



Variations in dark current for the Hinode EIS instrument

The removal of dark current from the EIS data is performed as part of the calibration when using the eis_prep software routine (available in Solarsoft) and is discussed in EIS software note No. 1 'Calibrating EIS data: the EIS PREP routine', section 3.2.

The dark current levels for the EIS detectors are measured on a monthly basis using data from the REGCAL074 study (which takes 100 second dark exposures and includes the pre-scan pixels in the readout).

Dark current variations over time

The plots below (figures 1-4) show the level of dark current over the period June 2007 – July 2011 (data missing between these dates is due to telemetry constraints). Individual plots are shown for each CCD readout port (two readout ports for each CCD). It can be seen that the dark current level is dependent on CCD temperature (the warmer the CCD temperature the higher the dark current value – as expected):

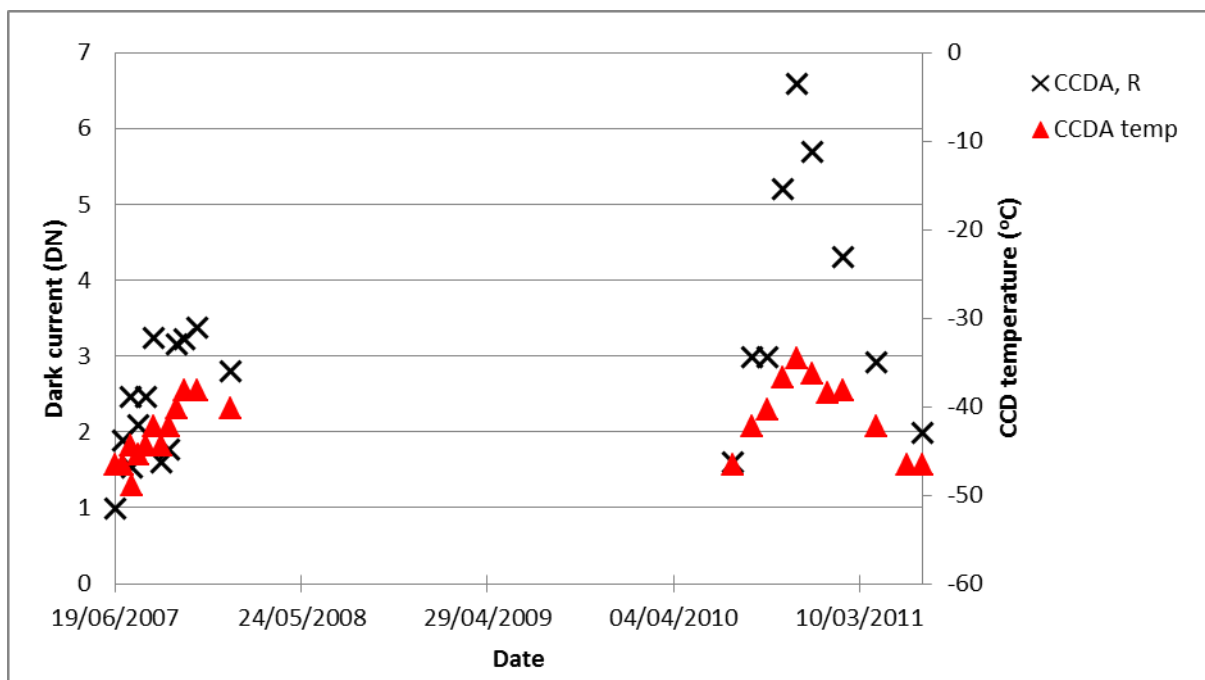


Figure 1 EIS dark current level for CCDA, R (June 2007 - July 2011)

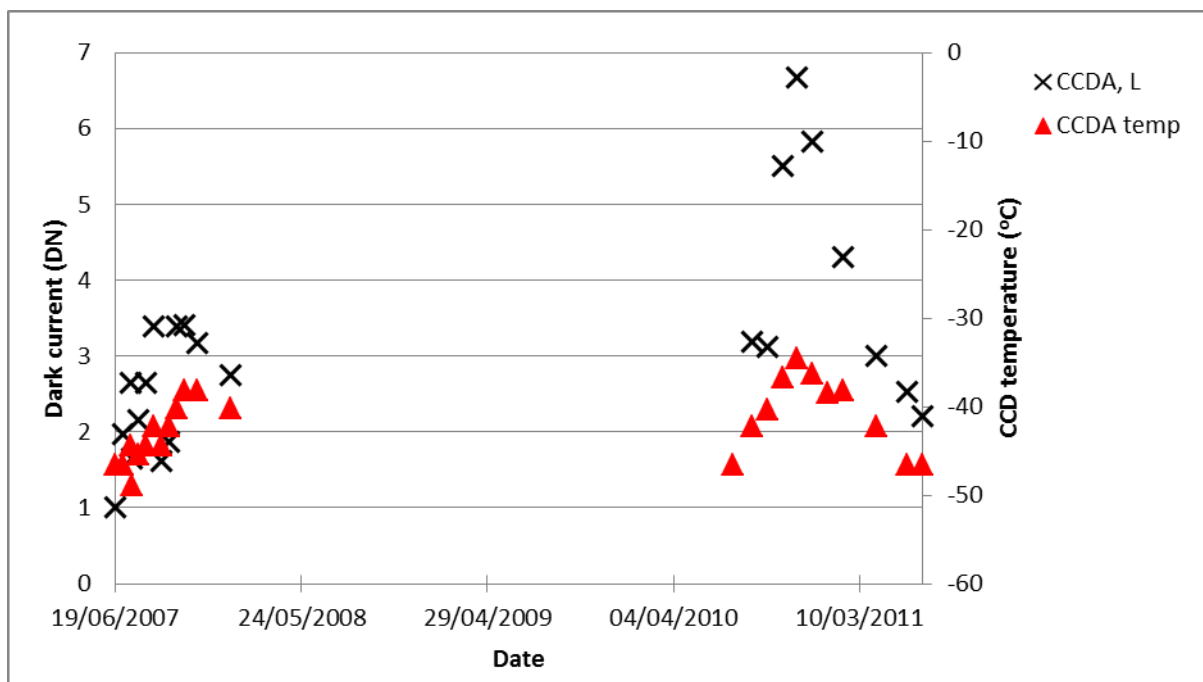


Figure 2 EIS dark current level for CCD A, L (June 2007 - July 2011)

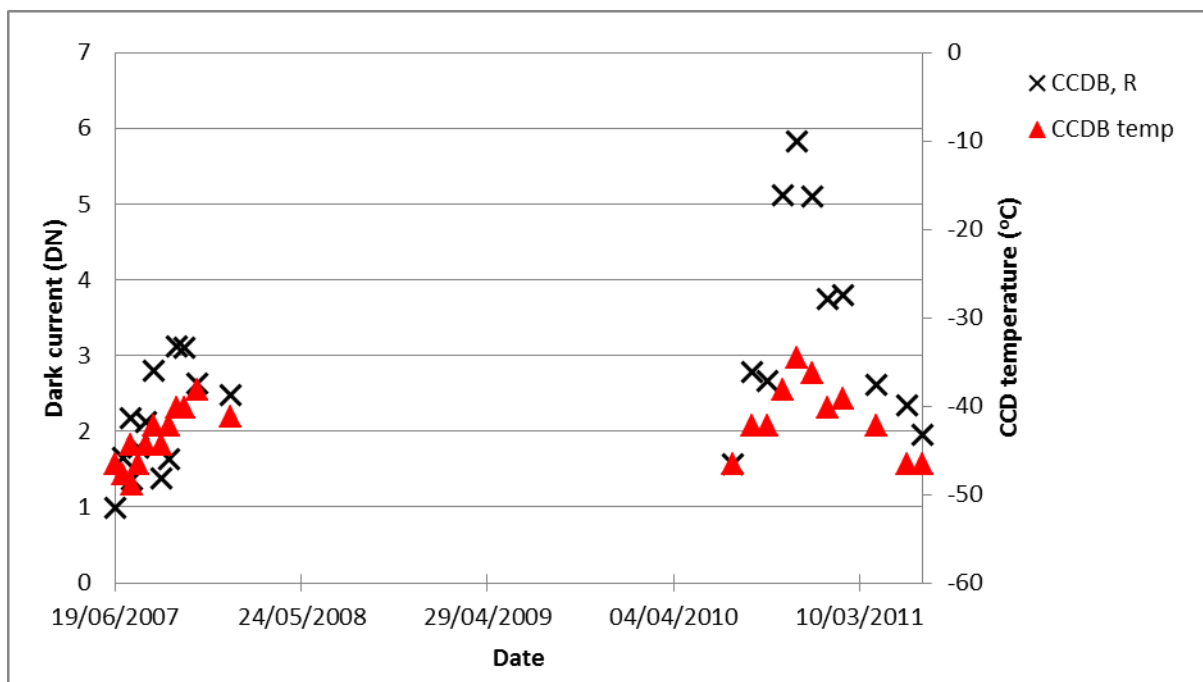


Figure 3 EIS dark current level for CCD B, R (June 2007 - July 2011)

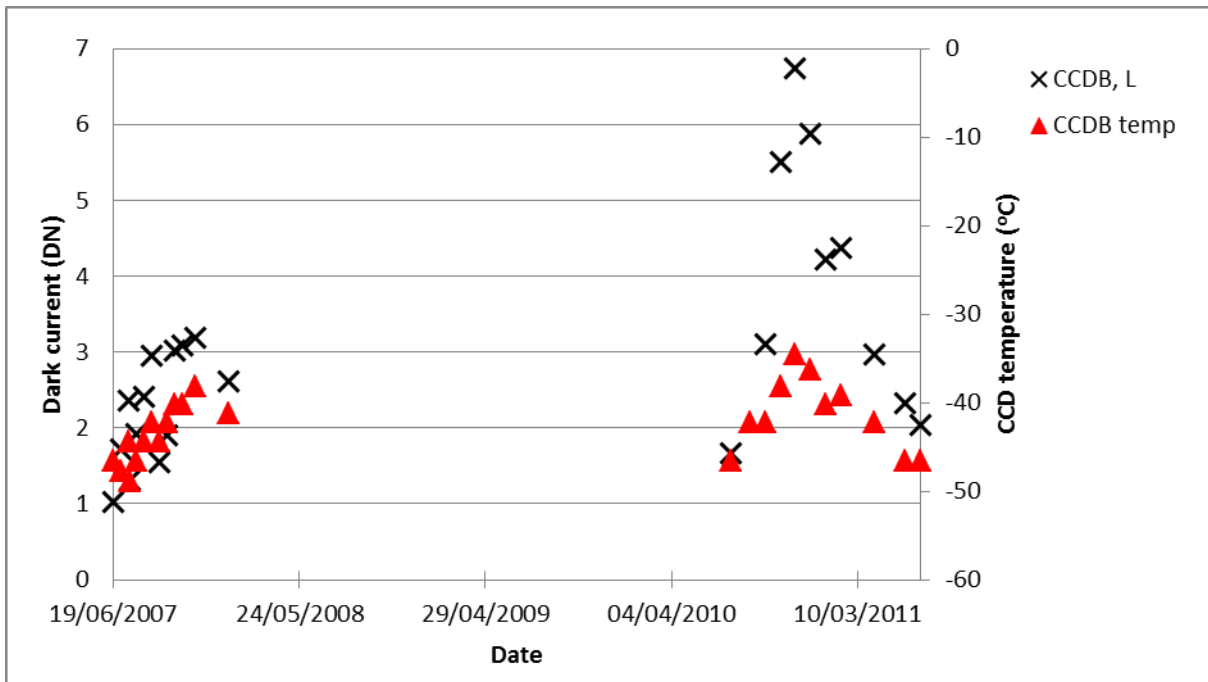


Figure 4 EIS dark current level for CCDB, L (June 2007 - July 2011)

Summary

The more recent data shows higher dark current levels compared to the earlier (2007) data due in part to warmer CCD temperatures and the possibility of radiation damage – although over the past 4 years an increase in dark current of only approx. 1-2 DN has been observed.

Dark current levels at varying CCD temperatures

The plots below (figures 5-8) show the dark current levels with varying CCD temperature for the period June 2007 – July 2011:

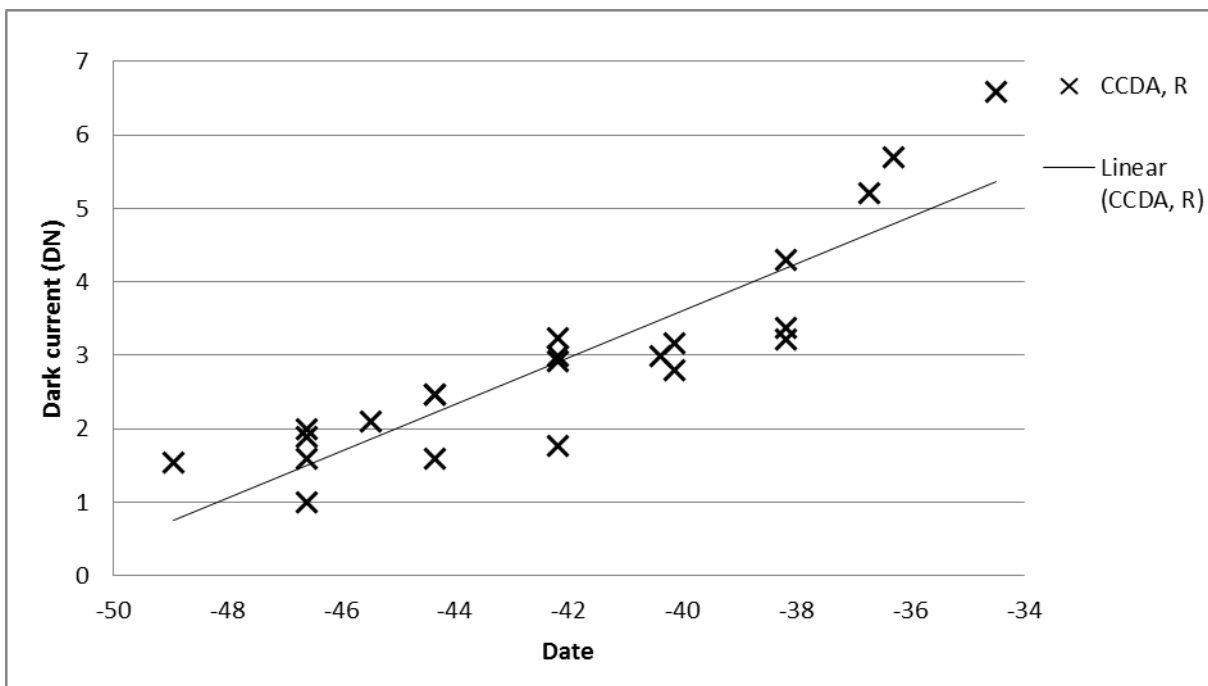


Figure 5 EIS dark current levels with varying CCD temperature for CCDA, R (data since launch)

Variations in EIS dark current

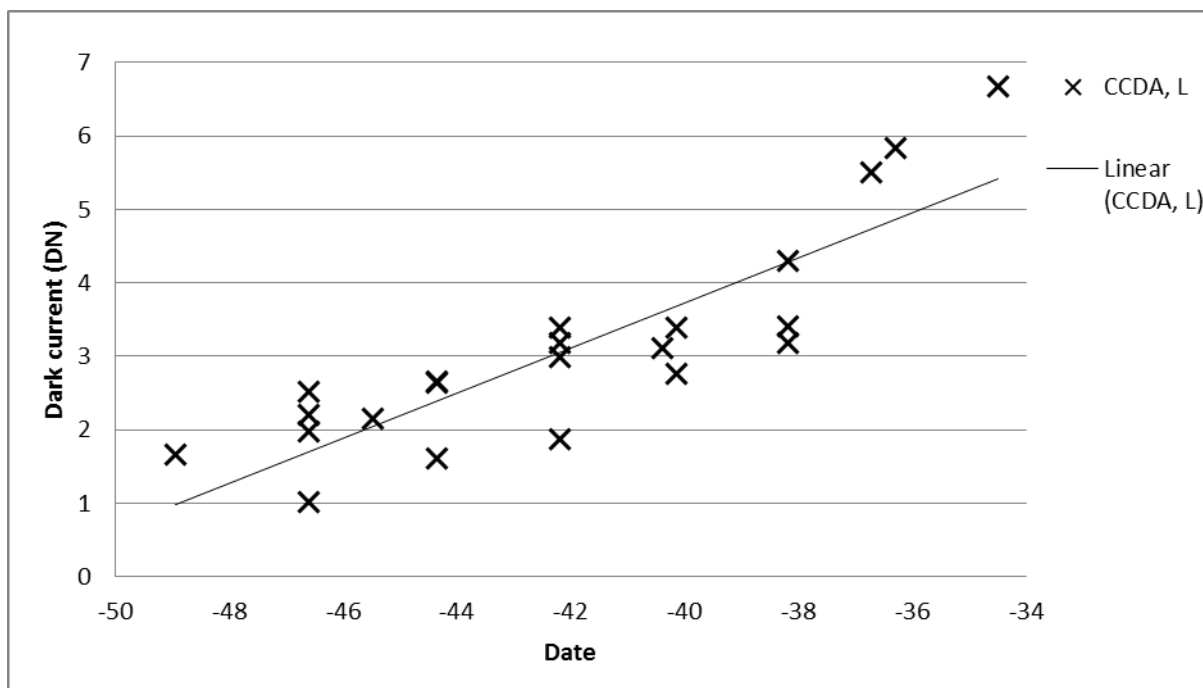


Figure 6 EIS dark current levels with varying CCD temperature for CCD A, L (data since launch)

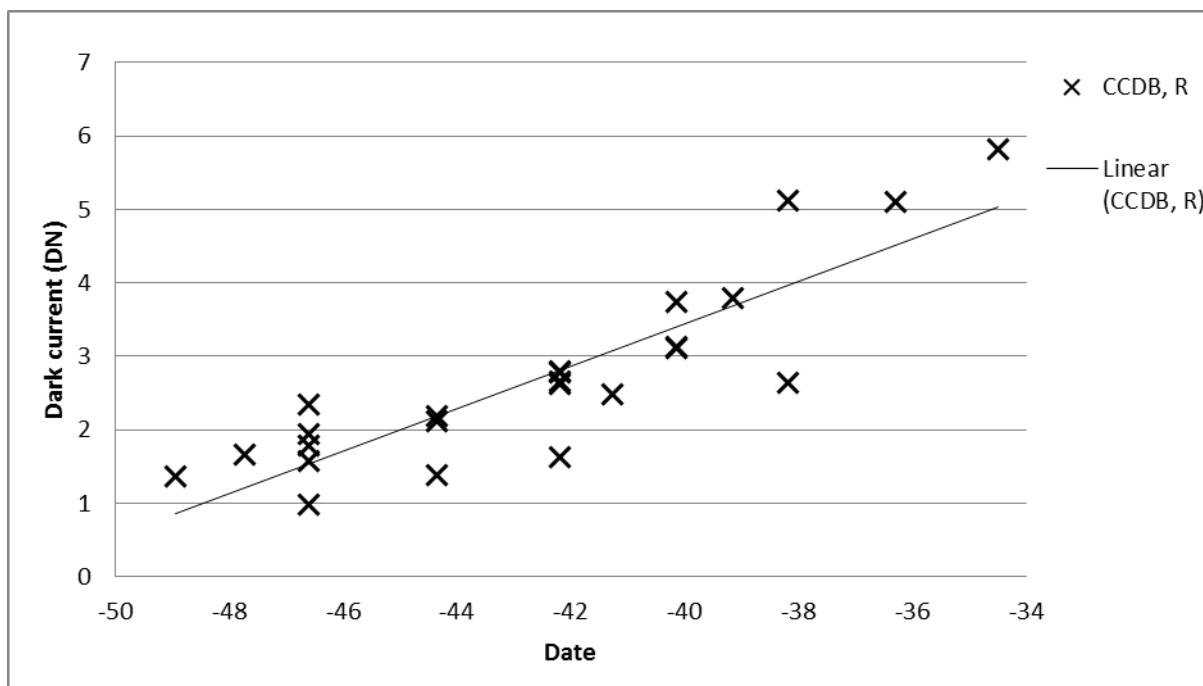


Figure 7 EIS dark current levels with varying CCD temperature for CCD B, R (data since launch)

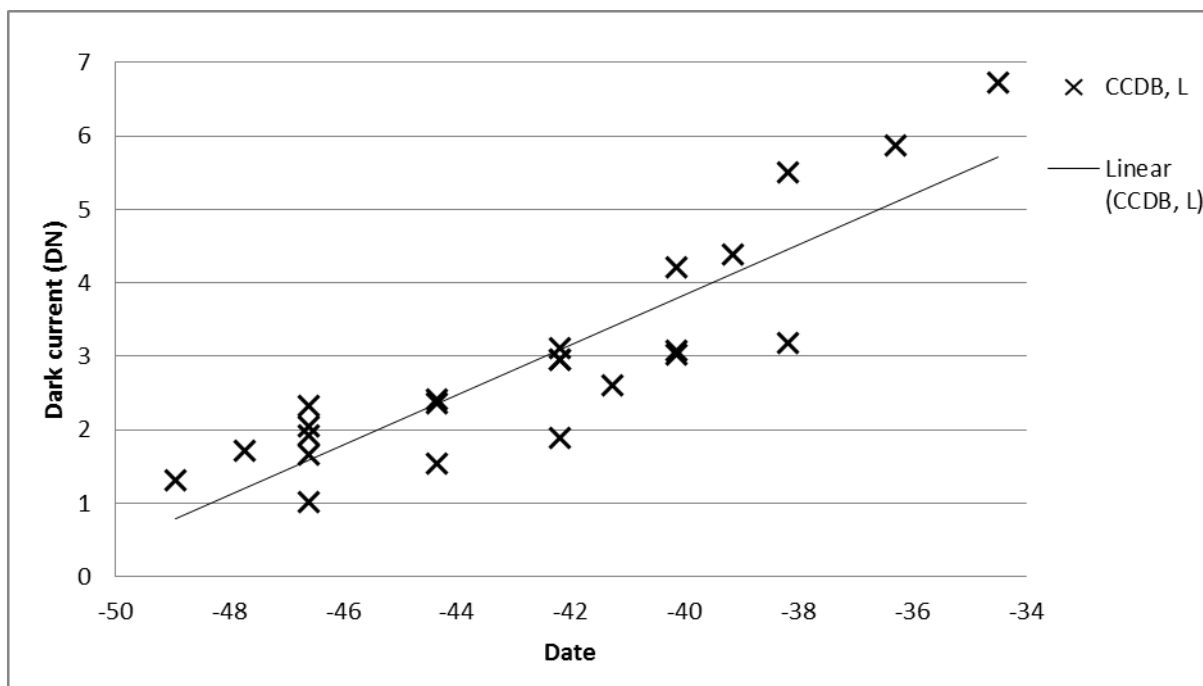


Figure 8 EIS dark current levels with varying CCD temperature for CCDB, L (data since launch)

Summary

As expected the dark current level increases as the CCD temperature increases. The typical EIS CCD temperature range is -46 to -36 °C (depending on eclipse heater setting changes). Over this 10 °C temperature range we observe a difference in dark current of approximately 3-4 DN depending on the CCD readout port.

Note.

CCDA, R and CCDA, L correspond to the long wavelength CCD (right and left readout ports).
CCDB, R and CCDB, L correspond to the short wavelength CCD (right and left readout ports).