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Atmospheric Chemistry and Physics Discussions



# *Interactive comment on* "New particle formation in the fresh flue gas plume increase the effective particle number emissions of a coal-fired power plant" *by* F. Mylläri et al.

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Interesting approach to use a helicopter to stay in a narrow plume. However, the data presented are totally different to other power station plume studies (see for example Junkermann et al, 2011, Junkermann and Hacker, 2015).

Unfortunately the manuscript does not discuss possible sampling errors due to inlet lines or to downwash of the helicopter, nor due to dilution of the stack flow with hot gas in the stack samples, though that might not be the most critical point.

The paper also does not mention how flight guidance was done. The plume as measured by the lidar and shown in the supplement is only about 100 wide after 800 m



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and slightly meandering, easy to miss when the flight track is not along the main wind direction and altitude is not perfectly matching.

As the date and time of the measurements are not given weather conditions cannot be checked with a simple HYSPLIT calculation. However, between the two flights a wind shift of 50 degrees was observed which cannot be considered as a stable wind direction. Wind direction for the FDG+FF off case is given as 210 degrees, the actual flight track is 225 degrees.

Wind direction for the FGD+FF on case is 260 degree. Only one short flight track is actually 260 degrees, the majority is either 272 or even 285 degrees, totally off the given wind direction.

Concerning the measurements within the stack errors due to the dilution with hot air may lead to further errors. Measurements were done at a location where the air, sulphur dioxide and most probably sulphuric acid mixture was still at 200 degrees. This temperature would likely suppress the production of small droplets in the stack (Brachert et al, 2013, 2014), the dilution by 1/27 with dry (?) air would further dry the air /droplet mixture and reduce the size of or even evaporate apparent droplets. For measurements and model calculations in the stack see Brachert et al, 2013, 2014. These papers show the sulphuric acid droplets are formed already inside the stack in agreement with the measurements of Junkermann and Hacker, 2015, showing that even at sunset (hardly any OH radicals) the particle flux is very close to what is measured under bright sunshine in the late morning, an indication that a larger fraction of the particles in the plumes have to be considered as are primary emissions.

Also, in agreement with Lonsdale et al, 2012 particle formation might be suppressed in the first hour by coemitted NOx. Further particle production occurs during transport, but this is at 5 m/sec several km downwind.

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