ANSWERS TO REFEREE #1

We thank the referee for his good appreciation of the paper and his comments.

REFEREE #1: 1) It would be better if the module(s) on deposition processes be explained in more detail since the authors claimed deposition might be one of the important error sources for ammonia.

AUTHOR: We add in Sect. 3.1: « Dry and wet deposition of gaseous and aerosol species is parameterized from three types of sequential resistances following the resistance analogy (Wesely, 1989). An aerodynamical resistance is estimated based on turbulent parameters (e.g. Monin-Obukhov length, friction velocity, dynamical roughness length). A quasi-laminary boundary layer resistance is calculated based on the molecular diffusivity of water and gaseous species and Prandl number. The surface resistance of vegetation and soils is estimated from several parallel resistances related to plant surfaces via opening of stomata, and related to non-stomatal deposition at plant and soil surfaces (Erisman et al., 1994). The scavenging of gases and particles, both in clouds and rain droplets, is included in CHIMERE. The scavenging of HNO_3 and NH_3 by cloud droplets (in rain droplets) is assumed reversible (irreversible). In clouds, particles can be scavenged by coagulation with cloud droplets or by precipitation, or can act as cloud condensation nuclei to form new droplets. Particles can also be scavenged by raining drops below the clouds. More details can be found in Menut et al. (2013). »

REFEREE #1: 2) The authors claimed that crustal species were minor and I agree with the authors on it. Another point that should be checked for the validity of the gas/particle equilibrium model is the effects of organic acids. Since some organic compounds (gas phase) were measured, a discussion on the effects of organic acids would be possible (though qualitative or semi-qualitative)

AUTHOR: We agree that this is an interesting topic but the ISORROPIA model does not take into account any of these effects. This point is thus beyond the scope of this paper.

REFEREE #1: 3) It would be nice to discuss on the sensitivity of ISORROPIA to the RH near to the deliquescence point of ammonium nitrate.

AUTHOR: The partitioning of inorganic compounds between the gas and the aerosol phase depends on temperature and RH conditions. As mentioned in Sect. 4.2.2, both parameters are slightly biased in the simulation (-1.6°C for temperature, +5.9% for RH) but these errors have a very limited influence for instance on NH_3 that increases by around 7% on average when the errors of RH and temperature are corrected in ISORROPIA. The impact of errors on meteorological parameters may be larger close to the deliquescence point of NH_4NO_3 where the partitioning between both phases is more strongly influenced by RH (and consequently by errors on RH). However, focusing on the days with RH between 60 and 65% (80%), the average increase of NH_3 only reaches +14% (6%). We propose to add the following sentences in Sect. 4.2.2: « Errors may be larger close to the deliquescence point where the influence of RH is stronger. The deliquescent RH (DRH) of NH_4NO_3 and $(NH_4)_2SO_4$ at 298K are 61.8 and 79.9%,

respectively (Seinfeld and Pandis, 2006). A mixture of both salts will have a DRH between these two extreme values. Focusing on days where RH ranges between 60 and 80% (i.e. close to the deliquescent point of the mixture), the average NH_3 increase is even lower (6%). It reaches 14% when considering RH between 60 and 65%. In any case, the impact remains limited. »