

SPEDAS 5.0 Release Notes, April 2022

SPEDAS 5.0 contains many new features and updates to existing features. The following lists summarize the significant changes implemented since the release of the previous version, SPEDAS 4.1, in October 2020.

Command line plotting and visualization tools (tplot, etc)

- Enhanced tplot putwin window management tool (added RELATIVE, TOP, and RIGHT, and CLONE options)
- Added NEG_COLOR keyword to tplot mplot tool
- Improved line style and handling of no_interp keyword in specplot
- Improved argument handling for isotropic, xlog, and ylog keywords for tplot plotxy tool
- Added a new color table preset line_clr=5 to loadct2 utility; replaces illegible yellow-on-white traces with orange-on-white
- Added "line_color_names" keyword to loadct2 utility, to allow specification of line plot colors by color names
- Updated general/examples/crib_colors.pro with additional examples for setting line colors
- Added RGB keyword to spd_get_color tool to return RGB values directly, rather than color table indices, when looking up colors by name
- Added option to allow two variables on a line in tplot labels
- Improved handling of dg (data gap) keyword in mplot_downsample_data utility
- Added dynamic array storage option to tplot get_data, store_data routines
- Improved the appearance of tplot labels when plotting time intervals shorter than 10 minutes
- Added NO_VTITLE_SHIFT option to tplot, to prevent misalignment of annotation labels and values in short-duration plots

File reader/writer, archive access protocols

- Fixed a crash in tplot2cdf when dlimits are set, but global attributes aren't
- Added capability to load Netcdf-4 files using IDL HDF5 library
- Fixed variable ordering bug in das2dlm interface
- Updated CDAWlib routines used by "Load Data via CDAWeb" interface
- Patched spdfcdawebchooser library to fix issue with HTTPS certificates on older IDL versions
- Updated CDF reader to fall back to looking for PARAMETER_TYPE attribute, if no VAR_TYPE attribute is found when loading variable metadata (non-ISTP attribute used in some Cluster data files)
- Updated HDF5 reader to load variable attributes
- Replace 'ECI' coordinate tag with 'GEI' in HDF5 files, for compatibility with SPEDAS coordinate system names
- Added time_var keyword, support for HST_INTEGER data type to HDF5 reader
- Improved error handling for attributes in HDF5 reader
- Updated HAPI client to use a custom JSON parser for SOSMAG requests
- Changed some HTTPS validation settings in the HAPI client to work more reliably on older IDL versions
- Updated kyoto_load_dst and kyoto_load_ae routines to support recently implemented redirection of HTTP requests to HTTPS URLs on Kyoto WDC servers. Replaced default HTTP URLs in initialization code with HTTPS equivalents.

GEOPACK magnetic field modeling library interface

- Modified dipole tilt period calculations so that first chunk center time is aligned with the first sample time
- Added `exact_tilt_times` keyword to force recalculation of tilt at each sample time
- Removed unnecessary parameters from GEOPACK TS07 model interface
- Added keywords for coefficients file and directory to GEOPACK TS07 model interface
- Added support for GEOPACK TA15N and TA15B models, including utilities to calculate N-index and B-index model inputs
- Updated dynamic pressure calculation to include user-specified alpha particle correction (defaults to `f_alpha=0.04`)
- Added support for GEOPACK TA15 models in trace routines
- Added `geopack_demo` sample code from GEOPACK 10 distribution
- Changed handling of `get_tilt` keyword to give better plot results for time intervals without data points
- Added `skip_ts07_load` keyword to eliminate unnecessary parameter loading in repeated calls to TS07 model
- Added helper routine to convert Kp values to GEOPACK `iopt` values for T89 model
- Added Kp keyword to T89 tracing and modeling routines, to allow directly specifying Kp values (as fixed values or `tplot` variables), rather than having to specify with generic 'par' array
- Fixed faulty range checking for Kp values in T89 field model.
- Removed use of 'keyword_set' for parameter checking in GEOPACK trace routines, so that `Kp=0` is accepted
- Reduced the default tilt calculation time interval in the GEOPACK t89 wrapper to 60 sec to better support use with low-orbit missions
- Updated SPEDAS helper routines for calculating N-index and B-index parameters for GEOPACK TA15 models; index values are now averaged over the 30-minute time interval preceding each raw value to match GEOPACK conventions.
- Updated `get_ta15_params` routine to update header comments, and ensure that the full model name was used for output `tplot` variables.

SPICE/ICY library interface

- Added capability to retrieve Jupiter and Saturn data
- Updated to reflect "no leap second" for June 2021, December 2021, and June 2022
- Cleanup of SPICE loaders
- Added PNG, WINDOW, MONITOR, VARNAMES keywords
- Added PLABEL, SLABEL keywords and support for `orrery_options`

Modeling/analysis tools

- Added ABSOLUTE keyword to minmax tool
- Added LAST_VALUE keyword to `interp.pro` to support "repeat last value" interpolation method
- Added XLOG and YLOG keywords to `interp` routine, to perform interpolation in log space
- Added TRANS keyword to `crossp` tool, to support both row-major and column-major inputs
- Added `f2pl` and `f3pl` tools to perform linear fits with breaks
- Added `ignore_nans` keyword to `tinterpolate_mxn`, to prevent NaNs in input from being propagated to interpolated values

- Updated tinterpol_mxn interpolation tool so that REPEAT_EXTRAPOLATE keyword repeats the first or last finite value in the input
- Added jul2unix tool to convert Julian dates to Unix times
- Fixed some compilation, IDL backward compatibility, and duplicate function name issues in aacgm_v2 library
- Added vec2elem and elem2vec tools for converting between orbital elements and state vectors
- Added region of interest definition routines bshock_2 (bow shock) and mpause_flag (s/c within magnetopause in XY projection)
- Added new rotation options [BxV, (BxV)xB] and [B, (BxV)xB] to 2-D slices

Plugins

- Added support for loading Cassini RPWS gain and spectra via das2dIm
- Added command-line and GUI load routine and configuration settings panel for Cluster (via Cluster Science Archive TAP API)
- Updated to latest versions of ERG and IUGONET plugins from their respective developers
- Added support for GOES-R (GOES-16 and -17) load routines, GUI load panel, overview plots, and configuration settings panel
- Fixed HTTPS certificate issue when downloading from NOAA GOES and POES servers
- Modified GOES and POES overview plot routines to avoid default creation of multiple PNG files when called from command line
- Added 'psa' and 'fast' keywords, IMA mass table calculations, HTTPS support to MEX load routines
- Updates to VEX load routines and error handling on FTP failures
- Added mask_uv keyword, unit conversions, gain correction updates, and TOF-mass mapping to Kaguya plugin
- Added 'bas' plugin for British Antarctic Survey magnetometer network
- Added plugin to support SOSMAG geostationary magnetometer data set
- MMS plugin updated for changes to SDC data products, numerous other enhancements and bug fixes
- THEMIS gmag load routine updated to include BAS network
- Updated several missions' GUI plugin configuration and data loading panels for better support of varying display sizes, resolutions, and high-DPI display settings
- Many updates & feature additions to other plugins, including MAVEN, Parker Solar Probe, and ELFIN
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SPEDAS GUI

- Magnetic Field Models panel updates
 - Corrected interface for TS07 model parameters
 - Added support for TA15 field models
 - Added "Use GEOPACK 2008" checkbox
 - Expanded time intervals for calculating field model parameters, to provide the necessary "seeding" prior to the time range of interest for certain models.
 - Changed naming convention for output variables, to avoid overwriting results between different field models
- Changed Real Time Kyoto AE (digitized at UCLA) to load 5-min average values
- Added spd_check_tplot2gui utility to tell when tplot variables can be loaded into the GUI (e.g. no more than 1-D arrays per sample), skip GOES-R variables that can't be loaded
- Added ESA HAPI server to GUI interface, to support loading SOSMAG data
- Fixed a number of usability issues:

- On small displays, some GUI controls were rendered off-screen with no way to reach them; logic was added to determine whether scroll bars were needed and how large the viewports should be
- On high-DPI displays in certain scaling modes, scaled-up text sizes clashed with explicit fixed pixel sizes for many GUI elements, resulting in incorrect panel sizes and truncated labels and field values. Removal of most widget size specifications allowed the interface to adapt better to the changed text size vs. icon or draw area proportions
- Interface to the HAPI client was changed to ease access to HTTPS servers under older IDL versions
- The `tplot_gui` command was updated to make better use of `tplot` variable metadata when importing `tplot` variables into the GUI

Performance/error handling improvements

- Added error handling for invalid pointers in `tplot_restore`
- Improved error checking in `tplot_restore` when appending to existing variables
- Improved performance of 'calc' tool by caching grammar attributes and parse tables rather than reloading each time 'calc' is invoked
- Improved detection and diagnostic messages for mismatched or missing time variables or `DEPEND_N` attributes when reading CDFs
- Added counter to avoid infinite loops when reading CDFs
- Improved error handling when writing CDFs with `tplot2cdf`
- Improved error handling in `spd_get_spectra_units` if no `DEPEND_1` attribute is set
- Improved error checking in `minvar_matrix_make`, to handle cases where input variable didn't have expected metadata