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# **IRENE: AE9/AP9/SPM Radiation Environment Model**

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## **Release Notes**

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Version 1.56.002

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Approved for public release; distribution is unlimited.  
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The IRENE (International Radiation Environment Near Earth): (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 IRENE (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

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V1.05.001 release: 06 September 2013

V1.20.001 release: 31 July 2014

V1.20.002 release: 13 March 2015

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V1.35.001 release: 03 January 2017

V1.50.001 release: 01 December 2017

V1.57.004 release: 11 July 2022

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# IRENE: AE9/AP9/SPM Radiation Environment Model

## Release Notes

**Version 1.56.002**

August 10, 2020

*Note: This document describes both the major feature updates of v1.56.001 and a minor update for v1.56.002.*

### Highlights

Please refer to the 'Ae9Ap9\_v1\_55\_003\_ReleaseNotes' document for a description of the significant revisions and enhancements of the model software since v1.50.001.

The accumulation capabilities were expanded with the ability to define multiple interval lengths.

The 'Boxcar' and 'Exponential Flux Average' accumulation modes were updated with additional features.

The Dose geometry list was extended and revised to more concisely describe the available choices.

The use of the new 'IRENE' name was expanded during this transition phase.

#### *change from v1.56.001:*

Issues related to the use of spaces within directory and file names were resolved.

### Software Changes

CmdLineIrene application (and its associated 'helper' applications):

- The CmdLineAe9Ap9 application name was changed to CmdLineIrene.
- The 'Accumulation Interval' input parameter was revised to allow multiple (up to 9) interval durations to be defined simultaneously.
- The equations used for the 'Exponential Flux Average' values were revised.
- The default output frequency for the 'Exponential Flux Average' values was changed to be at every ephemeris timestep.
- The 'Boxcar' accumulation increment specification was expanded to be able to follow the input ephemeris time steps, including variable time steps.
- New 'Report Times' input parameters were added for defining specific times at which the 'Boxcar' and 'Exponential Flux Average' values are reported.
- A new 'MCWorstCase' parameter was added as an option for reporting the highest value-to-date values of the 'Boxcar' and 'Exponential Flux Average' Monte Carlo flux accumulations.
- The Dose geometry list was extended to include a 'spherical4pi' choice, for full-sphere shield dose results. The existing 'spherical' choice was changed to 'spherical2pi', to explicitly identify it

as being *hemisphere* geometry. The previous usage of ‘spherical’ was following the terminology of the underlying ShieldDose2 model.

- The Windows (64-bit) binaries were built with the latest version of the Intel MPI Library.
- Model run failures caused by the use of spaces within directory and filenames were resolved.  
[↑ change from v1.56.001](#)

IreneGui application:

- The Ae9Ap9Gui application name was changed to IreneGui.
- The ability to generate and plot the ‘Boxcar’ and ‘Exponential’ average flux accumulation results was added to the GUI application.
- The Dose geometry list was extended to include a ‘spherical4pi’ choice, for *full-sphere* shield dose results. The existing ‘spherical’ choice was changed to ‘spherical2pi’, to explicitly identify it as being *hemisphere* geometry. The previous usage of ‘spherical’ was following the terminology of the underlying ShieldDose2 model.
- Model run failures caused by the use of spaces within directory and filenames were resolved.

[↑ change from v1.56.001](#)

API library:

- The C++, C and Python API was revised to allow the definition of ‘report times’ and activate the ‘worst case’ option for the boxcar and/or exponential accumulation mode results. The ‘application-level’ API is currently limited to only one accumulation mode and one accumulation interval specification.
- The Dose geometry list was extended to include a ‘spherical4pi’ choice, for *full-sphere* shield dose results. The existing ‘spherical’ choice was changed to ‘spherical2pi’, to explicitly identify it as being *hemisphere* geometry. The previous usage of ‘spherical’ was following the terminology of the underlying ShieldDose2 model.

Build Scripts:

- The build process was updated with the ‘IRENE’ name.

## Documentation Changes

- The *User’s Guide* document was revised, updating the description of the expanded capability of the accumulation Interval and Increment parameters, and adding descriptions of the new ‘Report Times’ and ‘Worst Case’ parameters. Descriptions of the new capabilities for the Boxcar and Exponential accumulations in the GUI were also added, and the GUI screenshots updated.
- The *Build Instructions* document was updated to reflect changes in the build process.
- The C++, C and Python API (Application Programming Interface) documents were updated with descriptions of the new and updated methods related to the newly-added capabilities.

## General

- The AE9 and AP9 runtime model databases are unchanged from the v1.50.001 release; therefore, the flux results produced for these models will be unchanged.

**Version Numbering Scheme:**  $Va.bc.ddd$

The '*a*' digit changes with major new architecture or feature changes in the model.

The '*b*' digit changes with updates of the model database files.

The '*c*' digit changes with minor new features in the model and/or interface software.

The '*d*' digits change with bug fixes and trivial feature tweaks.

**Contact Information**

Please send any questions, comments and/or bug reports to: [ae9ap9@vdl.afrl.af.mil](mailto:ae9ap9@vdl.afrl.af.mil)

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