

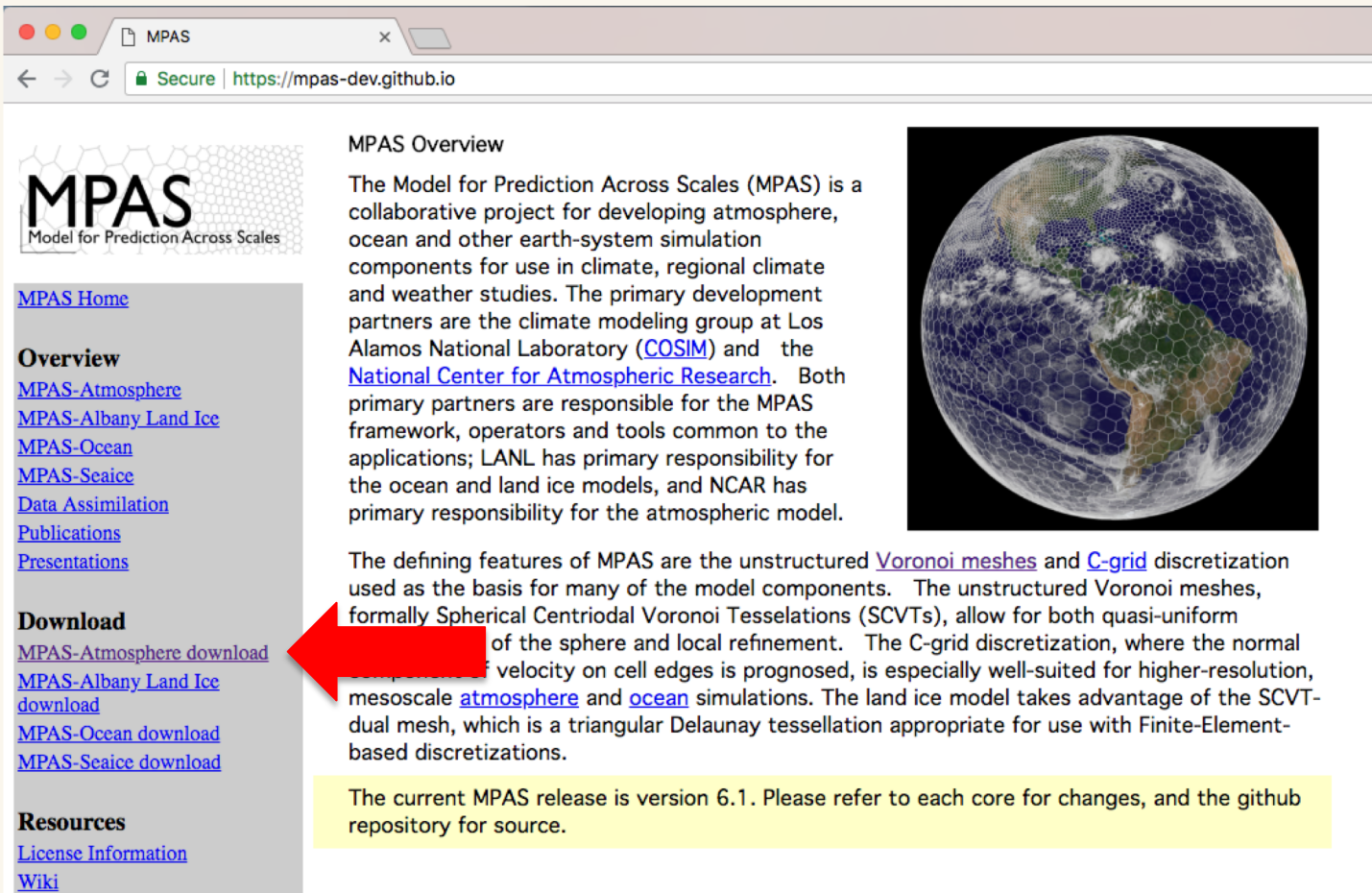
Obtaining and Compiling MPAS-A

When getting started with a new modeling system, a reasonable first question to ask is:

How do I get a copy of the source code?

- 1) The “traditional”, but not necessarily encouraged, method
 - Download a .tar.gz or .zip file
- 2) The preferred method
 - Make a *clone* of the MPAS-Model repository

One can navigate to a download link from the MPAS homepage at <https://mpas-dev.github.io/>



The screenshot shows a web browser window with the address bar displaying "https://mpas-dev.github.io/". The page content includes the MPAS logo, a navigation sidebar, and main text sections. A red arrow points to the "MPAS-Atmosphere download" link in the sidebar.

MPAS Overview

The Model for Prediction Across Scales (MPAS) is a collaborative project for developing atmosphere, ocean and other earth-system simulation components for use in climate, regional climate and weather studies. The primary development partners are the climate modeling group at Los Alamos National Laboratory ([COSIM](#)) and the [National Center for Atmospheric Research](#). Both primary partners are responsible for the MPAS framework, operators and tools common to the applications; LANL has primary responsibility for the ocean and land ice models, and NCAR has primary responsibility for the atmospheric model.

The defining features of MPAS are the unstructured [Voronoi meshes](#) and [C-grid](#) discretization used as the basis for many of the model components. The unstructured Voronoi meshes, formally Spherical Centriodal Voronoi Tessellations (SCVTs), allow for both quasi-uniform of the sphere and local refinement. The C-grid discretization, where the normal of velocity on cell edges is prognosed, is especially well-suited for higher-resolution, mesoscale [atmosphere](#) and [ocean](#) simulations. The land ice model takes advantage of the SCVT-dual mesh, which is a triangular Delaunay tessellation appropriate for use with Finite-Element-based discretizations.

The current MPAS release is version 6.1. Please refer to each core for changes, and the github repository for source.

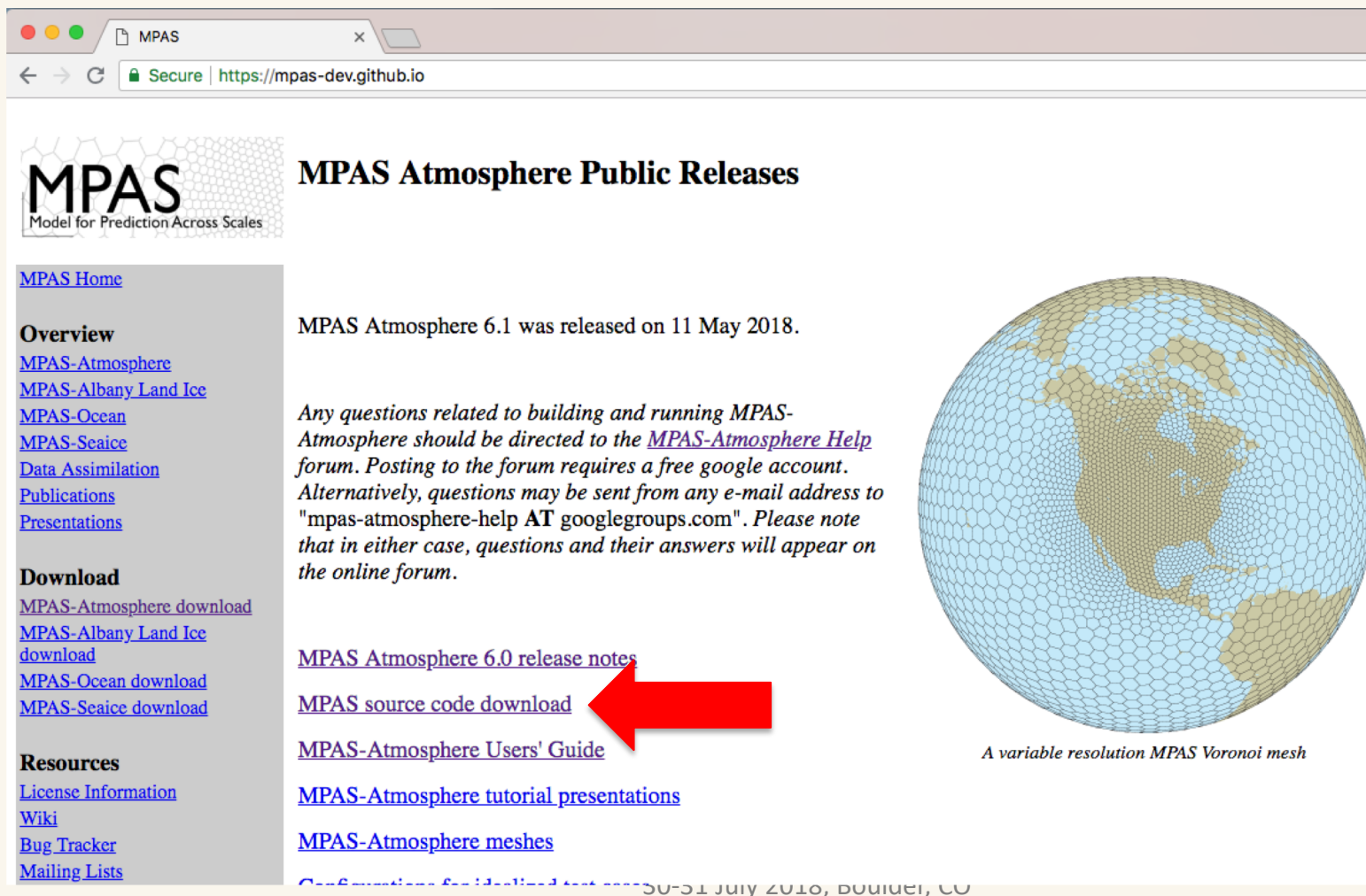
Download

- [MPAS-Atmosphere download](#)
- [MPAS-Albany Land Ice download](#)
- [MPAS-Ocean download](#)
- [MPAS-Seaice download](#)

Resources

- [License Information](#)
- [Wiki](#)

One can navigate to a download link from the MPAS homepage at <https://mpas-dev.github.io/>



The screenshot shows a web browser window with the address bar displaying <https://mpas-dev.github.io/>. The page title is "MPAS Atmosphere Public Releases". On the left, there is a sidebar with links: "MPAS Home", "Overview", "MPAS-Atmosphere", "MPAS-Albany Land Ice", "MPAS-Ocean", "MPAS-Seaice", "Data Assimilation", "Publications", "Presentations", "Download", "MPAS-Atmosphere download", "MPAS-Albany Land Ice download", "MPAS-Ocean download", "MPAS-Seaice download", "Resources", "License Information", "Wiki", "Bug Tracker", and "Mailing Lists". The main content area features the MPAS logo, the title "MPAS Atmosphere Public Releases", and a paragraph stating "MPAS Atmosphere 6.1 was released on 11 May 2018." Below this, there is a paragraph of text: "Any questions related to building and running MPAS-Atmosphere should be directed to the [MPAS-Atmosphere Help forum](#). Posting to the forum requires a free google account. Alternatively, questions may be sent from any e-mail address to "mpas-atmosphere-help AT googlegroups.com". Please note that in either case, questions and their answers will appear on the online forum." To the right of this text is a globe showing a variable resolution Voronoi mesh. Below the globe, the caption reads "A variable resolution MPAS Voronoi mesh". At the bottom of the main content area, there are several links: "MPAS Atmosphere 6.0 release notes", "MPAS source code download", "MPAS-Atmosphere Users' Guide", "MPAS-Atmosphere tutorial presentations", and "MPAS-Atmosphere meshes". A large red arrow points to the "MPAS source code download" link.

MPAS Atmosphere Public Releases

MPAS Atmosphere 6.1 was released on 11 May 2018.

Any questions related to building and running MPAS-Atmosphere should be directed to the [MPAS-Atmosphere Help forum](#). Posting to the forum requires a free google account. Alternatively, questions may be sent from any e-mail address to "mpas-atmosphere-help AT googlegroups.com". Please note that in either case, questions and their answers will appear on the online forum.

[MPAS Atmosphere 6.0 release notes](#)

[MPAS source code download](#)

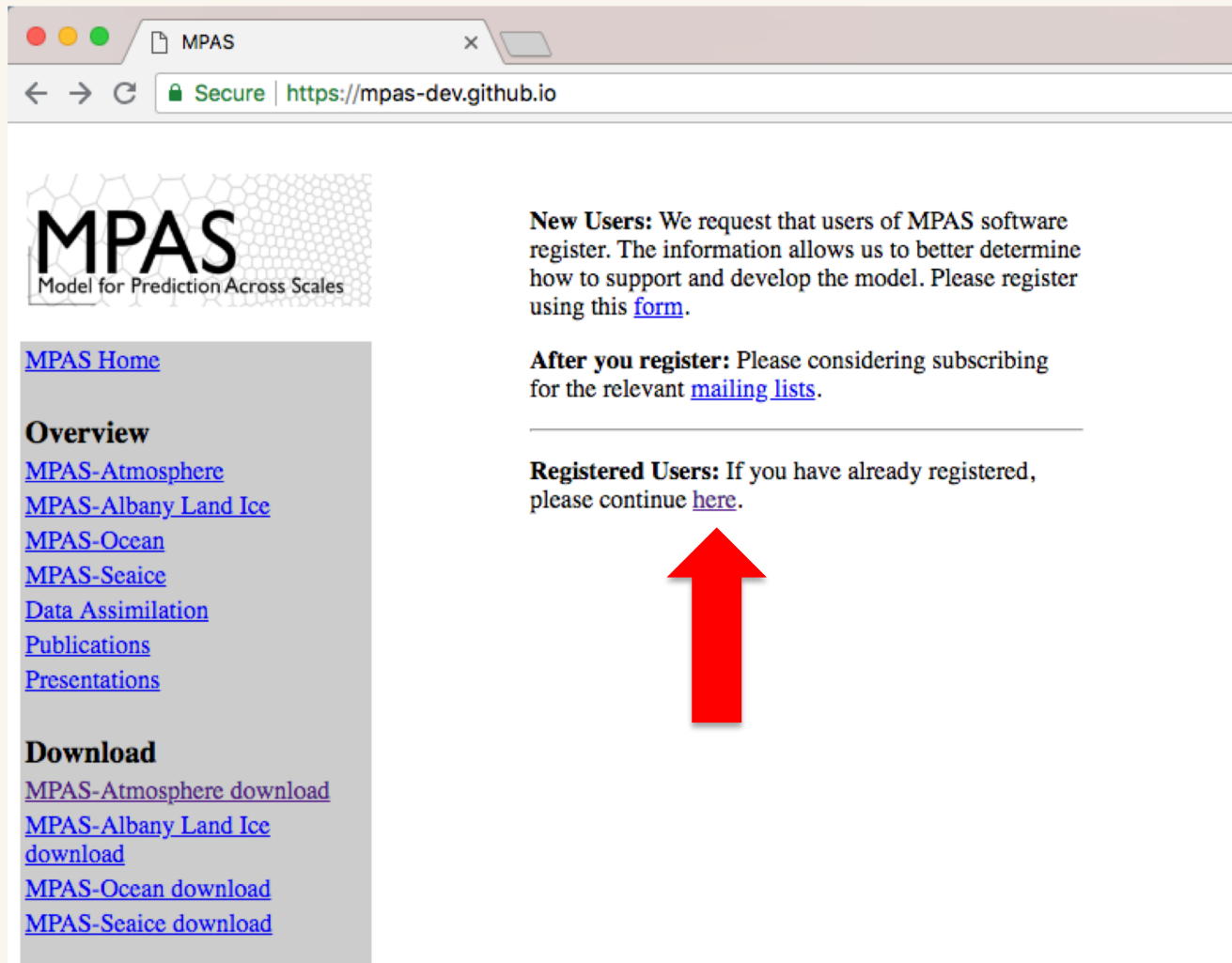
[MPAS-Atmosphere Users' Guide](#)

[MPAS-Atmosphere tutorial presentations](#)

[MPAS-Atmosphere meshes](#)

A variable resolution MPAS Voronoi mesh

One can navigate to a download link from the MPAS homepage at <https://mpas-dev.github.io/>



The screenshot shows a web browser window with the address bar displaying "https://mpas-dev.github.io". The page features the MPAS logo and a navigation sidebar on the left. The sidebar includes links for "MPAS Home", "Overview", "MPAS-Atmosphere", "MPAS-Albany Land Ice", "MPAS-Ocean", "MPAS-Seaice", "Data Assimilation", "Publications", and "Presentations". Below these are "Download" links for "MPAS-Atmosphere download", "MPAS-Albany Land Ice download", "MPAS-Ocean download", and "MPAS-Seaice download". The main content area contains three sections: "New Users" with a registration request and a link to a "form", "After you register" with a link to "mailing lists", and "Registered Users" with a link to "here". A large red arrow points upwards from the bottom of the page towards the "here" link in the "Registered Users" section.

MPAS
Model for Prediction Across Scales

[MPAS Home](#)

Overview

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- [Data Assimilation](#)
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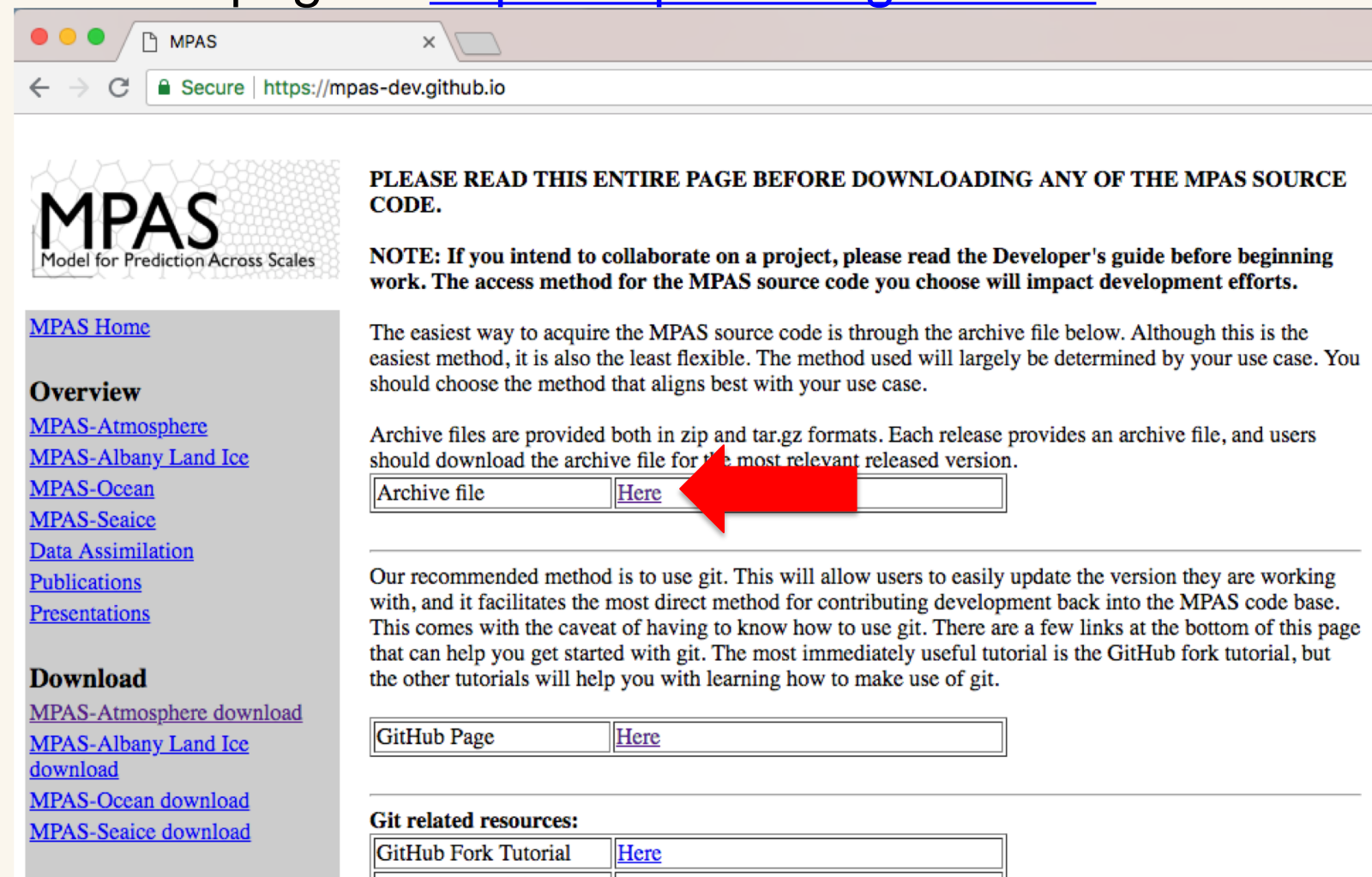
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New Users: We request that users of MPAS software register. The information allows us to better determine how to support and develop the model. Please register using this [form](#).

After you register: Please considering subscribing for the relevant [mailing lists](#).

Registered Users: If you have already registered, please continue [here](#).

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The screenshot shows a web browser window with the address bar displaying <https://mpas-dev.github.io/>. The page content includes the MPAS logo, a sidebar with navigation links, and main body text with download instructions. A red arrow points to the 'Here' link in the 'Archive file' section.

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PLEASE READ THIS ENTIRE PAGE BEFORE DOWNLOADING ANY OF THE MPAS SOURCE CODE.

NOTE: If you intend to collaborate on a project, please read the Developer's guide before beginning work. The access method for the MPAS source code you choose will impact development efforts.

The easiest way to acquire the MPAS source code is through the archive file below. Although this is the easiest method, it is also the least flexible. The method used will largely be determined by your use case. You should choose the method that aligns best with your use case.

Archive files are provided both in zip and tar.gz formats. Each release provides an archive file, and users should download the archive file for the most relevant released version.

Archive file [Here](#)

Our recommended method is to use git. This will allow users to easily update the version they are working with, and it facilitates the most direct method for contributing development back into the MPAS code base. This comes with the caveat of having to know how to use git. There are a few links at the bottom of this page that can help you get started with git. The most immediately useful tutorial is the GitHub fork tutorial, but the other tutorials will help you with learning how to make use of git.

GitHub Page [Here](#)

Git related resources:

GitHub Fork Tutorial [Here](#)

The “less preferred” method of obtaining code

One can navigate to a download link from the MPAS homepage at <https://mpas-dev.github.io/>

The screenshot shows the GitHub interface for the MPAS-Dev/MPAS-Model repository. The browser address bar displays the URL <https://github.com/MPAS-Dev/MPAS-Model/releases>. The repository page header includes the MPAS-Dev / MPAS-Model title, 42 Unwatch, 60 Star, and 123 Fork buttons. The navigation bar shows Code, Issues (14), Pull requests (10), Projects (0), Wiki, Insights, and Settings. The Releases tab is active, showing a list of releases. The latest release is MPAS Version 6.1, released on May 14 by akturner. It includes assets for Source code (zip) and Source code (tar.gz). The release description states: "This minor release of MPAS corrects some minor issues with the sea-ice biogeochemistry. It fixes the restartability test with BGC, corrects some BGC namelist flags and removes the zero value for a BGC dimension." Below this, MPAS Version 6.0 is listed, released on Apr 17 by matthewhoffman, with 13 commits to master since this release.

MPAS-Dev / MPAS-Model

Unwatch 42 Star 60 Fork 123

Code Issues 14 Pull requests 10 Projects 0 Wiki Insights Settings

Releases Tags Draft a new release

Latest release

v6.1
c970b61

MPAS Version 6.1

akturner released this on May 14

Assets

Source code (zip)

Source code (tar.gz)

This minor release of MPAS corrects some minor issues with the sea-ice biogeochemistry. It fixes the restartability test with BGC, corrects some BGC namelist flags and removes the zero value for a BGC dimension.

v6.0
ece5f71

MPAS Version 6.0

matthewhoffman released this on Apr 17 · 13 commits to master since this release

Assets

The “less preferred” method of obtaining code

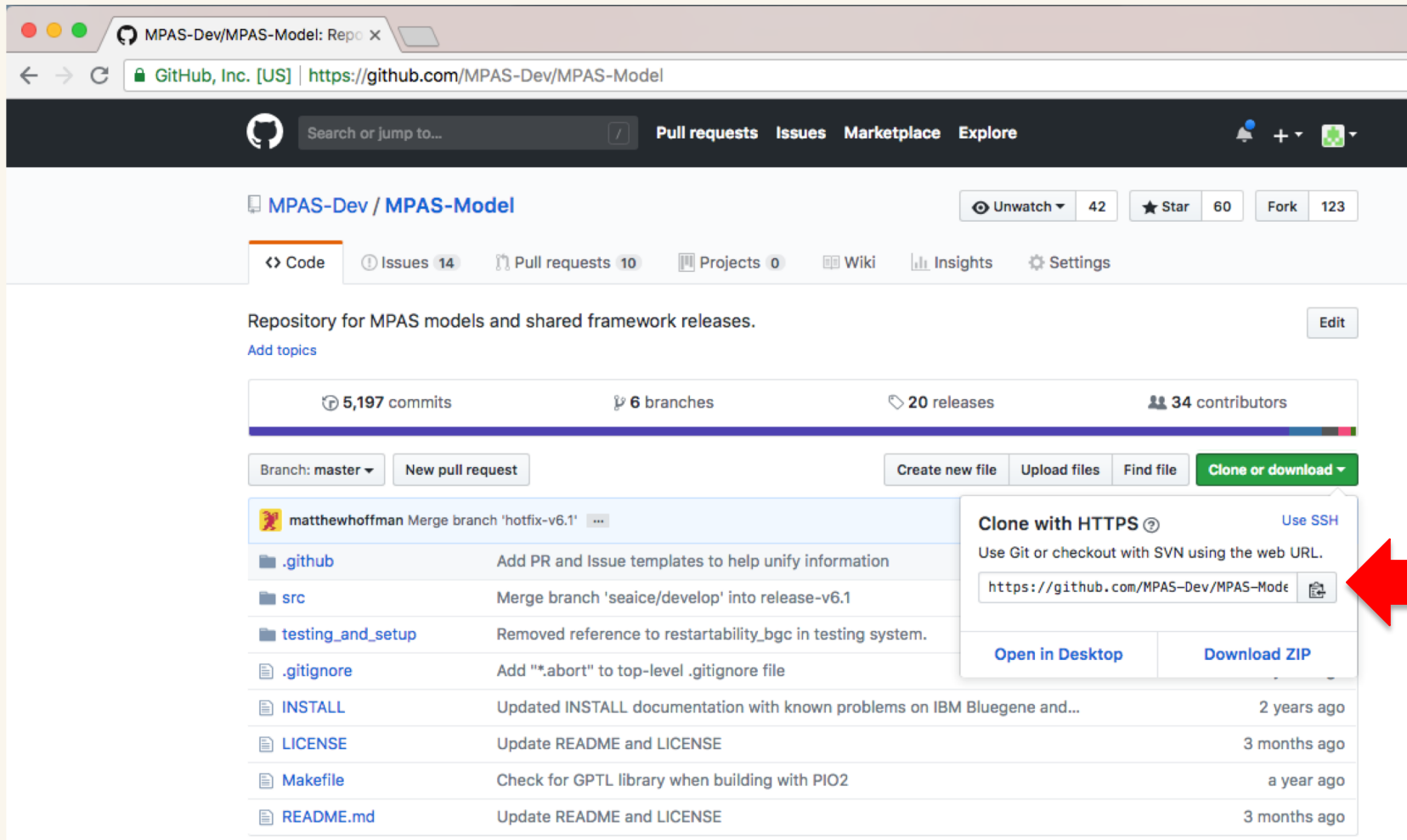
Downloading a .tar.gz file of a particular release of the MPAS code certainly works, but it has several disadvantages:

1. You’ll only obtain a specific release of the code
2. There’s no direct way to see the history of changes to parts of the code
3. There’s no easy route to updating to a newer release while preserving your local code modifications
4. It’s more difficult to see what local modifications have been made to the code
5. It’s more difficult to contribute improvements and fixes back to MPAS development

The preferred method of obtaining code

A much better option is to *clone* the MPAS-Model repository

- The repository URL can be found from the MPAS GitHub page at <https://github.com/MPAS-Dev/MPAS-Model>



The screenshot shows the GitHub repository page for MPAS-Dev / MPAS-Model. The repository has 5,197 commits, 6 branches, 20 releases, and 34 contributors. A dropdown menu is open for the 'Clone or download' button, showing the 'Clone with HTTPS' option selected. A red arrow points to the 'Clone with HTTPS' option.

Repository for MPAS models and shared framework releases.

5,197 commits 6 branches 20 releases 34 contributors

Branch: master New pull request Create new file Upload files Find file Clone or download

Clone with HTTPS Use SSH

Use Git or checkout with SVN using the web URL.

<https://github.com/MPAS-Dev/MPAS-Model>

Open in Desktop Download ZIP

File	Description	Updated
.github	Add PR and Issue templates to help unify information	
src	Merge branch 'seai/develop' into release-v6.1	
testing_and_setup	Removed reference to restartability_bgc in testing system.	
.gitignore	Add "*.abort" to top-level .gitignore file	
INSTALL	Updated INSTALL documentation with known problems on IBM Bluegene and...	2 years ago
LICENSE	Update README and LICENSE	3 months ago
Makefile	Check for GPTL library when building with PIO2	a year ago
README.md	Update README and LICENSE	3 months ago

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The preferred method of obtaining code

From the command-line, the following should be sufficient:

```
git clone https://github.com/MPAS-Dev/MPAS-Model.git
```

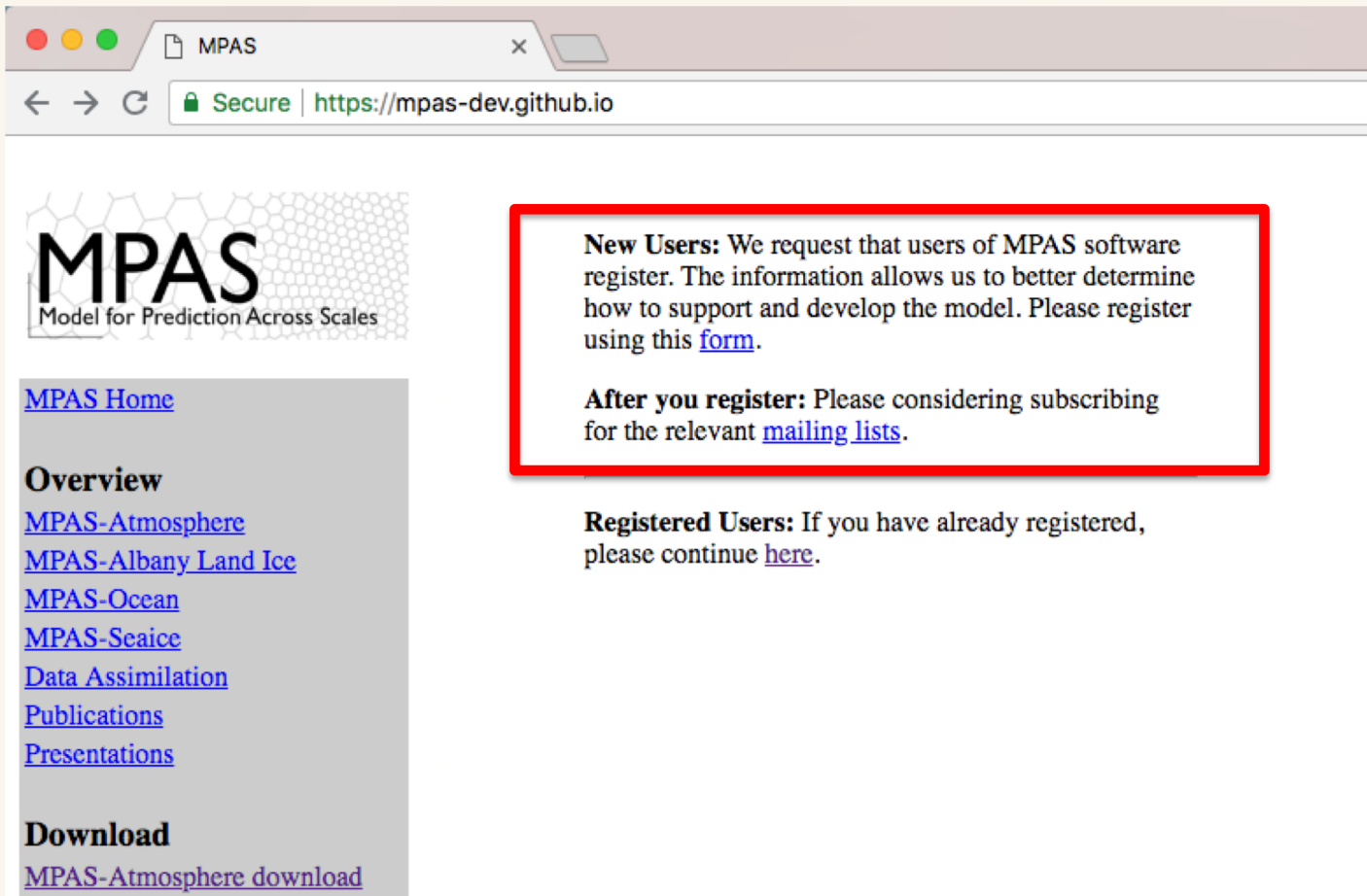
Cloning the repository should take about 10 seconds or less...*

```
$ git clone https://github.com/MPAS-Dev/MPAS-Model.git
Cloning into 'MPAS-Model'...
remote: Counting objects: 38647, done.
remote: Total 38647 (delta 3), reused 3 (delta 3), pack-reused 38643
Receiving objects: 100% (38647/38647), 16.22 MiB | 11.25 MiB/s, done.
Resolving deltas: 100% (30112/30112), done.
```

```
$ ls -d MPAS-Model/
MPAS-Model/
```

*... except when GitHub is being hit by a DDoS attack.

You may also like to register as an MPAS user and join the MPAS-Atmosphere Users mailing list



The screenshot shows a web browser window with the title 'MPAS' and the URL 'https://mpas-dev.github.io'. The page features the MPAS logo and a navigation menu on the left with links to 'MPAS Home', 'Overview', 'MPAS-Atmosphere', 'MPAS-Albany Land Ice', 'MPAS-Ocean', 'MPAS-Seaice', 'Data Assimilation', 'Publications', 'Presentations', 'Download', and 'MPAS-Atmosphere download'. A red-bordered box highlights a message for new users, stating that registration is requested to better support and develop the model, and providing a link to a registration form. Below this box, a message for registered users states that if they have already registered, they should continue to a specific page.

MPAS
Model for Prediction Across Scales

[MPAS Home](#)

Overview

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New Users: We request that users of MPAS software register. The information allows us to better determine how to support and develop the model. Please register using this [form](#).

After you register: Please considering subscribing for the relevant [mailing lists](#).

Registered Users: If you have already registered, please continue [here](#).

Preliminary requirements

In order to compile MPAS and its required libraries, working C and Fortran compilers are necessary

- The Fortran compiler should be recent enough to support the ISO_C_BINDING module from the Fortran 2003 standard and procedure pointer components of derived types
- Most versions of common compilers from the last couple of years should be fine

Building MPAS requires *at least* the following libraries:

- Any implementation of MPI-2, e.g., MPICH, MVAPICH, OpenMPI
 - Ensure that `mpif90` and `mpicc` commands are in your path
- Parallel-netCDF (<http://trac.mcs.anl.gov/projects/parallel-netcdf/>)
 - Set `PNETCDF` environment variable to base installation directory
- PIO (<https://github.com/NCAR/ParallelIO/>)
 - Set `PIO` environment variable to base installation directory

Assuming Fortran and C compilers are available, and a working MPI installation is also available, installing Parallel-netCDF and PIO should take less than 10 minutes:

Parallel-netCDF 1.8.1

```
$ setenv CC gcc
$ setenv FC gfortran
$ setenv F77 gfortran
$ setenv MPICC mpicc
$ setenv MPIF90 mpif90
$ setenv MPIF77 mpif90
$ setenv PNETCDF /home/duda/pnetcdf
$ cd parallel-netcdf-1.8.1
$ ./configure \
  --prefix=$PNETCDF \
  --disable-cxx
$ make
$ make install
```

PIO 1.7.1

*(Assuming environment variables
from Parallel-NetCDF installation)*

```
$ setenv MPIFC mpif90
$ setenv PNETCDF_PATH $PNETCDF
$ setenv PIO /home/duda/pio
$ cd pio1_7_1/pio
$ ./configure \
  --prefix=$PIO \
  --disable-netcdf \
  --disable-mpiio
$ make
$ make install
```

The PIO library is undergoing rapid development, and many different versions of the library are available; *which versions are supported and recommended?*

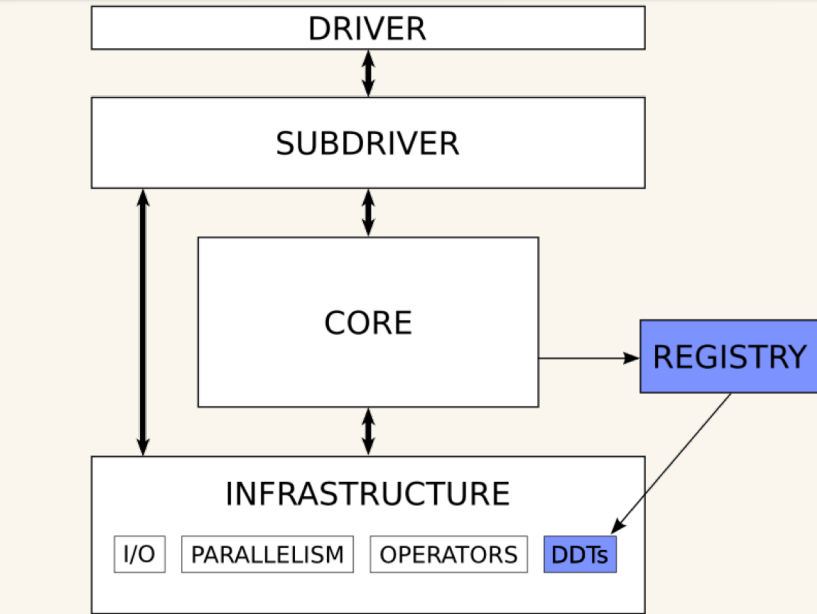
1) For ease of installation, try PIO 1.7.1

- Can be installed using only standard ‘configure’ and ‘make’ tools
- Supports NetCDF-3 and Parallel-netCDF I/O
- Download: https://github.com/NCAR/ParallelIO/releases/tag/pio1_7_1

2) If netCDF-4 I/O is needed or desirable, try the latest PIO release

- Requires recent versions of ‘cmake’, plus standard ‘make’
- Supports netCDF-3, netCDF-4 (in parallel via PHDF5), and Parallel-netCDF I/O
- Download: <https://github.com/NCAR/ParallelIO/>
- See iolib_installation.sh at <http://www2.mmm.ucar.edu/people/duda/files/mpas/sources/>

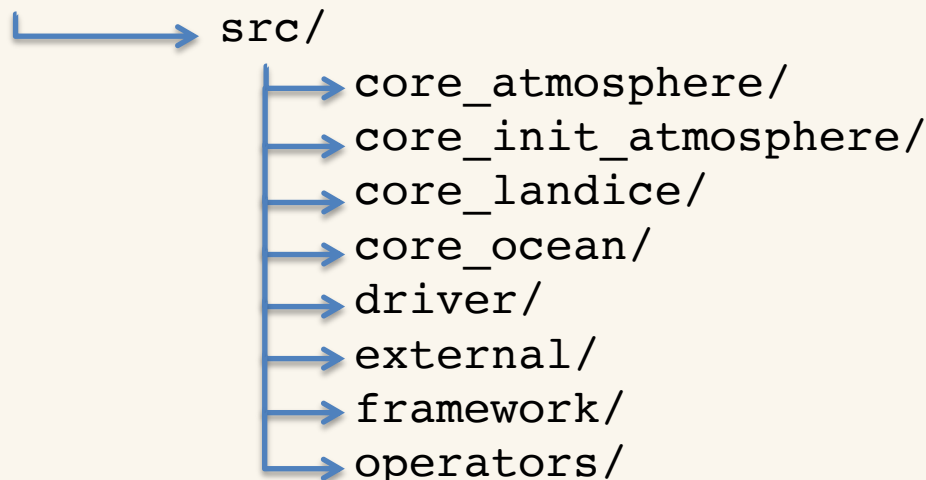
Model Organization



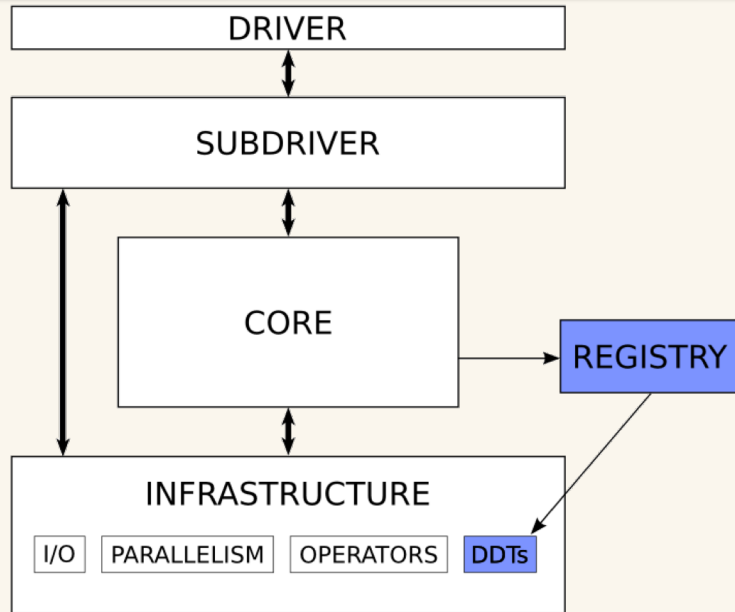
Checking out the MPAS code provides all MPAS models, not just MPAS-Atmosphere

- All models share a common set of infrastructure modules
- Each MPAS model is implemented as a “core” that lives in its own directory
- User must select which “core” to compile
- Each “core” is associated with a source code subdirectory under `src/` and has a Registry file (similar to WRF)

MPAS-Model/



Model Organization



Checking out the MPAS code provides all MPAS models, not just MPAS-Atmosphere

- All models share a common set of infrastructure modules
- Each MPAS model is implemented as a “core” that lives in its own directory
- User must select which “core” to compile
- Each “core” is associated with a source code subdirectory under `src/` and has a Registry file (similar to WRF)

Running MPAS-Atmosphere involves two “cores”:

- The **init_atmosphere** core is responsible for
 - Interpolating static fields to the mesh (similar to `geogrid.exe`)
 - Generating a vertical grid (similar to `real.exe`)
 - Horizontally and vertically interpolating meteorological data to the 3-d grid (similar to `metgrid.exe` and `real.exe`)
 - *Where to we get meteorological data? From `ungrib.exe`!*
- The **atmosphere** core is the model itself, the equivalent of `wrf.exe`

Compiling MPAS

There is no “configuration” step for MPAS, unlike, e.g., for the WRF model

- All build flags are either set in the top-level Makefile or on the command-line

General MPAS build command:

```
$ make target CORE=core <options>
```

target can be either

clean

or

xlf

gfortran

ifort

pgi

bluegene

... plus a few others...

For MPAS-Atmosphere, **core** may be

atmosphere

init_atmosphere

<options> can be zero or more of

DEBUG=true

AUTOCLEAN=true

PRECISION=single

OPENMP=true

USE_PIO2=true

Compiling MPAS

There is no “configuration” step for MPAS, unlike, e.g., for the WRF model

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... plus a few others...

For MPAS-Atmosphere, core may be

atmosphere

init_atmosphere

<options>

DEBUG=

AUTOCL

PRECISIO

OPENMP=true

USE_PIO2=true

If using the latest PIO2 library, be sure to set this option!



Compiling MPAS

Typical build of both the `init_atmosphere` and `atmosphere` cores involves:

\$ make `gfortran` `CORE=init_atmosphere` (*build `init_atmosphere_model`*)

\$ make `clean` `CORE=atmosphere` (*clean any infrastructure files used by both `init_atmosphere` and `atmosphere`*)

\$ make `gfortran` `CORE=atmosphere` (*build `atmosphere_model`*)

By default, MPAS cores are built with double-precision reals

MPAS-Atmosphere can be built in single precision

- Add `PRECISION=single` to build commands for single-precision executables
- execution time ~35% less compared with double-precision
- output files approximately half as large
- Beginning with MPAS v3.0, it is possible to run the model in double precision while writing history files in single precision!

Cheyenne users: you're in luck!

If you're working on Cheyenne, there are just seven commands to obtain and build everything you need (assuming the default module setup):

```
module unload netcdf
module load pio
git clone https://github.com/MPAS-Dev/MPAS-Model.git
cd MPAS-Model
make ifort CORE=init_atmosphere PRECISION=single USE_PIO2=true
make clean CORE=atmosphere
make ifort CORE=atmosphere PRECISION=single USE_PIO2=true
```

Chapter 3 of the MPAS-Atmosphere Users' Guide provides more details on compiling I/O library prerequisites as well as the MPAS-A model itself

Chapter 3

Building MPAS

3.1 Prerequisites

To build MPAS, compatible C and Fortran compilers are required. Additionally, the MPAS software relies on the PIO parallel I/O library to read and write model fields, and the PIO library requires the standard NetCDF library as well as the Parallel-NetCDF library from Argonne National Laboratory. All libraries must be compiled with the same compilers that will be used to build MPAS. Section 3.2 summarizes the basic procedure of installing the required I/O libraries for MPAS.

In order for the MPAS makefiles to find the PIO, Parallel-NetCDF, and NetCDF include files and libraries, the environment variables `PIO`, `PNETCDF`, and `NETCDF` should be set to the root installation directories of the PIO, Parallel-NetCDF, and NetCDF installations, respectively.

An MPI installation such as MPICH or OpenMPI is also required, and there is no option to build a serial version of the MPAS executables. MPAS-Atmosphere v5.0 introduces the capability to use hybrid parallelism using MPI and OpenMP; however, the use of OpenMP *should be considered experimental* and generally does not offer any performance advantage. The primary reason for releasing a shared-memory capability is to make this code available to collaborators for future development.

3.2 Compiling I/O Libraries

IMPORTANT NOTE: *The instructions provided in this section for installing libraries have been successfully used by MPAS developers, but due to differences in library versions, compilers, and system configurations, it is recommended that users consult documentation provided by individual*