# GOES 13 Readiness Review
# Particle Sensors

April 8, 2010

# GOES 13 particle detector overview

- 3 instrument suites
  - MAGPD/MAGED (medium energy)
  - EPEAD (high energy)
  - HEPAD (really high energy)
- Outline for each suite
  - Overview
  - Issues
  - Impacts
  - Solutions

# MAGPD/MAGED Overview

- Instrument characteristics
  - Completely new to the GOES series
  - Each instrument has 9 telescopes (electrons 30-600 keV, 5 bands; protons 80-800 keV, 5 bands)
- Uses
  - Relevant to spacecraft surface/interior charging, ring current modeling
  - Forecast office
    - Not currently used by the forecast center
  - Space Weather Program
    - Data delivered to NGDC used by
      - Satellite community for anomaly analysis
      - Satellite community for developing radiation environment models needed in satellite design
      - Researchers developing ring current models necessary for geospace models

# MAGPD/MAGED

- Issues
  - Data are currently not in appropriate flux units
  - Out of band particle contamination corrections are not applied (CR has been submitted)
  - Dead-time corrections not applied (CR has been submitted)
  - Telescopes are not inter-calibrated
    - Intercalibration is a significant research endeavor. Initial analysis shows very large telescope and satellite intercalibration differences. It is unclear if the differences are energy band shifts or attenuation.
- Impacts
  - To the Forecast Center
    - No immediate impacts to the forecast center
    - No new SWPC products (Geospace models, SEAESRT) can be developed/implemented until data is improved
  - To the Space Weather Program
    - The data is not be reliable for anomaly assessment and environmental models for satellite design
    - The data is not adequate for research or ring current modeling
- Solutions
  - Add clean up tasks to long list of other SWPC tasks and complete them whenever possible
  - Include intercalibration as part of GOES-R validation prep work to be proposed this year
  - Outside help/ Funding
    - NESDIS
    - NGDC?
    - Graduate student project
      - LASP is heavily involved in RBSP and may be willing to have a student work on the data in preparation for RBSP
      - THEMIS researchers?
    - NASA
      - Has funded other short term data improvement projects in the past
  - At the minimum NGDC will need a description of the issues for users until they can be addressed.

# EPEAD overview

- Instrument characteristics
  - Identical to previous GOES but now 2 look directions (East/West)
  - 1 proton (.74-14 MeV, 3 bands) and alpha (3.8-61 MeV, 3 bands) telescope
  - 1 proton dome (15-900 MeV, 4 bands), 1 alpha dome (50-500 MeV, 3 bands), 1 electron dome (>.6, >2,>4 MeV)
- Uses
  - Relevant to spacecraft interior charging, single event upset anomalies, airline HF communication loss, aircrew/spaceflight health concerns
  - Forecast Center
    - Displays GOES 11 electron data and > 2Mev threshold alerts issued
    - Displays GOES 11 >10, >50 >100 and >10 MeV proton data and threshold alerts issued
    - DRAP uses GOES 11 >10 MeV proton flux
  - Space Weather Program
    - Data delivered to NGDC used by
      - Satellite community for anomaly analysis
      - Satellite community for developing environment models for satellite design
      - Developing models for aircrew radiation dose

# EPEAD

- Issues
  - Calibration coefficients are uncertain
    - They were determined decades ago but never documented. It is unclear whether the coefficients being used now are appropriate because of design changes in 1980s?
  - New electron calibration coefficients were applied that change the energy bands
    - Needs to be updated on web and notice put out to customers when the change happens
  - New views have been created to account for database table changes but not clear if they have all been tested
- Impacts
  - To the Forecast Center
    - The old >.6 MeV electron flux will change when the new calibrations are applied
    - May be glitches because of database table changes
  - Space Weather Program
    - The general lack of information on the calibration coefficients makes the data difficult to use for research or modeling
- Solutions
  - NGDC data users need an explanation of the calibration coefficients being applied. This is challenging because some of the calibration coefficients were determined from former SWPC scientists and not documented. Others were determined by ATC and have been considered proprietary.

# HEPAD Overview

- Instrument characteristics
  - Identical to previous GOES
  - 1 proton (330->700 MeV , 4 bands) and alpha (2560->3400 MeV, 2 bands)
- Uses
  - Relevant to single event upset anomalies and human space flight radiation health risks
  - Forecast Center
    - None
  - Space Weather Program
    - Data delivered to NGDC used by
      - Satellite community for anomaly analysis
      - Satellite community for developing environment models for satellite design
      - Developing models for aircrew radiation dose models

# HEPAD

- Issues
  - High voltage on the photomultiplier tube may not be set appropriately.
    - NASA SOCC has traditionally been responsible for this setting
    - A new method was used for NOP but no one applying the method understands it so we are not sure it has been done appropriately.
  - The singles channel high resolution count rates are wrong in early PLT data
    - There was a bug in the preprocessor that was repeating data in the wrong columns
- Impacts
  - To the Forecast Center
    - None
  - Space Weather Program
    - Until we can be certain about the high voltage the data are questionable for anomaly analysis and environmental models, and a.
    - The issue with the singles channels will be confusing to users if PLT data is released
- Solutions
  - I'm working with SOCC to understand the high voltage setting
  - Need to replay PLT data with finished preprocessors before NGDC releases I tto the public.