

Interactive comment on “Nepal Emission Inventory (NEEMI): a high resolution technology-based bottom-up emissions inventory for Nepal 2001–2016” by Pankaj Sadavarte et al.

Anonymous Referee #2

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General comments Overall, this is an interesting, well-researched piece of work and is worthy of publication. However, there is some confusion about the scope of the study. Although the abstract states that the study focuses on the energy-use sectors and agro-residue open-burning, Section 3.2 also includes estimates of agricultural CH₄ emissions from livestock (but not rice cultivation) although these estimates do not appear in any graphs or tables as far as I can see. This is rather confusing and perhaps CH₄ should be omitted altogether (as Referee #1 suggested). However, if CH₄ is to be included, then perhaps all other major anthropogenic CH₄ sources should be covered as well, including rice paddy, landfill waste, waste-water etc. Also, if the study were to be expanded to include non-combustion agricultural activities, then adding ammonia

C1

(NH₃) (e.g. from livestock manure management and application of N-fertilizers) to the list of inventoried pollutants would also add value. This is because NH₃ is a very important precursor (in addition to NO_x and SO₂) of secondary inorganic aerosol, and so would need to be included if the inventory results were ever to be used as input to subsequent atmospheric chemistry transport modelling. I also agree with Referee #1 that comparisons of the results with other inventory initiatives that cover Nepal, especially EDGAR and GAINS-Eclipse, would enhance this study.

Specific comments Scope of study. On page 22 (lines 1 and 2) it states that ‘For analysis and comparison purposes, only the combustion based emissions from energy sources are considered, leaving out fugitive emissions from livestock management.’ So this begs the question: What about open-burning of crop residues – were these included? Residential open burning. Not clear what is meant by residential ‘open burning emissions of wood and residues’ on line 20 of Page 2, ‘heating outside’ on lines 17-18 of page 8 and ‘Space heating, Open burning’ in Table S2. If this is this just burning of biomass in open fires indoors this should be clarified. The term ‘open burning’ suggest to me that the fires are located outside the house (in the open) which seems a strange way to heat a house. Page 5, line 6: Does the 15-fold increase in vehicle registrations over 2 decades equate to an actual 15-fold increase in vehicle numbers – or just better enforcement of registration rules? Line 16: Should this be ‘IPCC Tier 1’ or ‘EMEP/EEA Tier 1’ or both? Kerosene lamps. Little distinction is made between kerosene wick lamps and kerosene hurricane lamps – (although ‘kerosene lanterns’ are referred to once on page 22, line 9, which I assume equates to hurricane lamps?). In Table S2, for BC, only the emission factor (EF) for wick lamps (90 g/kg) is given, from Lam et al (2012), although that paper (Table S5) estimates 20% of kerosene used for lighting in this region is likely to be in hurricane lamps (EF for BC is 9 g/kg). Do the authors therefore assume no hurricane lamp use for their calculations? Also, in Table S2, Lam et al (2012) is given as the source of the N₂O and SO₂ EFs, but these do not exist in that paper (as far as I can see) and the OC EF of 0.52 g/kg in Table S2 compares with the average of 0.4 g/kg for wick lamps given in Lam et al. Please

C2

could the authors correct and/or explain the derivation of their EFs for kerosene-fuelled lighting. Brick kilns: Page 13, line 2: It would be nice to know how many of the 557 FCBTKs had the zig-zag firing technology, and also how many VSBK there were.

Technical corrections Page 2, line 14: 'Tons' is not an SI unit – presumably this should be 'tonnes'? Then Gg is used thereafter. Consistency in use of units required – suggest using Gg throughout (or Tg for CO₂ and CO). Page 4, line 21: Should 'intake' be 'exposure'? Line 22: children (not childrens') Page 6, line 6: 'arising' not 'arousing'. Line 16, Delete '-forcing' as SLCPs stand for 'short-lived climate pollutants'. Page 9, line 7: Replace 'rest' with 'the remaining'. Line 8, 'LPI' and 'SMI' should have been defined earlier in this paragraph. Line 26: Insert 'data on' between 'provided' and 'how'. Page 11, line 22: Should be 'we intend' not 'we tend'. Page 13, line 19: Who is the personal (not personnel) communication from? Page 17, line 7: Replace 'they' with 'there'. Page 19, line 2: Replace 'small increase in' with 'slightly higher level of'. Line 6, Replace 'increase' with 'difference'. Line 8, insert 'being' at start of line. Page 21, line 18: Replace 'spike in 2016 energy' with 'large increase in 2016 energy use'. Page 24, line 1: For 'aerosols' the %SO₂ is included in the list yet NO_x is also an important precursor of secondary inorganic aerosol – why not include this too? If NH₃ were to be added to the inventory (see general comments), this would also need to be added for the same reason. Page 24, line 2: High OC emissions are referred to as shown in Fig 6 – but CO is in that fig, not OC. Has there been a mix-up over OC versus CO? Page 22, line 19: The text includes the 2011 emission estimate for CO and then on page 23, lines 5 & 6, emissions of CO₂, CH₄ and N₂O. Why were these not included in Figure 5(a) or perhaps in a separate table? Page 25, lines 19 & 20: Values given here for all species apart from SO₂ are slightly different from those given in Table 5. Page 27, lines 23 & 24: Need to rephrase this – I don't think diesel gen-sets were changed to zig-zag firing! Figure 9: Make clear this graph is for 2011. Table 6: Make clear that these values are emission ratios (MTM/NPL). Table S3: Footnote 'e' refers to the liquid fuel combustion in industry having a 22.5% sulfur retention. But liquid fuels leave no ash and so there should be zero sulfur retention in ash – so this must be wrong. If

C3

this footnote should have applied to coal use in industry, then again 22.5% looks wrong as USEPA's AP42 (5th edition, Section 1.1.3.2) implies only 5% retention-in-ash for bituminous coal (the type of coal used in Nepal). Please explain.

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C4