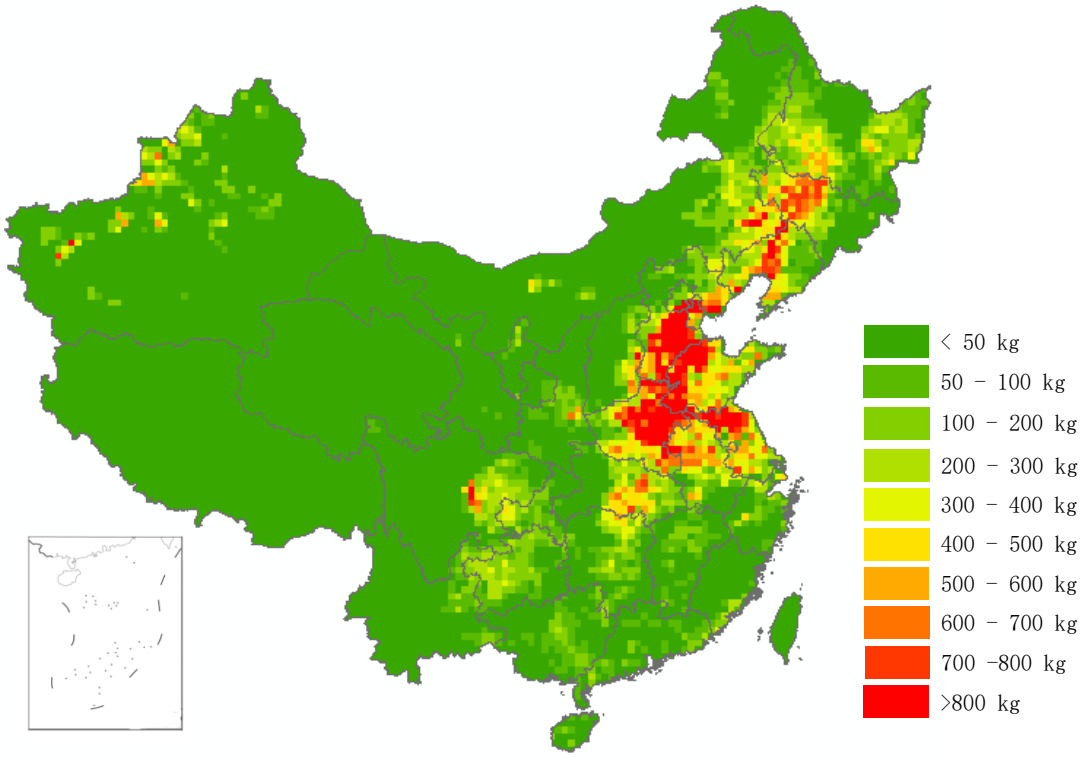
(e) May


< 50 kg
50 - 100 kg
100 - 200 kg
200 - 300 kg
300 - 400 kg
400 - 500 kg
500 - 600 kg
600 - 700 kg
700 -800 kg
>800 kg

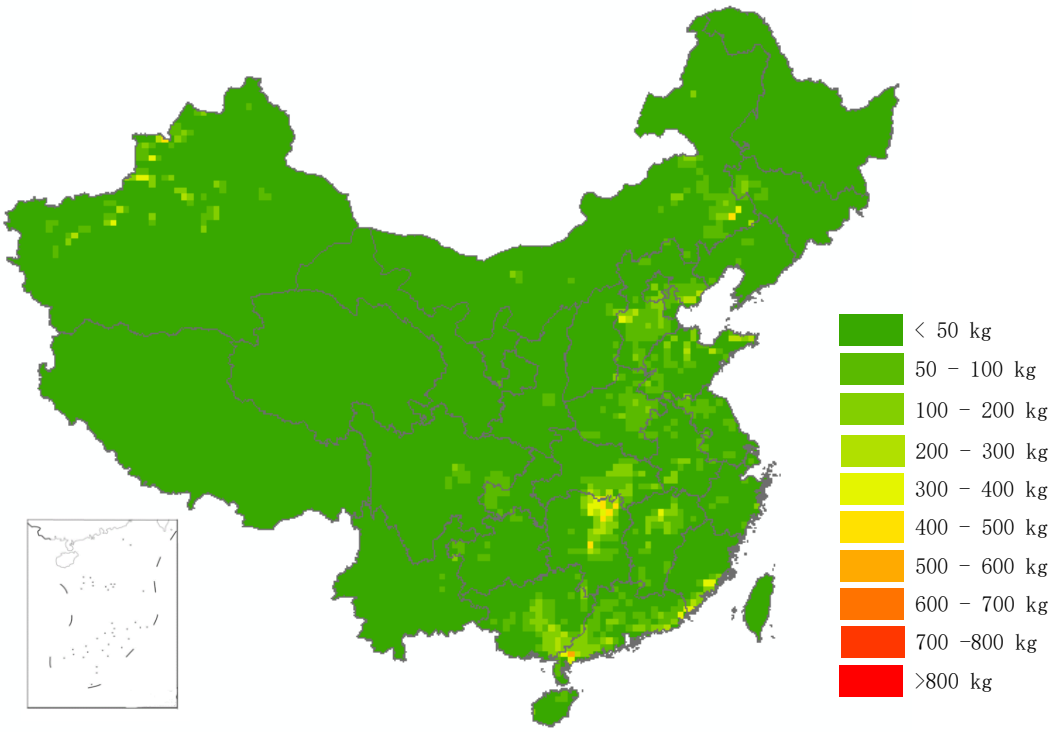
(f) June


< 50 kg
50 - 100 kg
100 - 200 kg
200 - 300 kg
300 - 400 kg
400 - 500 kg
500 - 600 kg
600 - 700 kg
700 -800 kg
>800 kg

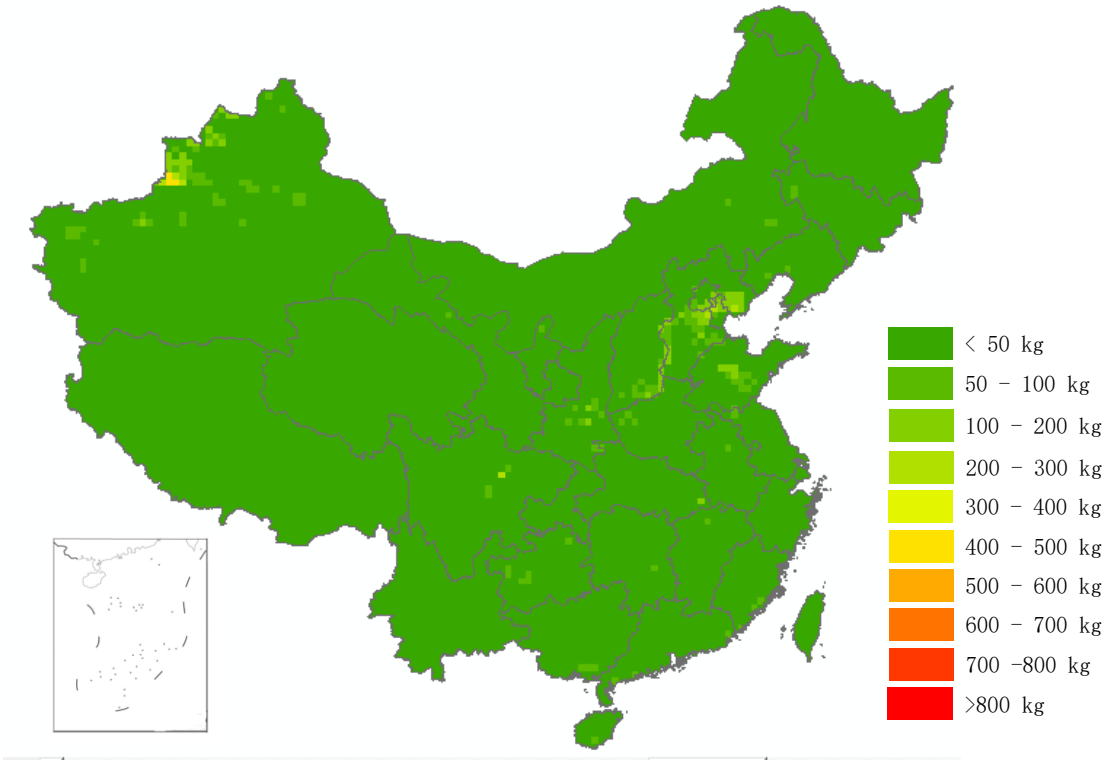
(g) July



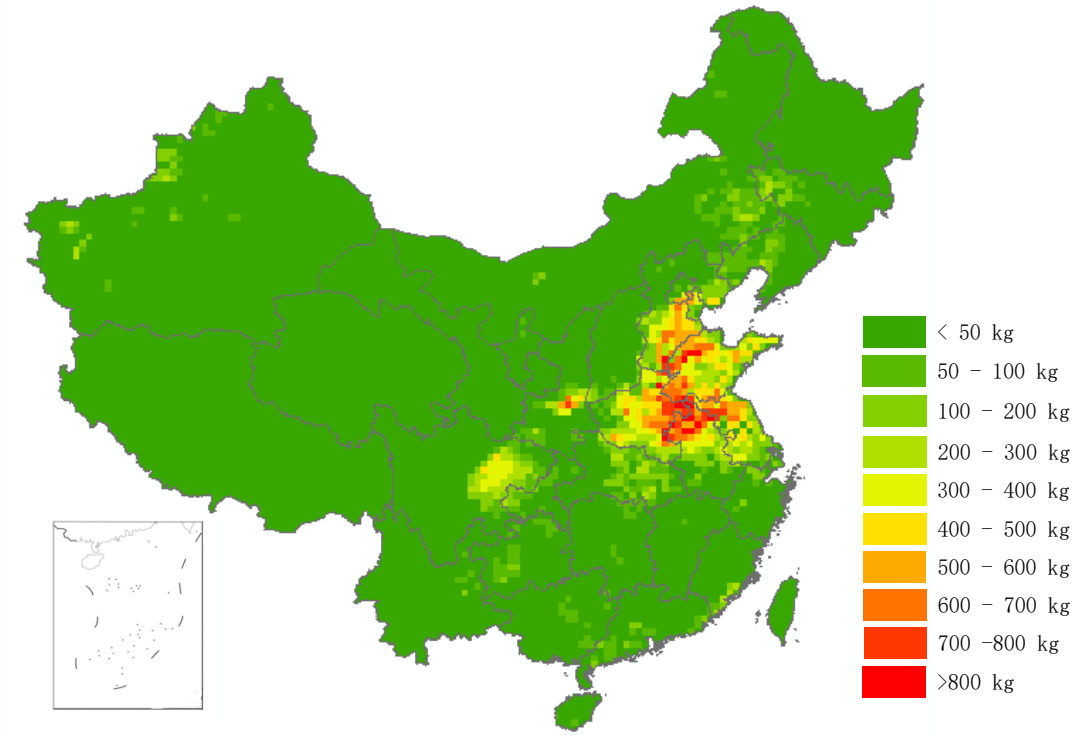

(h) August



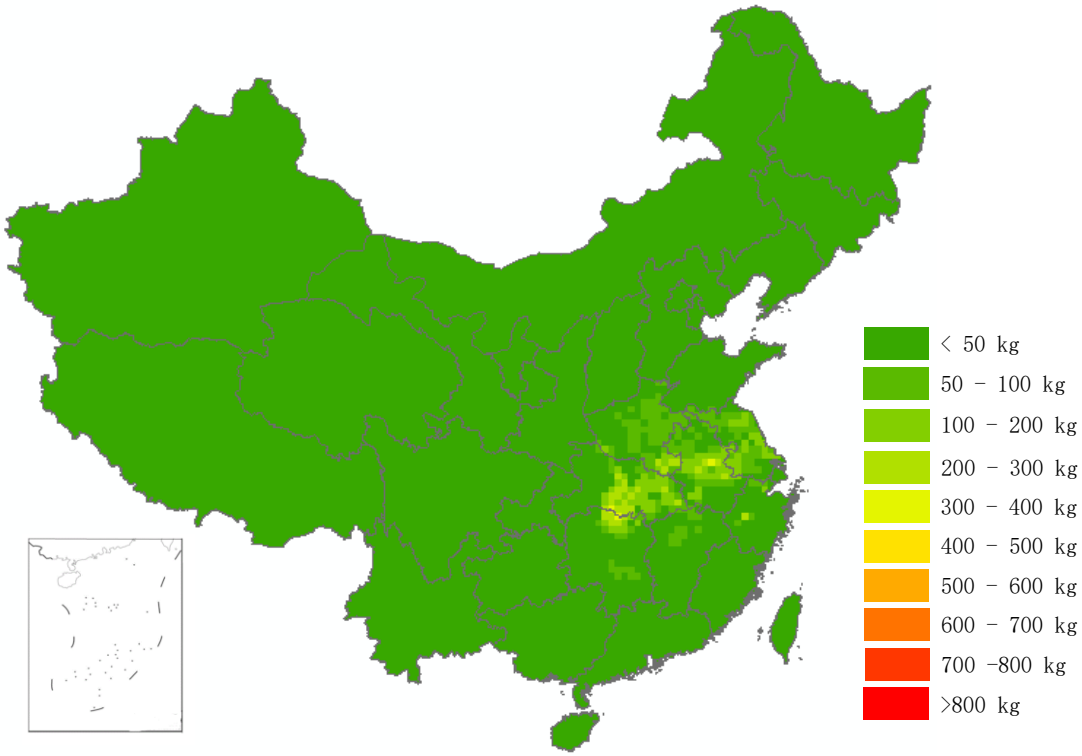
(i) September




(j) October



(k) November




(l) December

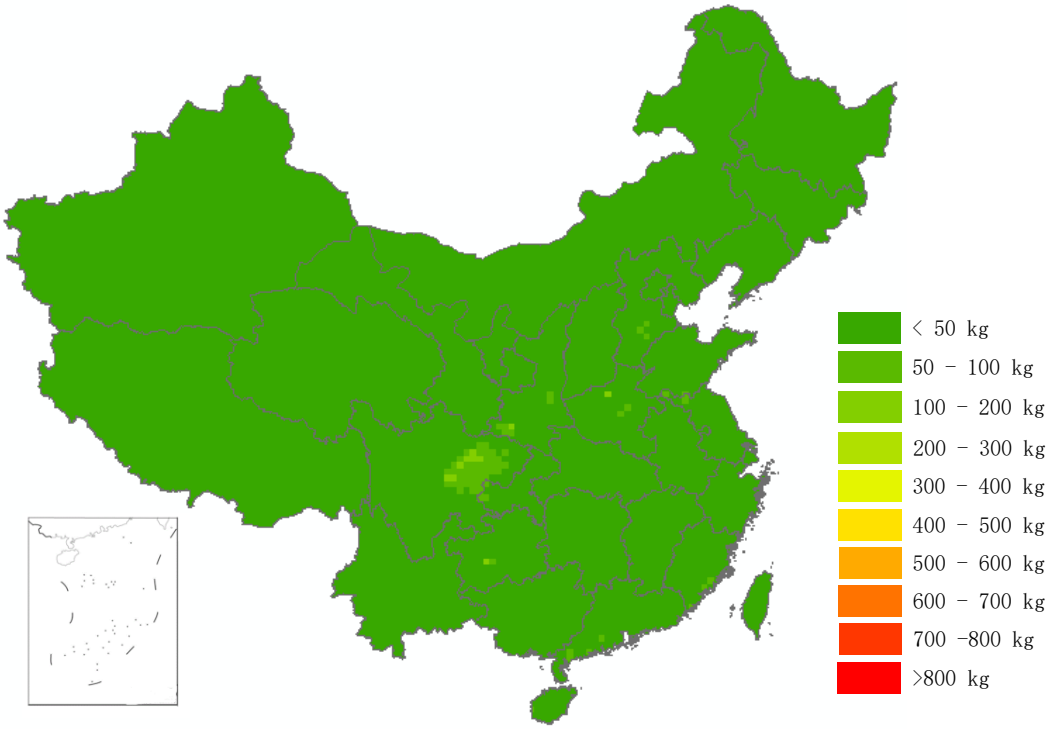



**Fig.S1**. Monthly NH3 emissions from N fertilizer use

## 2 Updating the emissions in different years to the year of 2011

In order to make the comparison more reasonable, we updated the emissions in different

years to the year of 2011 based on the changes of fertilizer use, temperature and precipitation.

(1) fertilizer use

The basic emission factors in each research remain same. First of all, the $NH_3$ emissions are affected by the amount of fertilizer used. The amount of different fertilizer types used in each province from 2000 to 2011 were obtained from the Chinese statistic materials. The values for the whole country were shown in the following figure. We firstly updated the $NH_3$ emissions in these researches according to the changes of fertilizer use.

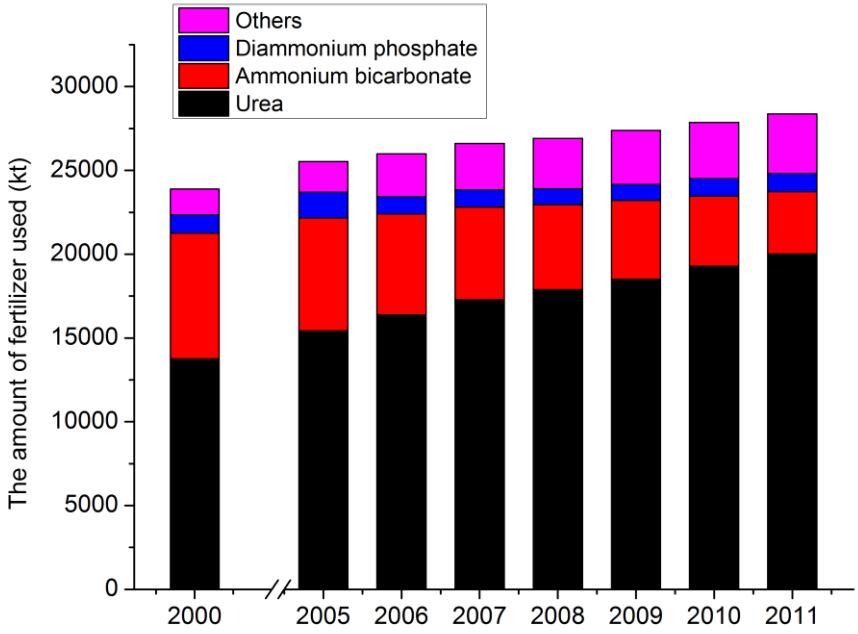



**Fig.S2**. The amount of different fertilizer types used in China from 2000 to 2011

(2) temperature

Zhang et al. (2011) and Huang et al. (2012) considered the impacts of temperature on emission factors. The averaged temperatures in major cities for each province and each month in the year of 2005, 2006 and 2011 were obtained from the China statistical yearbook. The annual averaged temperatures were shown in the following figure:

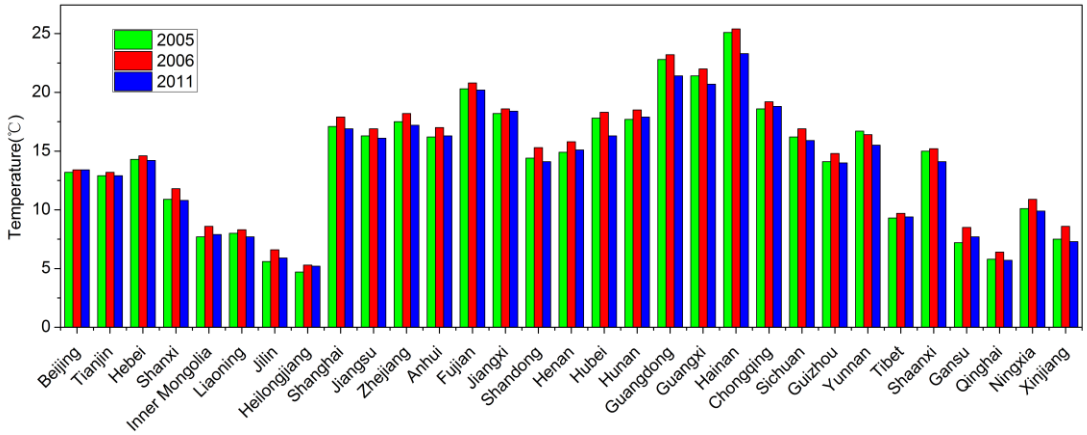



**Fig.S3**. The provincial temperatures in the year of 2005, 2006 and 2011

In the research of Huang et al. (2012), she set four temperature intervals: <10℃, 10-20℃,

20-30℃ and >30℃. In each temperature interval, specific emission factor was used. The interval width is 10℃, but the temperature change between these years, so we don't consider the impacts of temperature on the result of Huang et al. (2012).

In the research of Zhang et al. (2011), the impact factor of temperature $RF_{temperature}$ is determined by equation:

$$RF_{temp} = e^{\left(0.1386\times\left(T_{month}-T_{year}\right)/3\right)} / 2$$

Here, $T_{month}$ is the monthly averaged temperature and $T_{year}$ is the annual averaged temperature. We adjusted the $NH_3$ emission in Zhang et al. (2011) from 2005 to 2011 according to the change of $RF_{temp}$.

(3) precipitation

Zhang et al. (2011) considered the impacts of precipitation on emission factors. The precipitations in major cities for each province and each month in the year of 2005 and 2011 were obtained from the China statistical yearbook. The total precipitations were shown in the following figure:

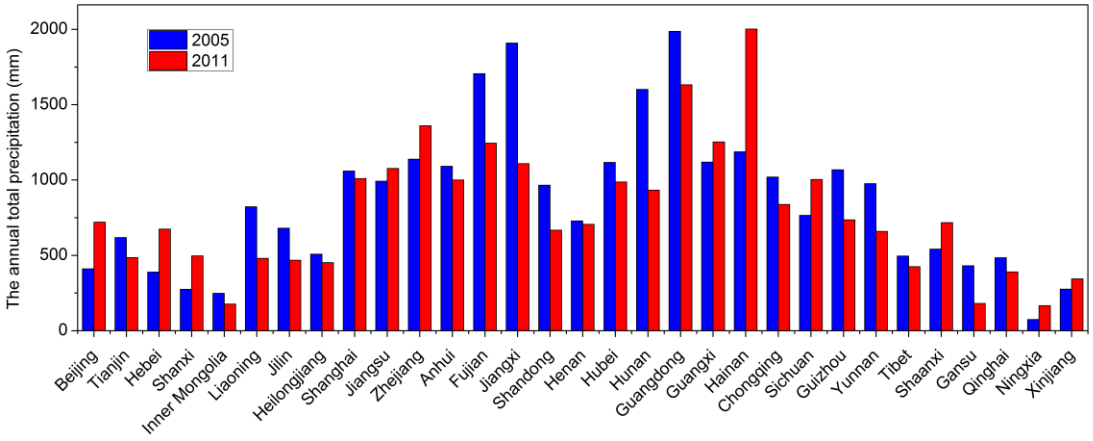



**Fig.S4**. The provincial precipitations in the year of 2005, 2006 and 2011

In the research of Zhang et al. (2011), the impact factor of precipitation $RF_{precipitation}$ is set as 0.75, 0.80, 0.85, 0.90, 0.95 and 1.0 for significant rainfall events (>5 mm in 24 h) within 24h, 24-48h, 48-72h, 72-96h, 96-120h and >120h. We adjusted the $NH_3$ emission in Zhang et al. (2011) from 2005 to 2011 according to the change of days with significant rainfall events (>5 mm in 24 h).

## 3 Comparison with other studies

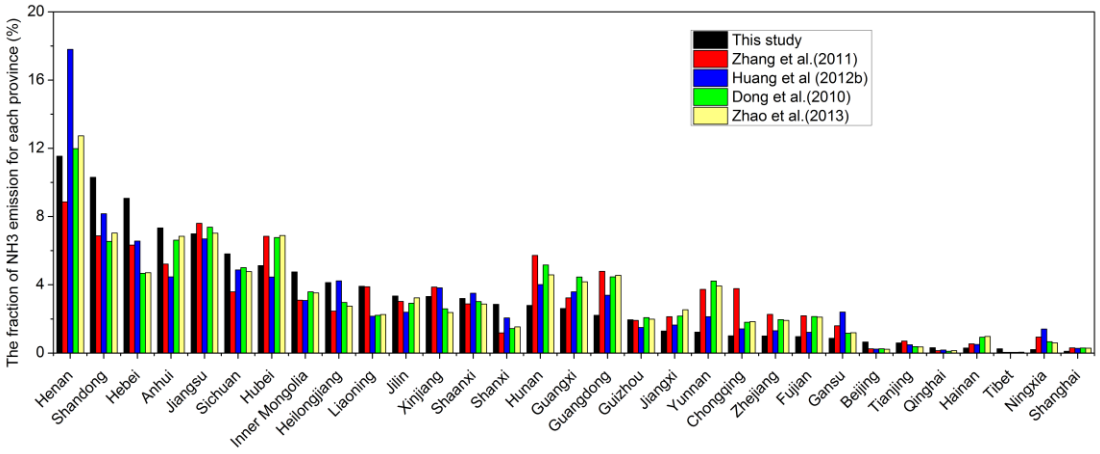



**Fig.S5.** Comparison of provincial NH3 emissions from N fertilizer use in different studies

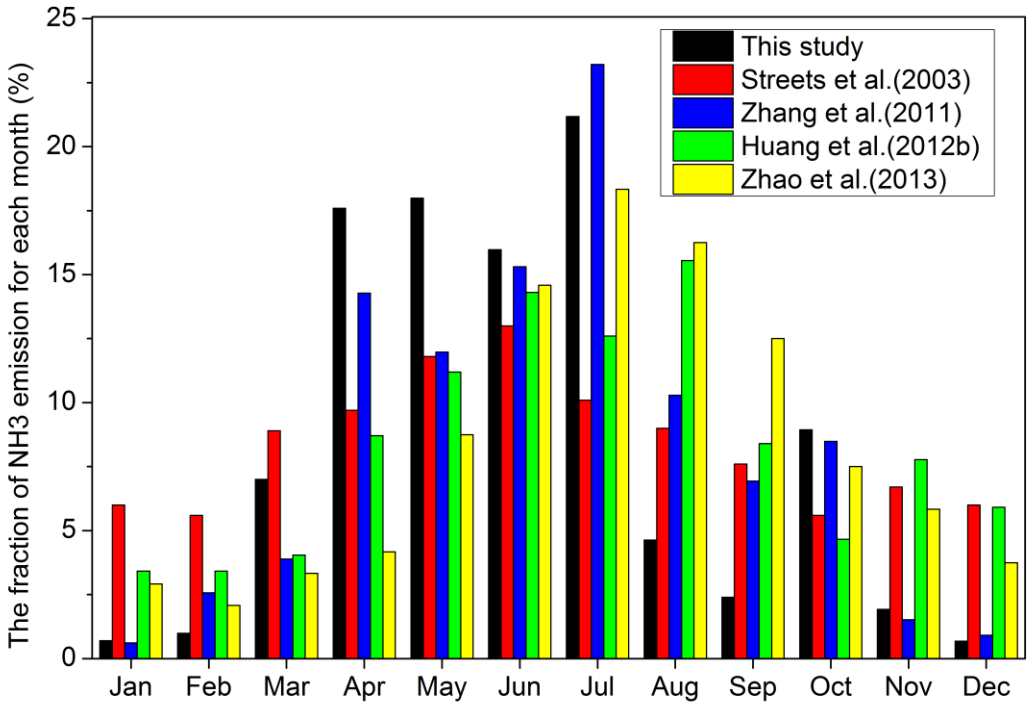



**Fig.S6.** Comparison of monthly NH3 emissions from N fertilizer use in different studies