Note on GOES 13-15 Solar Protons and Yaw Flips

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The GOES 13, 14 and 15 satellites are capable of a yaw flip, in which the satellite rotates about the axis pointed toward the center of the earth. The yaw flip is performed for the benefit of the GOES Imager and Sounder (see *GOES N Series Data Book*, Revision D, February 2010, p. 3-6 and p. 4-6). The consequence of a yaw flip for the solar proton measurements by the GOES Energetic Proton, Electron and Alpha Detector (EPEAD) is that the detector formerly looking east (west) now looks west (east). In general, the GOES westward observations of solar protons most closely approximate the conditions in the interplanetary medium near Earth because the geomagnetic cutoffs are much lower for the westward direction than for the eastward direction. As a result, the westward-observed fluxes commonly are an order of magnitude greater than the eastward-observed fluxes. Therefore, users of the archive data need to know which data channels represent westward- and eastward-observed fluxes.

In the NGDC archive data files, one encounters variable names such as "P2E_COR_FLUX" AND "P2W_COR_FLUX". It is *not correct* to assume that the 'E' and 'W' in these names refer unvaryingly to eastward and westward look directions. As described in Section 2.5 of GOESN-ENG-048 Rev D (available at http://www.ngdc.noaa.gov/stp/satellite/goes/documentation.html):

> The EPEAD telemetry channels labeled 'E' look westward when the spacecraft is upright (yaw flip flag = 0) and eastward when the spacecraft is inverted (yaw flip flag = 1). These are labeled 'B' on the summary and quality control (QC) plots.
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> The EPEAD telemetry channels labeled 'W' look eastward when the spacecraft is upright (yaw flip flag = 0) and westward when the spacecraft is inverted (yaw flip flag = 1). These are labeled 'A' on the summary and quality control (QC) plots.

The orientation notes on the monthly QC and summary plots (e.g., 'B=East') refer to the state at the beginning of the month.

NGDC has plans to make the yaw flip flag available along with the rest of the GOES 13-15 housekeeping data. In the meantime, the following historical summary may be helpful in interpreting the data. It covers times for which EPEAD data are available at NGDC. It will be updated periodically.

GOES 13

May 2010 – September 2012: Upright for the entire period

GOES 14

GOES 14 was in the inverted state during the SEP event in early September 2012. As of September 24, 2012, it is still inverted. Since the GOES 13 (GOES East) imager and sounder were taken out of service on September 23, 2012, it is anticipated that GOES 14 may take over as the GOES East satellite.

GOES 15

September 2011 to date:

GOES 15 undergoes a yaw flip twice a year at the equinoxes. The maneuver lasts about half an hour; the times given below are approximate.

Yaw Flip Date	Yaw Flip UT	Resultant State	Resultant EPEAD Orientation
September 22, 2011	c. 1800	0 (upright)	'E' / 'B' = westward 'W' / 'A' = eastward
March 20, 2012	c. 2100	1 (inverted)	'E' / 'B' = eastward 'W' / 'A' = westward
September 20, 2012	c. 2100	0 (upright)	'E' / 'B' = westward 'W' / 'A' = eastward