Review of "CSIRO Environmental Modelling Suite (EMS): Scientific description of the optical and biogeochemical models (vB3p0).

The manuscript provides a compilation of many individuals' past coding efforts to develop the EMS. The model, consisting of biogeochemical, optical, and sedimentary components, is within the scope of GMD and scientifically relevant. Collecting the mathematical descriptions of the major model components into a single document linked to the model code and User Guide might improve convenience for EMS users. The authors provide sufficient documentation to reproduce their results. The language is clear and the presentation is well-structured, though a spellchecker should be run on the document as there are a number of typos.

Most if not all of the material has been previously published in the peer-reviewed literature. Hence, the material cannot be considered novel, nor does the manuscript represent a substantial advance in modelling. Because this manuscript represents a collection of previously published work, little effort is spent explaining why parameterisations are the way they are. While methods and assumptions may be valid, they are not always clearly outlined. References to the primary literature are given, but the manuscript cannot be understood by a non-expert reader as a stand-alone document. Likewise, the model is given a perfunctory evaluation that includes no discussion of the biases. More detailed assessments are cited, but the reader of the present manuscript is left with no real understanding of why the model performs well (and what biases may be due to) in the examples provided.

It is difficult to make recommendations that could improve this manuscript, in its present form, with respect to the principal review criteria because added detail with respect to model formulation and more complete model assessments have already been published. Reproducing earlier work at length is not feasible. My recommendation is to refocus the manuscript to a summary of the equations (as already done), followed by a meta-analysis of model performance across past applications. A thorough discussion of systematic biases across ecosystems could represent a major advance for the model. Included in this meta-analysis should be a description of how the many "not attributed" parameters (in the supplement) are tuned. Perhaps the authors could even go further, and address those biases by presenting an improved model.

Specific comments:

P3 line 15 replace “which” with “that”

P3 line 20 “is unlimited”

P4 line 16 replace “to” with “by”

P4 line 22 “to geometric”

P5 line 4 replace “with” with “and”

P6 lines 2-5 Please delete those 2 sentences.

P6 line 14 “dramatic”

P8 Fig 4. IPIP is not the same abbreviation used in the text or Figure 5. What do the stars mean? What does the dashed line mean around meteorology?

P9 line 1 replace “recalculated” with “diagnosed”, replace “optimise” with “reduce”

P9 line 2 delete “and accuracy”, replace “recalculated at” with “diagnosed for”

P10 line 16/Eqn 1 wc vs wsink- not consistent

P12 line 30 “calculate”

Figs 7&8 should be referenced earlier than they are

P13 line 5- P15 line 4 Are the 2 schemes assessed?

P15 line 13 “include”

P18 Fig. 9 caption “calculate u”

P22 line 10 “as good”

P23 line 18 “functional groups”

P25 lines 5-7 Please break this sentence in two.

P27 Please define HPLC the first time it is used

P32 line 3 delete “is”

P32 line 6 replace “is” with “are”

P35 line 19 “additional”

P37 line 13 “inefficient”

P38 Table 14 caption “lost to the water”

P41 line 31 This sentence is an outlier and could be moved to earlier in the text

P43 line 10 “we will”

P44 line 18 “sit”

P44 line 19 replace “the” with “be”

P56 line 11 “that is”

P58 line 9 “while mineralogy”

P62 line 6 “to the water”

P65 line 15 “adjusts”

P69 line 3 “drawdown”

P69 line 12 “have not been”

P71 line 5 “are the same”

P72 line 5 “by instead”

P76 line 8 “slightly”

P79 line 27 “its use”

P79 line 32 remove “available”

P81 line 14 “such as”

P82 line 1 “have allowed”