

## ***Interactive comment on “The net climate impact of coal-fired power plant emissions” by D. T. Shindell and G. Faluvegi***

### **Anonymous Referee #2**

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#### General comments:

This paper presents an analysis of the climate effects of coal fired power plants. It is mostly focused on the balance between the long term warming effect CO<sub>2</sub> emissions and the short term cooling of aerosol emissions, and how this balance may be influenced by air quality controls. It mainly considers the effects of the new power plants that may be built in China and India.

The interest of this paper for ACP readers is low in its current state. It is not obvious to identify what is really new in this paper. The fact that sulfate aerosol may mask part of the warming from CO<sub>2</sub>, and that this masking effect is only temporary is not really new (see for instance Andrea et al., Nature, 2005 or Dufresne et al., GRL, 2005). How the results presented in this paper compare with raw computations where the radiative

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forcings or the temperature changes are simply estimated by linear regression between existing scenarios? What are the added values of this study? I am convinced this paper could be interesting and provide valuable information, but its presentation needs to be improved.

I also have one concern: in their discussions and analysis, the authors (1) consider only the emissions by the added power plants and not by the currently existing plants and (2) consider only the emissions from China and India and not those from USA which currently has the largest emissions. These two hypothesis are consistent as most of the new power plants will probably be installed in China and India, not in the USA. But if these hypothesis are held, the title should be modified and the discussion of the historical context should be shortened. If these hypothesis are modified, the emissions by existing power plants should be better addressed. See also comments below.

I am not sure ACP is the right journal to published this paper, may be Climatic Change could be better. In any case, I recommend this paper be modified before being published.

## Specific Comments:

The figures and the captions need to be checked and improved (colors do not matched)

P. 21259, L. 6-7: "Nearly half the known reserves are in the US, China and India, countries with large projected increases in energy demand over coming decades." If the reserves are large in the US, why is the possible large increase of emissions not considered for this country?

P. 21259, L. 18-19: "While the separate impacts of short lived pollutants on air quality and of CO<sub>2</sub> on climate are relatively well characterized, the interplay between the two has not been examined closely." Some studies still exist: see for instance Andrea et al., Nature, 2005 or Dufresne et al., GRL, 2005.

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P. 21260, L. 16-17: how these growth compared with those used in SRES or RCP scenarios?

P. 21263, L. 1: the AIE is also considered in the control emissions (Fig. 1)

P. 21263, L. 19-25: - the initial radiative forcing (RF) for existing power plants has a negative value probably because emissions before year 2000 are not considered. The most important for this study is the change of the RF between year 2080 and 2000. This should probably be highlighted by the authors - It could be interesting to add a scenario with constant CO<sub>2</sub> emissions but a decrease of SO<sub>2</sub> emissions due to air quality pollutant controls. - USA constant emissions could be added for comparisons

P. 21264, L. 5: "Hence these results provide a rough estimate..." This is not correct as the RF not only depend and the emission amplitude, but also on the emission growth rate. A more in depth analysis is given by the authors p. 21270

Fig. 2: this figure and the corresponding text is difficult to read as the line colors are not correct

P. 21265, L. 2: "The greatest difference..." This sounds quite obvious. The authors want to highlight that aerosols do not affect the RF at the end of the century? If yes, please also consider the already published results previously mentioned

P. 21265, L. 9 and L. 23: Specify that Figs. 3 and 4 are consistent with already published results

P. 21266, L. 2: If uncertainty in estimating the climate impact of FUTURE EMISSIONS is addressed, emissions of current power plants and the role of possible air quality pollutant controls should be included. Currently this section address only the emissions from the ADDED power plants.

P. 21267, L. 5-13: The comparison with constant emissions RFs should be included.

P. 21270, L. 27: "relatively slower than faster rise in Northern Hemisphere": in the

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Southern Hemisphere?

P. 21272, L. 15-16: Please also cite already published results that obtained same conclusions.

P. 21272, L. 19: "Hence the  $1.5 \text{ W/m}^2$  forcing ...to contribute a substantial fraction of the total projected climate forcing". How this compared with a direct comparison between the CO<sub>2</sub> emitted globally and only by power plants?

P. 21273, L. 15 and 19: There is no other references than The New York Times?

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