

***Interactive comment on “The chemistry CATT–BRAMS model (CCATT–BRAMS 4.5): a regional atmospheric model system for integrated air quality and weather forecasting and research” by K. M. Longo et al.***

**Author’s response to interactive comment from Anonymous Referee #1**

The authors thank to the reviewer for the positive and encouraging feedback. His (er) comments are addressed below.

**Referee #1 General comments**

*Please write out all acronyms - as a specific example, "RAMS", used on page 1177, or "ODEs" on page 1180 should be expanded. Also, formulas of chemical compounds should be identified when first introduced, for instance "... CH<sub>4</sub> (methane) ".*

**Authors:** We reviewed all the acronyms and chemical formulas and wrote out when needed.

- Page 1177, line 20: Regional Atmospheric Modeling System (RAMS)
- Page 1180, line 25: ordinary differential equations (ODEs)
- Page 1181, lines 18-20: Regional Atmospheric Chemistry Mechanism (RACM, Stockwell et al., 1997) with 77 species, Carbon Bond (CB, Yarwood et al., 2005) with 36 species, and the Regional Lumped Atmospheric Chemical Scheme (RELACS, Crassier et al., 2000) with 37 species.
- Page 1185, line 6: Use RACM instead of Regional Atmospheric Chemical Mechanism because the acronyms had been already written out.
- Page 1178, line 14: AErosol RObotic NETwork (AERONET, Holben et al., 1998). The reference was also included.
- Page 1183, line 17: Global Emissions Inventory Activity of the Atmospheric Composition Change: the European Network (GEIA/ACCENT)
- Page 1187, line 13: Following the suggestion of another referee, the reference to central processing unity (CPU) was removed.

- Page 1189, line 9: O<sub>3</sub> (ozone), CO (carbon monoxide), CH<sub>4</sub> (methane), CO<sub>2</sub> (carbon dioxide)
- Page 1189, line 16: Inter-tropical Convergence Zone (ITCZ)
- Page 1191, line 7: Moderate Resolution Imaging Spectroradiometer (MODIS)
- Page 1191, line 12: Land Ecosystem–Atmosphere Feedback model (LEAF v.3, Walko et al., 2000)
- Page 1191, line 26: MOCAGE (*Modélisation de la Chimie Atmosphérique Grande Echelle*)
- Page 1191, line 9: eliminated (CO)
- Page 1194, line 3: (CETESB, Companhia de Tecnologia de Saneamento do Estado de São Paulo)
- Page 1193, line 6: Weather Research and Forecasting model coupled with Chemistry (WRF-CHEM)
- Page 1194, line 5: NO<sub>x</sub> (nitrogen oxides)
- Page 1195, line 9: Eliminate (NO<sub>x</sub>)
- Page 1196, line 7: volatile organic compounds (VOC)
- Page 1197, line 24: Use Fortran90 instead of FORTRAN 90

### **Referee #1 Specific comments**

*Some English language issues should be addressed (please re-read the manuscript to check for issues beyond the examples given here). Some corrections pertaining to the clarity of text, described below, are also needed.*

**Authors:** We appreciated the recommendation. The paper went through a careful English revision in order to improve its reading and the specific points addressed were corrected.

**Page 1176, line 18:** ... over long duration is still too computing time consuming ... → ... over long duration is computationally still too demanding ...

**Authors:** Done

**page 1179, line 14:** "... long wave radiations ..." → "... long wave radiation ..."

**Authors:** Done

**page1179, line 6:** "... sub-grid diffusion ..."

**page1191, line 13:** "... vertical PBL diffusion ..."

*Although (unresolved) sub-grid scale turbulence is (often) represented with diffusion-like terms in the dynamics equations of atmospheric models, it should be called "sub-grid scale turbulence" or "unresolved turbulence", not "sub-grid diffusion".*

**Authors:** Done

**page1179, line 6:** "... the sub-grid diffusion in the planetary boundary layer (PBL)..." , was replaced by "the sub-grid scale turbulence in the planetary boundary layer (PBL)..."

**page1191, line 13:** " The vertical PBL diffusion parameterization of RAMS..." , was replaced by "The RAMS parameterization for the unresolved turbulence in the PBL..."

**Page 1180, line 4:** "... and lost of the species ..." → "... and loss of the species ..."

**Authors:** Done

**Page 1180, line 5:** "The lost ..." → "The loss ..."

**Authors:** Done

**Page 1180, line 6:** "... gaseous photochemistry, kinetic and aqueous chemistry ..." → "... photochemistry, gas phase and aqueous chemistry ..." (chemists do not use the term kinetic chemistry)

**Authors:** Done

**Page 1181, line 14:** "Gaseous kinetic and photochemistry" → This would likely mean "Gas phase kinetics and photochemistry", but "Gas phase and photochemistry" would be much clearer.

**Authors:** Done

**Page 1185, line 16:** "where sis" → "where s is"

**Authors:** Done

**Page 1186, line 3:** "The first one is the fact ..." It is not clear what this means.

**Page 1186, line 15:** "x" in equation 6 has not been declared as far as I can tell; please explain what x is.

**Authors:** Thanks for pointing these errors! The text was in fact incomplete in the original manuscript. A missing phrase, which contains the definition of **x** and the justification of the solution, has been included:

"The majority of the computational effort involves the solution of this linear system, which has the basic form:

$$\mathbf{A} \cdot \mathbf{x} = \mathbf{b} \quad (5)$$

where **A** is a **N** × **N** matrix, **x** is the vector solution and **b** is the vector of independent terms. Fortunately, two properties of this system of equations can be used to speed up processing. The first one is the fact..."

**Page 1186, line 19:** "outmost" → "utmost"

**Authors:** Done

**Page 1187, line 12:** "cache line conflicts" Do you mean "cache misses"? "Cache miss" is a much more common term than "cache conflict", and better describes the nature of the problem.

**Authors:** Following the suggestion of another referee, we eliminated this sentence and further mentioning to the cache issue.

**Page 1189, line 1:** "The robustness of the CCATT-BRAMS system is explored through- out two case studies covering from the regional to local scale and from biogenic and fire emissions to urban emissions impacts." - A system is robust when it resists to perturbations and remains in a certain state despite the perturbations. However, what is being discussed in the manuscript is the evaluation of the model performance relative to observations. So it should read "performance" rather than "robustness".

**Authors:** Done

**Page 1189, line 25:** "... measurements were already compared with several different models results," → "... measurements were previously compared with results from several different models (references here),"

**Authors:** Done. Now reads: "For model CO evaluation we refer to Andreae et al. (2012), in which BARCA A CO measurements were previously compared with results from several different models: Stochastic Time Inverted Lagrangian Transport (STILT, Lin et al., 2003), a combination of the Weather Research and Forecasting model with Chemistry (WRF-CHEM, Grell et al., 2005) with the Green House Gas module (GHG, Beck et al., 2011), HYbrid

Single-Particle Lagrangian Integrated Trajectory program (HYSPLIT4, Draxler and Rolph, 2003), and WRF-CHEM and CCATT-BRAMS with 3-BEM fire emission sources (Longo et al., 2010).”

**Page 1195, line 9:** *"ratios follows" → "ratios follow"*

**Authors:** Done

**Page 1195, line 22:** *"results tends" → "results tend"*

**Authors:** Done