Review of

Inventory of anthropogenic methane emissions in Mainland China from 1980 to 2010

By Peng et al. (2016), ACPD submitted for publication under ACP

The paper documents an interesting and unique emissions dataset of methane for China (excluding Hong Kong and Macao) with timeseries 1980-2010 and gridmaps at 0.5degx0.5deg. This CH4 inventory is important input in the first place for the 2 National Communications of 10/12/2014 and of 8/11/2012 of China to UNFCCC but also for the Hemispheric Transport of Air pollution Task Force under the CLRTAP and complements there the MIX dataset, documented in Li et al. (2015, ACPD).

The dataset is a bit weak on:

1) the spatial distribution and could benefit of connecting with Tsinghua University (Q. Zhang) and maybe also with PKU-NH3 (X. Huang) to improve the latter.
2) the temporal resolution which would need to be for the HTAP community at least monthly. The seasonality is in particular important for agricultural sectors, which are the major sectors for CH4. The dataset could improve on this using the temporal profiles in particular for rice cultivation from large literature by Chinese scientists.

The paper compares its inventory with other emissions inventories of USEPA and EDGARv4.2, but should extend this by considering also the national inventories reported by China in its National communications to UNFCCC. The paper also evaluates the changes of the sector-specific emissions over time, but could be completed with a real trend uncertainty and analysis of the major determinants for these trends (such as CH4 recovery of coal mining as pushed under the CDM, change in conditions of rice cultivation, etc.).

General comments

The documentation of the dataset could be considerably improved by:

1) Giving a full documentation of the sectors covered (maybe making use of the Common reporting format of the UNFCCC reports) and providing also info on what is not included. E.g. what is included in the gas/oil exploitation? Only gas/oil exploration and venting or also the transmission of gas/oil in pipelines, gas distribution networks (very important source, leading to hotspots in cities). What is not included in the coal exploitation? If the emissions of abandoned mines, closed mines are not estimated, this should be mentioned.
2) Giving a full documentation of the spatial distribution. References for the geo-spatial proxy datasets are missing.
3) Elaborating more on the intercomparison of inventories, including the UNFCCC National Communications of China and using the uncertainty recommendations of IPCC GL (2006)

The content of the paper could be enriched by:

1) Addressing the seasonality, in particular of the agricultural activities. Ideally providing monthly gridmaps with full documentation of used temporal profiles.
2) When describing the emissions at province level, please mention that Macao and Hong Kong are not included. Please compare the emissions magnitude and emission trends between the different provinces. Can there be particular shifts of emissions from one province to another be observed over time? How do the emission factors (per unit of activity) vary amongst the different provinces? Maybe also a mapping of the major emission sectors for each province might be interesting.
3) Highlighting the fact that the database is a fully consistent bottom-up database with activity data and with recovery (correction factor), which allows to conclude for the trend analysis on the determinant factors of some CH4 mitigation measures (e.g. CH4 recovery of coal mining, also CH4 recovering of the gas/oil exploitation, waste separation, …) with the effect they had on the emissions of China. Please derive which reduction potentials further exist.
4) Discussing an outlook on how to maintain and update the database, at which frequency, using which data sources.

Specific comments

-) English could be improved: p.1 l13 "have", l14 "contribute"; p4, l18 "are"; p5, l18: remove "emissions", p7, l9 there are few measurements, p12 l26 "and northward of" needs to be corrected; p13, l6, "Yevich", p14, l1 "and 5.2%" should be "to 5.2%"; p.17 l13 "publicly"

-) abstract: please mention that it is an ANNUAL bottom-up inventory

-) page 2 line 22: is the 2010 number of EPA reported/calculated or projected. If it is the latter, please make the difference between reported/calculated data and projected data. Also in fig. 2, make the distinction by have e.g. open circle for projected data.

-) page 3: instead of mentioning "English and Chinese literature", please give the real list of references (and mention the language in the reference list).

-) page 3: formula: what do you mean exactly with "conditions". Do you mean "technologies/ practices, modi operandi"? Moreover: why is the EF not varying in time but only the correction factor?

-) page 4: "CH4 utilization or flaring"? You mean the "CH4 recovery instead of venting into the atmosphere"? Please use the standard reporting language (as also in the CDM)

-) page 4 – Table 1: enteric fermentation is (as described in the IPCC GL (2006)) depending for the dairy cattle on the milk production per head and for the non-dairy cattle and other cattle on the live weight per head. These details would be of interest, also complementing the info in the IPCC GL (2006).

-) page 5: What do you mean exactly with "biomass burning"? Only small scale or also forest fires, etc. ? Moreover, in formula 2: Why do F and theta not have the index C?

-) page 6: in e.g. UK we see huge differences in EF for the fugitive emissions from coal mines, because of different geological underground (based on measurements). Is Zeng et al (2006) for China, a much larger country than UK not reporting a similar large variety?

-) page 6: Have emissions estimates from abandoned mines, closed mines been omitted?

-) page 6 – Table 2: please specify the CH4 recovery of coal mining gas in the table per province. Please add to the Table also the rice cultivation per province and reflecting as such the difference in cultivated area times the number of cropping seasons. This would be valuable information that adds to the information at Chinese province level in the IPCC GL2006)

-) page 7 l7: please specify the EFs in kg CH4 per TJ instead of per kton oil or per m3 gas, because the heat value can change significantly between the different types of oil and different types of gas. Please have an evaluation of the gas distribution leakage. Even though Lelieveld et al (2005, Nature) did not found large leakages from transmission pipelines, it is well-known that the gas distribution networks (especially of the old steel pipeline networks in older cities) are subject to large leakages.

-) page 8, l2: Is the China Env. Stat. Yearbook not showing differences in practices between large versus small or young versus new cities?

-) page 9, l7: please map carefully in a table for each (sub-)sector the specific proxy datasets (over time) are used; page 9, l14 why is livestock distributed with agricultural gross domestic product and GDP and not with the maps of animal numbers, as available from the geonetwork at the FAO site? Why is the oil & gas distributed with GDP, if there are data available on oil and gas exploitation from NOAA? Why considering only 414 coal exploitation sites, if Liu et al (2015, Nature) has a map of several thousand sites. The two-step distribution as described in lines 19-20 should be used for all (sub-)sectors.

-) page 10, l8: please carefully derive when the acceleration in CH4 emissions start, definitely after 2000, but can we even say in 2002 when China joined the WTO?

-) page 12, l16: Seen the relative large variation in rice emissions over time (in EDGARv4.2 varying from 19.2 to 11.9 Tg CH4/yr), please compare the emissions of the same years: so the 2005 value of 13.2 Tg CH4/yr with the NDRC value of 7.9 Tg CH4/yr and with the Chen (2013) estimate of … in 2005.

-) page 13, l1: maybe a discrepancy can be found in the definition of "biomass burning". Please have a careful look what is included: vegetal waste burning, agricultural waste burning, crop residue burning, field burning, grassland fires, woodland fires, forest fires, …?

-) page 14: l3: EDGARv4.2 uses the CDM of UNFCCC as input for all developing countries on coal mine gas recovery (cfr. IEA's CO2 from fuel combustion book, part III, GHG).

-) page 16: please give a quantitative evaluation of the mitigation measures and an outlook on the further reduction potential based on the references. Page 16, l6: please evaluate carefully that new PVC gas distribution networks are better than the old steel networks and that new transmission pipelines (such as for the connection Russia and China) are not expected to lead to high leakages. Input on these issues can be gained also from the Chapter 5 of the AMAP report on CH4 from Hoeglund-Isaksson et al. (2016)