PRESTO Update – NE DOLWG September 2017

Ryan Decker NASA/MSFC Natural Environments Branch/EV44
BJ Barbre Jacobs/EV44
James Brenton Jacobs/EV44
John Orcutt Jacobs/EV44

ryan.k.decker@nasa.gov
Background

- NASA’s Space Launch System (SLS) is using vertically complete atmospheric measurements in vehicle design analyses and day-of-launch (DOL) operations support
  - Designing the vehicle using wind energy spectral content not dependent on instrumentation source
  - Using measured winds as input for DOL I-Load Update (DOLILU) vehicle trajectory and loads assessments
  - Allows for multiple data sources to be used in DOLILU assessments
- The United States Air Force Eastern Range (ER) at Cape Canaveral Air Force Station provides atmospheric data through network of weather balloons and Doppler Radar Wind Profiler (DRWP) instruments
  - Automated Meteorological Profiling Systems (AMPS)
    - Low Resolution Flight Element (LRFE)
    - High Resolution Flight Element (HRFE)
  - Jimsphere
  - Tropospheric DRWP (TDRWP) – NASA owned
  - 915 MHz DRWP
- MSFC Natural Environments (NE) branch has developed software (Profile Envision and Splice Tool (PRESTO)) to produce vertically complete profiles from available sources
Spliced Profile Sources:
- Earth Global Reference Atmosphere Model (GRAM) mean monthly winds
- AMPS LRFE
- 48-MHz TDRWP
- 915-MHz DRWP
Project Deliverables & Milestones

• PRESTO development requires compliance with NASA Software Engineering Requirements (NPR 7150.2B) standard
  – Project documentation
    • Approved
      – Software Development Plan
      – Software Requirements Specification
      – Software Design Document
      – Software Test Plan
      – Software Version Description
      – Software User Manual
      – Software Maintenance Plan
  – Test cycles
    • Unit Testing – Completed 10/16
    • Acceptance Testing – Completed 4/17
    • End-to-End Testing – Completed 6/17
  – Technical reviews
    • Software Design Review – Completed 4/16
    • Test Readiness Review – Completed 3/17
    • Acceptance Review – Completed 8/17

• Delivered PRESTO v1.6 to SLS in August 2017
Forward Work

• Update PRESTO TDRWP read routine based on the results of the SLS TDRWP certification results
• Integrated subsystem testing of software in DOLILU process
PRESTO Inputs
PRESTO Main

Graph

Wind Speed vs Height

Selected Spliced Profiles Composition:
LWPS Splice
Source 1: LR_2016_174_1014
Source 2: PS_2016_174_1009
Filter Wavelength: 5000 m

ryan.k.decker@nasa.gov
PRESTO Header Output

<table>
<thead>
<tr>
<th>Line</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Splice – lets the user know it’s a splice file</td>
</tr>
<tr>
<td>2.</td>
<td>Filter: - displays the filter wavelength</td>
</tr>
<tr>
<td>3.</td>
<td>mdtf_filenames: - the MDTF filenames of the input data (not including GRAM)</td>
</tr>
<tr>
<td>4.</td>
<td>wind_sources: - the source and release time (and Radar site and QC info) of all inputs in the spliced order</td>
</tr>
<tr>
<td>5.</td>
<td>wind_splice: - the wind splice altitudes</td>
</tr>
<tr>
<td>6.</td>
<td>thermo_sources: - the thermodynamic sources (LR and GRAM only)</td>
</tr>
<tr>
<td>7.</td>
<td>thermo_splice: - the thermo splice altitude</td>
</tr>
<tr>
<td>8.</td>
<td>units: - the units of the data in the file</td>
</tr>
<tr>
<td>9-12.</td>
<td>Content for software reading PRESTO data</td>
</tr>
<tr>
<td>13-6101.</td>
<td>PRESTO data</td>
</tr>
</tbody>
</table>
PRESTO State Diagram

Errors
No provided input dates (6 possible errors)
No provided input times (2 possible errors)
No provided directories (4 possible errors)
Incorrect date format (6 possible errors)
Incorrect time format (2 possible errors)
Incorrect directory format (4 possible errors)
No data in supplied date range

Errors
No data in files
Wrong data format
Data fails tolerance check

Errors
Selected profile has no data to display

Errors
No profiles selected to splice
More than three profiles selected to splice
No LR in splice selection
Filter wavelength is negative or greater than 20 km.
Gap was found in a spliced profile

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PRESTO Splicing Flowchart

“High Source”

TDRWP Profile

Interpolate to 10 m

Fill & Flag gaps where data is missing

Flag excessively large gaps (> half the filter wavelength)

Check for overlap

Yes

Gaussian weighting to GRAM above measured

Output data to 30 m intervals

Error message appears

Fail

Pass

Check shear

“Low Source”

LR wind Profile

Interpolate to 10 m

Fill & Flag gaps where data is missing

Flag excessively large gaps (> half the filter wavelength)

Apply Gaussian weighting scheme

1-D linear interpolation between profiles

Check shear

1-D interpolation across the shear over larger interval

Pass

Fail

“High Source”

“Low Source”


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