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# Conclusions and perspectives

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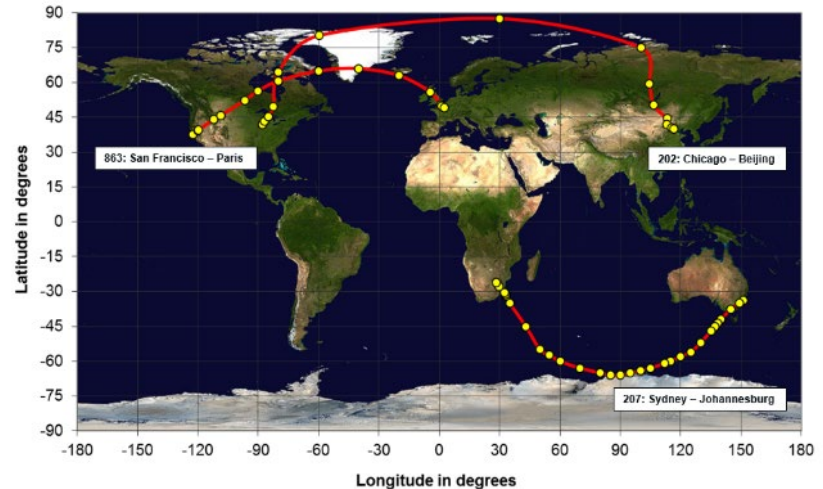
# Summary (1)

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- GLE **characteristics** may vary in a **wide range**: *intensity, energy spectrum, anisotropy at the Earth surface...*
  - Many input parameters to be used by models
- GLEs are **not predictable**
  - The dose assessment to be done *a posteriori*
- Selection of GLEs for the EURADOS study:
  - *GLE42 on 29 September 1989*
  - *GLE69 on 20 January 2005*
  - The two most important for the last 40 years

## Summary (2)

- Nine **codes** used for calculating **doses due to GLEs** to crew members, some of them being used on a **routine basis** for **occupational exposure**
- Two main families:
  - *Monte Carlo techniques*
  - *Semi-empirical solution based on a fit to experimental data*
- Selection of the **most exposed routes at high latitudes**



# Conclusion

- The increase of the dose is **significant** for **a given flight** at high latitude

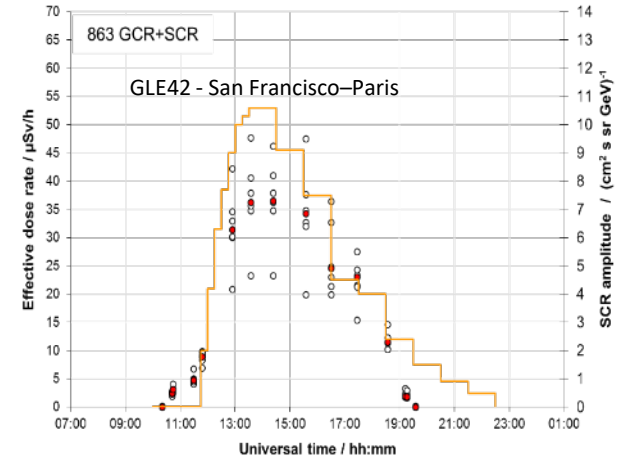
- GLE42: Effective Dose<sub>GLE</sub> = 2 to 3 x Effective Dose<sub>GCR</sub>
- GLE69: Effective Dose<sub>GLE</sub> = 4 to 6 x Effective Dose<sub>GCR</sub>

→ Significant for a given flight but neglectable in comparison to the annual dose for crew members

- The **better the inputs** are known, the **better the results**

- ± 29 % for GLE42, with a precisely specified primary proton spectra
- ± 50 % for GLE69, based solely on literature data

→ In a real situation, the reliability may be significantly worse!



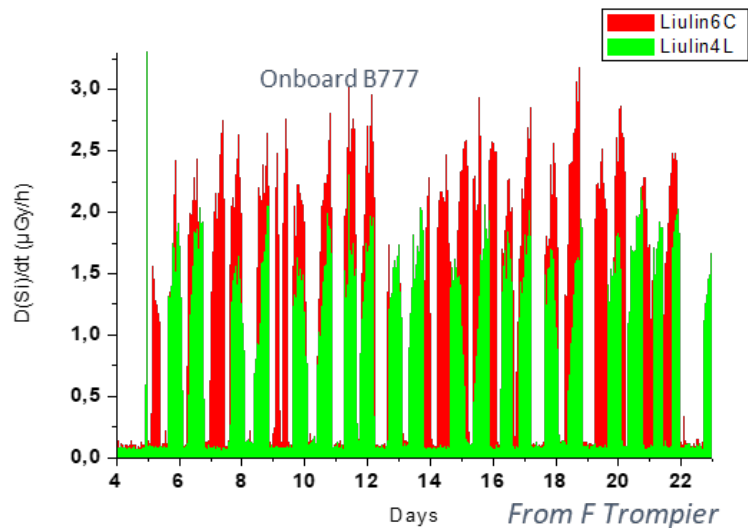
# Recommendations

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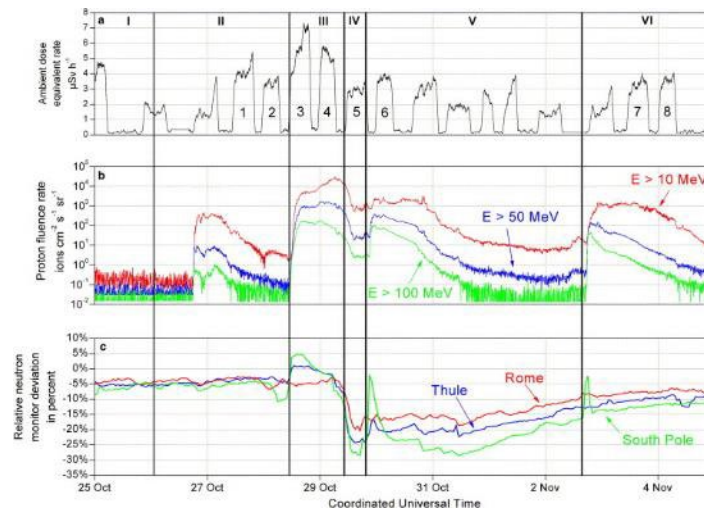
- Investigate for a traceable and robust **procedure** for the determination of the **primary proton spectral** data for GLEs
- Validate the models by **experimental data**
  - Continuous onboard measurements already existing with some airlines
- Define a procedure to decide to **consider (or not) a GLE** for dosimetric purposes
  - Ongoing within the WG11/TG10 using NM measurements

# Examples of on-board measurements

Continuous measurements on-board more than 30 aircraft with Air France



TEPC reference measurements at aircraft altitudes during Halloween solar storms, 2003



Ref: TEPC reference measurements at aircraft altitudes during a solar storm, P. Beck, M. Latocha, S. Rollet, G. Stehno, *Advances in Space Research*, Volume 36, Issue 9, 2005, Pages 1627-1633.

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# Questions & Answers

Peter Beck (Coordinator)