

Coordinated Magnetic Field Observations by Apollos 15 and 16

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Lunar Science Forum, NASA Ames Center
July 20, 2010

(Illustration: NASA
Heliophysics Committee Report)

A Milestone in Magnetism Research: Measuring Lunar Magnetic Field during *Space Race*

- The Lunar Surface Magnetometer installed by **Apollo 12** astronauts on 19 November 1969 marks the first ever magnetic measurements on the lunar surface.

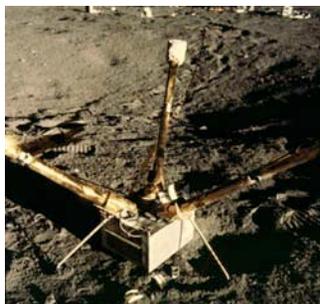


Apollo Magnetic Field Experiments

Lunar Surface Magnetometer



Palmer Dyal & Charles Sonnet (NASA Ames)

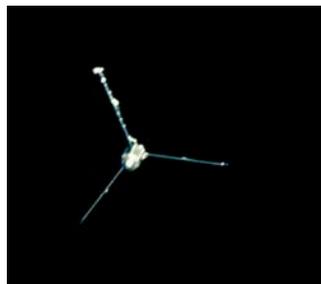


LSM:
A12, A15, A16

Sub-satellite Biaxial Magnetometer



Paul Coleman (UCLA)

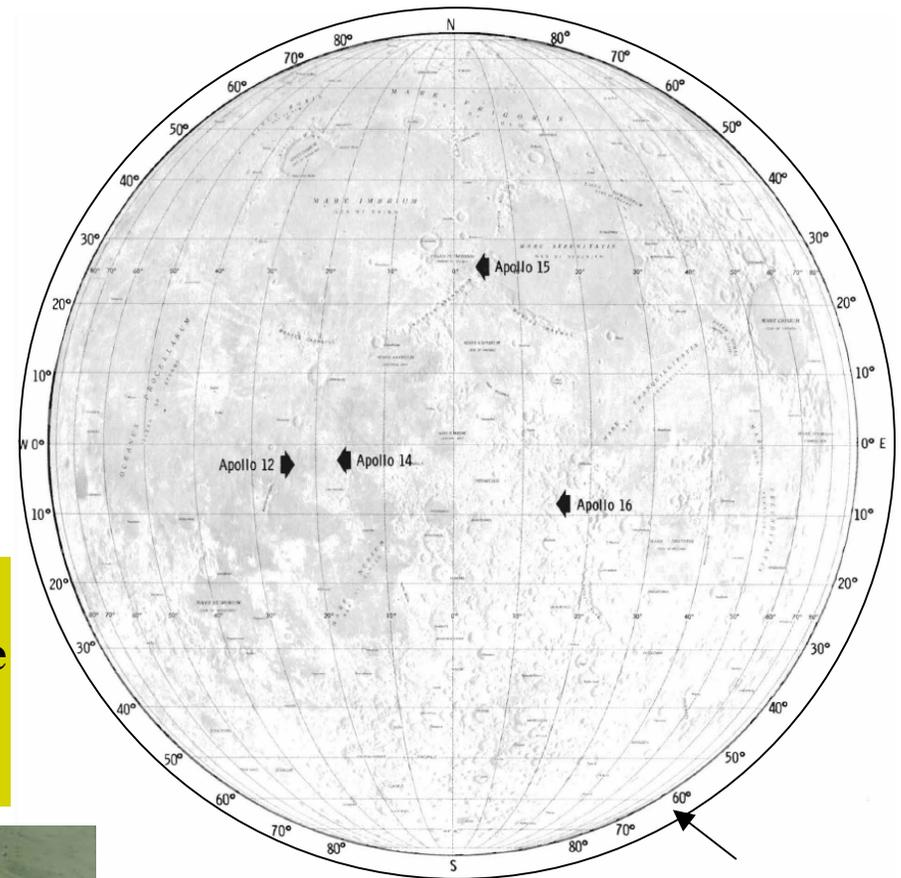


SBM:
A15, A16

Lunar Portable Magnetometer



LPM: A14, A16

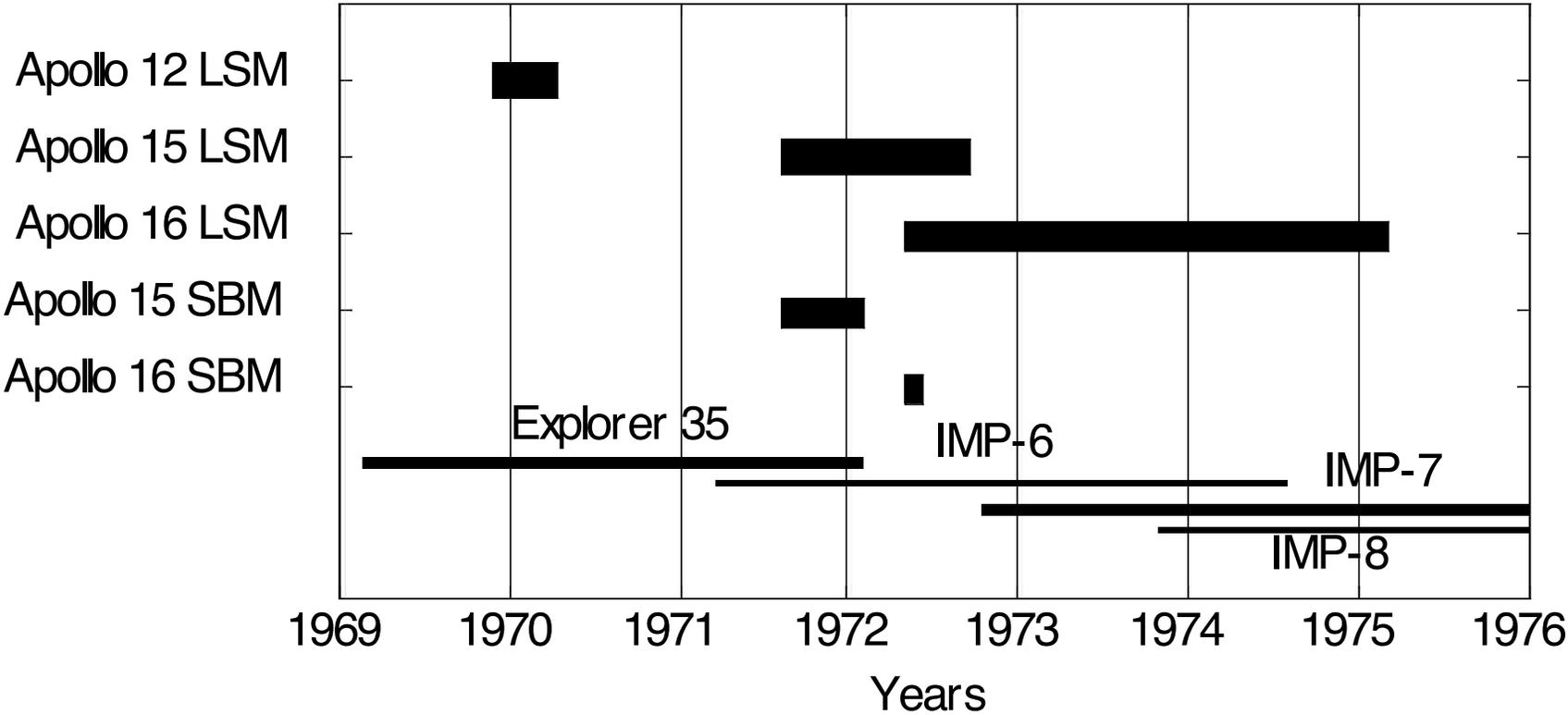


Apollo 15 & 16 subsatellites

Conditions of Apollo Magnetic Field Data

- The data were stored in 36-bit words: Not compatible with present formats.
- LSM and SBM were made by different machines using different formats for alphanumeric characters and floating points .
- Not all the information needed to restore data is documented.
- Changes were made in data due to archiving needs.
- No attitude data for Apollo sub-satellites. Orbit plots for Apollo 15 sub-satellite have been secured.
- At this moment the reading of LSM data is time-consuming – due to the additional efforts in identifying time words.

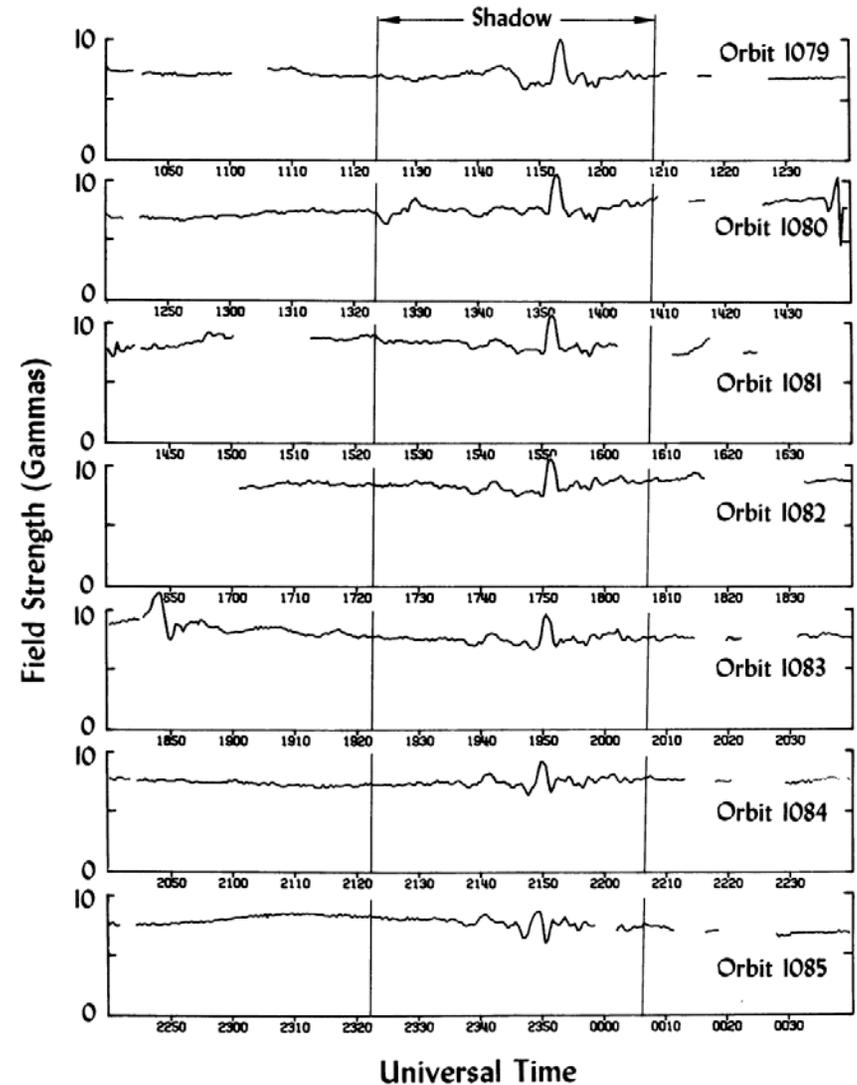
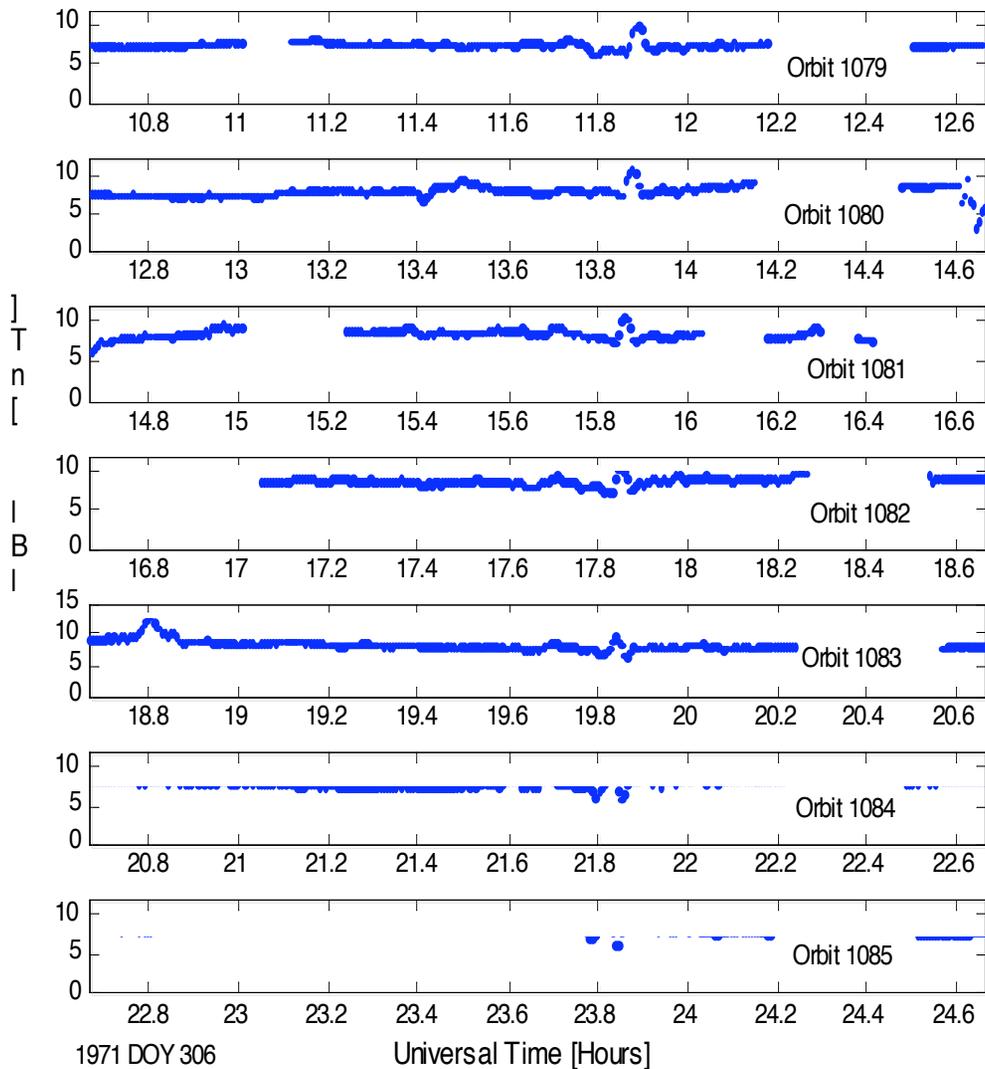
Apollo Magnetic Field Data at NSSDC (Digital)



This study: Apollo 15 LSM & SBM

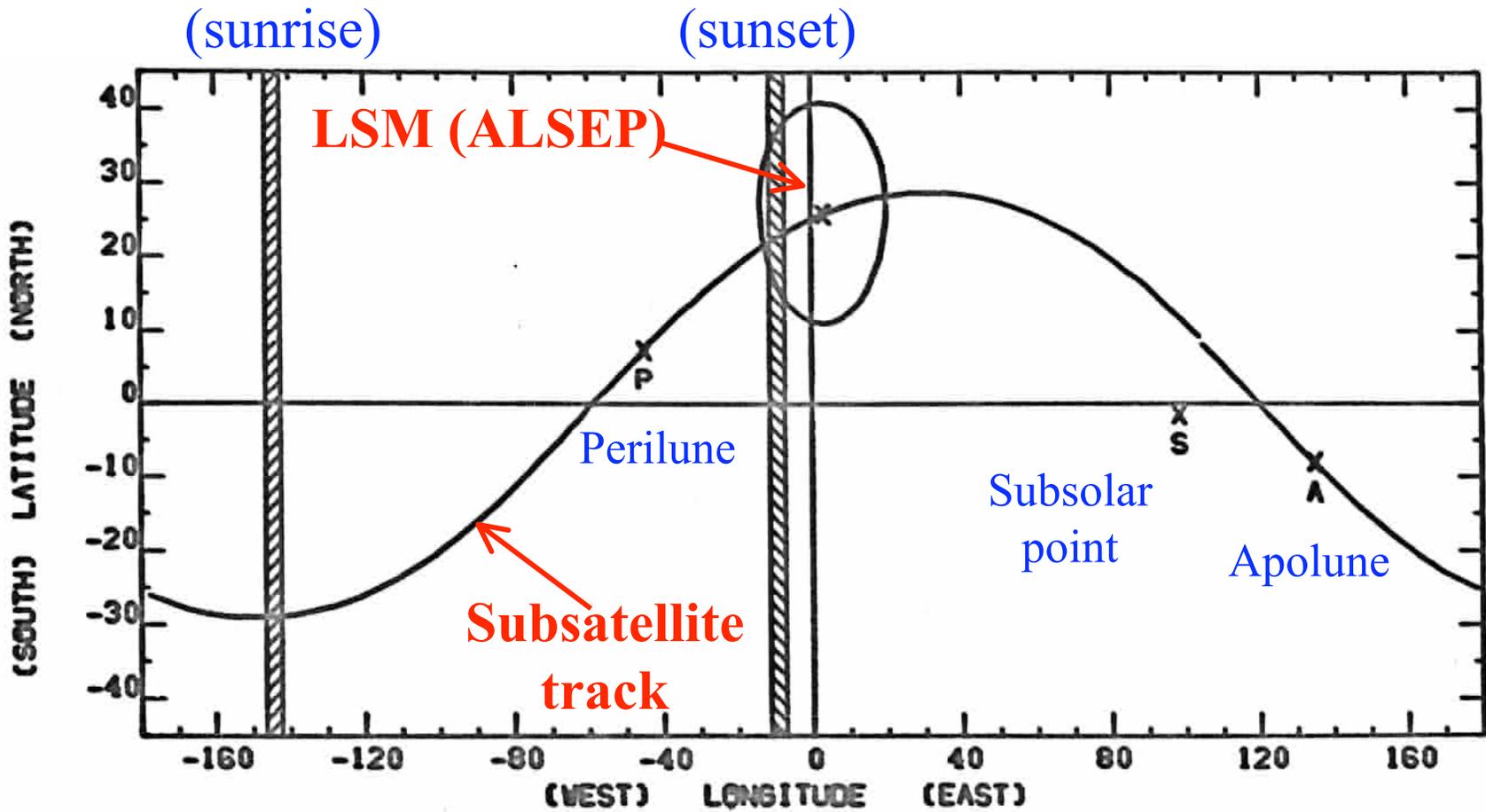
Comparison with Published Results (SBM)

Apollo 15 Subsatellite Magnetometer



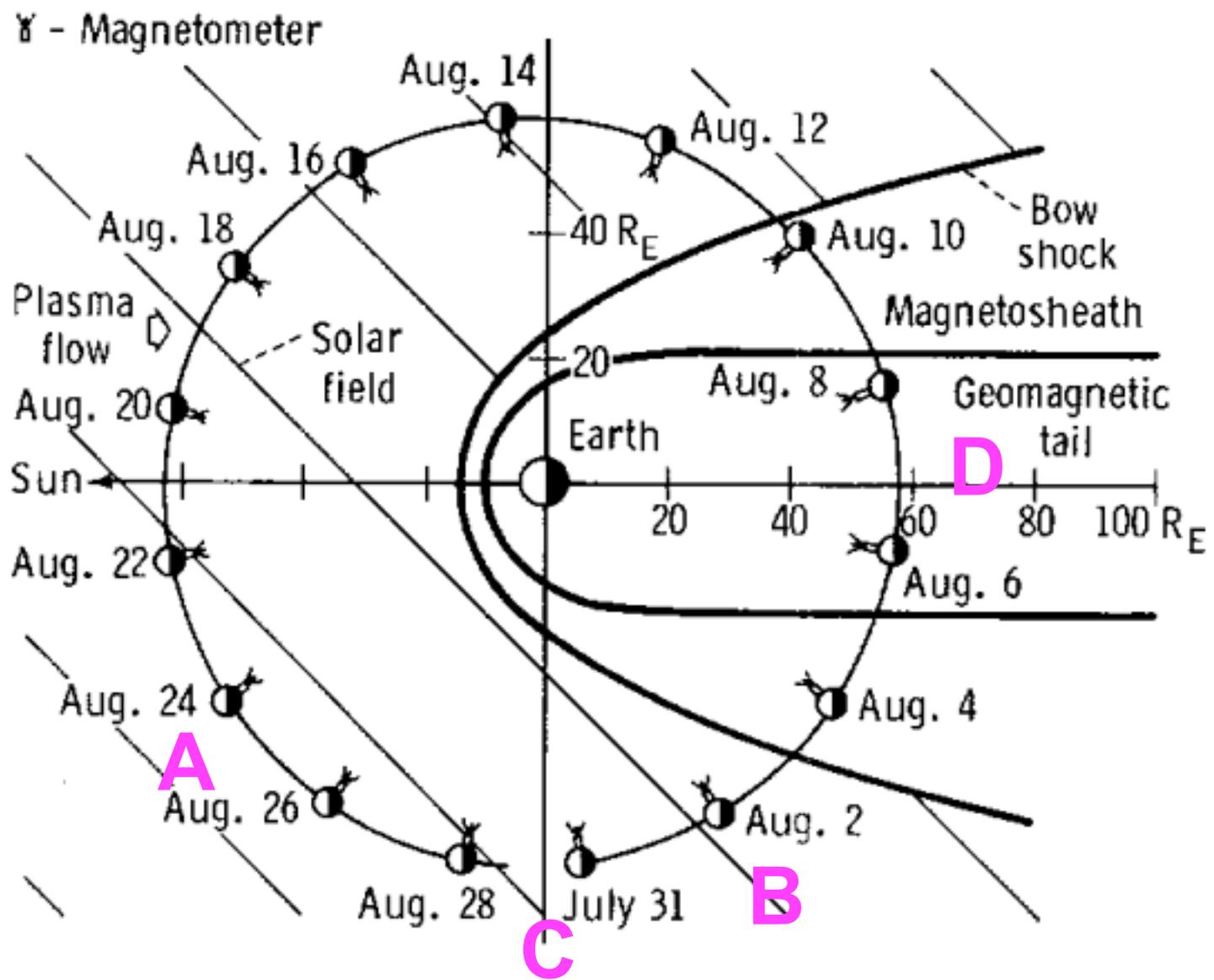
Russell et al. [1975]

ALSEP and Subsattellite Positions

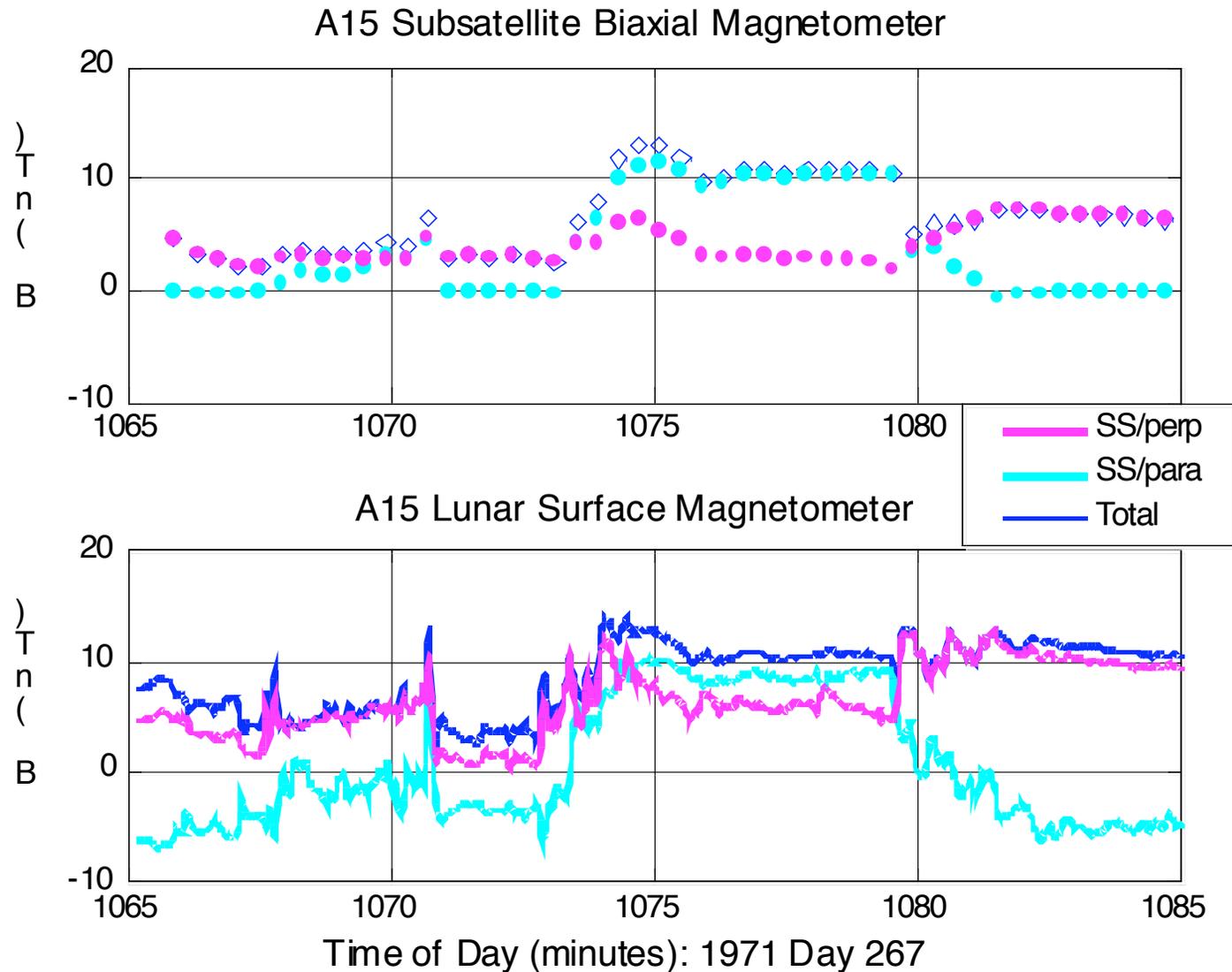


ORBIT	633	634	635	636	637	638
PERILUNE	952	1151	1351	1550	1750	1949
APOLUNE	1051	1251	1450	1650	1850	2049

START DAY-FIRST ORBIT 9/26/71 CALCULATED 9/26/71 PROCESSED 4/01/72
 TRACKING ORBIT = 640

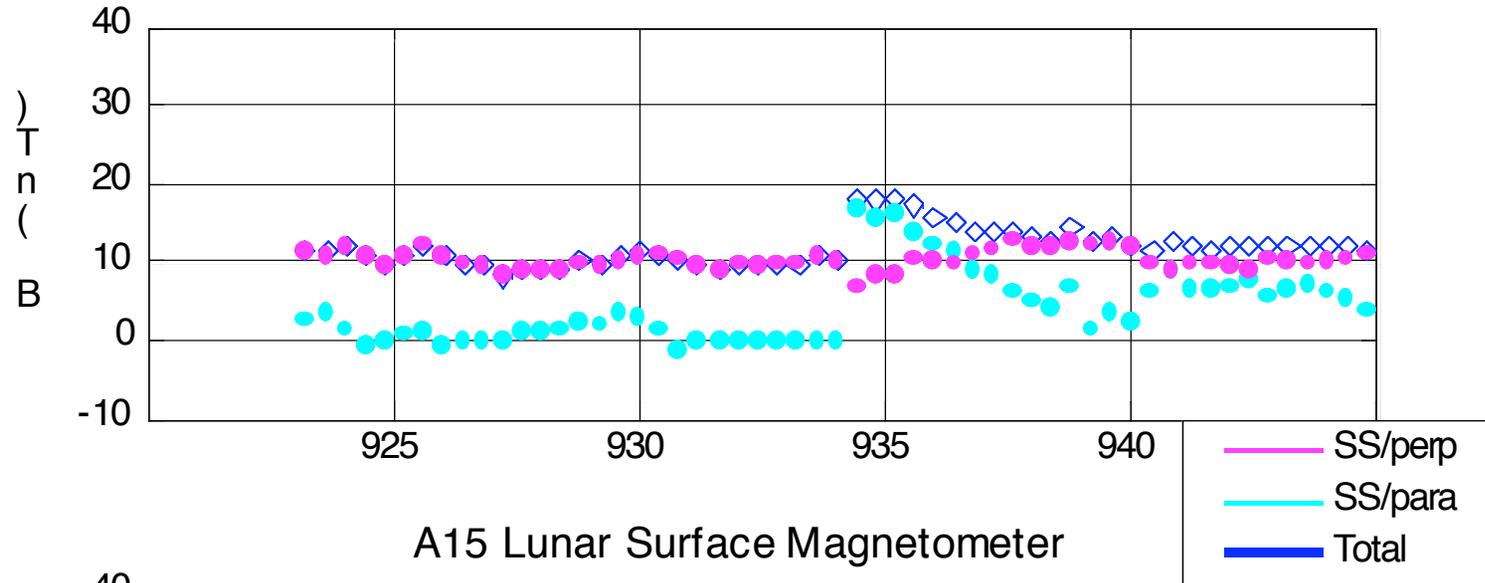


A. Solar wind (Nighttime)

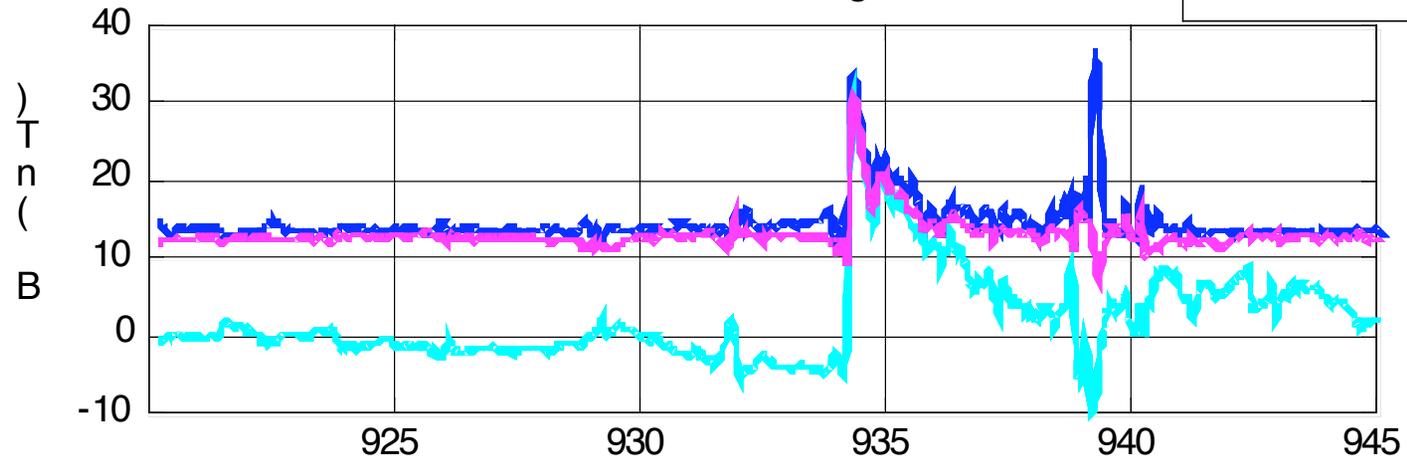


B. Solar Wind (Daytime)

A15 Subsatellite Biaxial Magnetometer



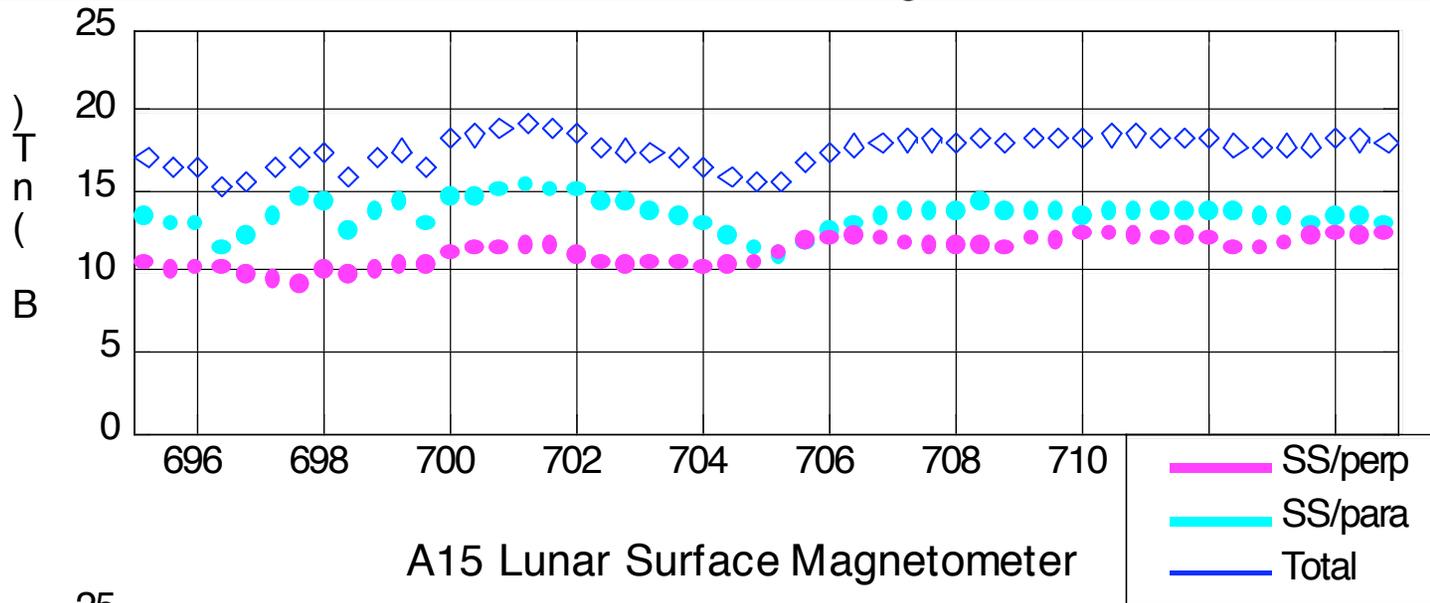
A15 Lunar Surface Magnetometer



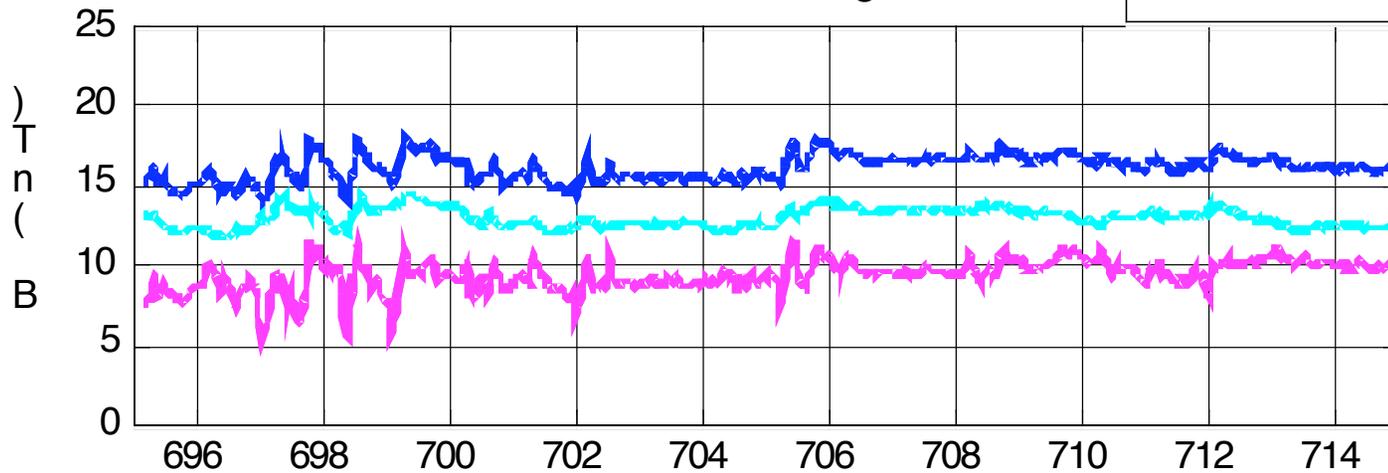
Time of Day (minutes): 1971 Day 269

C. Sunset

A15 Subsatellite Biaxial Magnetometer

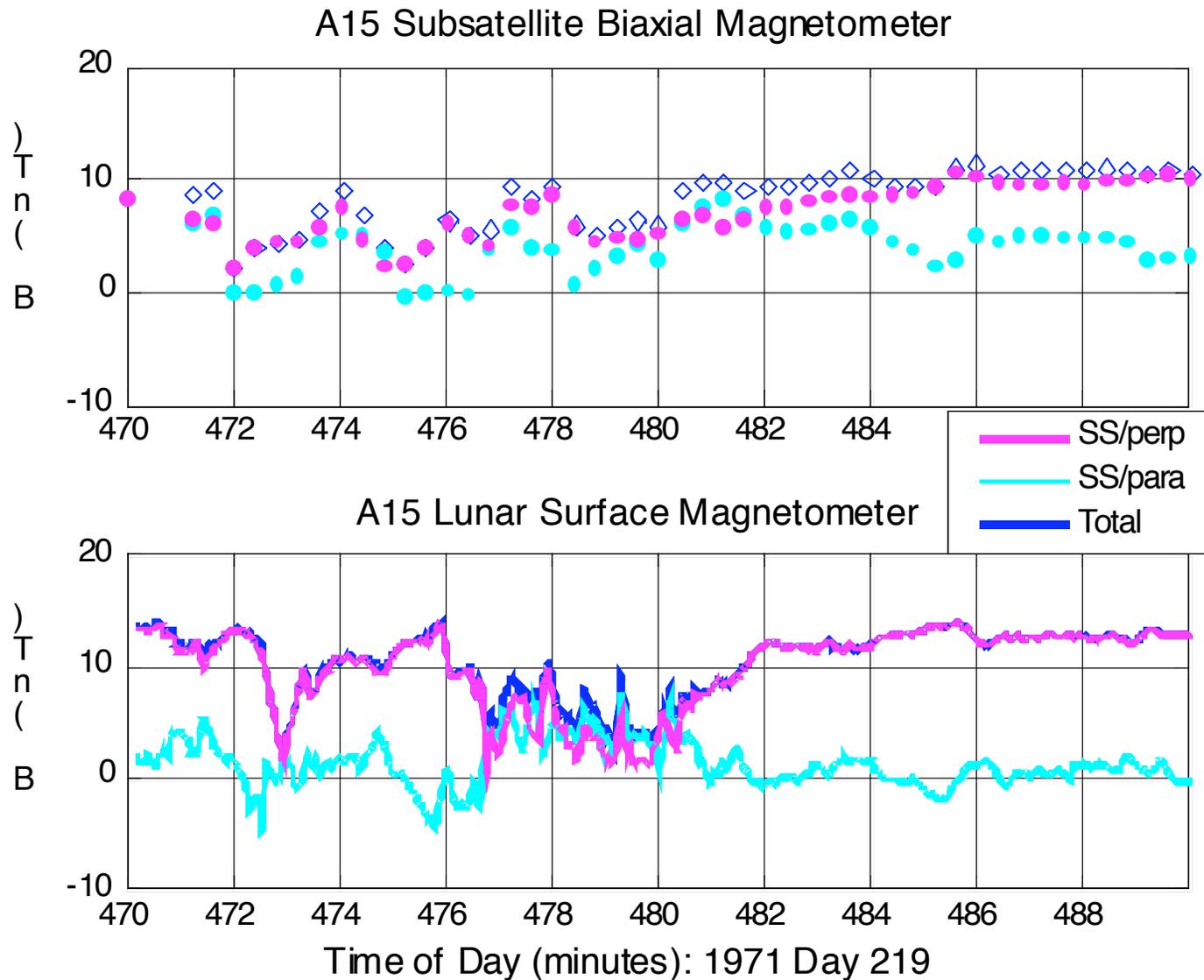


A15 Lunar Surface Magnetometer

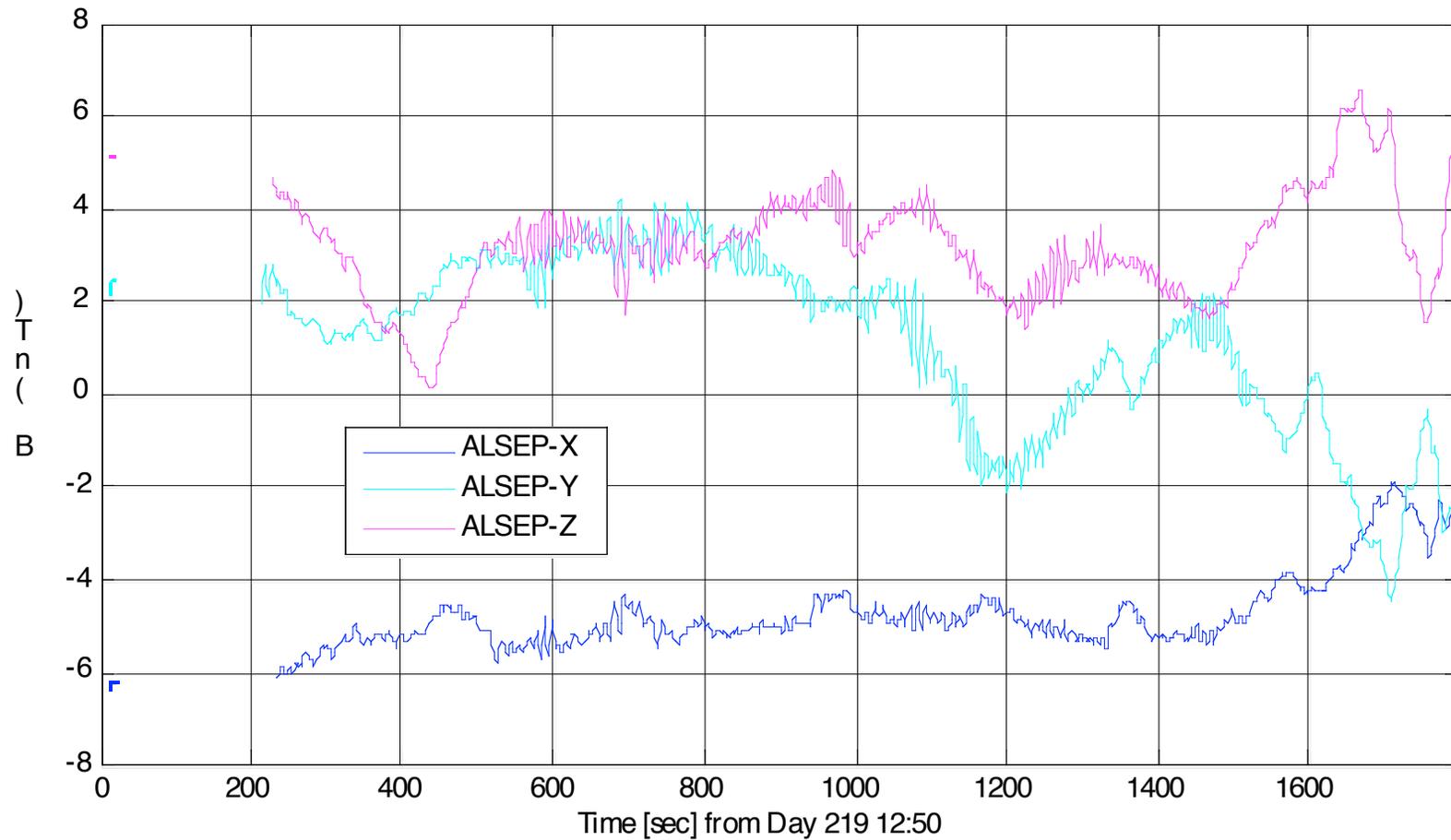


Time of Day (minutes): 1971 Day 268

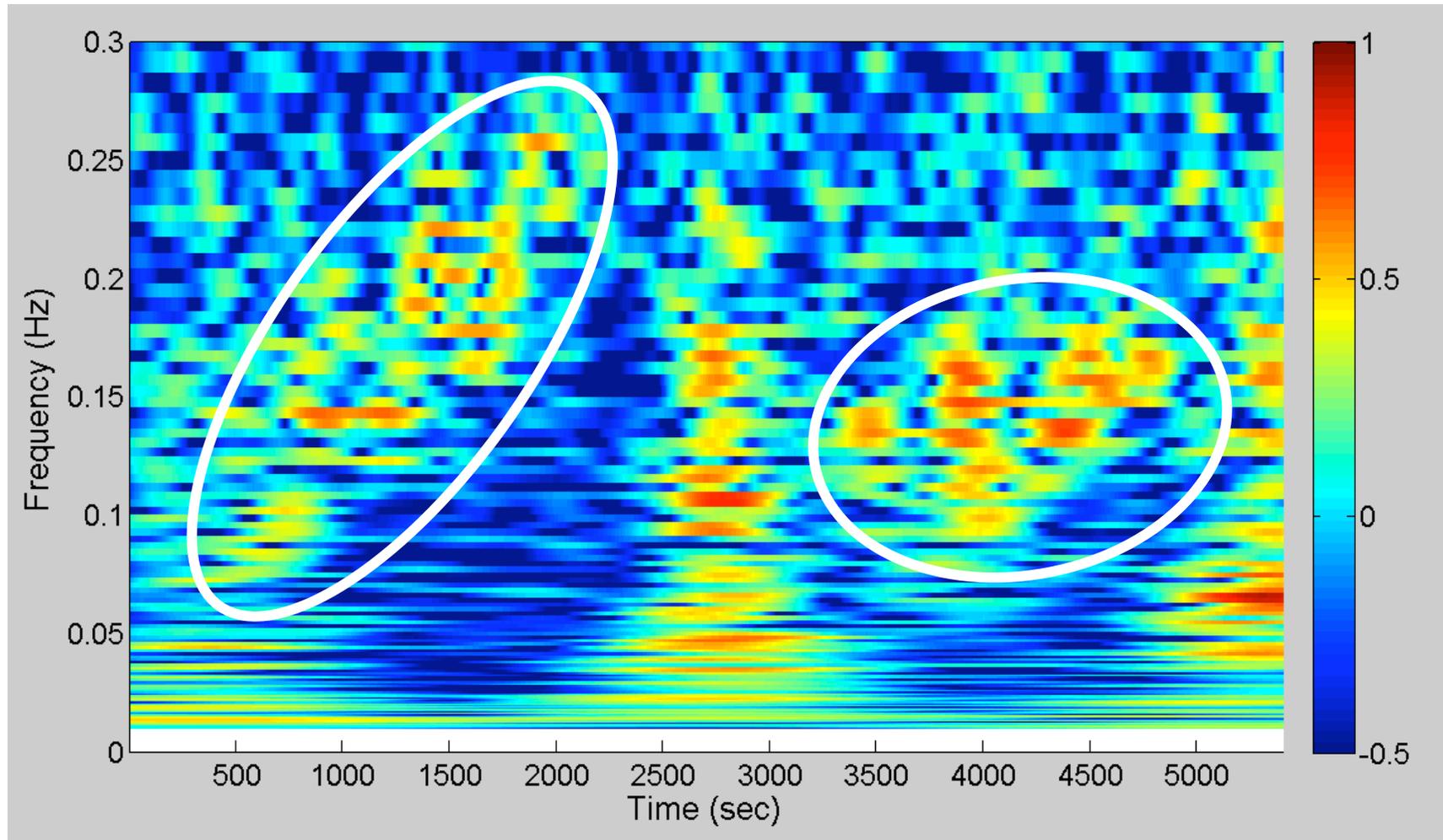
D. Magnetotail (Daytime)



ULF Waves in the Magnetotail Observed by LSM



Wavelet spectrogram of LSM data (magnetotail)



Summary

- We have been able to recover the archived subsatellite and surface magnetometer data from Apollo missions.
- The observations by LSM and SBM during conjunctions show very similar magnetic field values. The Apollo 15 LSM saw slightly higher magnetic field magnitude when the station was on the sunward side in the solar wind.
- LSM observed ULF waves in the magnetotail. Generation mechanisms of these waves are under investigation.
- More effort is needed to recover the attitude data for Apollo 16 subsatellite.

