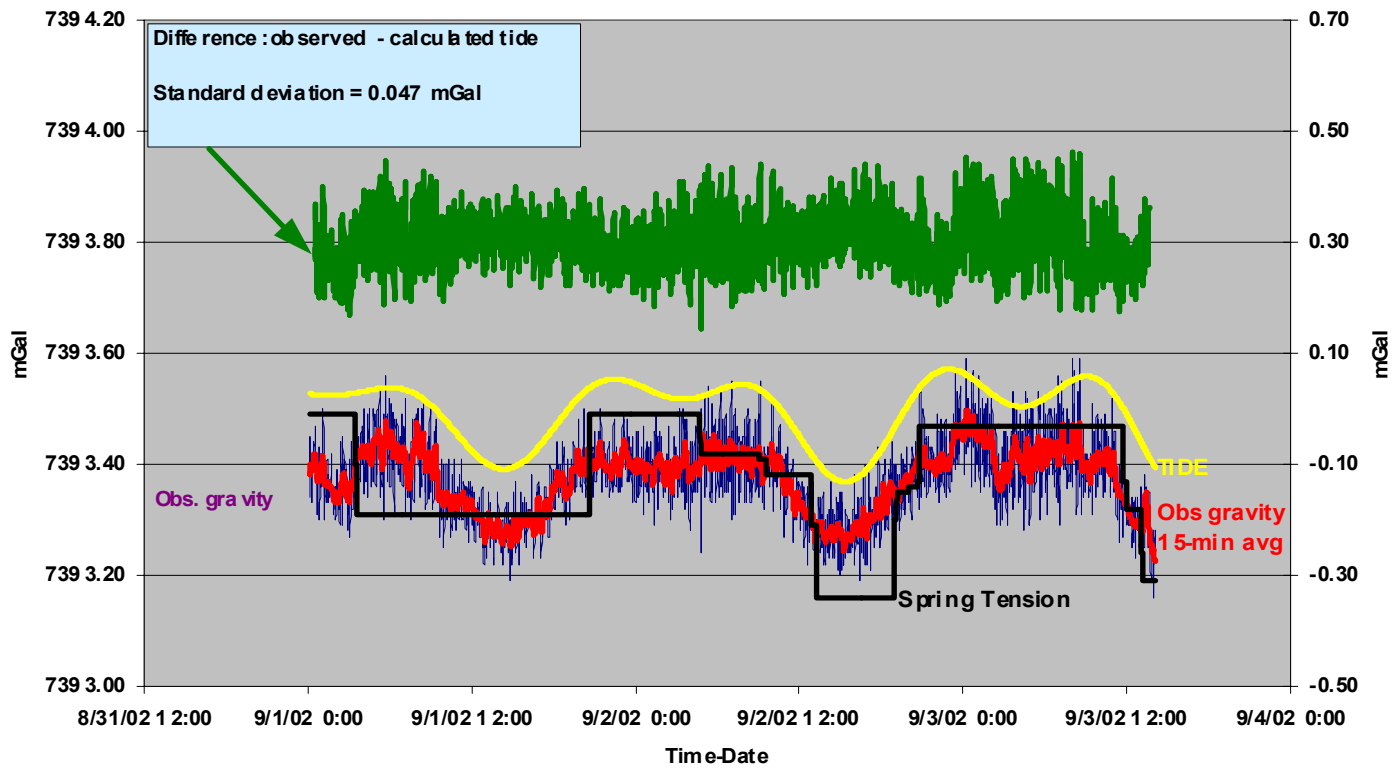
A Study of Noise and Signal Detection Threshold:
L&R Air-Sea System II and SAGE – S-meter Controls Systems
By Alan T. Herring, EDCON

L&R Air-Sea System II - 2002

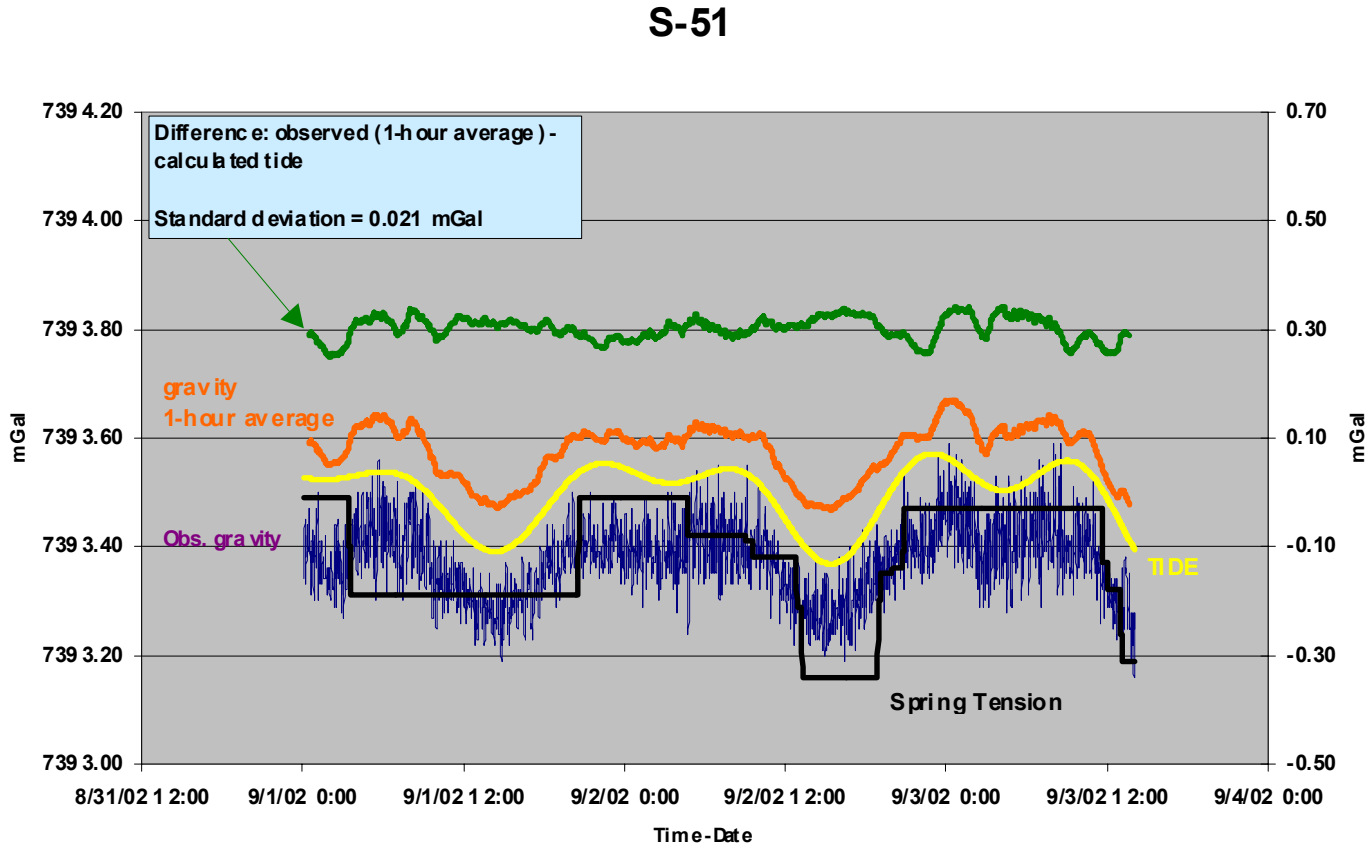
S-51



In this example, L&R Air-Sea System II, S-51, clearly tracks tidal variation while in a quiet location on land. Both the gyro-stabilized table and the spring-tension adjustment servo were operating. This figure demonstrates that the Air Sea System II will track gravity changes smaller than 0.1 mGal. Displayed on the plot is observed gravity sampled at one-minute intervals (decimated from one-second records).

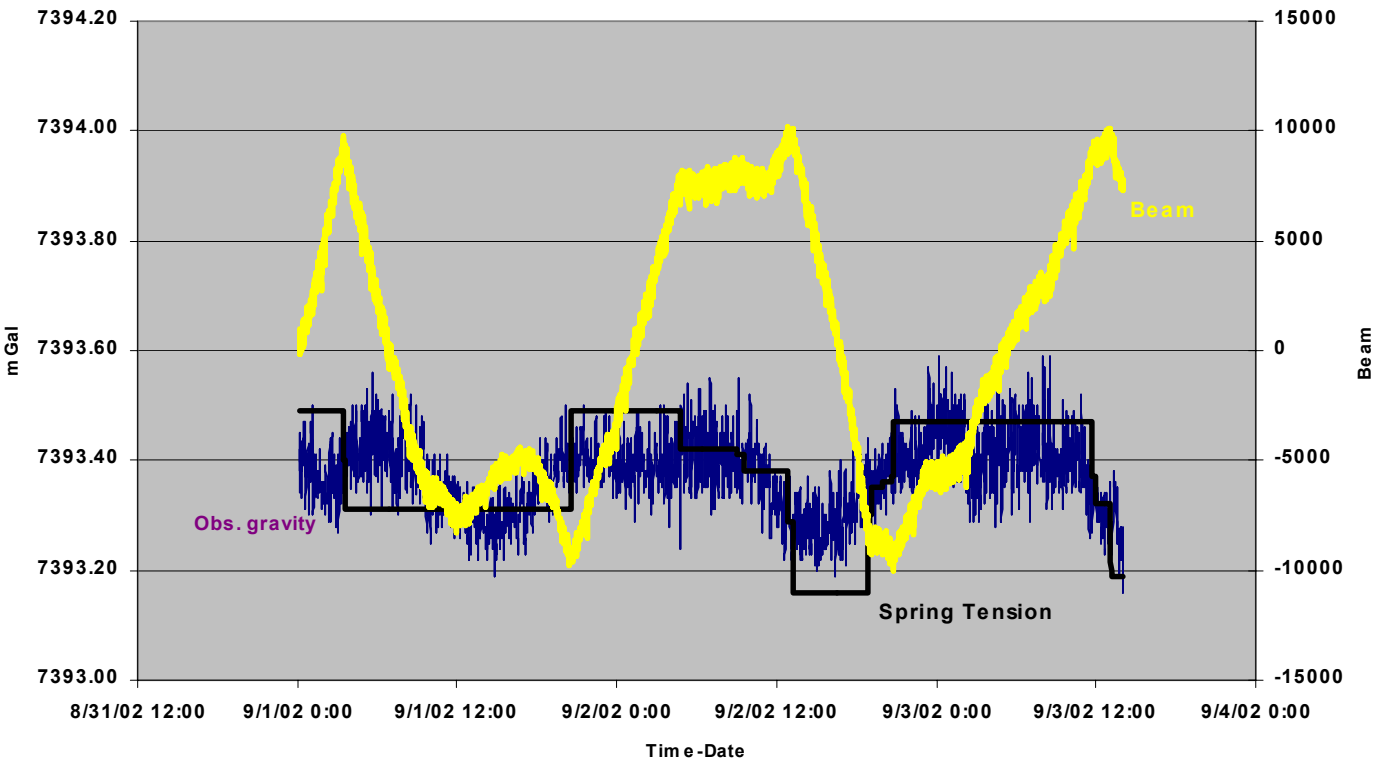
L&R Air-Sea System II - 2002

S-51



The same data from the L&R Air-Sea System II, S-51, is displayed with a one-hour running average.

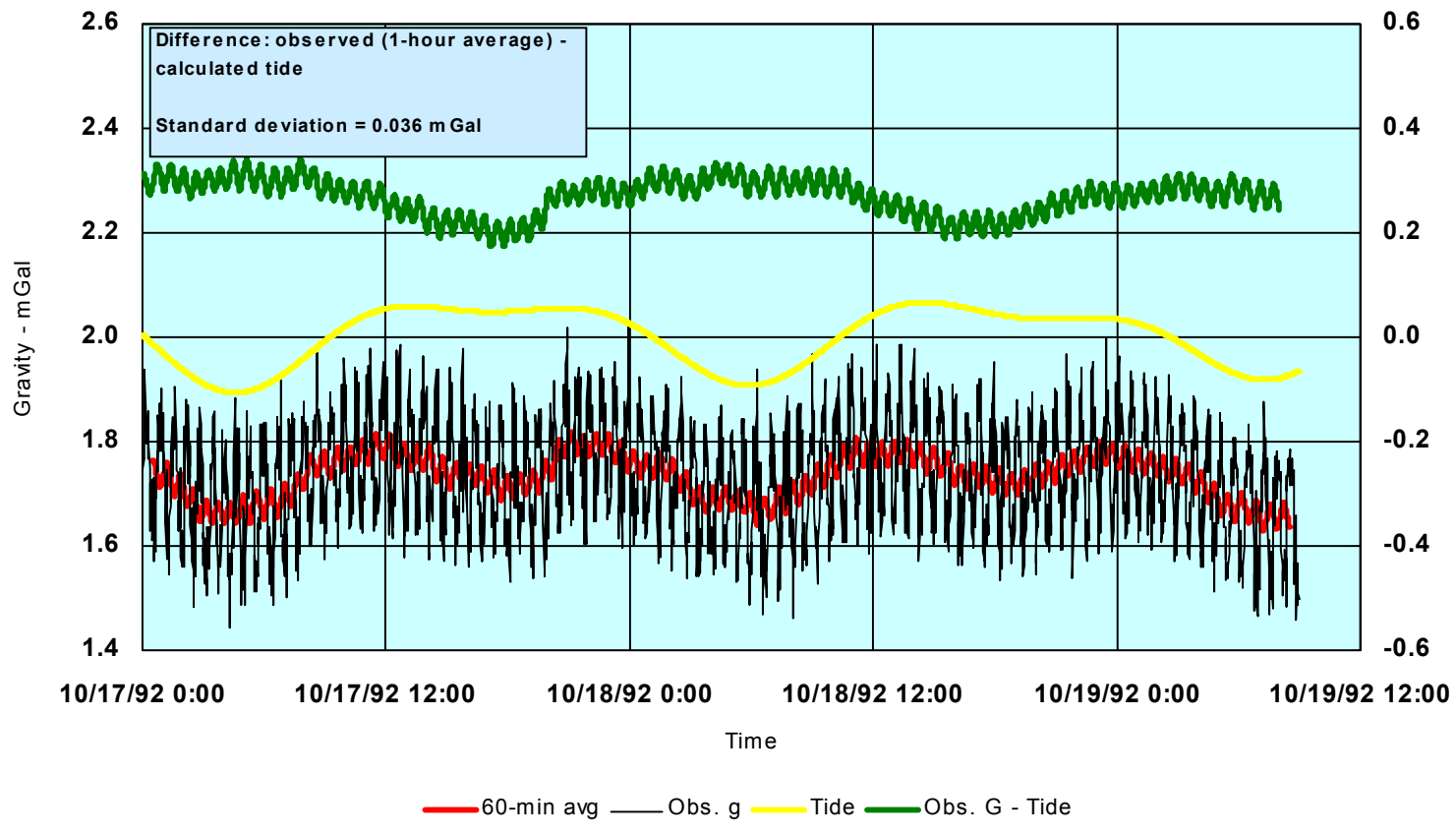
L&R Air-Sea System II - 2002



This example from the Air Sea System II demonstrates the accuracy and effectiveness of small adjustments in spring tension – as small as 0.01 mGal.

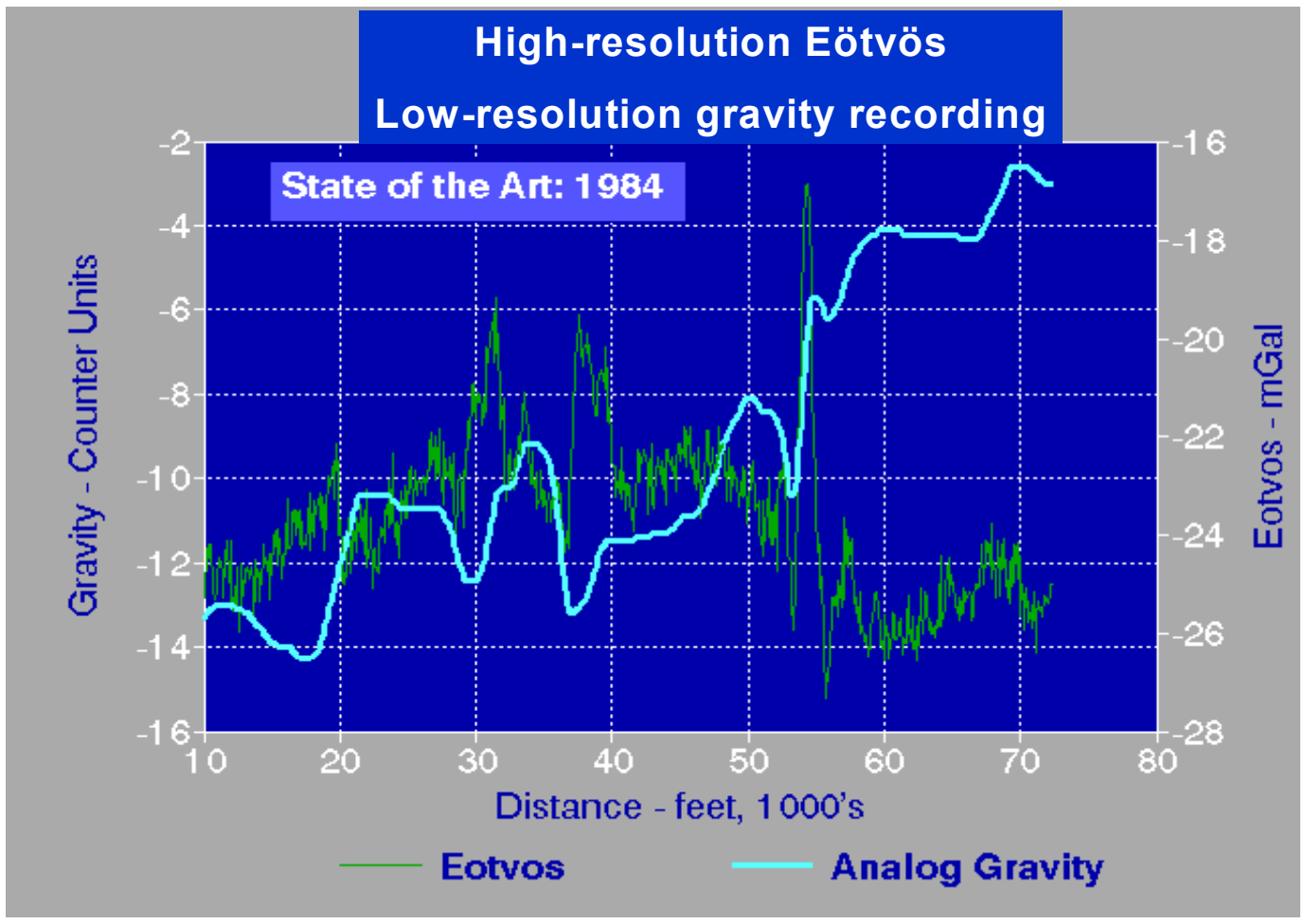
Note that the spring tension adjustments result in the expected changes in beam motion while the tracking of computed gravity shows no discontinuous behavior.

SAGE 1992



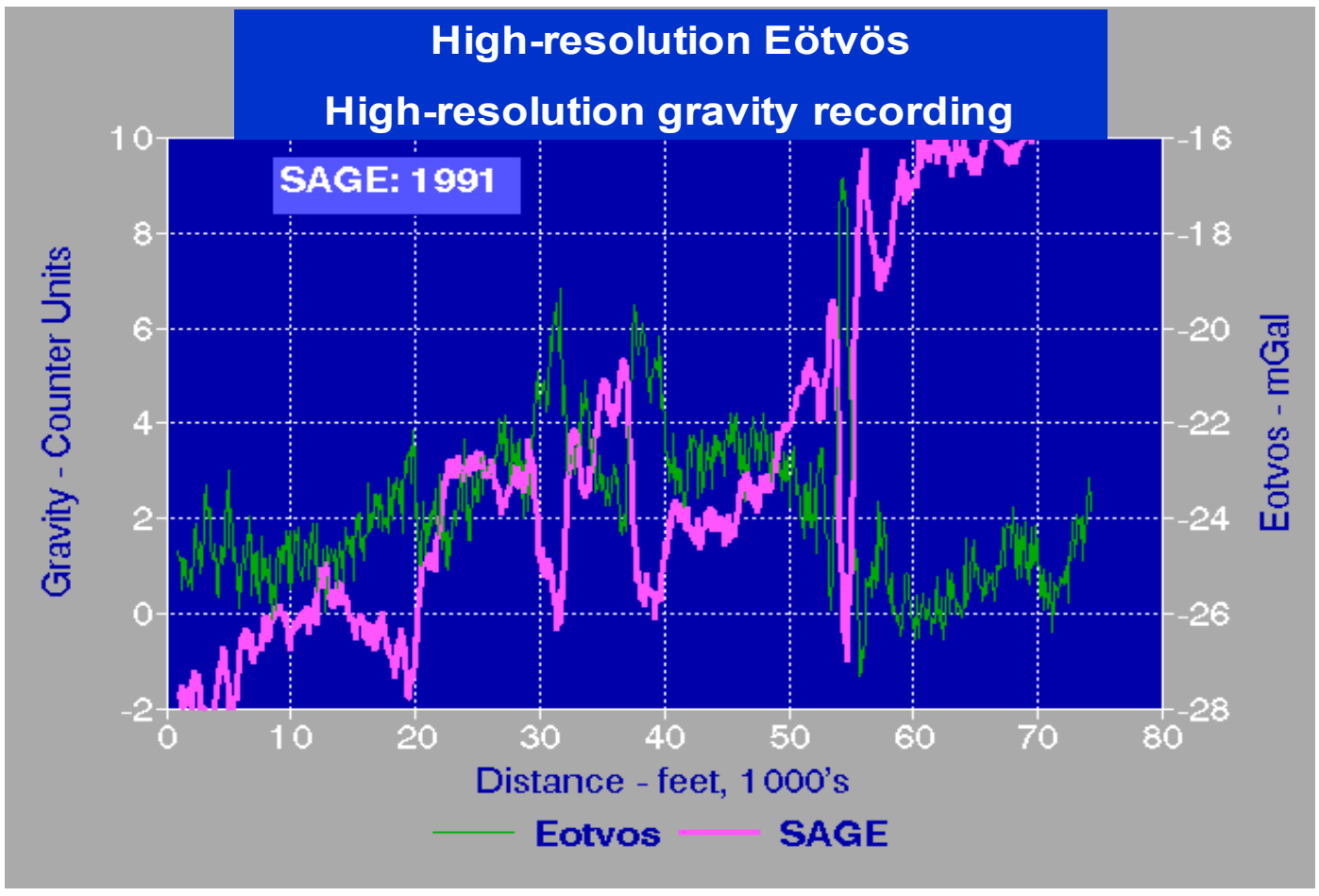
SAGE was the first S-meter operating system designed to reduce system noise, enable effective 1-second sampling, and take advantage of the more accurate Eötvös corrections available from GPS.

Earlier meter operating systems (and many later ones) filtered the output of the meter too heavily to accurately track short-period Eötvös events.



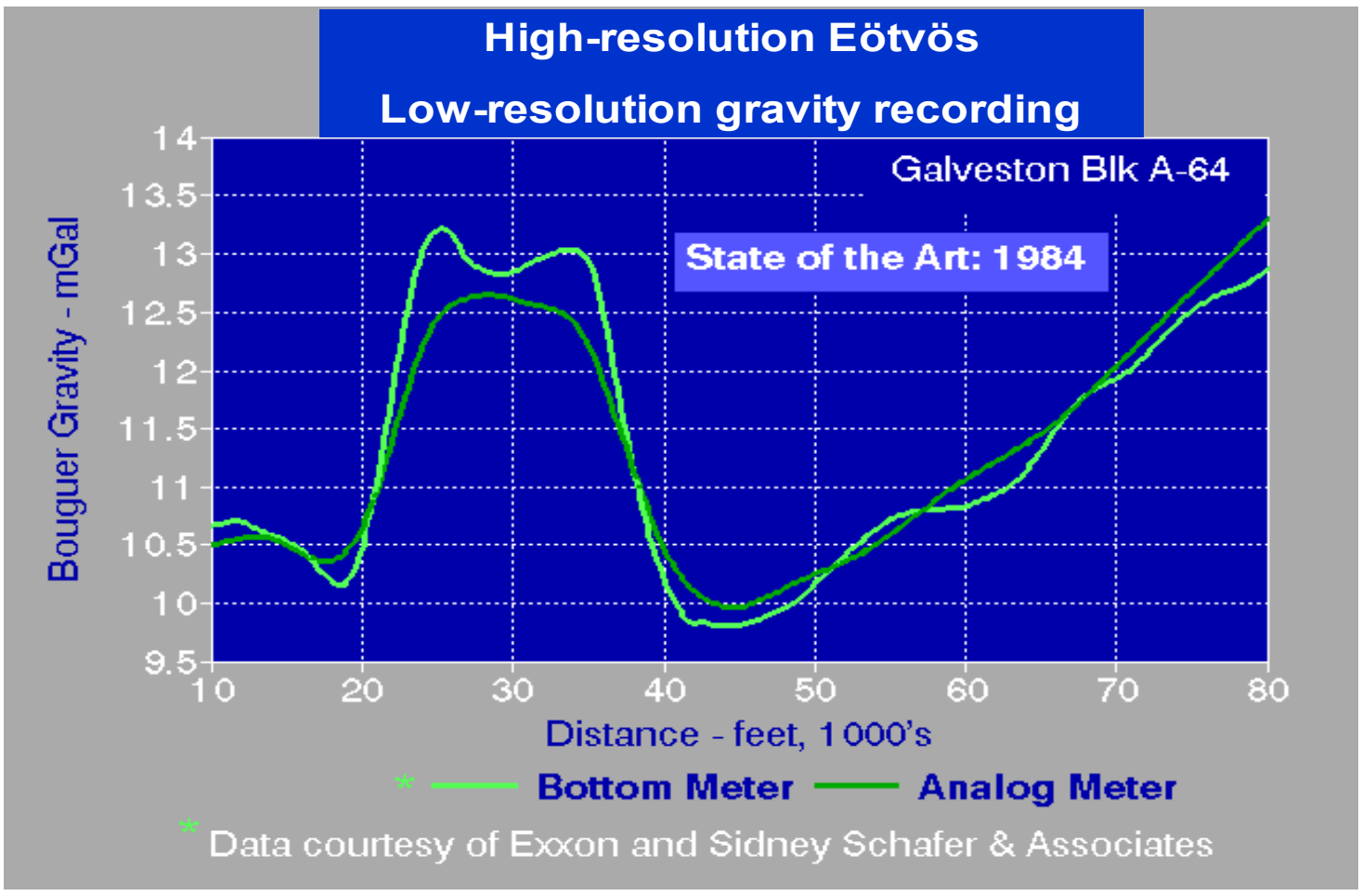
The 3-minute RC filtering that was employed in the analog meters and some later digital systems distorted the output of the meter so that accuracy of the Eötvös correction was compromised.

GPS navigation systems with a direct output of velocity provided much more accurate Eötvös corrections than previously possible.

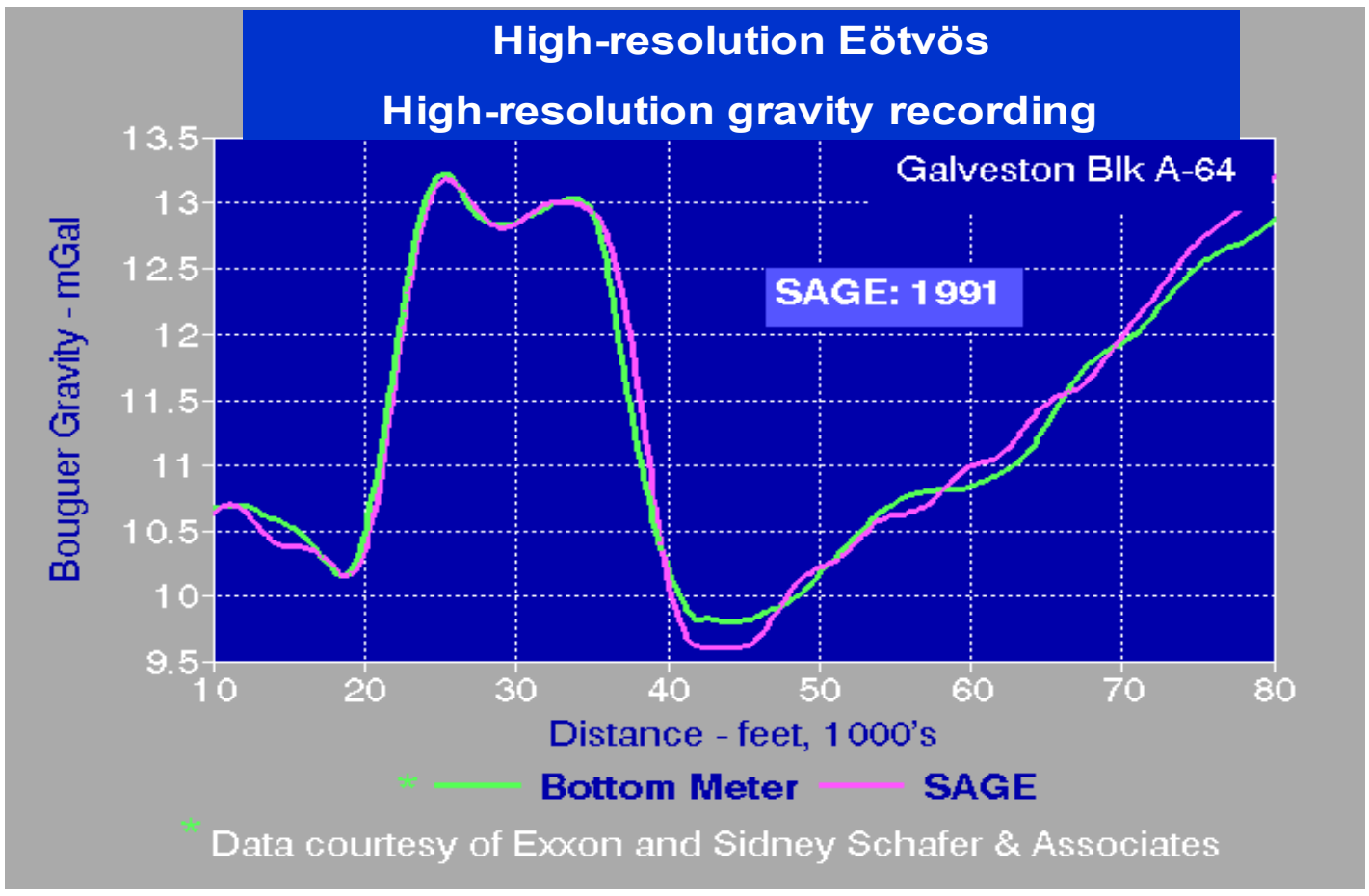


This is an example of the close match in response achieved with SAGE with one-second sampling and GPS.

This close match in response resulted in more accurate corrected gravity which in turn required less filtering.



Filtering required with the typical analog systems resulted in the loss of short-period signal.



The combination of more accurate Eötvös corrections and the improved recovery of signal from the S-meter sensor resulted in improved recovery of the gravity signal.

Air Sea System II Improvements

- **Faster beam sampling, higher resolution digitizing**
- **Improved filtering**
- **Lower noise digital gyro circuitry**
- **Higher-gain platform response**