An extended investigation of the long-term trends in the fluxgate magnetometer (FGM) calibration parameters on the four Cluster spacecraft

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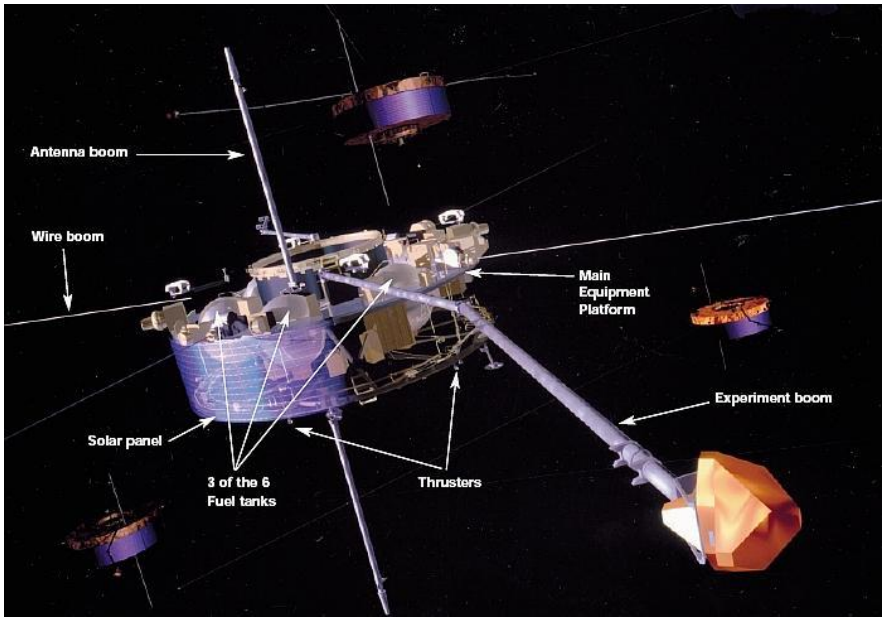
Background: The ESA Cluster Mission & FGM



Cluster: 4 spacecraft, Earth-orbiting, magnetosphere observing

All FGM instruments continue to work on main hardware chain
No degradation in any performance parameters or housekeeping indicators

Over 20 years of calibrated FGM data at spin, 5vps, and full resolution (22vps)

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FGM Calibration and Archiving: Why is it important?

Each orbit (51-57 hours) is individually calibrated for each sensor & each range

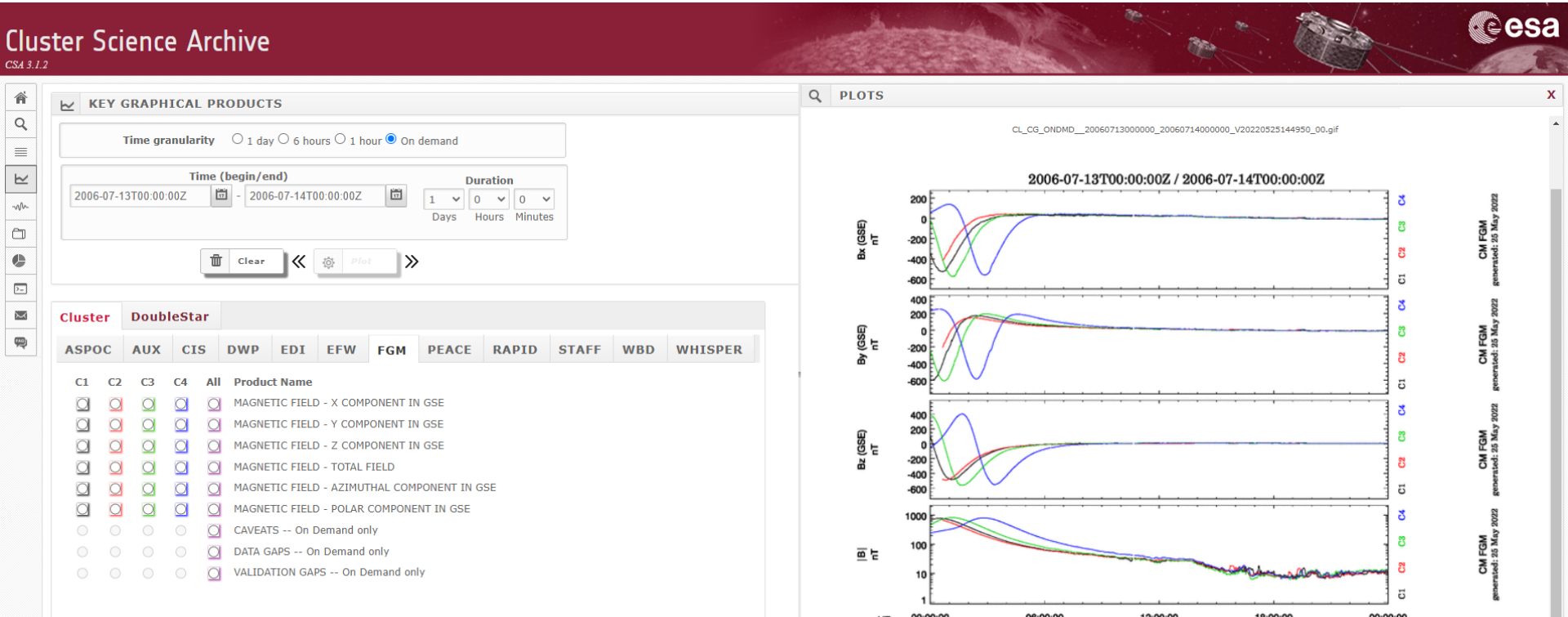
- All magnetic-field data visually inspected – '**Validation**' – before submission

Other Cluster instruments require FGM data for their calibration

DWP, PEACE, RAPID all use 5vps data in their instrument calibration pipelines

All Cluster FGM data is delivered to the Cluster Science Archive (CSA)

Accessible on creation of a CSA account: https://csa.esac.esa.int/csa-web/#search



2001-2012 calibration parameter stability

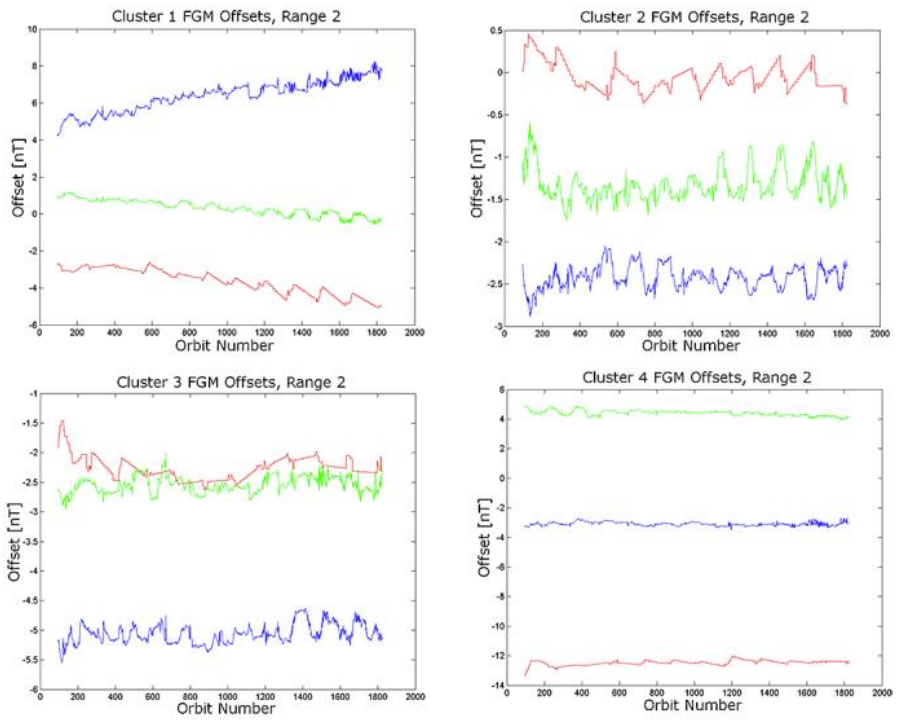


Figure 4. Range 2 spin-axis (O_1, red) and spin-plane (O_2 and O_3, blue and green) offsets in nanoteslas for orbits 93–1825 (February 2001–February 2012).

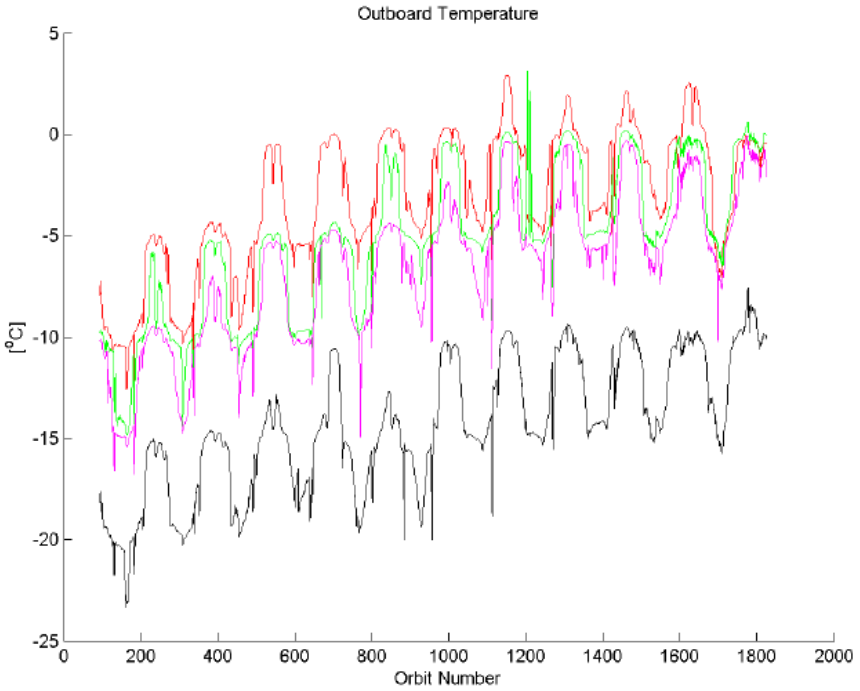


Figure 2. Outboard sensor temperatures in degrees Celsius for each spacecraft for orbits 93–1889 (February 2001–August 2012). C1 – black, C2 – red, C3 – green, C4 – magenta.

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Alconcel, L-NS, Fox, P, Brown, P, Oddy, TM, Lucek, EL, and Carr, CM. Geosci. Instrum. Method. Data Syst., 3, 95–109, https://doi.org/10.5194/gi-3-95-2014, 2014.

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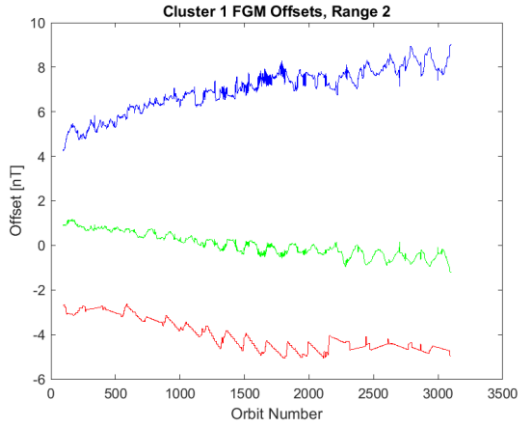
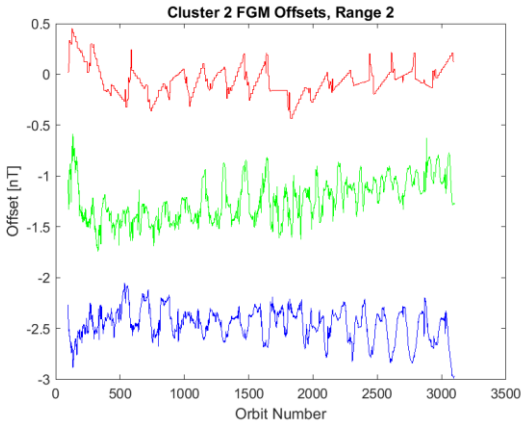
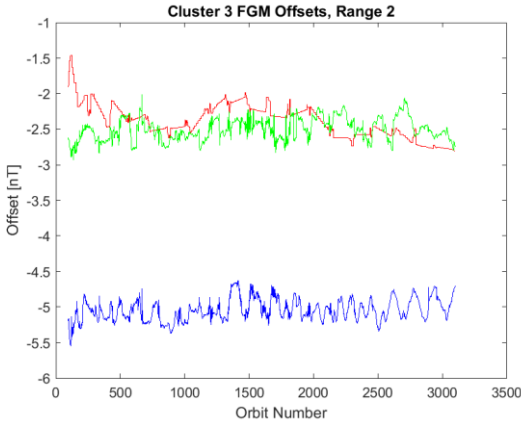
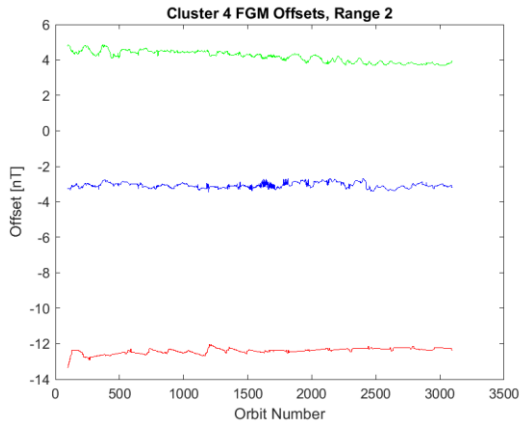
2001-2020 calibration parameter stability









Cal parameter stability maintained over an additional 8 years of data.

No clear correlation with boom temperatures or other HK parameters demonstrated

Improvements in calibration to focus on methods for determining spin-axis offsets (red traces) without using interpolation, and integration of additional data into the archive

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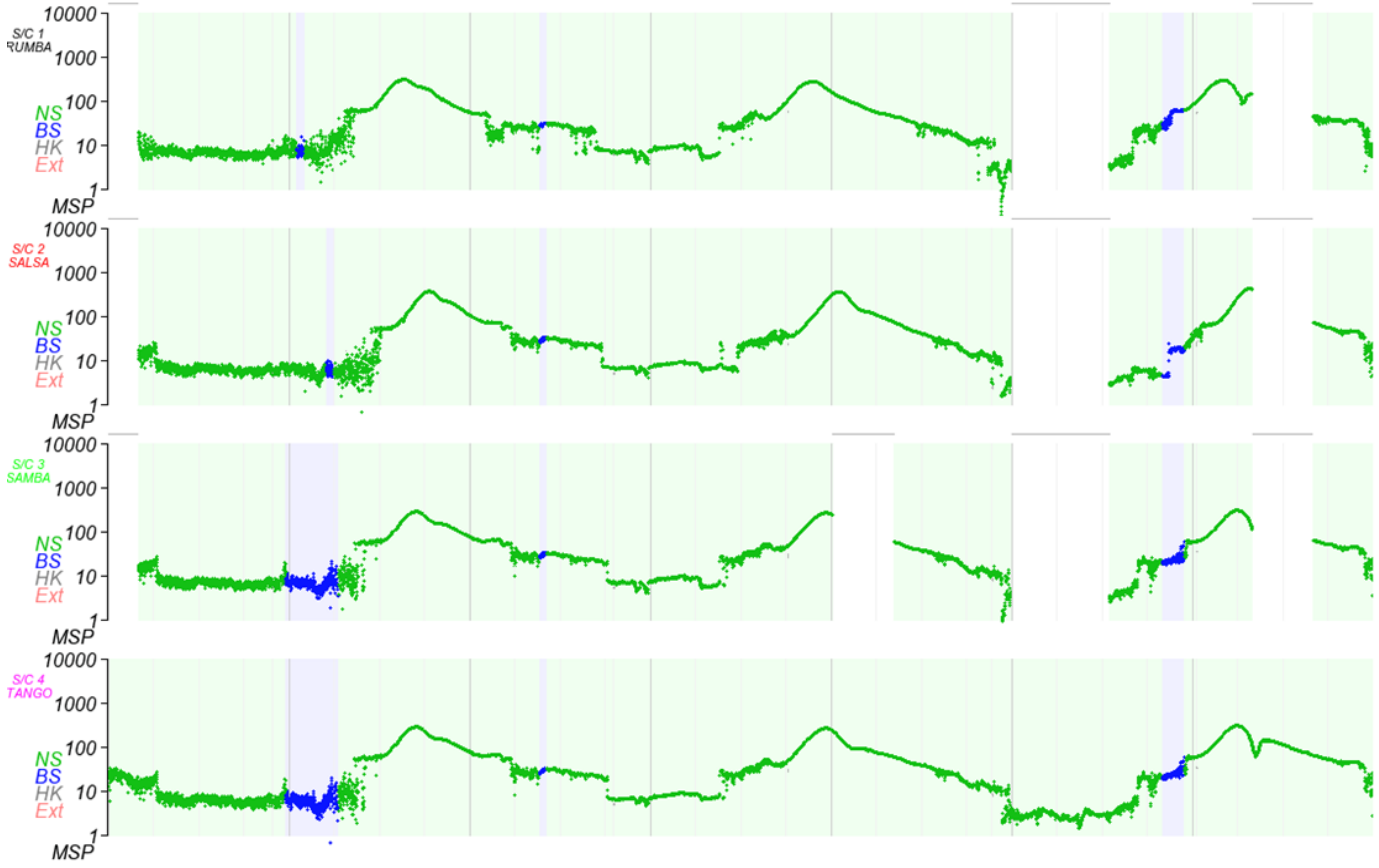
Calibration improvements

Data from 25-31 Jan 2016; blue is Extended Mode



~10-20% of FGM data taken in Extended Mode

Data de-spun and spin-averaged

Special handling to recover vector times

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