

# MAARBLE- Standard particle database to be used for data assimilation

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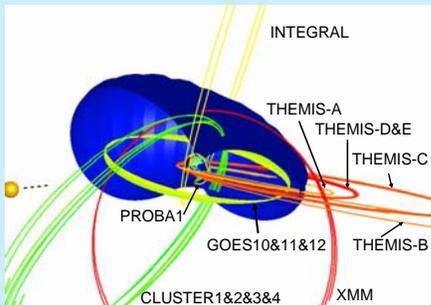


One objective of MAARBLE project (see relevant poster on display at this meeting) is to select and collect European and US particle data sets along different orbits to further perform optimal data assimilation with the Salammbô code and a ensemble Kalman filter. A primary list of missions envisaged so far is XMM/ERMD, INTEGRAL/SREM, PROBA-1/SREM, GIOVE-B/SREM, Cluster/RAPID, THEMIS/SST, Polar/CEPPAD and GOES/SEM. When available in the public domain, the instrument response function is collected and provided as well. Particular effort is devoted to SREM data processing using the Singular Value Decomposition technique to derive smooth proton and electron fluxes. We present here the status of this database where all data sets are standardized into a unique data format following PRBEM international standards.

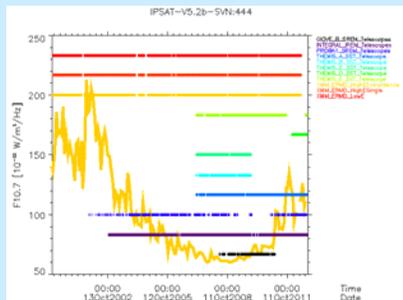
## Selection and standardization of electron data sets

- European particle data sets have been collected along different orbits (XMM/ERMD, INTEGRAL/SREM, PROBA-1/SREM, GIOVE-B/SREM and Cluster/RAPID – 1 to 4).
- US particle data sets have been collected along different orbits (THEMIS/SST – A,B,C,D,E, Polar/CEPPAD and GOES/SEM)
- Instrument response functions have been collected when available in public domain for each instrument.
- All data sets have been standardized into a unique data format (cdf-istp-prbem) and are made available in count rates (when response function is available) as well as in flux units.
- Magnetic coordinates of measurement location have been computed ( $L^*$ , B/Equator Magnetic local time) following PRBEM international standard (see [http://craterre.onecert.fr/prbem/Standard\\_File\\_Format.pdf](http://craterre.onecert.fr/prbem/Standard_File_Format.pdf)).
- This particle database will be maintained for the duration of the project at least. New data are ingested every night. All flux data can be plotted using the IPSAT web based software (<http://craterre.onecert.fr/ipsat/index.php>)

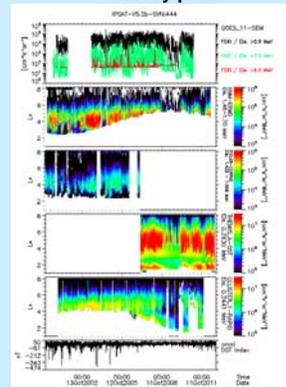
Spatial coverage (Example taken on 2008/01/05-2008/01/10):



Time coverage, 2000/01/01-2012/10/24 (for count rates):



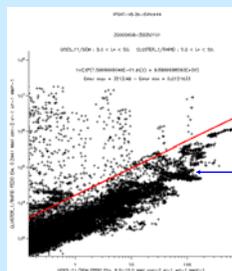
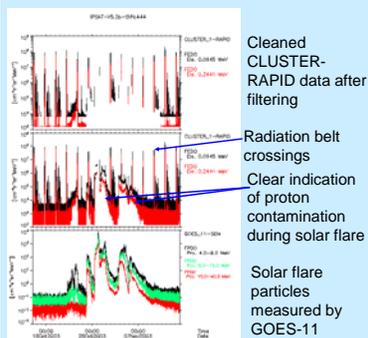
Survey plot:



## Data quality

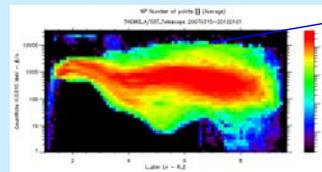
Trapped electrons and ions, solar flare particles and galactic cosmic rays cohabit in space and their measurements are not at all straightforward. The consequence is that all measurements have to be analyzed in detail based upon our current knowledge of radiation belt global structure and dynamics as well as instrument physics. This analysis has to focus on instrument contamination, saturation, background, glitches ... and cross-calibration. This is of prime importance before any further use of the data. This work is currently in progress and is performed according to PRBEM recommendation ([http://craterre.onecert.fr/prbem/Data\\_analysis.pdf](http://craterre.onecert.fr/prbem/Data_analysis.pdf)). Each individual data are then flagged where 0 denotes highest quality, 1 denotes problem with time resolution, 2 denotes possible contamination, 3 denotes saturation and 4 denotes any other problem while 10 indicates data have not been analyzed.

Example of data contamination



Solar proton removal algorithm for 0.244 MeV electron channel:  
If  $Cluster1/RAPID(e, E=0.244MeV) \leq e^{-7.2 \cdot 10^{-4} \cdot \ln(GOES/SEM(p, E=9-15MeV)) + 9.2}$   
then CLUSTER measurement is contaminated by solar flare protons.

Example of saturation



THEMIS-SST instrument saturates (due to electronic deadtime) to around 15000 counts/second

### Known issues to be addressed next

- Data analysis to define data quality flag must be performed:
  - done for GOES/SEM series, XMM/ERM and Polar/CEPPAD
  - partially done for CLUSTER/RAPID series
  - to be done for other missions

THEMIS/SST data must be reprocessed to include latest SST processing and calibration routines (updated calibration factors, ageing corrections, more accurate dead-time correction factors, cross-contamination removal scheme).

MAARBLE web site : <http://www.maarble.eu/>

## Acknowledgements:

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## Disclaimer:

This paper reflects the authors' views and the European Union is not liable for any use that may be made of the information contained therein.

