

Construction of Long Term Interplanetary H and He Datasets in the Framework of the ESA SEPTEM/ESHITEM/SEPCALIB Projects

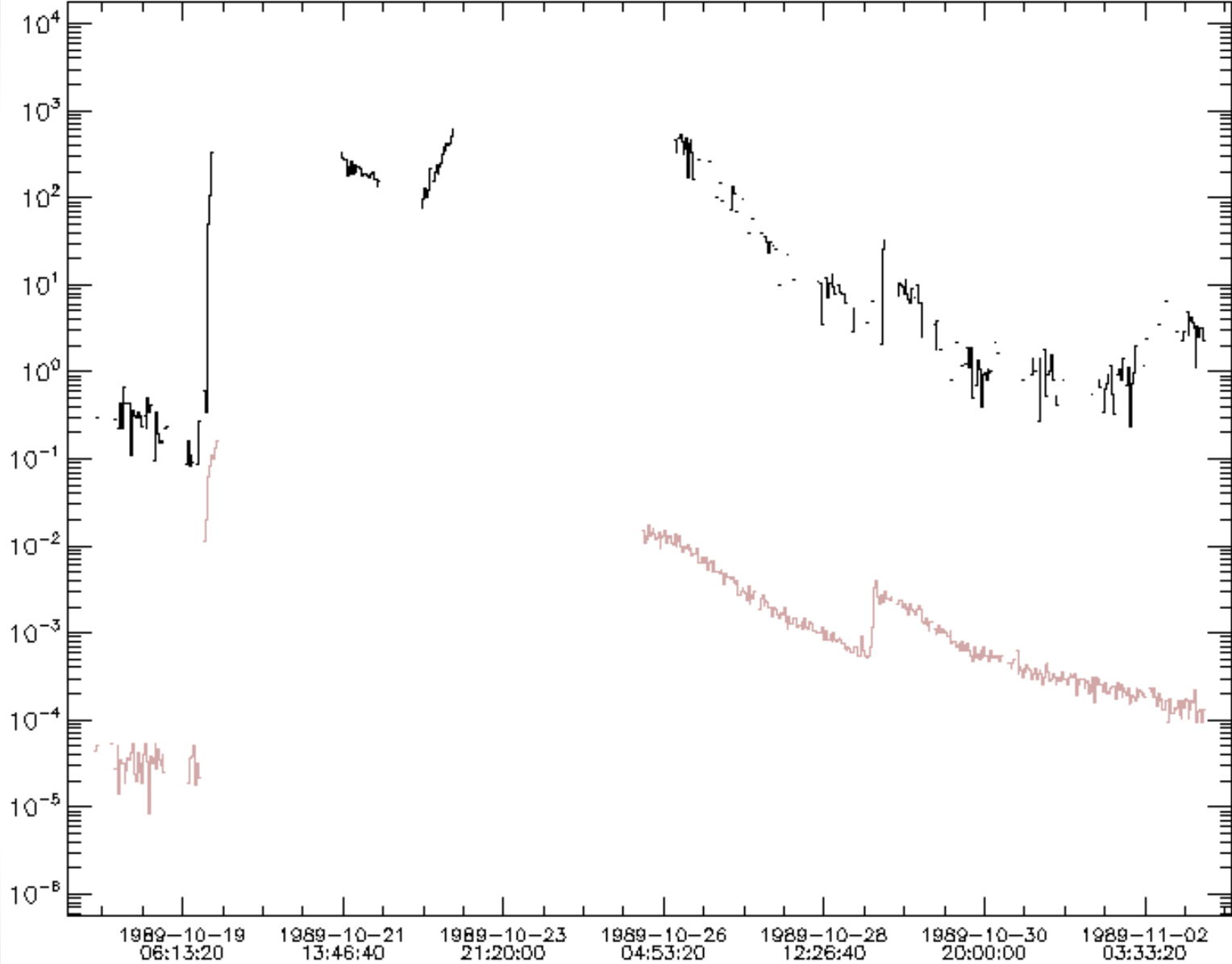
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IMP8/GME Proton channels (new cleaned)



178.0-230.0 MeV H flux

4.94-5.96 MeV H flux

ESA SEP modelling projects

- SEPEM (Solar Energetic Particle Environment Modelling, ESA Contract 20162/06/NL/JD)
 - Reference H dataset: combination of GME H data and SEM H data cross-calibrated using GME
 - Statistical modelling of SEP fluxes/fluences and radiation effects
 - <http://dev.sepem.oma.be/>
- SEPCALIB (ESA Contract 4000108377)
 - Re-specification of GOES/SEM energies using GME channels
 - Correction for GME LED (≤ 20.5 MeV) failure in April 1984
- ESHIEM (Improvement of Energetic Solar Heavy Ion Environment Models, ESA Contract 4000107025/12/NL/AK)
 - Update of reference H dataset using SEPCALIB
 - Reference He dataset using GME and SEM data (SEPCALIB)
 - Abundance ratios for heavy ions relative to He
 - Geomagnetic shielding
 - Error propagation in statistical modelling

Dataset construction

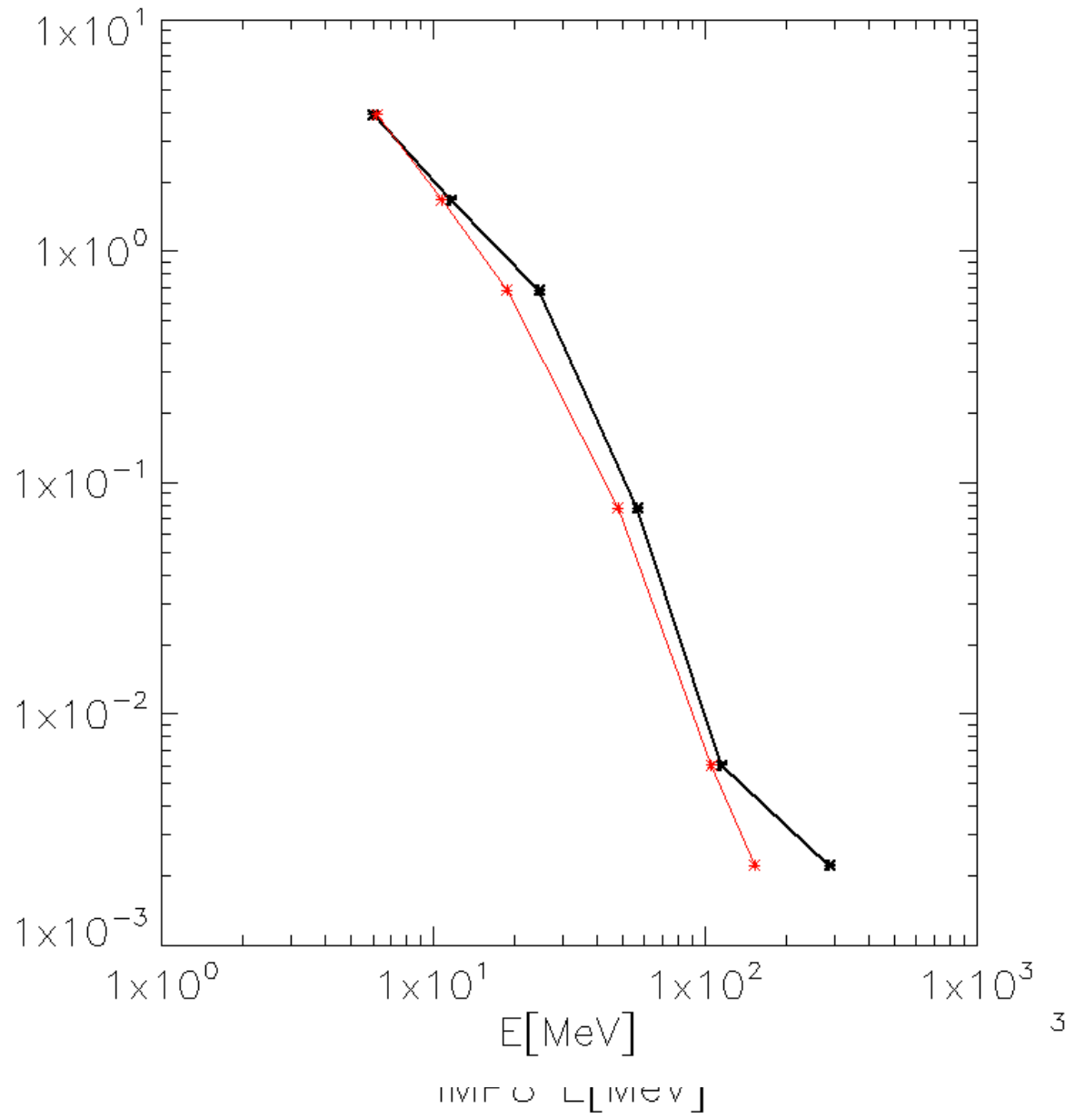
- ESP method (Xapsos et al, IEEE Trans. Nucl. Sci., 51, 3394–3398, 2004)
 - Use IMP8/GME data in combination with GOES data to fill gaps (IDS dataset)
 - Requires accurate scaling factors
 - SEM energies are poorly determined, resulting in flux overestimates
- SEPEM method
 - Re-bin GME and SEM fluxes to 10 reference energy channels (5–200 MeV/nuc, logarithmically spaced)
 - Linear fit of corresponding GME/SEM flux channels -> apply inverse relation to SEM fluxes
 - Flawed by poorly determined SEM energies

D_z

● S

GOES08 flux

flux [(cm² s sr MeV)⁻¹]



1x10²

3

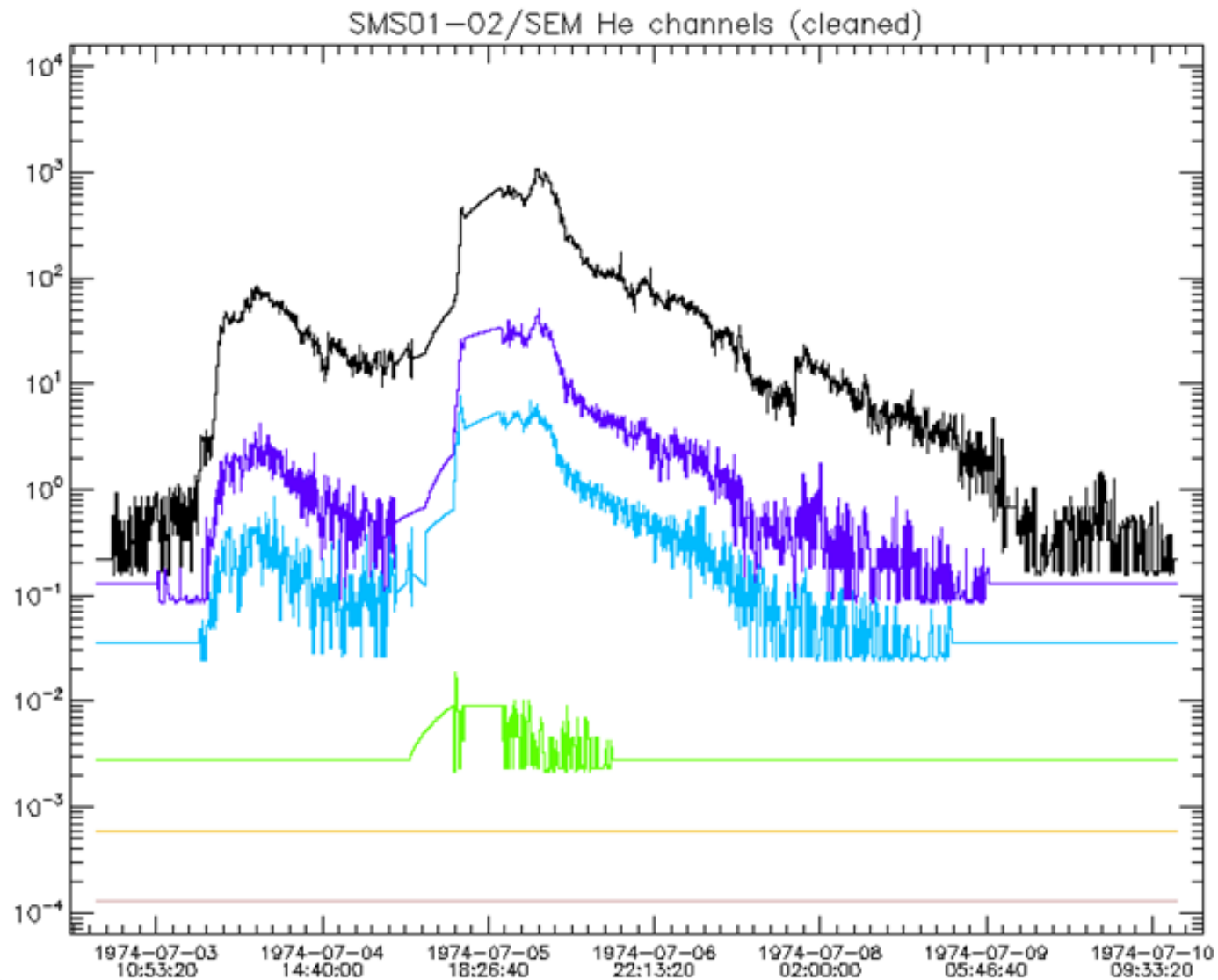
E [MeV]

GOES data sources

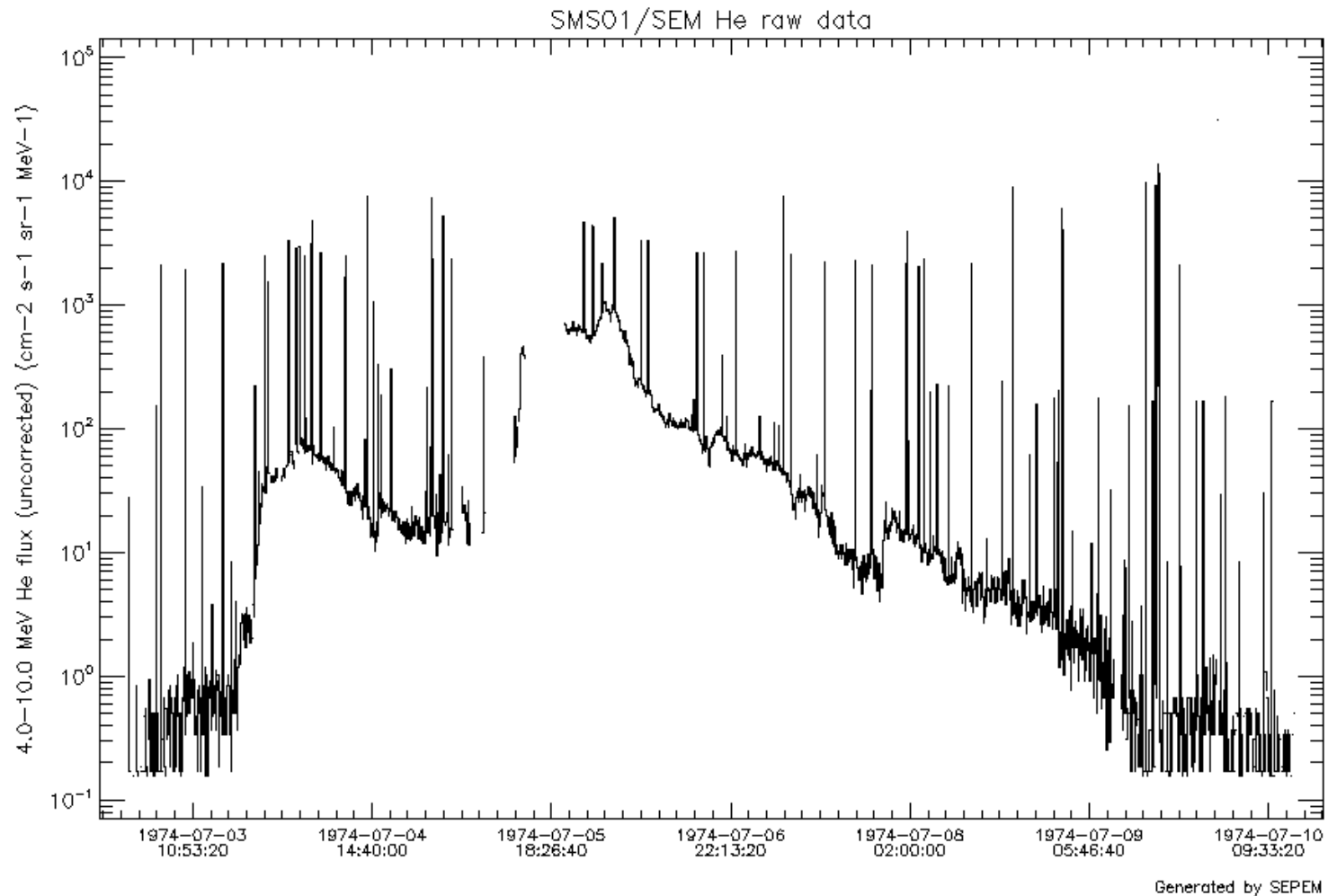
- 2011–present (netCDF): http://satdat.ngdc.noaa.gov/sem/goes/data/new_avg/
- 1986–2011 (ASCII .TXT): <http://satdat.ngdc.noaa.gov/sem/goes/data/avg/>
- 1974–1985 (FITS): <http://satdat.ngdc.noaa.gov/sem/goes/data/full>

Spacecraft	Start Time	End Time	Usage
SMS01	Jul 1974	Oct 1975	Jul 74 – Oct 75
SMS02	Feb 1975	Mar 1978	Nov 75 – Mar 77
GOES01	Jan 1976	May 1978	Apr 77 – Jul 77
GOES02	Aug 1977	May 1983	Aug 77 – May 83
GOES03	Jul 1978	Dec 1979	Not used
GOES05	Jan 1984	Mar 1987	Jan 84 – Feb 87
GOES06	May 1983	Dec 1994	May 83 – Dec 83
GOES07	Mar 1987	Aug 1996	Mar 87 – Feb 95
GOES08	Jan 1995	Jun 2003	Mar 95 – May 03
GOES09	Apr 1996	Aug 1998	Not used
GOES10	Jul 1998	Dec 2009	Not used
GOES11	Jul 2000	Feb 2011	Jun 03 – Jan 11
GOES12	Jan 2003	Sep 2010	Not used
GOES13	May 2010	Present	Feb 11 – Dec 15

GOES data cleaning

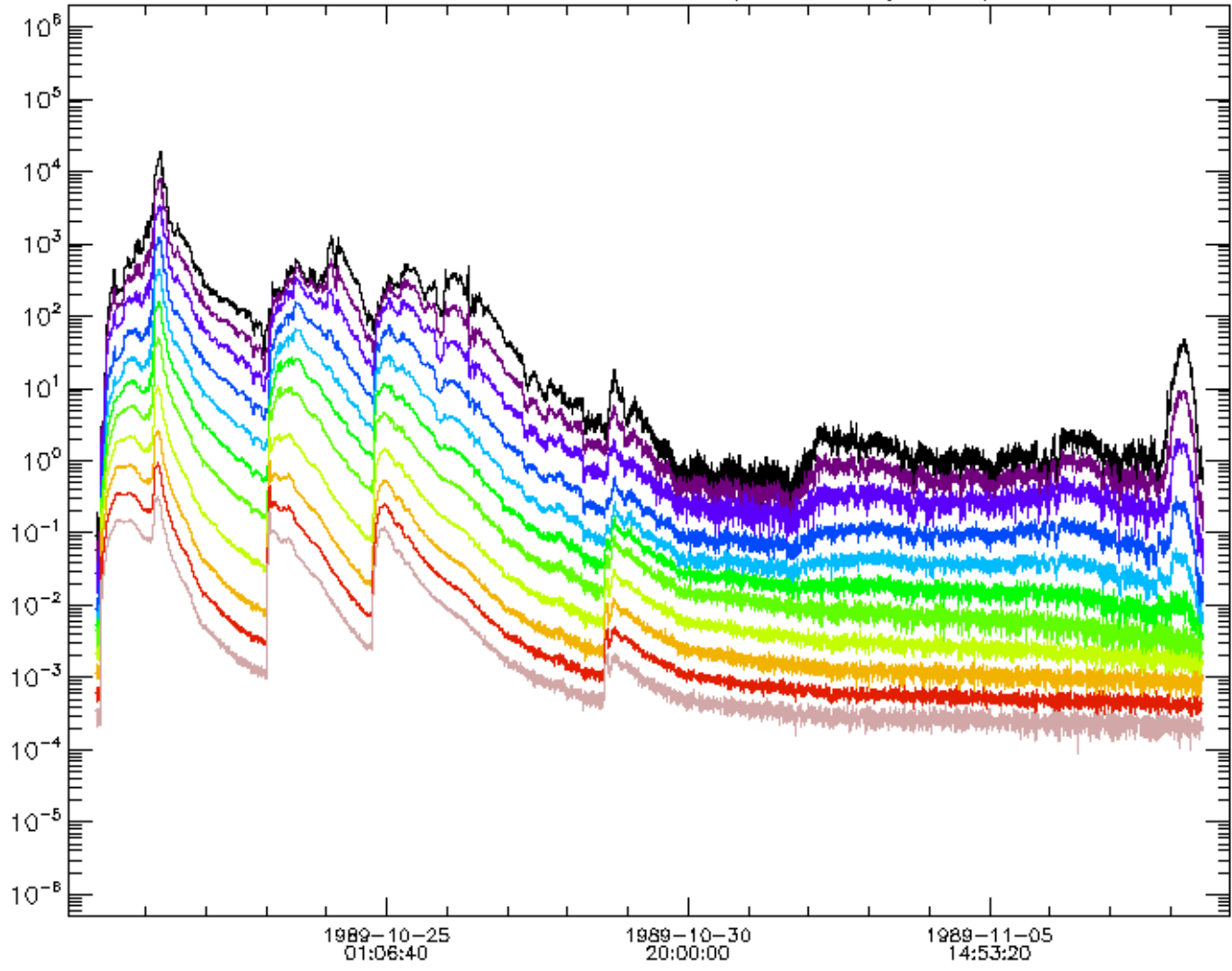


Effect of cleaning



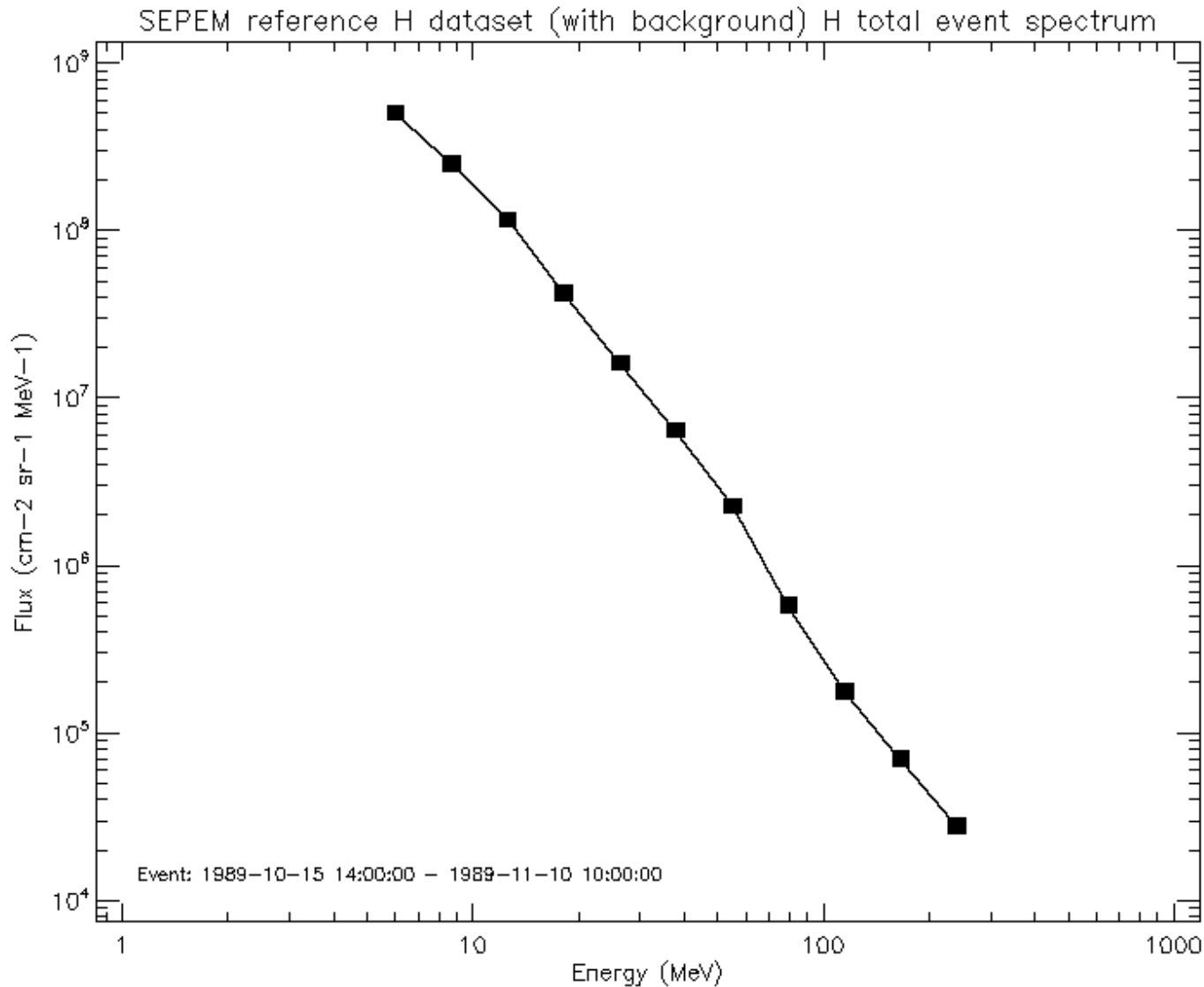
Final H dataset

SEPEM reference H dataset (with background)

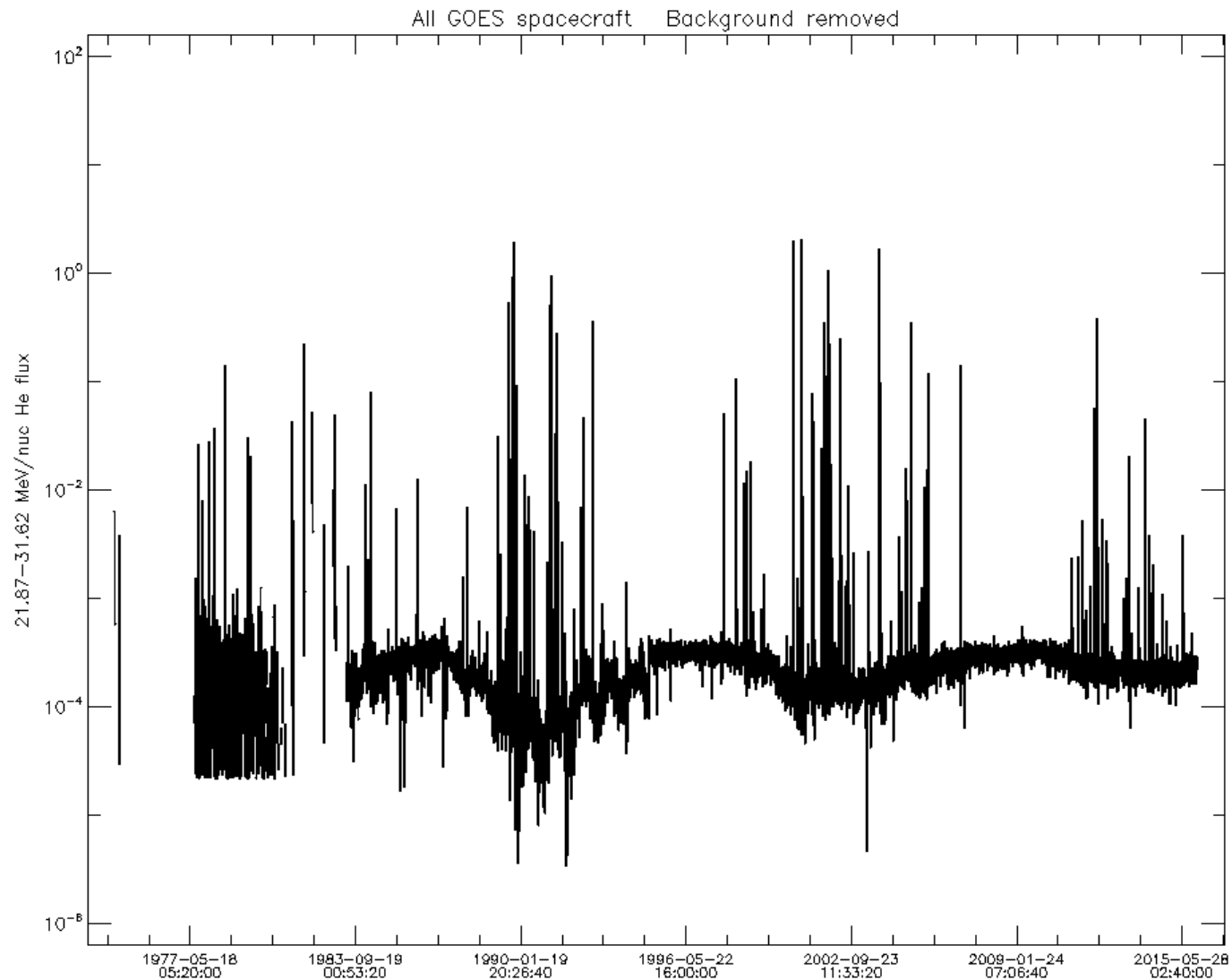


- | | |
|------------------------|------------------------|
| 5.00–7.23 MeV H flux | 7.23–10.46 MeV H flux |
| 10.46–15.12 MeV H flux | 15.12–21.87 MeV H flux |
| 21.87–31.62 MeV H flux | 31.62–45.73 MeV H flux |
| 45.73–66.13 MeV H flux | 66.13–95.64 MeV H flux |
| 95.64–138.3 MeV H flux | 138.3–200.0 MeV H flux |
| 200.0–289.2 MeV H flux | |

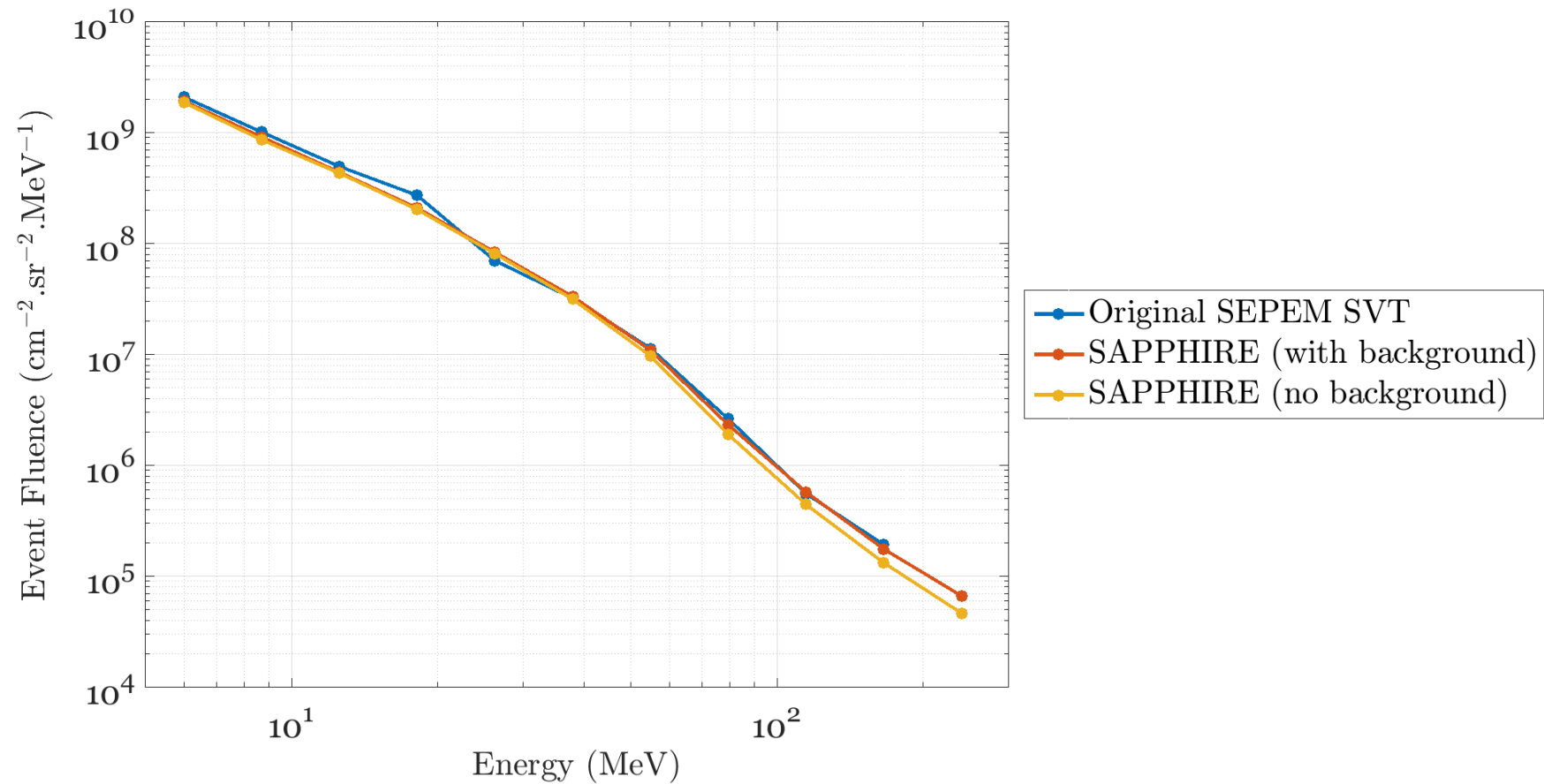
H Oct 89 event spectrum



Final He dataset



Effects on statistical models



Future improvements

- Background removal was applied to He data (due to high SEM instrument threshold): during events, remove 3-day average from before and after event.
- Background should also be removed from H data.
- The background algorithm should be improved.
- Add GOES-13 data at regular intervals (6 months).
- The H and He reference datasets are available at ftp://ftp.estec.esa.int/private/pjiggins/anonymous/SEPEM_RDS_v2-00.zip

When ESHIEM development is complete, the datasets will be made available on the SEPEM server.