# LIS User's Guide

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# 1 Introduction

This is a draft of LIS' User's Guide. This document describes how to download and install the code and data needed to run LDAS for LIS' "First Code Improvement" milestone – Milestone F. It describes how to build and run the code, and finally this document also describes how to download output data sets to use for validation. Updates to this document will provide more detailed instructions on how to configure the executable and will address the graphical user interface.

This document consists of 6 sections, described as followed:

1 Introduction: the section you are currently reading

2 Preliminaries: general info., steps, instructions, and definitions used throughout the rest of this document

3 Obtaining the Source Code and Datasets: the steps needed to download and install the code and data

4 Building: the steps needed to build the LDAS executable

5 Running: the steps needed to prepare and submit a run, also describes the various run-time configurations

6 Retrieving Output Data: the steps needed to download data generated by the LIS team during its testing runs.

## 2 Preliminaries

This code has been run on NASA Ames' SGI Origin systems. These instructions expect that you are logged onto turing.nas.nasa.gov, and that you are running the executable on lomax. Updates to this document will provide more general instructions for running this code on generic workstations.

You are expected to be working within your */cluster/lomax/nobackup1/$USER* directory, where $USER is your login name.

Throughout the rest of this document this directory shall be refered to as *$WORKING*.

Depending on the test-cases run, this code requires 250MB to 32GB of memory.

The installation of this code requires 64MB of hard disk space. An additional 25GB is needed for the input data files. Depending on the test-cases run, an additional 425MB to 20GB of hard disk space is needed for output per run.

# 3 Obtaining the Source Code and Datasets

This section describes how to obtain the source code and datasets needed to run LDAS for LIS' "First Code Improvement" milestone – Milestone F.

1. Download the *source.tar.gz* and the *scripts.tar.gz* files from http://lis2.sci.gsfc.nasa.gov:9090/Fcode/ into your working directory, *$WORKING*.
2. Download the *intput.tar.gz* file from http://lis2.sci.gsfc.nasa.gov:9090/Fdata/INPUT/ into your working directory, *$WORKING*.
3. Unpack the files. Run:

```
% gzip -dc input.tar.gz | tar xf -
% gzip -dc source.tar.gz | tar xf -
% gzip -dc scripts.tar.gz | tar xf -
```

## 3.1 Source files

Unpacking the *source.tar.gz* file will create a *$WORKING/LDAS/src-par* sub-directory. The structure of *src-par* is as follows:

| Directory Name | Synopsis |
|---|---|
| clm2 | Top level clm2 land surface model sub-directory |
| clm2/biogeochem | |
| clm2/biogeophys | Biogeophysics routines (e.g., surface fluxes) |
| clm2/camclm_share | Code shared between the clm2 and cam (e.g., calendar information) |
| clm2/csm_share | Code shared by all the geophysical model components of the Community Climate System Model (CCSM). Currently contains code for CCSM message passing orbital calculations and system utilities |
| clm2/ecosysdyn | Ecosystem dynamics routines (e.g., leaf and stem area index) |
| clm2/main | Control (driver) routines |
| clm2/mksrfdata | Routines for generating surface datasets |
| clm2/riverroute | River routing (RTM) routines |
| clm2/utils | Independent utility routines |
| driver | LIS' LDAS driver routines |
| iplib | Interpolation routines |
| lib | Libraries needed for linking |
| make | Makefile and needed headers |
| noah | NOAH land surface model |

Source code documentation may be found on LIS's web-site at http://lis.gsfc.nasa.gov/Documentation/MilestoneF/Documentation/lis/index.html.

## 3.2 Input data files

The *input.tar.gz* file contains forcing data and 1/4 deg input data files. Unpacking the *input.tar.gz* file will create a *$WORKING/LDAS/input* sub-directory. The structure of *input* is as follows:

| Directory Name | Synopsis |
|---|---|
| BCS | Soil and Vegetation Classifications |
| GVEG | Land/Sea mask |
| AVHRR_LAI | Leaf Area Index files |
| GLDAS4 | GEOS forcing data |

Once you have unpacked the *input.tar.gz* file, you need to download the 5 km input datasets. Files ending in .bfsa, .bin, and .gz are binary files. Files ending in .txt are flat ASCII files.

1. Download

   alb_01_5KM.bfsa
   alb_02_5KM.bfsa
   alb_03_5KM.bfsa
   alb_04_5KM.bfsa
   gfrac_01_5KM.bfsa
   gfrac_02_5KM.bfsa
   gfrac_03_5KM.bfsa
   gfrac_04_5KM.bfsa
   gfrac_05_5KM.bfsa
   gfrac_06_5KM.bfsa
   maxsnalb_5KM.bfsa
   tbot-uncr_5KM.bfsa

   from http://lis2.sci.gsfc.nasa.gov:9090/Fdata/INPUT/BCS/NOAH/ into *$WORKING/LDAS/input/BCS/NOAH*

2. Download

   clay60_5KM.bfsa
   por60_5KM.bfsa
   sand60_5KM.bfsa
   silt60_5KM.bfsa
   sim60soil5KM.txt
   soicol60_5KM.bfsa

   from http://lis2.sci.gsfc.nasa.gov:9090/Fdata/INPUT/BCS/ into *$WORKING/LDAS/input/BCS*

3. Download

UMD_605KM.txt.gz
UMD_60mask5KM.txt.gz

from http://lis2.sci.gsfc.nasa.gov:9090/Fdata/INPUT/GVEG/ into *$WORKING/LDAS/input/GVEG*

4. Download

   CLIM05_5KM.bin
   CLIM06_5KM.bin
   CLIM05_SAI_5KM.bin
   CLIM06_SAI_5KM.bin

   from http://lis2.sci.gsfc.nasa.gov:9090/Fdata/INPUT/AVHRR_LAI/ into *$WORKING/LDAS/input/AVHRR_LAI*

5. Change directory to *$WORKING/LDAS/input/GVEG*. Unzip the UMD_605KM.txt.gz and UMD_60mask5KM.txt.gz files; i.e.,

   ```
   % gzip -d UMD_605KM.txt.gz
   % gzip -d UMD_60mask5KM.txt.gz
   ```

# 4 Building

This section describes how to build the source code and created the executable, LDAS, for LIS' "First Code Improvement" milestone – Milestone F.

First perform the steps described in section 3. Then

1. Change directory into *$WORKING/LDAS/src-par/make/MAKEDEP*
2. Run: `% gmake`
3. Change directory into *$WORKING/LDAS/src-par/make*
4. Run: `% gmake -f Makefile.lomax`
5. Move the resulting executable, named LDAS, into the *$WORKING/LDAS* directory; i.e., `% mv LDAS ../../`

# 5 Running

This section describes how to run the LDAS executable.

There are 4 different configurations that the code was run in for our Milestone F tests and performance runs. They are:

1. LDAS running CLM at 1/4 deg – labeled clm.25
2. LDAS running CLM at 5km – labeled clm.5km
3. LDAS running NOAH at 1/4 deg – labeled noah.25
4. LDAS running NOAH at 5km – labeled noah.5km

To run the code, first perform the steps described in section 4 of this document. Then:

1. Change directory into *$WORKING/LDAS*
2. Run the PBS init shell script: `% sh pbsinit.sh user group`

   where user is your login name and group is your project's group id.
3. Run the appropriate shell script. For example, to run NOAH at 5km resolution, `% sh noah.5km.sh`

   These shell scripts will configure the run and submit the run into the queue on lomax.

The output datasets created from these runs are written into sub-directories of the *$WORKING/LDAS/OUTPUT/* directory (created at run-time), where these sub-directories are named using the above labels. The output data consists of ASCII text files and model output in binary format.

In addition, log files from these runs are written into the *$WORKING/LDAS* directory, and PBS output is written into the *$WORKING/LDAS* directory.

For example, running NOAH at 5km, using the *noah.5km.sh* shell script, will generate *$WORKING/LDAS/OUTPUT/noah.5km*, *$WORKING/LDAS/noah.5km.log*, *$WORKING/LDAS/pbs.noah.5km.out*, and *$WORKING/LDAS/pbs.noah.5km.err*.

# 6 Retrieving Output Data

This section describes how to download datasets generated by LIS' development team for LIS' "First Code Improvement" milestone – Milestone F.

Two output datasets are available for download, one from a 5 km NOAH run and another from a 5 km CLM run. The 5 km NOAH datasets are located at http://lis2.sci.gsfc.nasa.gov:9090/Fdata/OUTPUT/NOAH-5km/, and the 5 km CLM datasets are located at http://lis2.sci.gsfc.nasa.gov:9090/Fdata/OUTPUT/CLM-5km/.

The output data files for NOAH are

- *LDAS.E999.2001061100.NOAHgbin*
- *LDAS.E999.2001061103.NOAHgbin*
- *LDAS.E999.2001061106.NOAHgbin*
- *LDAS.E999.2001061109.NOAHgbin*
- *LDAS.E999.2001061112.NOAHgbin*
- *LDAS.E999.2001061115.NOAHgbin*
- *LDAS.E999.2001061118.NOAHgbin*
- *LDAS.E999.2001061121.NOAHgbin*

Note, each file-name contains a date-stamp marking the year, month, day, and hour that the data corresponds to. The output data files for CLM are similar.

These output data files are large and require post-processing before reading them. Therefore several data plots have been generated, and they are found on LIS' web-site at http://lis.gsfc.nasa.gov/Documentation/Documents/output/.