**Geoscientific
Model Development
Discussions**

Interactive comment on "LANL* V2.0: global modeling and validation" *by* J. Koller and S. Zaharia

Anonymous Referee #1

Received and published: 2 May 2011

General Comments:

This manuscript provides a substantial update to the LANL* method of computing the magnetic drift invariant L*. This update is significant in that it enhances usability usability and provides a validation against an array of orbits. I recommend its publication, subjected to minor revisions.

Specific Comments:

1) I'm curious if the authors have looked at adding more inputs to the neural net, such as Kp, AE, etc. This would make the ANN no longer a surrogate model, but it might compute more accurate L* values (of course, determining "accuracy" would be difficult).

2) There are two categories of EMIC waves: compression- and convection-related

EMICs [*McCollough et al.,* 2010]. The second paragraph of the introduction ought to mention compression-related EMICs, as they are believed to arise from different processes than those attributed to

convective EMIC waves.

Technical corrections:

P575

L1-2: Suggest rewording the first two sentences as follows: "We describe in this paper a new version of LANL*, an artificial neural network (ANN)

for calculating the magnetic drift invariant L*. This quantity is used for modeling radiation belt dynamics and for space weather applications."

L6: Suggest replace "type of orbit" with "location", since this is more general.

L13: Should "LANL-V2.0" be "LANL*-V2.0?"

L19: Suggest rewording the first sentence: "...Van Allen belts describe a donut-shaped regions surrounding Earth that is filled wit highly

energetic charged particles which are trapped in the geomagnetic field."

L23: Suggest prepending "The belts are dynamic: ..." or similar to the sentence that begins, "For example...".

L24: "magnitudes" -> "magnitude"; omit "and days."

L26: Consider replacing "time variations in" with "dynamics of."

P576

L8: "...the adiabatic..." -> "...their adiabatic..."; "gyro-invariant" -> "cyclotron invariant"

L9: Suggest rewording the sentence starting on this line to: "...is related to the line integral along the magnetic field between...".

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L12: Suggest prepending "contour" before "integral".

L19: Reword/rework this paragraph to emphasize that in realistic fields, particles of different pitch angles have different L*'s for the same

point in space.

P577

L5: This statement could use a citation, such as a review paper or textbook chapter (i.e., [*Wolf,* 1995]).

L6: "Earth's geomagnetic field" seems redundant. You could remove "Earth's".

L9: "Olsen-Pfitzer" should be "Olson-Pfitzer".

L10: "a host of" seems excessive. The statement sounds clearer with this omitted.

L24: "long" should be "lengthy".

P578

L15-16: Suggest replacing "...following a series of models published..." to "...in a series of models developed...".

L25: Either "a" or "the" should appear before "...partial ring...".

P579

L9: Suggest to introduce SpacePy as "the SpacePy product" instead of just "SpacePy".

L17: "LANLstar" -> "LANL*" (?) If LANLstar is the command, it should be explained somewhere.

P580

L13: ViRBO should be referenced more completely (e.g., spell out Virtual Radiation Belt Observatory) in addition to listing the URL.

P581

L15: swap "randomly" and "selected" so it reads, "We randomly selected..."

P583

L21: [*McCollough et al.,* 2008] appeared in Space Weather, not Adv. Space Res. Otherwise citation is

P585

Table 1, Row 5: "nPA" -> "nPa".

P592

Fig 6: Suggest changing the color in the Dst plot to a third color (e.g., green).

P593

Fig 7: ibid.

References

McCollough, J. P., J. L. Gannon, D. N. Baker, and M. Gehmeyr (2008), A statistical comparison of commonly used external magnetic field models,

Space Weather, 6, S10001, doi:10.1029/2008SW000391.

Wolf, R. A. (1995), Magnetospheric configuration, in *Introduction to Space Physics*, edited by M. G. Kivelson and C. T. Russell, chap.10,

pp. 288–325, Cambridge Univ. Press, New York.

Interactive comment on Geosci. Model Dev. Discuss., 4, 575, 2011.