Computation:
Data Structures and Input Data

Data structures found in models

Coordinate system conversion issues

Data input into / data output from CCMC

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Data structures - Grids found in models:

3D magnetosphere: cartesian grids

- **block structure** (BATS-R-US)
- **regular, spacing varying** (UCLA-GGCM)
- **spherical, varying radius** (Fedder-Slinker-Mobarry, used by ring current model)

2D ionospheric grids:

polar / spherical 2D: magnetic latitude , longitude

- equidistant, two hemispheres (BATS-R-US, UCLA-CTIM)

vertical slice: geographic latitude, height

- non-regular (**SAMI2** ionospheric model)

Data formats found in models:

F77_unformatted:

+ fast-loading

+ fairly portable among SUN and Beowulfs (Endianness can be changed with compiler option or during read in IDL)

+ can be read with C/C++ programs as well

- not readily portable from CRAY (64 vs. 32-bit floats, integers)

Formatted - compressed ASCII (**UCLA-GGCM**):

+ compact, portable over platforms

- slow-loading for large datasets compared to binary

- library needed to read (fortran library provided was successfully used with programs written in FORTRAN, C, IDL)

Data formats - cont'd

Formatted ASCII:

+ readable in Fortran, C, C++

- slow to read

- data may be organized by grid location, not variable arrays

- may require reorganization of data after read

Unformatted binary: e.g. direct dump of arrays (C, C++)

+ easy to read for the same program executable

- limited accessibility if data not preceded and followed by long integer record length (as required by **FORTRAN**).

Data formats - issues

Unstructured-grid output:
list of point locations and variables
x,y,z, r,theta,phi, P,V_x,...
often found in ASCII outputs (good for inspection)
arrays: x(N),y(N),z(N),P(N), V_x(N)...

Structured-grid output: grid arrays sized NX,NY,NZ,
data arrays sized N=NX*NY*NZ; arrays are following
one-another: x(NX),y(NY),z(NZ), Rho(N), P(N), ...
for **regular** cartesian, polar (cyl.), spherical coordinates

Data format - Special Grids

Block-based grid (BATS-R-US):

x(NX,Nblks), y(NY,Nblks)..., P(N*Nblocks),V_x

Distorted sperical (Lyon-Fedder-Mobary-Slinker):

r(N1,N2),theta(N2),phi(N3), P(N1*N2*N3), P(...)

Grid defined by magnet. field lines (SAMI2):

glat(N),z(N), N_H(N),...

no grid description x(NX),y(NY) possible

All special grids:

Interpolations are necessary to generate regularly-gridded slices and lines and volumes.

Grids may vary in time.

Grid Specs - Input Data

Solar wind: combine data from at least 2 instruments on each satellite at different timings (16, 60, 64 s, ...) and date format (year,month ,day vs. year, doy):

GEOTAIL: mag, plasma

ACE: mag, plasma

real-time data: (NOAA-SEC):

- already sampled to 1 minute intervals,
- transformed to **GSM** coordinates.
- Data show many gaps during simulation tests especially with an interesting event happening.

Coordinate conversion: **GSM->GSE**, **x,y-> -x,-y**, ...

Need **full date and time** (also good for output data).

Output from CCMC

Web interface:

What additional features are needed?

Raw data (on request):

What data may be needed other than full model output?