

Generating an Ensemble Restart File

Step-3



In this presentation ...

- You will learn how to generate an ensemble restart file using LDT.
- The ensemble restart file will then be used to initialize the data assimilation based run (in Step-6).
- Look at the LDT output file generated.

Running LDT: Our Testcase Overview

- Next, we will generate a file, referred to as a "**restart**" file, that will include an ensemble of the model states from the LIS *open-loop (OL)* case.
- This step uses a single output restart file from the *OL* run, produced in Step 2, and LDT expands it to become an ensemble size of N , specified by the user.
- The final ensemble restart file will then be used to *initialize* the LIS data assimilation (DA) run in Step 6.

Download necessary files to run this step ...

- 1) Download the "Step 3" tarred-gzipped file from the LIS testcases webpage ("*testcase3_ldt_ensrst.tgz*").
- 2) Unpack the above testcase files into your working directory, `$WORKING_DIR`,
- 3) Once unpacked, you will see the following directories and files:
 - `DA_ensrst` → Contains all the files below;
 - `ldt.config` → The LDT config file for this step
 - `target_ldtlog.0000` → The "target" LDT log file;
 - `target_LIS_EnRST_NOAH36_201801010000.d01.nc` → The "target" LDT generated ensemble restart file ("EnRST") to start the Noah LSM DA run in Step 6.

Creating an ensemble restart file (from a single member restart file)

Use LDT to do the ensemble upscaling/downscaling.

upscale - generates a multi-member ensemble restart from a single member file

downscale - generates a single member ensemble restart from a multi-member restart file:

```
LDT running mode:      "Ensemble restart processing"  
Processed LSM parameter filename: ./lis_input.nldas.noah36.d01.nc
```

```
LIS restart source:      "LSM"  
Ensemble restart generation mode: "upscale"  
Input restart filename:    
../OL_OUTPUT/SURFACEMODEL/201801/LIS_RST_NOAH36_201801010000.d01.nc  
Output restart filename: ./LIS_EnRST_NOAH36_201801010000.d01.nc  
Number of ensembles per tile (input restart): 1  
Number of ensembles per tile (output restart): 12
```

```
LIS restart source:      "Routing"  
Ensemble restart generation mode: "upscale"  
Input restart filename:  ./LIS_RST_HYMAP_router_ 201801010000.d01.bin  
Output restart filename: ./ensrst.bin  
Number of ensembles per tile (input restart): 1  
Number of ensembles per tile (output restart): 12
```

The LDT configuration file: ldt.config

- For this specific case, the LDT config file will contain the following entries:
 - LDT running mode: "Ensemble restart processing"
 - LIS number of surface model types: 1
 - LIS surface model types: "LSM"
 - LIS restart source: "LSM"
 - Ensemble restart generation mode: "upscale" ← This entry creates the "ensemble" file
 - Input restart filename:
../OL_OUTPUT/SURFACEMODEL/201801/LIS_RST_NOAH36_201801010000.d01.nc
 - Output restart filename: ./LIS_EnRST_NOAH36_201801010000.d01.nc
 - Number of ensembles per tile (input restart): 1 ← Single instance of model states
 - Number of ensembles per tile (output restart): 12 ← Increasing to ensemble size of 12 members

Running LDT – Generate Ensemble Restart File

- Copy your compiled **LDT** executable file to `${WORKING_DIR}/DA_ensrst`
- Run the **LDT** executable with the `ldt.config` file provided:

```
./LDT ldt.config
```

- Was the run successful?
 - **Yes** ⇒ *Great job!*
 - **No** ⇒ *Let's check for any run-time error messages or files ...*
- Let's check our `ldtlog.0000` file to confirm how our run ended.

Viewing the LDT output files in:

- You can look at the file produced:
LIS_EnRST_NOAH36_201801010000.d01.nc

using ncvview, Matlab or any other viewing package that supports netcdf files.

- Compare with the "target" version of the file provided from the downloaded Step 3 files:
target_LIS_EnRST_NOAH36_201801010000.d01.nc
- When viewing the file, you will see several of the model states that will be used to initialize the data assimilation run.