gmd-2024-117 – Reply to referee #3

Dear referee #3,

Thank you for your supportive review. Please find our replies to your comments below. Your original comments are repeated in italics, our replies in blue, normal font, and text passages which we included in the manuscript are in bold.

The paper describes the implementation of the submodel DWARF within the framework of the modular earth submodel system (MESSy) and its application in some exemplified test cases. The DWARF submodel allows the creation of a simplified model substituting the usually used dynamical base model in the MESSy framework. The advantage of this concept is having a simple test environment for the application, development, and performance testing of single submodels or a combination of submodels.

We like to clarify here, that the MESSy DWARF is not a submodel but a basemodel of the MESSy system. A submodel alone could never replace a basemodel.

Overall it is a well-written paper, well suited for GMD and should be published after minor revisions.

Thanks for your positive assessment of our work.

General comment:

Describe in more detail the difference between DWARF and DWARFDCD at the beginning of Section 3. Maybe describe it in more detail, e.g., as done in the supplement on page 10.

Comparing DWARF to DWARFDCD means to compare a basemodel with a regular submodel, respectively. DWARFDCD is a MESSy submodel required in DWARF setups to provide the prognostic variables, which would be provided by the basemodel, if a fully-fledged dynamical model is used. Following the suggestion of referee #1 we added, at the beginning of Sect. 3, what would be required, if the submodel MECCA should be run in the DWARF setup. This includes the following paragraph:
Temperature and specific humidity are prognostic variables. Dynamical basemodels provide the set of prognostic variables as determined by their dynamical core. In MESSy, these are made accessible to the MESSy submodels via the infrastructure submodel TENDENCY (see Sect. 3.1.1). As the DWARF does not contain a dynamical core, the regular MESSy submodel DWARFDCD (DWARF's Dynamical Core Dummy) provides a set of prognostic variables (see Sect. 3.1.1).
This hopefully clarifies the relationship between DWARF and DWARFDCD.

Section 3:

Line 124 and line 149:

You mention the prognostic variables provided by the base model and restrict this to these of the equation of motion. It would be best if you wrote this more generally, as all these variables are integrated forward from the primitive equations.

changed in line 124 to**.. which are the variables used to solve the primitive equations.**
line 149 was deleted due to changes made in response to referee # 1.

Section 4:

Line 306/307: "For the sake of simplicity they are kept constant in time."

Does that mean that the tendencies are not added to the chemical tracers?

Please clarify.

No it does not. This paragraph is not at all referring to tracer tendencies. It is about temperature, pressure and specific humidity fields, which are required for the calculation of the reaction rates. Due to a change w.r.t. a comment by referee #2, this should be clearer now. The whole paragraph now reads:
As the reaction rates in MECCA depend on temperature, pressure, and humidity, the initialisation of these fields influences the simulated kinetics directly. Note, that in this setup the temperature, pressure and humidity fields are only initialised. For the sake of simplicity they are kept constant over time. Furthermore, the calculation of the photolysis frequencies (submodel JVAL) influences

the chemistry and depends itself on solar activity, orbital parameters, pressure, ozone, the cloud cover, the relative humidity, the albedo, and on the surface type (land or sea).

Technical correction:

Avoid setting an extra period in cases where the sentence ends with an abbreviation: Line 78, Line 95

Changed.

Change for clarity: Line 137:

. . . a prognostic variable set . . . $\rightarrow$ *. . . a set of prognostic variables . . .*

Done.