Reply to Anonymous Referee #2

We would like to thank you very much for your comments and remarks.

General comments

One of the main aims of the paper was to build systematic mathematical background for multi-model ensemble systems. Therefore we had to use mathematical notions and include formulas. It is true there are many formulas in the paper that can scare off many readers. We are however prepared to run that risk comforted by Immanuel Kant's famous statement: "In any knowledge there is as much truth as there is mathematics".

p. 14270 l14. To be more precise we speak about independence of *random variables* representing models and measurement, not just data. This concerns model and measurement errors or pdfs. Hence we think that assumption that models and measurement are independent is reasonable. We have reformulated the paragraph to clarify that we use the notion of independence and correlation as it is used in probability theory. Below we have marked main changes in red (same as in reply to reviewer 1).

…More formally, the independence of two systems can be expressed by the independence of random variables i.e.: two variables z_1 and z_2 representing two models are independent whenever their joint probability can be calculated as a product of individual ones i.e. $p(z_1, z_2)=p(z_1)p(z_2)$. This condition is reasonable in the case in which z_1 is the result of a model and z_2 is a measurement, but it is not difficult to imagine that it will not apply necessarily to two models. In fact in the latter case the condition applies to all results extracted from the two pdfs and implies that there is not possibility of a synergic contribution of the two models to the same result. In general this is a condition that is difficult to satisfy and verify for any atmospheric model. We will therefore relax the independence condition, thus requiring that the members of our ensemble are un-correlated in the sense of un-correlated random variables. This is a more realistic assumption to the extent that it applies to the average behavior rather than the intrinsic properties of each model. Formally the un-correlation is in fact defined as: $E\{z_1 z_2\}=E\{ z_1\}E\{ z_2\}$ where $E\{\}$ is the expectation value. The un-correlation includes the VL(2007) condition of independence of identical pdfs but also the condition of different pdfs or partly overlapping ones, as depicted schematically in Figure 2. Hence we have transferred the notion of correlation (or independency) from probability theory to the models. We are aware of the fact this is not commonly used term in ensemble systems but this allows us to use precise mathematical formulations.