

Interactive comment on “*Improving the stomatal resistance, photosynthesis and two big leaf algorithms for grass in the regional climate model COSMO-CLM*” by Evgenii Churiulin et al.

L.A. Timofeeva
tilarisa@gmail.com

The international group of authors shares the findings of their research on improving several algorithms included in COSMO-CLM. They have applied the model as a flexible tool for taking into account land-atmosphere fluxes and phenological properties, which can change due to global warming. The authors' idea is new (at least to me). The interdisciplinary core of the research makes it especially worth-while and up-to-date.

However, to help readers to understand quite complex content the authors have to pay more attention to details and relevant explanation of principal matters. In my opinion, the following terms need clarification in Abstract to attract more readers, who are not experts in plants.

C3 vs. C4 plants (first met in Line 13)

It would be useful to address the main differences between the two types of plants, which are due to their ability and manner to fix carbon dioxide in cool and warm seasons. Please provide some examples of “C₃ grass plants in Germany” just to make the picture more vivid and realistic.

One-big leaf vs. two-big leaf approach (first met in Lines 14-15)

The difference between these two approaches is critical. Implementation of a two-big leaf approach means dividing vegetation into sunlit and shaded portions. This has complicated calculating dramatically and is worth highlighting, even though the approach is explained in subsection 2.4.2.

Dry leaf calculations (first met in Line 21)

What parameter do the authors imply? Please explain. I could not find either definition or equations in the paper.

There are other points in the paper that need to be improved to enhance its readability.

Line 10. “Climatic changes towards warmer temperatures” can be replaced with a more common term “Global warming” that looks suitable in the context.

Line 65. The full definition of LAI (the Leaf area index) should be placed before the abbreviation.

Line 95. Equations 7 and 8 look the same. Please check.

Line 264. “The focus of the research was on statistical analysis of the summer months” has no sense, since not months but certain parameters can be analyzed, which are listed in the next sentence.

Lines 303-304. There is a statement that the absolute error for precipitation is 4.45%. It must be corrected, since the absolute error cannot be in %.

Line 357. It is not clear where in North America is situated the region for which the published in-situ stomatal resistance data were found. This is important to decide if the data can be used for validation of the results.

Line 372. Table 3. I find myself doubtful what CTR stands for. Besides, the word DATE seems strange in two columns between v3.5 and v4.5e.

Line 486. “Evapotranspiration plays an important role in determining the component of energy balance”. What component do the authors mean?

Moreover, I have noted a number of issues that need rewriting. In my opinion, too many punctuation marks are used, such as dash, colon, and brackets. Besides, spelling of the word “parameterization” and use of articles are not consistent.

I should confess English is not my native tongue; moreover, the authors' vocabulary and writing style might differ from mine. However, some English language flaws are obvious and should be corrected. I consider the shortcomings noted by me might be consequences of the authors' urgent willing to share their latest findings.

I have also paid attention to the fact that several references, explaining basic foundations, were made to modern resources instead of appropriate older ones. One example is in Line 34, de Noblet-Ducoudre and Pitman, 2021. There is classic research on the role of soil and its parameters in land-atmosphere interaction, starting from Dokuchaev. All of all, the Reference list includes a wide range of resources, which are accessible via the links provided. This is only one of the numerous strengths the paper has.

To begin with, the paper is perfectly structured. Each section logically presents all the information announced in Abstract. In section 2, the changes implemented in the TERRA-ML and COSMO-CLM models are described. These noticeable changes have made applying COSMO even more time and resource consuming than it usually is. The modified algorithms are quite detailed described in the text and in Appendix A. Codes as a Python package and data are available via the links provided. All this proves that the authors are experienced data scientists and programmers.

Thorough statistical analysis of a number of modeled characteristics was carried out based on the relevant parameters, including the Kling-Gupta Efficiency index, which has become quite popular recently. The choice of different validation datasets seems to be convincing. What I miss is a more detailed discussion in terms of botanic.

I would like to highlight that the authors reasonably evaluate perspectives of possible future research; they will try to implement new algorithms, which will enable accounting carbon uptake rate, changes in temperature and different growing seasons.