

Although the authors have implemented some of the changes required by the reviewer, they fail to comprehend the biggest issue of their work.

As mentioned at several places in the reviewer comments, the BA1980 scenario is completely wrong to interpret today's emission regional levels as well as to evaluate the impact of emissions control legislation in mitigating air pollution. Please find below further reviewer's comments in red to the authors' answers to the former review (reported in black).

- "The numbers and statistics presented by the reviewer (unfortunately without reference) are representative of the current legislation (CL) simulation and cannot be used for the BA1980."

Please find below the reviewer's comments including the references:

- Whereas China and the USA show similar population growth rates (of respectively 0.012 /yr and 0.011 /yr), CO₂ emissions in China increased much stronger than in USA (0.099/yr and 0.051/yr respectively).

- Moreover China showed an acceleration in emissions increase (more than 10% in average) in 2002-2010, the period with flattening of the population growth rate (only 0.0047 /yr). - Africa and the Middle East show a fast population growth rate (0.037 /yr) but modest emissions growth rate of 0.047/yr (similar to USA).

- EU showed only a very small population growth rate of in average 0.0030%/yr which is difficult to link with the emissions decrease rate (of -0.0035/yr in average). This exercise illustrates that a constant emissions per capita factor has different meanings for different regions and as such, it is unclear what the meaning of a BA1980 scenario with constant per capita emissions is.

References:

-For the population data:

UNPD (UN Population Division) (2015). World Population Prospects (WPP), The 2015 Revision United Nations, Department of Economic and Social Affairs, Population Division

-For the EDGARv4.2FT2014 CO₂ emissions trends:

(http://edgar.jrc.ec.europa.eu/overview.php?v=CO2ts_pc1990-2014)

Olivier, J.G.J., G. Janssens-Maenhout, M. Muntean and J.A.H.W. Peters (2015). Trends in global CO₂ emissions: 2015 Report, JRC 98184,2015. (and references therein)

Olivier and G. Janssens-Maenhout, CO₂ Emissions from Fuel Combustion -2014 Edition, IEA CO₂ report 2014, Part III, Greenhouse-Gas Emissions, ISBN 978-92-64-21709-6.

-For the per capita emissions and implied emission factors, specified per region:

Janssens-Maenhout, G., Crippa, M., Guizzardi, D., Dentener, F., Muntean, M., Pouliot, G., Keating, T., Zhang, Q., Kurokawa, J., Wankmüller, R., Denier van der Gon, H., Kuenen, J. J. P., Klimont, Z., Frost, G., Darras, S., Koffi, B., and Li, M.: HTAP_v2.2: a mosaic of regional and global emission grid maps for 2008 and 2010 to study hemispheric transport of air pollution, Atmos. Chem. Phys., 15, 11411-11432, doi:10.5194/acp-15-11411-2015, 2015.

“Our hypothetical scenario BA1980 neglects (in purpose) the globalization of industry that happened the last decades, since it is constructed as a business-as-1980 scenario. BA1980 assumes that nothing has changed, other than the population itself (including regional information).”

The authors have not understood that especially regional changes of population cannot be considered as drivers of the emissions happening in the corresponding regions. How can the authors justify their scenario? They developed a scenario which cannot be used to reach any conclusion on emission changes.

“None of those scenarios represents what we wanted to test, which would have been a combination of STAG_TECH (but global stagnation) and STAG_ENERGY but for 1980 fuels etc. and no increase in energy demand.”

What did the authors want to test? How can the authors decouple the impact of policy on air quality if they did not develop an adequate scenario?

“Based on our scenario the human activities in each region remain the same as in 1980- this means we do not account for globalisation of the industrial activities. This is afterwards indirectly accounted when discussing the increase in the energy demand based on Table S2b (see our earlier reply). Of course, in another scenario, the emissions could increase with human activity and not human population. In our scenario though it is clearly stated (by the name of the scenario – Business-As-1980) that human activity does not change in any way, only number of humans per grid. **This results to the population increase being the only driver for emissions increase, which we believe is the best reference scenario for one to use in order to study the impact of emissions control legislation at any region.**”

The authors should prove that what they believe is true and that the scenario they developed is, as they state, the best one to study the impact of emission control legislation in any region. Moreover, the authors should discuss what they have additionally learnt from their study compared to the Crippa et al. (2016) and the Turnock et al. (2016) papers or other retrospective scenarios existing in literature.

“The scope of this paper is to prove that in order to evaluate the effect of applied emission control legislation, the comparison of the pollutant levels of present years to pollutant levels based on a scenario that just keeps the anthropogenic emissions constant to the levels of a past year is not correct. Scenarios that take into account population increase and migration (shown here) and energy demand (not simulated but calculated and discussed here) should be used instead. This is already stated in the title, abstract and conclusions of the manuscript. In order to extract any results by a model simulation, a thorough validation of the model results needs to be done. Otherwise, any results produced by said model would not be credible. This leads to the current structure of the paper, which demonstrates that the model calculates realistic concentrations of pollutants, and then addresses the key point of the paper.”

The reviewer does not agree that the scope of the paper is reached through the methodology and study developed by the authors. The authors need to change the title of their paper since their current analysis cannot assess “The success of emissions control legislation in mitigating air pollution”.