

Review of

New ozone-nitrogen model shows early senescence onset is the primary cause of ozone-induced reduction in grain quality of wheat

by

Jo Cook et al.

The paper details the addition of nitrogen process into the DO3SE-Crop model. Nitrogen O₃ interaction within a plant physiology is a very important element toward the definition of the yield of a crop and its quality.

The paper is complete and there are no major comments or suggestions to be made a part for the 3 listed below. It is supported by a thorough and complete literature, which well places the current study in terms of scientific relevance and novelty. The content is presented in a clear and structured way and it is supported by necessary appendices.

This kind of modelling is complicated by definition, as it has to rely heavily on observation and parametrizations while aiming at a level of generality and applicability to a number of different cases. The authors have taken all necessary steps to make sure that they are in control of the parameter space and are able to identify rather precisely the relevant parameters that control the process.

In light of the above, the paper may be published though I would like 3 points to be clarified.

1- in the nice flow-chart representation of figure 1 the authors present the complete chain of causes and effects that relate O₃ and N detailing what is in the model already, what is not and what has been added.

If I concentrate on box 1, I see for example that the process of neutralization of ozone uptake into the leaves is not modelled so my question is how do you calculate the excess of ROS not neutralised which then affects all other boxes (2 and 3)? How do you go from "Ozone enters the leaf" to "Accelerated senescence" in box 2 and "Reduced carboxyl oxidation" in box 3 in the actual model? It looks as if the chain that defines the storage of N is well represented in the new module but for ozone we go from entrance in the leaf to carboxyl efficiency reduction. Is the rest parameterised?

2- In the analysis of the Sensitivity results the authors mention:” . In our sensitivity analysis we observed a difference in the magnitude of S1 (the uncertainty in the output variable that is attributed to varying only that parameter) and ST (the uncertainty in the output variable that is attributed to varying a chosen parameter in combination with the other selected parameters) (Saltelli et al., 2008) between the different O3 treatments. It is unclear why this effect occurred. It isn’t possible to determine whether the magnitude of S1 and ST is anomalous for the low or medium O3 treatments, or whether a pattern exists at all in S1 or ST between O3 treatments since the present study considers data on one cultivar for one location only.” Can this discrepancy be attributed to a non-linear interaction between additional parameter added in the analysis and the other one? This would explain an increased sensitivity and could be determined by analysing the level of co-relation existing between the parameters used for the sensitivity. May be worth exploring.

3- This manuscript will be published as contribution to the TOAR Special Issue. However, I do not see a single reference to the project in the paper, which seems a bit odd in my humble opinion. Clearly, it could be published as a standalone publication, though if the authors have chosen the TOAR SI they must have a reason and the readers should be informed about it. Otherwise it looks like a “hopping on a freight train” (apologies for the analogy no offense intended) when you would have plenty of credit to afford a ticket for the first class wagon. I am sure there is a plausible explanation and a paragraph that links this beautiful work to TOAR should be added.