

Comparison of solar proton events data

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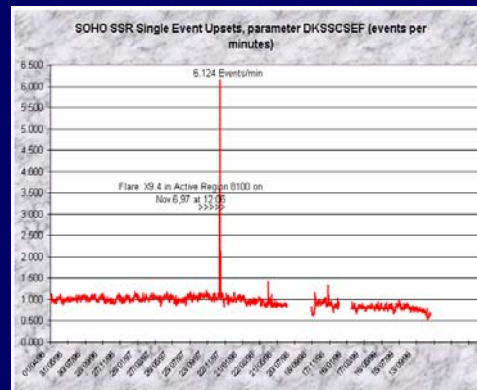
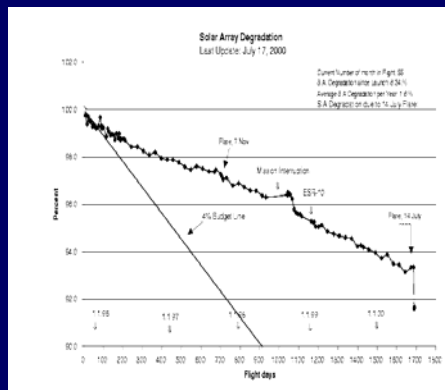
S. Bourdarie

ONERA

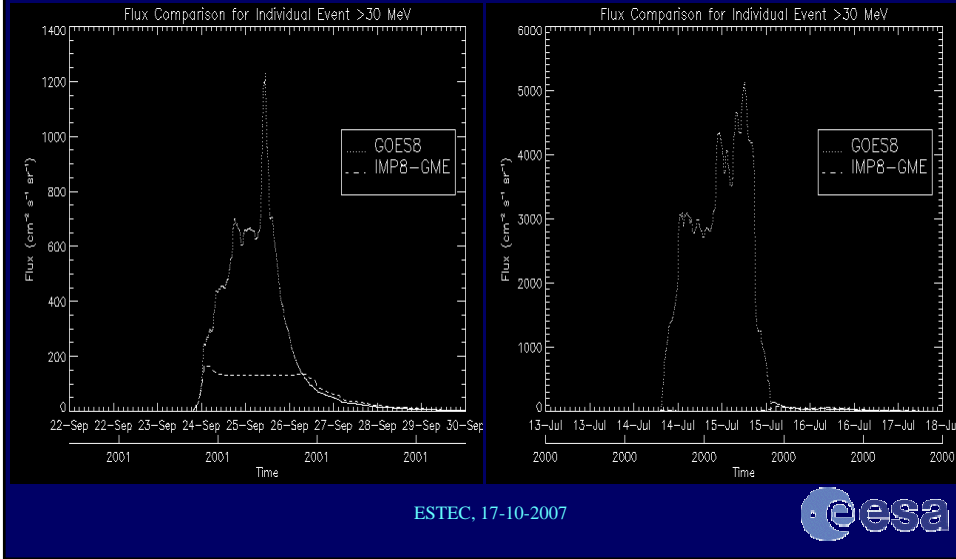
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Example of Effects

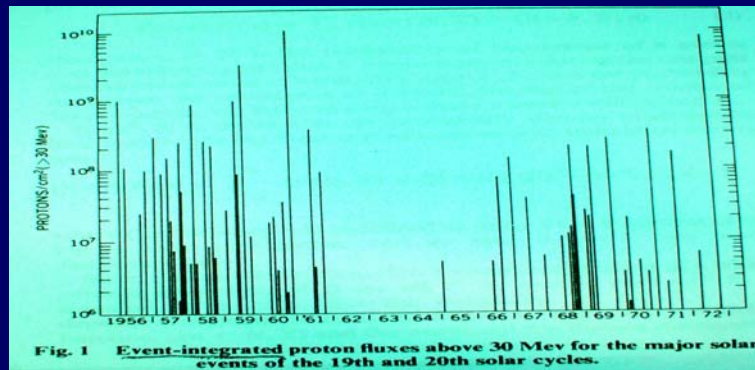


Solar Proton Events Seen by Different Detectors



Using One Solar Cycle: King [1974]

- IMP 4, 5, 6 data over solar cycle 20
- 24 ordinary events
- 1 anomalously large event
- => Burrell statistics (compound Poisson)+log-normal.

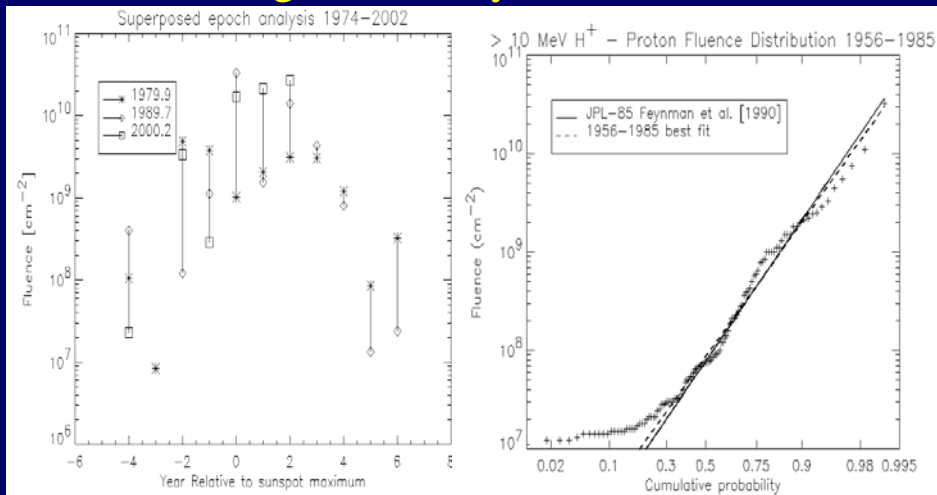


King [1974]

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Using 3 Solar Cycles: JPL-85



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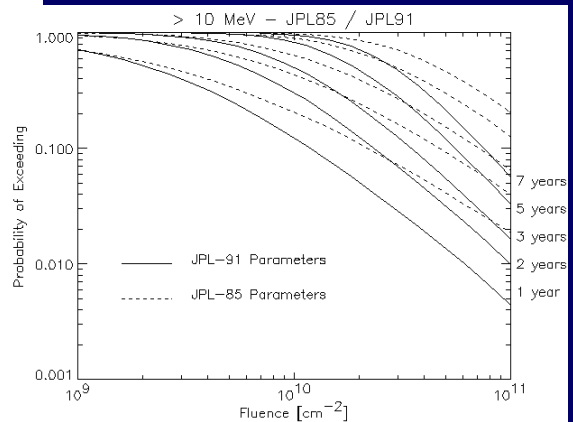


Using 3 Solar Cycles: JPL-85 & -91

$$f(F) = (1/\sqrt{2\pi}\sigma) \exp -\frac{1}{2}[(F - \mu)/\sigma]^2$$

$$P(> F, \tau) = \sum p(n, w \tau) Q(F, n)$$

$$p(n, w \tau) = e^{-w \tau} (w \tau)^n / n!$$



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Data quality and calibration effects

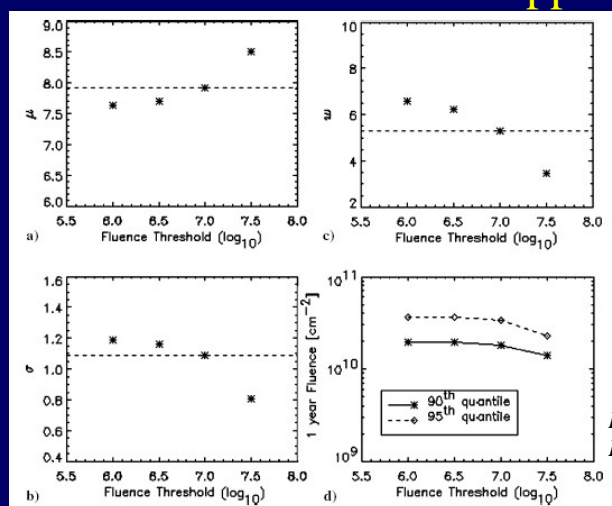
Effects (Feynman et al., Xapsos et al., Mottl and Nymmik, Boscher et al., Rosenqvist et al...):

1. Event selection criteria (grouping of events)
2. The choice of flux threshold for event identification
3. The choice of fluence threshold for event identification
4. The identification of the high activity part of the solar cycle
5. Parameter fitting procedure of the event intensity distribution
6. Size of the dataset
7. Calibration uncertainty
8. Data gaps
9. Ghost events (glitches, ...)

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Effect of threshold on JPL approach

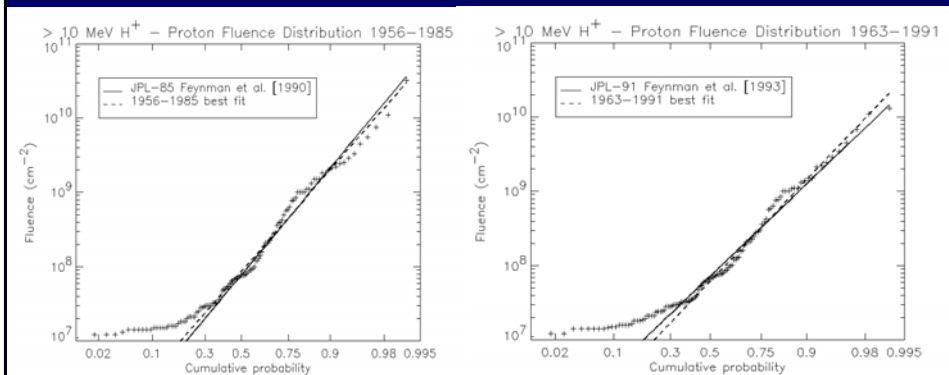


Rosenqvist and Hilgers, GRL, 2003

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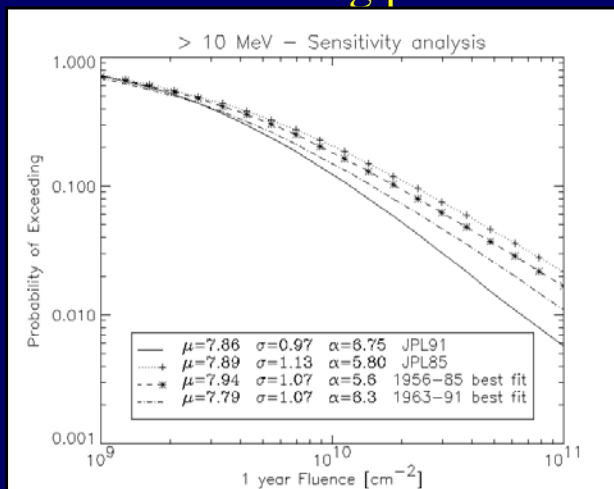
Effect of data fitting procedure



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Effect of data fitting procedure



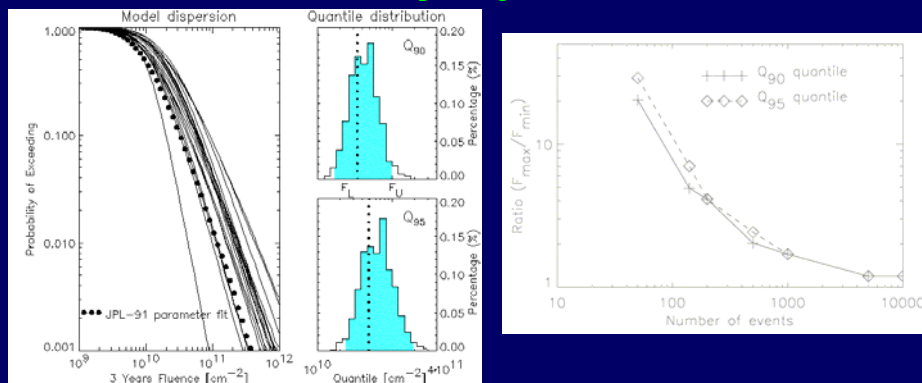
Rosenqvist et al.
JSR, 2005

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Size of the data set

- Check of models stability through 90th & 95th quantile fluence distribution w.r.t adding more data (left panels) and the size of the sample (right).

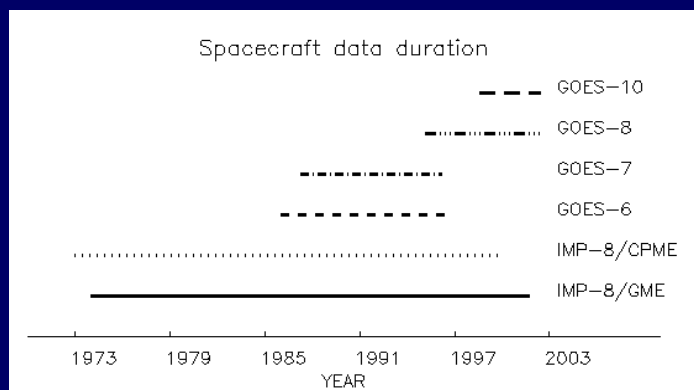


In Rosenqvist and Hilgers, GRL, 2003

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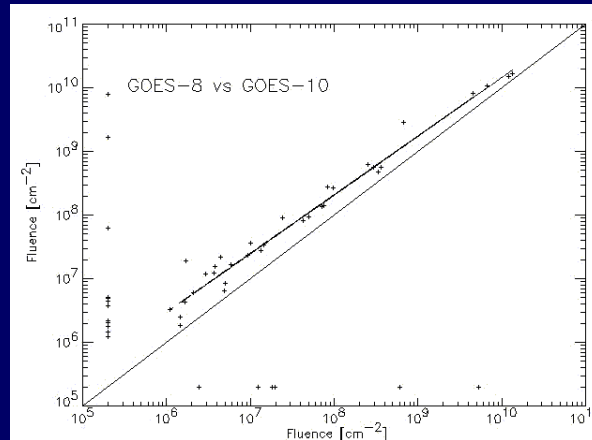
Calibration and data quality



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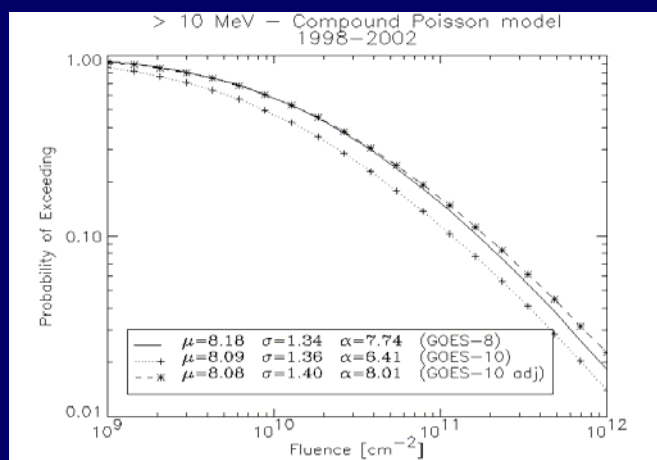
Use of different data sets



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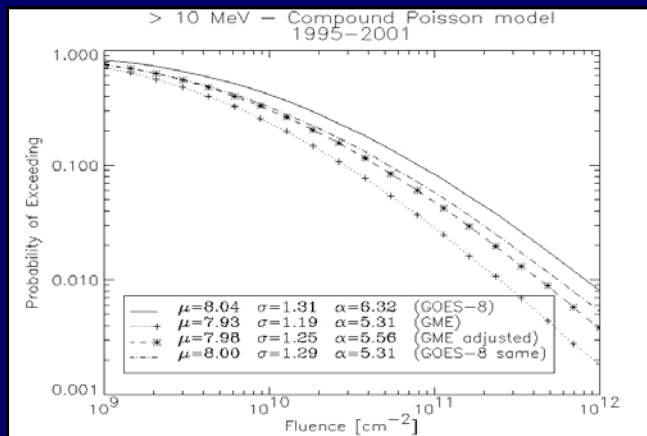
Use of different data sets



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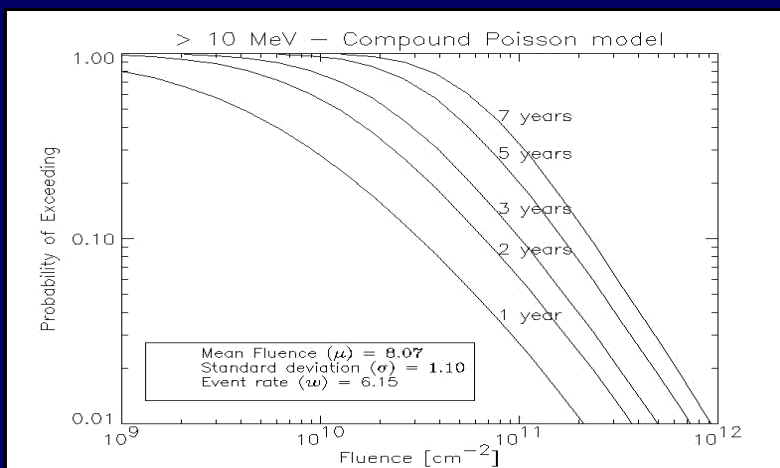
Comparing GOES-8 and IMP-8



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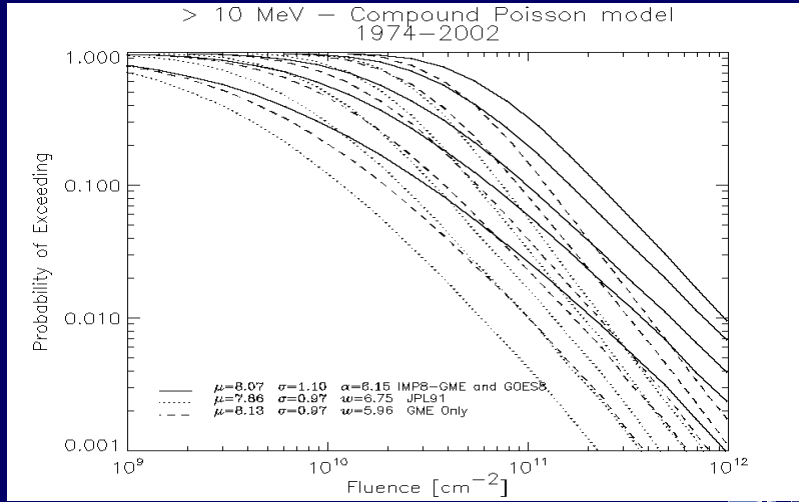
Combining IMP-8 and GOES-8 (>10 MeV)



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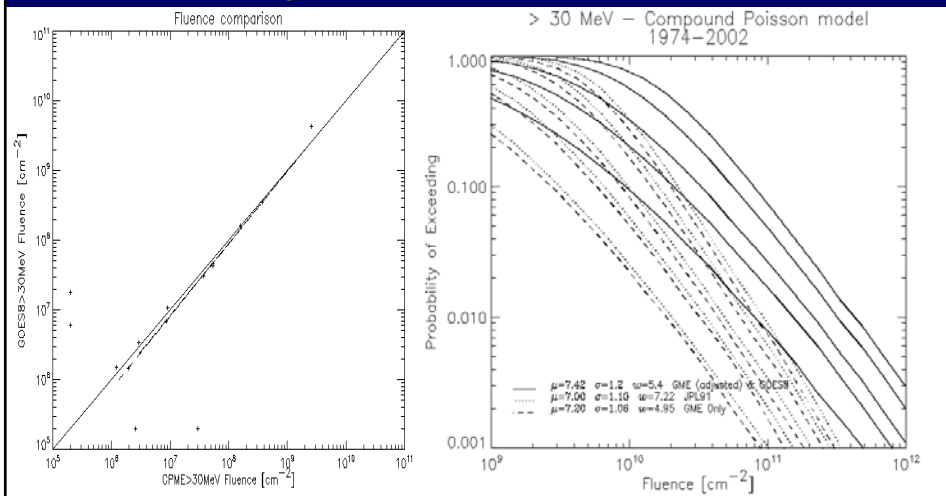
Combining IMP-8 and GOES-8 (>10 MeV)



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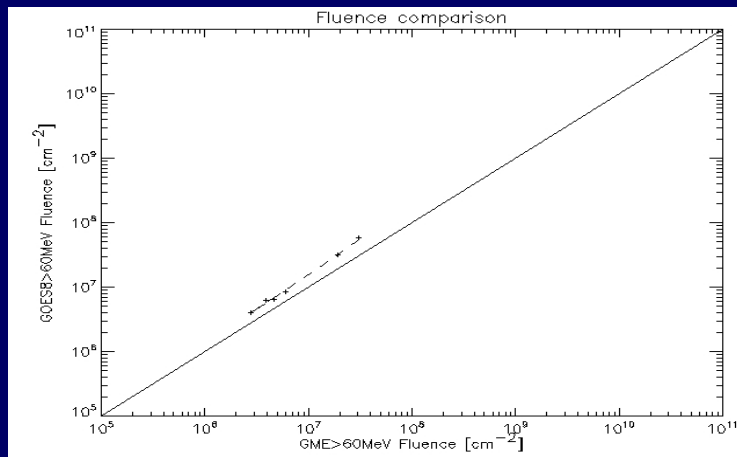
Combining IMP-8 and GOES-8 (>30 MeV)



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Combining IMP-8 and GOES-8 (>60 MeV)



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How to improve?

- Work on the flux.
- Capture uncertainty.

$$P(F) = \iiint P(F, \mu, \sigma, w) d\mu.d\sigma.dw$$

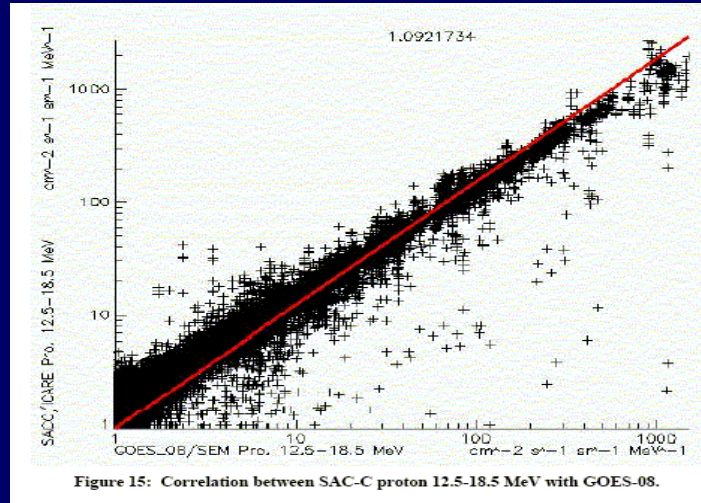
$$P(F, \mu, \sigma, w)$$

Can be determined through
Bayes theorem.

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Working with the flux



(cf Bourdarie)

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Conclusion

- Risk of uncertainty in data is high
- Also risk raised by data processing
- Comparing several sources helps.
- More solar proton data are required to improve the models.

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