AE9/AP9/SPM Radiation Environment Model

Release Notes

Version 1.20.002

The AE9/AP9/SPM model was developed by the Air Force Research Laboratory in partnership with MIT Lincoln Laboratory, Aerospace Corporation, Atmospheric and Environmental Research, Incorporated, Los Alamos National Laboratory and Boston College Institute for Scientific Research.

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The AE9/AP9/SPM model and related information can be obtained from AFRL's Virtual Distributed Laboratory (VDL) website: https://www.vdl.afrl.af.mil/programs/ae9ap9

V1.00.002 release: 05 September 2012

V1.03.001 release: 26 September 2012

V1.04.001 release: 20 March 2013

V1.04.002 release: 20 June 2013

V1.05.001 release: 06 September 2013

V1.20.001 release: 31 July 2014

V1.20.002 release: 15 January 2015

In a future release of AE9/AP9/SPM, the model will be renamed to be
"International Radiation Environment Near Earth" (IRENE).

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Highlights

Please refer to the 'Ae9Ap9_v1_20_00**1**_ReleaseNotes' document for a full description of the revisions and enhancements of the model since v1.05.001.

Minor source code and runtime table modifications were applied to improve the calculated flux values at low altitudes.

The newly-released IGRF table of coefficients for 2015 has been incorporated into the magnetic field model database file. The neural net database files for the calculation of K, Phi and Hmin adiabatic invariant coordinates have been regenerated with the updated magnetic field model. The update of these database files will change the flux values calculated by the AE9/AP9/SPM model.

Software Changes

Ae9Ap9 model library

- A routine was revised to ensure the K/Hmin coordinate grid is used when calculating flux values at low altitudes.
- A routine was revised to smoothly interpolate the calculated flux values to zero at the lower boundary of the K/Hmin coordinate grid.

Build scripts

- The build scripts were revised to ensure correct compiler switches are applied when using newer versions of CMake (>2.6) on Linux systems. This resolves situations where the model performance is extremely poor, even when built in 'release mode'.

Documentation Changes

- The *AE9/AP9/SPM Radiation Environment Model User's Guide* document was revised to correct minor typographical and grammatical errors, and clarify some of the parameter descriptions. Appendix D was split into two appendices; the references to these were updated appropriately throughout the User's Guide.
- The *AE9/AP9/SPM Radiation Environment Model Known Issues and Limitations* document was added to the distribution.

Database Changes

AE9V121

- Revised K-H_{min} lower boundary specifications, enabling the smooth interpolation of flux values to zero at this point.

IGRF magnetic field model

- The 'igrfDB.h5' database file was updated to include the newly-released 2015 coefficient values.

Adiabatic Invariant Coordinates

- The neural network database files, 'fast_hmin_net.mat' and 'fastPhi_net.mat', were regenerated, having been "trained" with the updated IGRF magnetic field model. The Phi and Hmin values produced using the current (2015) and previous (2010) neural networks may differ by the expected 1% training error, even for dates with unchanged IGRF coefficients. While this error is well within the uncertainty in the full calculation of the Phi and Hmin values using the IRBEM library, the calculated model flux values may have larger differences, up to 5-15% RMS. Therefore, one should not expect to exactly reproduce the results of AE9/AP9/SPM model runs using the previous versions of these database files.

General

- The previous versions of the model databases are available, if desired. However, it is generally recommended that those be used with the AE9/AP9/SPM model software release in which they are included.

Contact Information

Please send any questions, comments and/or bug reports to
AFRL.RVBXR.AE9.AP9.Org.Mbx@us.af.mil

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