Data Assimilation Research Testbed Tutorial

Section 16: Diagnostic Output

Version 1.0: June, 2005

DART Diagnostic Output Categories:

1. State space:
Values of models state vector.
Output using netCDF format.

2. Observation space:
Values of the observations.
DART specific obs_sequence format for now.

3. Regression confidence factor:
Values for state vector / observation pairs.
Output as flat ascii.

4. Program diagnostic output:
Identification for source code version and namelist values.
Error, warning, message output from modules.

State Space Diagnostic Files:

Available in netCDF (common data format)
    (http://my.unidata.ucar.edu/content/software/netcdf/index.html)

1. Prior state   (Prior_Diag.nc): state before assimilation.
2. Posterior state (Posterior_Diag.nc): state after assimilation.
3. Truth   (True_State.nc): truth for OSSEs.

Contents of prior and posterior controlled by filter_nml:
    1. *output_state_ens_mean = .true.*, (include ensemble mean);
    2. *output_state_ens_spread = .true.*, (include ensemble spread);
    3. *num_output_state_members = 20*,
          (include this many of the individual ensemble members);
    4. *output_interval = 2*, (only output every nth assimilation time);

Output interval for True_State.nc in perfect_model_obs_nml.

Viewing the State Space netCDF files:

1. Standard DART matlab diagnostics:
   a. plot_bin: rank histograms,
   b. plot_correl: correlation x(t) with all other state vars at all times,
   c. plot_ens_err_spread: rms error and spread,
   d. plot_ens_mean_time_series: time series of ens. mean,
   e. plot_ens_time_series: time series all available ensembles,
   f. plot_phase_space: 3D phase space time evolution,
   g. plot_sawtooth: truth, prior and posterior time series,
   h. plot_total_err: total error for different fields,
   i. plot_var_var_correl: x(t) correlation to single variable, all times.

Viewing the State Space netCDF files:

2. ncview: a quick, dirty, but surprisingly useful netCDF viewer
   (http://meteora.ucsd.edu:80/~pierce/ncview_home_page.html)
   Displays spatial slices, time series,...

3. Many other graphical/analysis programs can read netCDF
   (Note that we use udunits metadata convention)

<u>Observation Space netCDF files:</u>

Observation sequence file output by filter has prior, posterior, observed value, (and truth for OSSEs)

Contents of *obs_sequence.final* controlled by filter_nml:
1. obs_sequence_in_name = "obs_seq.out",
   Name of input observation sequence file.
2. obs_sequence_out_name = "obs_seq.final",
   Name of output final observation sequence.
3. output_obs_ens_mean = .true.,
   Output the ensemble mean observation estimate.
4. output_obs_ens_spread = .true.,
   Output the ensemble spread.
5. num_output_obs_members = 0,
   Output this many individual ensemble estimates.

(See section 18 for viewing obs_sequence files).

Regression confidence factor output:

Controlled by reg_factor_nml:
    1. save_reg_diagnostics = .true., should file be output?
    2. save_reg_diagnostics = .false., name of output file

File size could be (model size) x (number obs.) x (number assim times).
    Very big, even for small models.

Normally, modify code in reg_factor_mod.f90 to control:
    Output is at end of select_regression = 1 code block.
    Format?

Plotting tools?