

Development of the HARM model for aviation dosimetry

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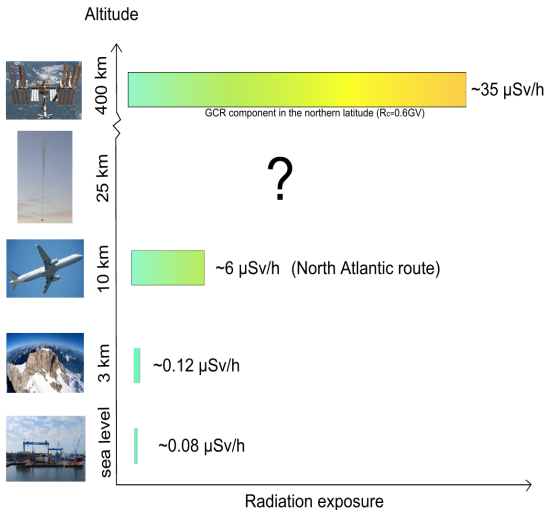
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- ☐ Introduction & Model Description
- ☐ Applications
- ☐ Status & Conclusion

“Snapshot”: High Altitude Radiation



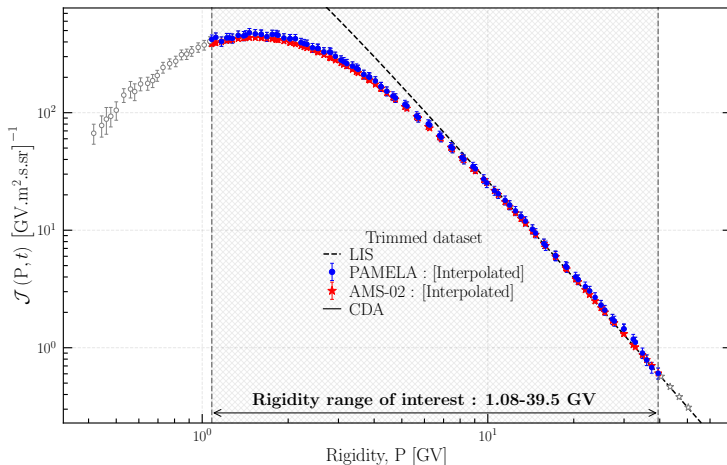
$$\mathcal{D}_r(P_c, t, h) = - \int_{h_0}^h \int_{P_c}^{\infty} \frac{d\mathcal{D}_f}{dP} dP dh = \int_{h_0}^h \int_{P_c}^{\infty} \mathcal{J}(P, t) \mathcal{F}(P, h) dP dh$$

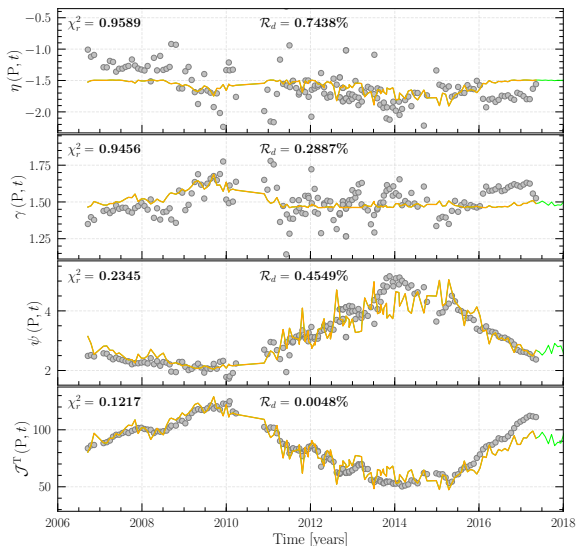
$$\text{Dorman Function : } \mathcal{D}_f(P_c, h) = \mathcal{D}_0(P_c, h) [1 - \exp(-\alpha(P_c/P_0)^{-\kappa})]$$

$$\text{CDA solution : } \mathcal{J}(P, t) = \mathcal{J}_0(P) \exp \left[-\frac{\psi}{\beta \eta P^\gamma} \right]$$

$$\text{Yield function : } \mathcal{F}(P, h) = F_0 (\mathcal{R}_0^{a_0} + P^{a_0})^{\frac{\gamma_1 - \gamma_2}{a_0}} P^{\gamma_2}$$

CDA : GCRs Primary particles...





Credit data [All NMs]: <https://www.nmdb.eu/>

- Validated model with TEPC data
- We have to:
 - Incorporate SEP spectral observations.
 - Simulate the impact of the 1000 hours annual flight time limit on dose accumulation on various flight routes.
 - Improve the model flexibility and weaknesses.

Model GUI...

Welcome to the HARM Flight Dose Calculator

New User Registration

Subscription Token

Great Circle (GC) Route

Date and flight time:

Aircraft type:

Flight cruise altitude:

Departure Airport:

Destination Airport:

-OR-


Pre-Defined Routes

Flight route (FR)

Peripatetic schedule (PS)

☐ Generate Report

(Re-)calculate-&-Plot



About

GC route

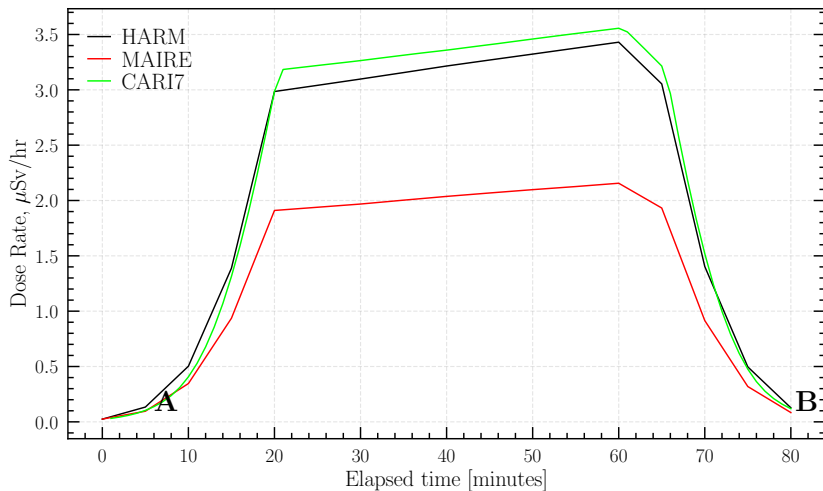
FR -file format

PS -file format

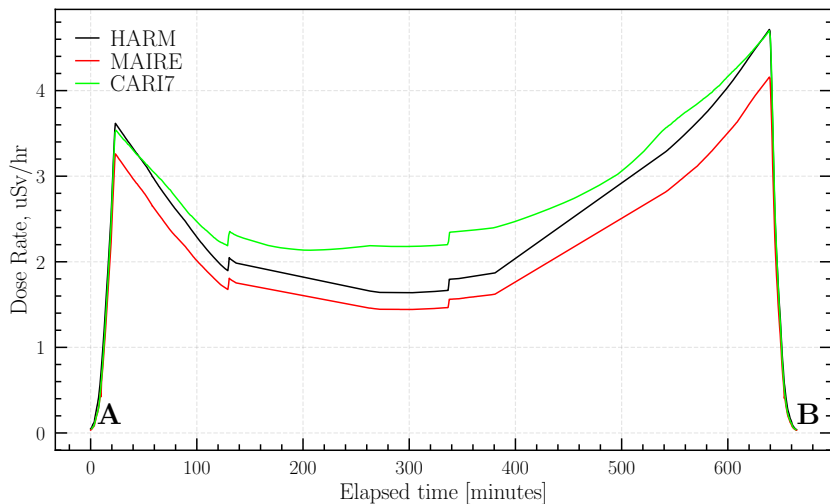
User-Survey

Exit/Close

Local Flight...



International Flight: Equator crossing...



- The Dose Rates calculated by the HARM are systematically lower (approx. 15%) than those calculated by CARI-7.
Possible reasons include:
 - CARI-7 doses take into account the aircraft shielding, whereas HARM assumes values in atmosphere.
 - CARI-7 uses dose conversion coefficients from ICRP Report 106 whereas HARM doses mimic the TEPC data observation.
- The origin of these differences is under investigation and this analysis will be updated as soon as possible.

Thank you for your attention !

NELSON MANDELA
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