**Geoscientific
Model Development
Discussions**

Interactive comment on "The Meteorology-Chemistry Interface Processor (MCIP) for the CMAQ modeling system" *by* T. L. Otte and J. E. Pleim

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We thank the reviewer for the positive and constructive comments on our manuscript. The feedback from the reviewer has improved the quality of the manuscript. The reviewer's specific comments (shown in *italics*) are addressed below.

There are a few places in the manuscript where it is unclear where MCIP sits within the CMAQ modeling system. For example, in the abstract, it is mentioned that MCIP "is a vital piece of software within the CMAQ modeling system" (see L7-8, P1450) and that it "acts as both a post-processor to the meteorological model and a pre-processor to

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the CMAQ modeling system" (see L10-11, P1450). This is confusing; how can MCIP be a part of and a pre-processor to the CMAQ modeling system at the same time.

The reviewer is correct that MCIP cannot concurrently serve as a part of and a pre-processor to the CMAQ modeling system. The second quote from the text (above) was modified to indicate that MCIP is "a pre-processor to the emissions and the CTM in the CMAQ modeling system".

I would suggest including a schematic diagram of the structure of the CMAQ modeling system, and explaining this diagram in order to clarify where MCIP sits within it (e.g., reconfiguration of the output files from a meteorological model for the CTM, and for the plume rise calculation in the emissions data preprocessor).

We believe including and explaining the schematic of the CMAQ modeling system could be useful, but it is really unnecessary in this paper. We believe that the reviewer's suggested changes to the Abstract (above) and Sect. 1, paragraph 3, (including the reviewer's suggestions, below) sufficiently clarifies where MCIP sits within the CMAQ modeling system:

"The Meteorology-Chemistry Interface Processor (MCIP) is a critical component of the CMAQ modeling system that post-processes the meteorological model output fields and pre-processes them for the emissions and the CTM. MCIP ingests the meteorological model fields from multiple models in their native output formats, performs horizontal and vertical coordinate transformations, diagnoses additional atmospheric fields, defines gridding parameters, and prepares the output in a format that is common to the CMAQ modeling system. MCIP is used in offline modeling applications with the CMAQ modeling system. The output from MCIP is a suite of model-ready meteorological fields that are input for emissions processing and for the CTM."

There are too many instances of the expression "CMAQ modeling system", which make some parts of the text difficult to read. For instance, the authors could replace "The

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CMAQ modeling system" by "It" L24-25, P1450 and L1, P1451. Please minimize the occurrence of the expression "The CMAQ modeling system" in the text.

The text was modified as suggested by the reviewer. The phrase "CMAQ modeling system" was also removed in other places in the manuscript, as appropriate.

The statement "There are three primary components of air quality modeling systems: the meteorological fields, the emissions inputs, and the chemical transport model (CTM)." (see L5-6, P1451) is correct only for offline air quality modeling systems. I would suggest adding "offline" before "air quality modeling systems".

The text was modified as suggested by the reviewer. Also, the parenthetical definition of "offline" was moved from Sect. 1, paragraph 3 to the sentence that was modified to include "offline".

Also, I would move the sentences on "offline modeling" (L27, P1451 to L3 P1452) after the first sentence of the paragraph L5, P1451.

This suggestion was not taken. We prefer the flow of the paragraphs as they were originally written.

In the abstract, it is claimed that the manuscript provides "an updated overview of MCIP, documenting the scientific changes that have been made since it was first released as part of the CMAQ modeling system in 1998". While the manuscript does provide an updated overview of MCIP in a technical sense, it does not discuss in detail the scientific changes that have been made to it. Maybe the authors could include a table summarizing the major scientific changes that have been made to it since 1998 and refer to this table in the text.

Many of the scientific changes that have been made to MCIP since its original release in 1998 have been included in this manuscript, including the formal equations for the

linkages with MM5v3 (Sect. 4.1) and WRF-ARW (Sect. 4.2), the use of the M3Dry routine for dry deposition velocity calculations and the required input fields (Sect. 5.3), and the GOES satellite processing (Sect. 5.4). In addition, several other aspects of MCIP have been introduced, such as the coupling with various physics schemes in MM5v3 and WRF-ARW, and major improvements have been made in code structure and functioning during the elapsed time. These changes have not necessarily been identified as "new since 1998", but no other documentation on MCIP includes this information. While a timeline of the changes to MCIP may be useful here, it would be too difficult to summarize those changes in a table. However, the detailed change log ("CHANGES" file) is concatenated and distributed with each release of MCIP. A sentence has been added to the end of the last paragraph of Sect. 1: "Additional detailed information regarding the timeline of changes to MCIP is provided as part of the official releases of MCIP."

P1451, L23: I would suggest change "and pre-processes these data for the CMAQ system" to "and pre-processes them for the CTM".

The text was modified to "and pre-processes them for the emissions and the CTM".

P1452, L4: Please change "and air quality modeling" to "and for the CTM".

The text was modified as suggested by the reviewer.

P1452, L15: Please change "The goal of the MCIP design is to limit" to "MCIP is designed to limit".

The text was modified as suggested by the reviewer.

P1452, L26: Please change "including the emissions processing component" to "including its emissions processing component".

The text was modified as suggested by the reviewer.

P1455, L1-23: Does MCIP ensure mass conservation when using 'layer collapsing'? Since "Layer collapsing is performed in MCIP as a final step before the output is created" (see L5-6, P1455) and "The layer fields are collapsed using simple vertical interpolation" (see L7-8, P1455), it is unclear whether MCIP ensures mass conservation or not when using 'layer collapsing'.

No. MCIP does not always ensure mass conservation when layer collapsing is used, at least not with the current algorithm based on vertical interpolation. At the end of that paragraph, we have added the caveat, "Layer collapsing will ensure mass conservation only when a CTM layer is comprised of no more than two meteorological model layers and when the layer interfaces of the CTM layers are coincident with layer interfaces from the meteorological model's vertical structure."

P1456, L5: Please check whether one should use "WRF Model" or "WRF model" and use it throughout the text.

The NCAR-generated documents refer to the model as either "WRF" or the "WRF model". All instances of "WRF Model" have been changed to "WRF model" in the text.

P1456, L6-7: Please change "to the chemical transport model in the CMAQ system" to "to the CTM".

The text was modified as suggested by the reviewer.

P1456, L24 and L28: Please change "CMAQ" to "the CTM".

The text was modified as suggested by the reviewer.

P1457, L1 and L5: Please change "CMAQ" to "the CTM".

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The text was modified as suggested by the reviewer.

P1458, L3: Please replace "the WRF model output file" by "this file".

The text was modified as suggested by the reviewer.

P1458, L25: Please change "feedbacks" to "feedback".

The text was modified as suggested by the reviewer.

P1463, L12: Please change "WRW" to "WRF".

The text was modified as suggested by the reviewer.

P1465, Equation 12: There is a '-' sign missing on the right-hand side of Equation 12.

Equation 12 is correct as written in the manuscript in GMDD. Equation 11 has been modified so that it is consistent with Equations 10 and 12.

P1468, L12: Please change "CMAQ" to "the CTM".

The text was modified as suggested by the reviewer.

P1472, L17: Please change "CMAQ" to "to the CMAQ modeling system".

The text was modified as suggested by the reviewer.

P1485, caption of Fig. 1: CMAS is not defined.

The acronym CMAS, which stands for "Community Modeling and Analysis System", has now been spelled out in the caption of Fig. 1. It is defined in the text in Sect. 7.