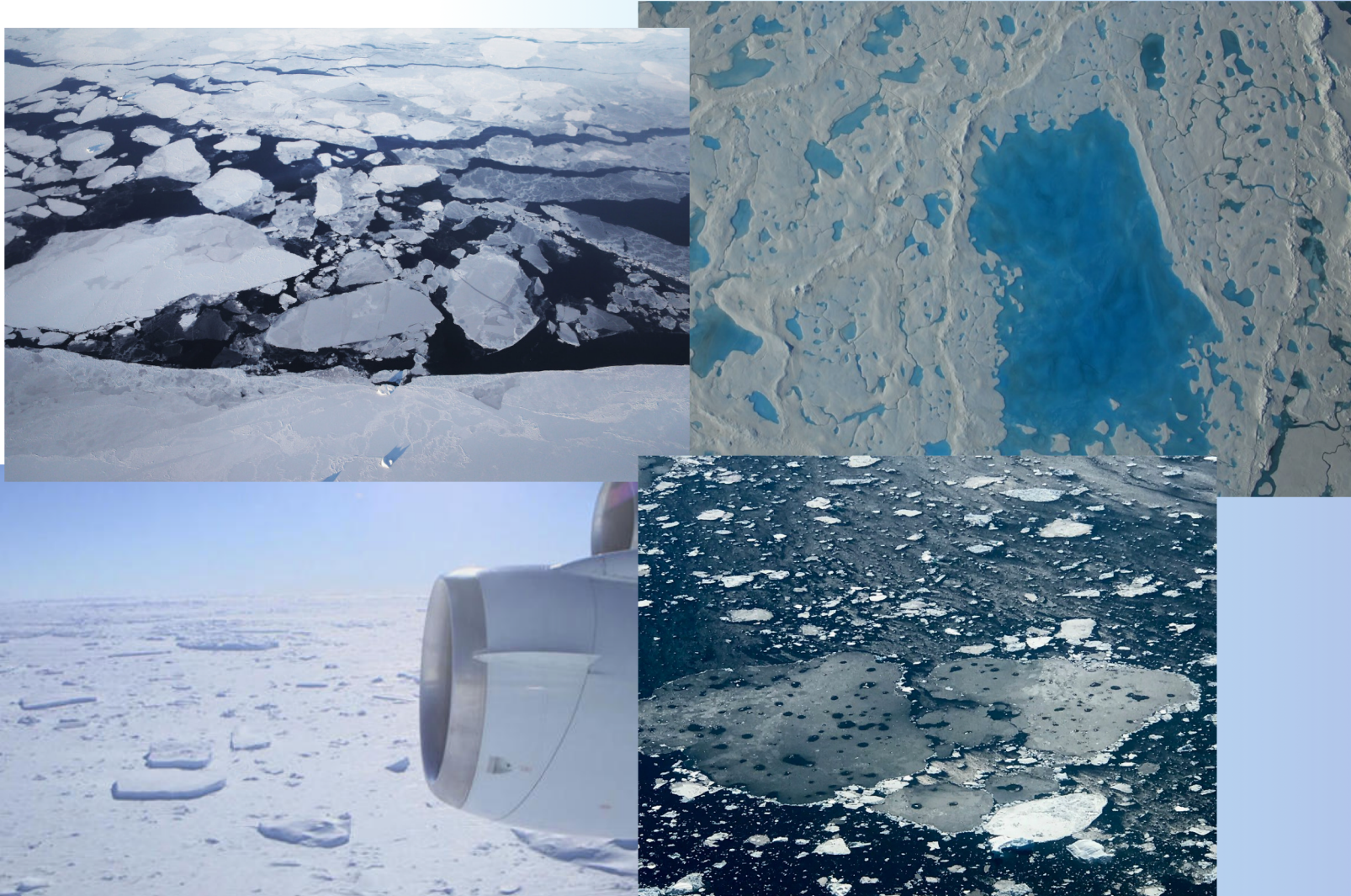


# Overview of CICE and Icepack

Alice DuVivier



# Sea Ice Cover - Reality

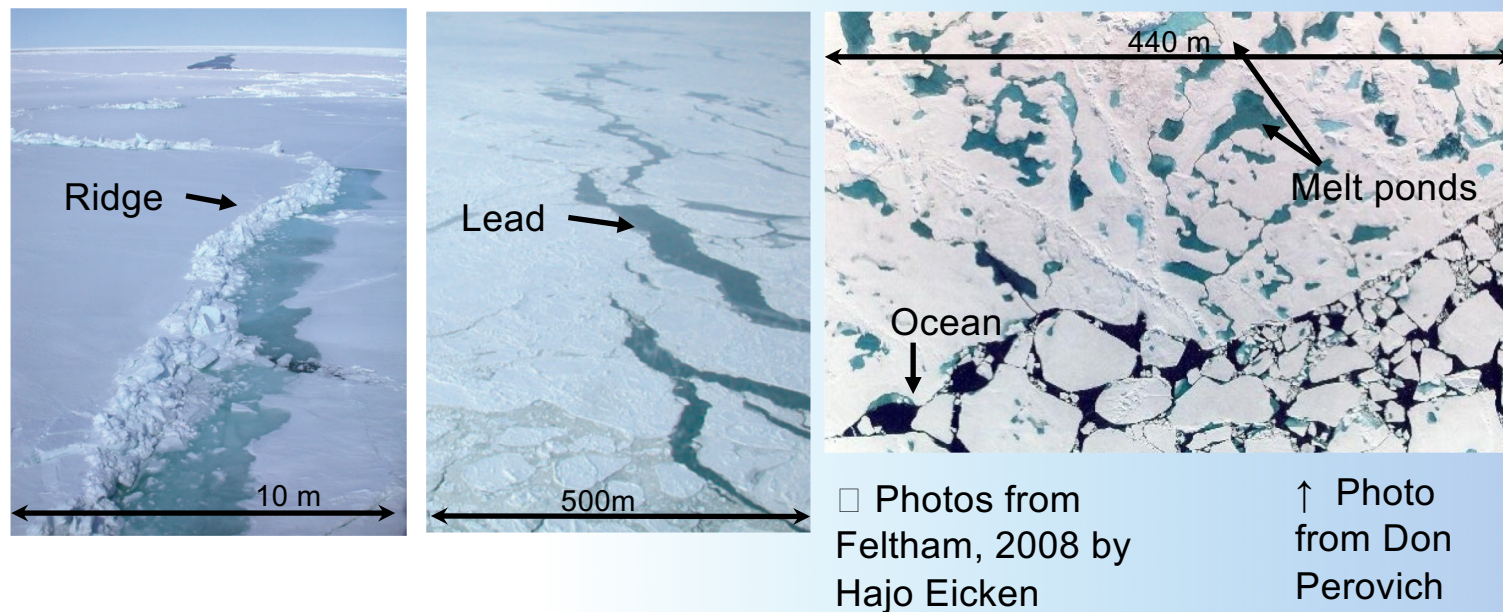


Photos from NASA Operation IceBridge



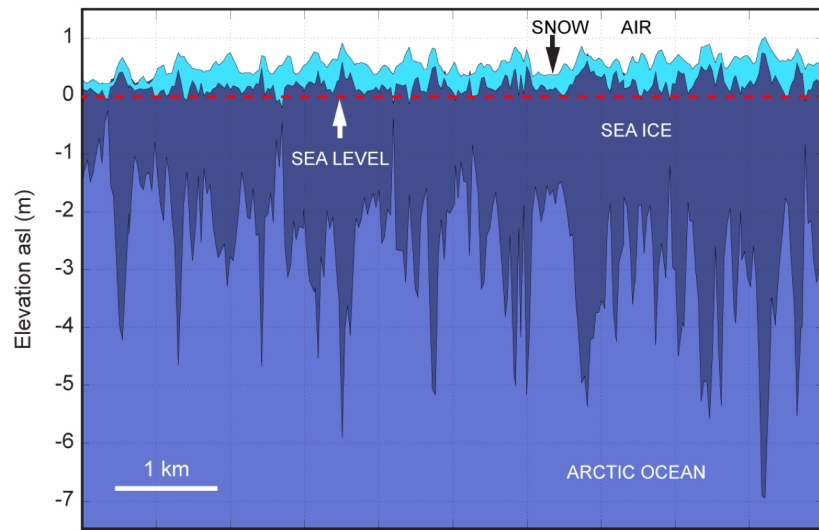


# Sea Ice Cover - Reality

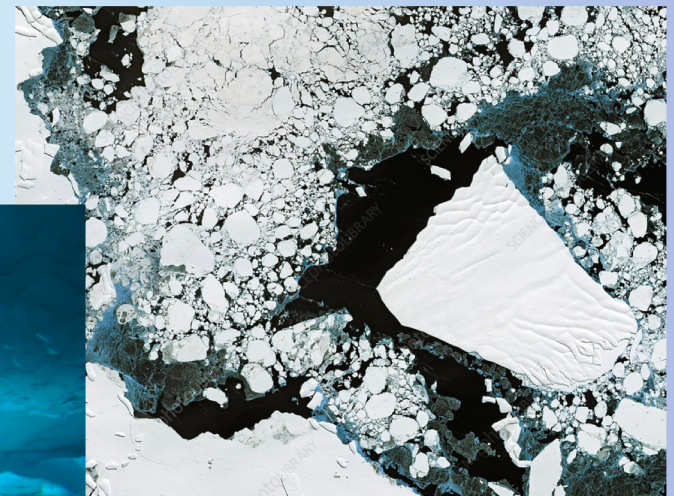


- Heterogeneous – lots of types of subgridscale variability
  - Surface conditions: Snow depth and fraction, melt ponds, aerosols, etc.

# Sea Ice Cover - Reality



NASA Operation IceBridge



DMC satellites – vis sciencephotolibrary.com

- Heterogeneous – lots of types of subgridscale variability
  - Surface conditions: Snow depth and fraction, melt ponds, aerosols, etc.
  - Thickness
  - Floe sizes
- Moving ice means properties move around



# Sea Ice Cover - models

- Properly simulating sea ice is important for surface energy budget, hydrologic cycle, etc. in an Earth System Model

## **CICE has the following features:**

- Dynamics: model solves force balance for sea ice motion
- Thermodynamics: model solves for vertical/lateral ice melt and growth
- Ice thickness distribution and floe size distribution: model sub-gridscale parameterization that accounts for spatial heterogeneity in ice.
- **Details about the scientific options available in CICE will follow this afternoon**



# CICE History

1994  
1995  
1996  
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2011  
2012  
2013  
2014  
2015  
2016

and continuing

Transcribed Semtner 3-layer model into Fortran 77

EVP released

CICE 1.0

CICE 2.0

CICE 3.0

CICE 3.1

CICE 3.14

CICE 4.0

CICE 4.1

CICE 5.0

CICE 5.1.2

CICE Consortium

NPS validation of EVP

EVP in NCAR PCM (via NPS)

NCAR CSIM v2

GFDL CM2 (EVP only)

UK HadGEM1

Canadian sea ice workshops

NRL ACNFS implementation

NRL ACNFS validation

NCEP CFSv2 (EVP only)

NRL ACNFS becomes operational



# CICE 6 code structure

[github.com/CICE-Consortium/CICE](https://github.com/CICE-Consortium/CICE)

## **CICEcore (dynamical core)**

- Momentum
- Stress
- Transport
- Grid/parallelization
- I/O
- Etc

[github.com/CICE-Consortium/Icepack](https://github.com/CICE-Consortium/Icepack)

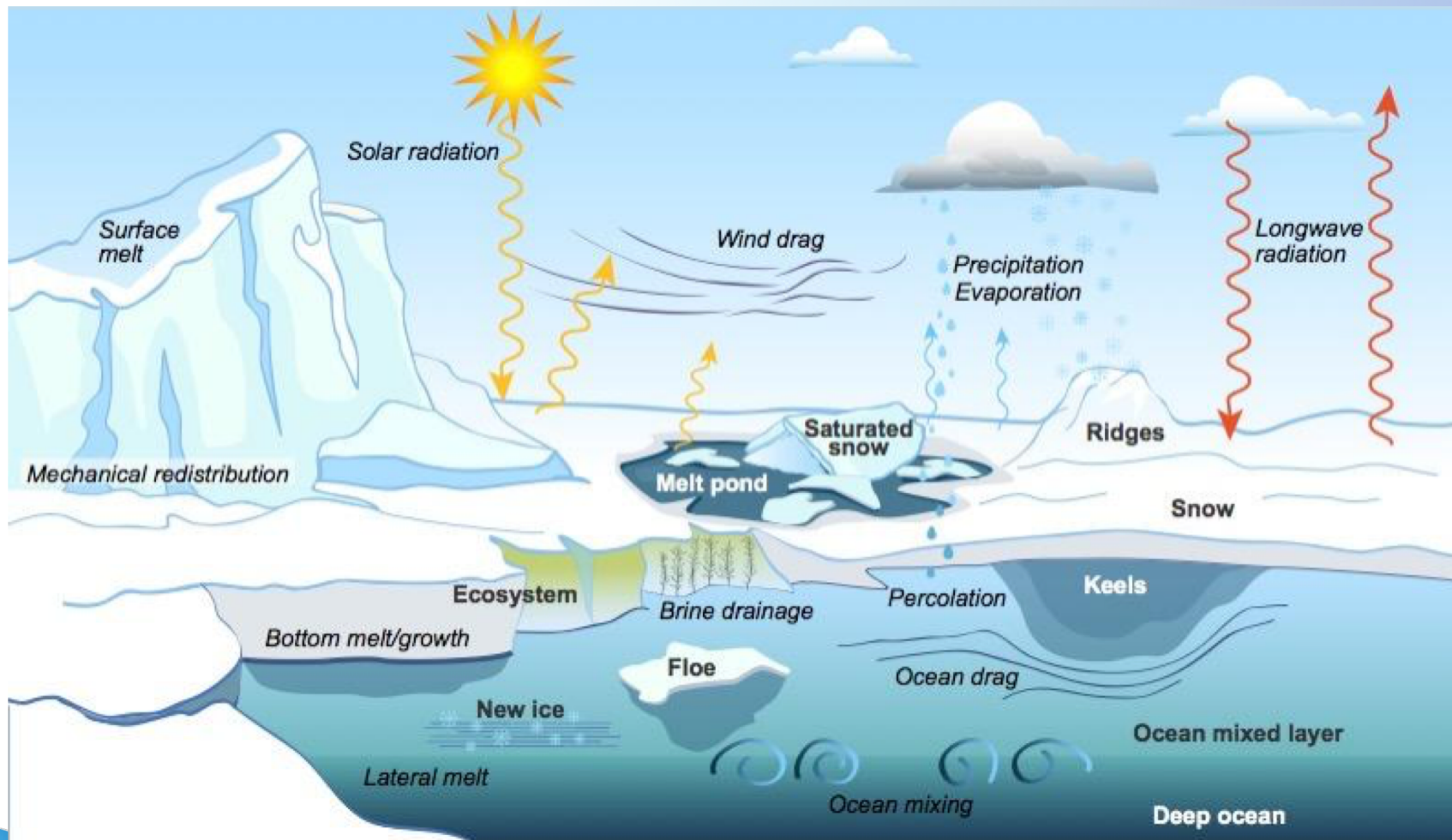
## **Icepack (column physics)**

- Ice thickness distribution
- Thermodynamics
- Ridging
- Biogeochemistry





Icepack represents critical, vertically active sea ice processes, including thermodynamics, ridging, biogeochemistry, and associated area and thickness changes.



# CICE

- GitHub tour
  - Repos, wikis, resources page, documentation
- Directory structure



# Consortium Github – About-Us

CICE-Consortium / About-Us

Watch 4 Star 1 Fork 5

Code Issues 1 Pull requests 0 Actions Projects 0 Wiki Security Insights Settings

Background and supporting information for the CICE Consortium [Edit](#)

[Manage topics](#)

30 commits 1 branch 0 packages 0 releases 4 contributors

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

		Latest commit 5a0438b 9 hours ago
reports	adding reports directory and reports	12 months ago
CodeOfConduct.md	Update CodeOfConduct.md	2 years ago
DistributionPolicy.pdf	Correcting footers	3 years ago
Governance.pdf	Uploading pdfs of governance docs	3 years ago
PoliciesandGuidelines.pdf	Uploading pdfs of governance docs	3 years ago
README.md	README: fix capitalization of 'GitHub'	9 hours ago
TermsOfReference.pdf	Uploading pdfs of governance docs	3 years ago

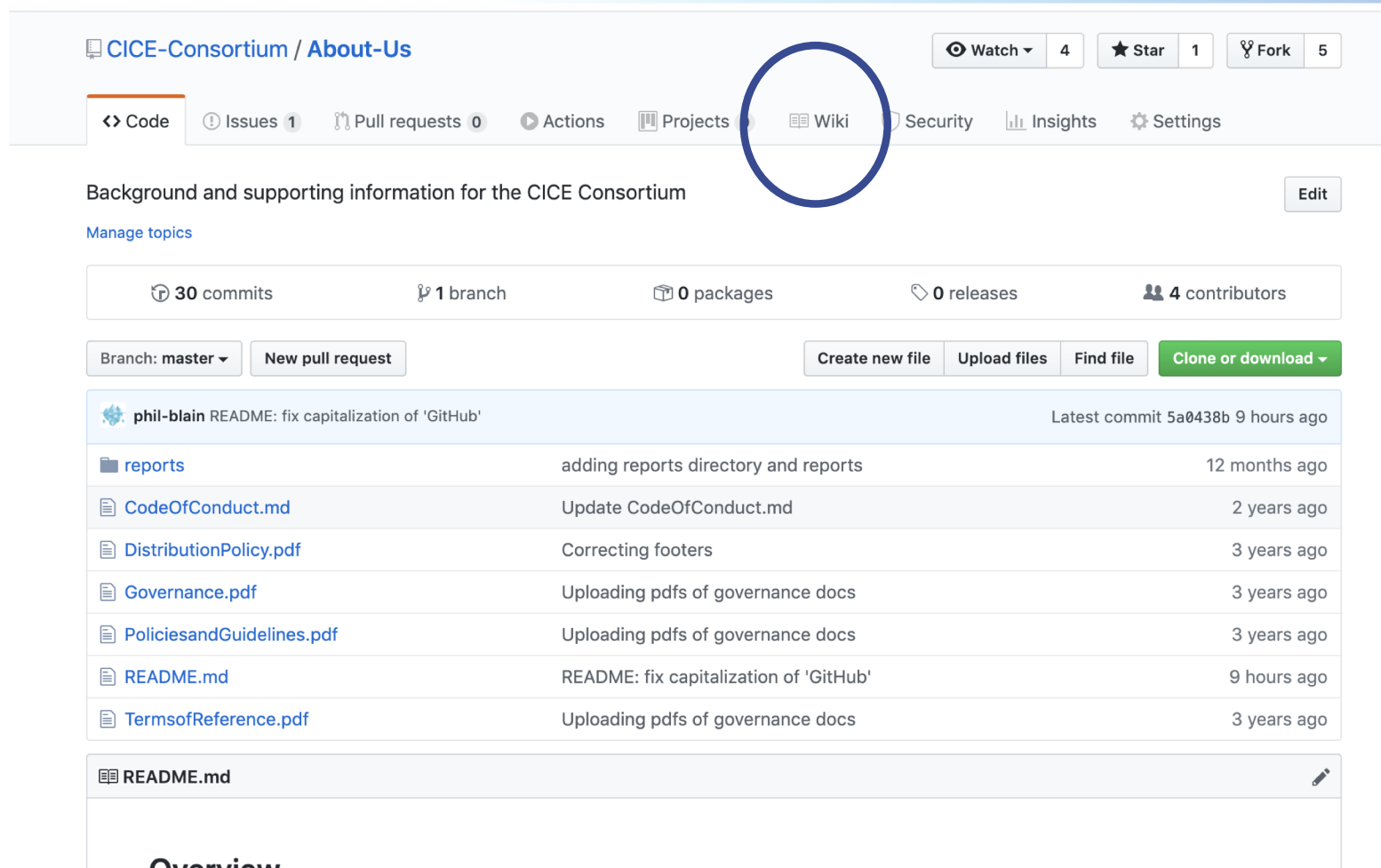
README.md

Overview





# Consortium Github – About-Us



CICE-Consortium / About-Us

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Background and supporting information for the CICE Consortium [Edit](#)

[Manage topics](#)

30 commits 1 branch 0 packages 0 releases 4 contributors

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

phil-blain README: fix capitalization of 'GitHub' Latest commit 5a0438b 9 hours ago

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CodeOfConduct.md	Update CodeOfConduct.md	2 years ago
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PoliciesandGuidelines.pdf	Uploading pdfs of governance docs	3 years ago
README.md	README: fix capitalization of 'GitHub'	9 hours ago
TermsOfReference.pdf	Uploading pdfs of governance docs	3 years ago

README.md



# Consortium Github – About-Us

## Welcome to the CICE Consortium!

The CICE Consortium is a group of stakeholders and primary developers of the Los Alamos sea ice model (CICE), formed to maintain the current CICE model for existing and new users, to incorporate and maintain new research and development, and to accelerate scientific sea ice model development and its transfer into operational use.

Please see the [About-US README.md](#) for basic information about the Consortium.

## Code repositories

- <https://github.com/CICE-Consortium/CICE>
- <https://github.com/CICE-Consortium/Icepack>
- <https://github.com/CICE-Consortium/Test-Results>
- <https://github.com/CICE-Consortium/CICE-svn-trunk>

The column physics portion of the code is 'Icepack'. CICE includes Icepack as a git submodule. Code documentation is included within each code repository, and links to data and additional information and numbered model releases can be found on the wiki pages of each repository.

## More information

See the [Resource Index](#) and pages linked at right for further information.

CICE Consortium

Pages 14

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[Overview](#)

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[Organization and Governance](#)

[News and Highlights](#)

[List of publications](#)

[Contact Information](#)

[Community Forum](#)

[CICE releases](#)

[Icepack releases](#)

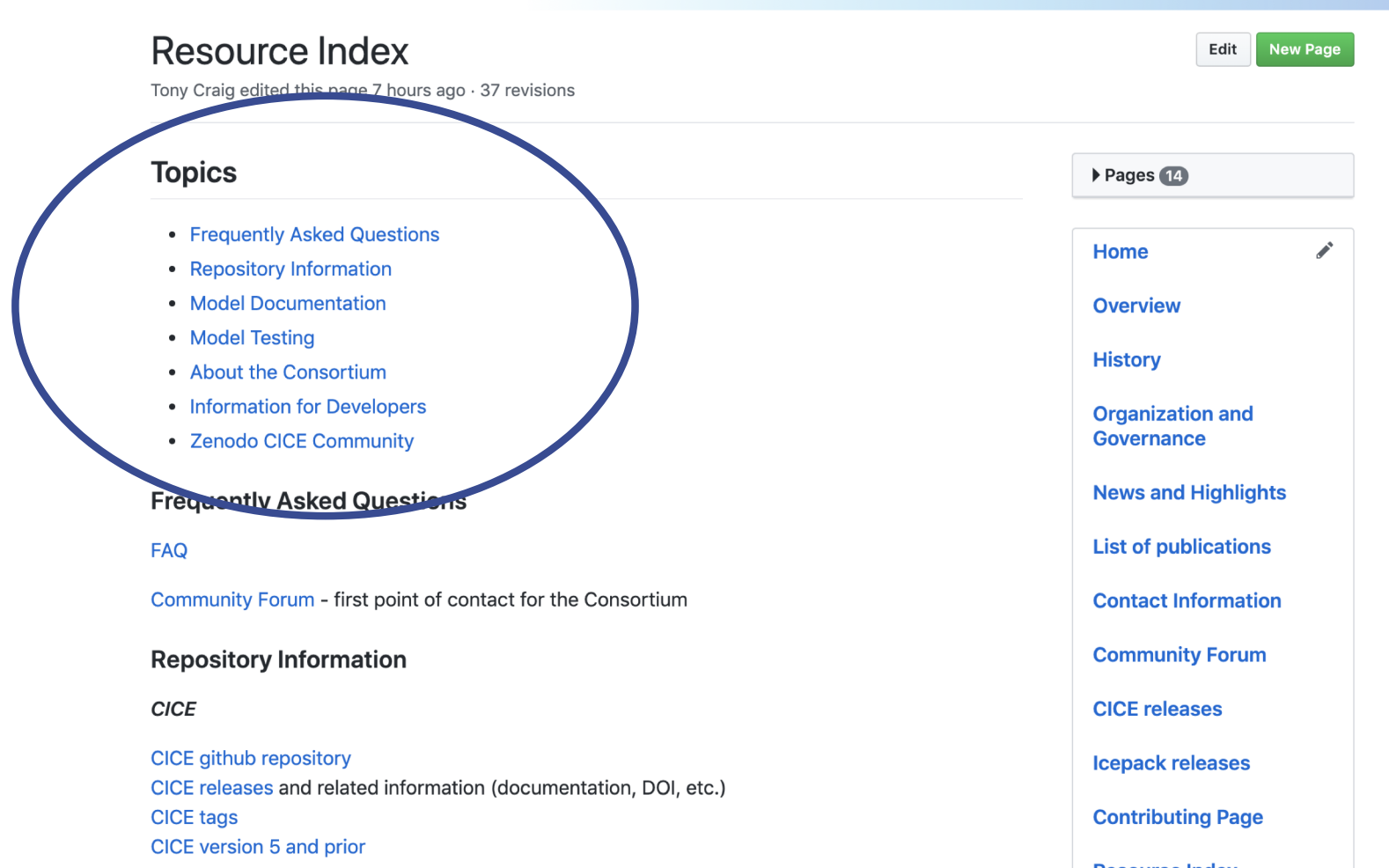
[Contributing Page](#)

[Resource Index](#)

[Frequently Asked Questions](#)



# Consortium Github – About-Us



**Resource Index** Edit New Page

Tony Craig edited this page 7 hours ago · 37 revisions

## Topics

- [Frequently Asked Questions](#)
- [Repository Information](#)
- [Model Documentation](#)
- [Model Testing](#)
- [About the Consortium](#)
- [Information for Developers](#)
- [Zenodo CICE Community](#)

## Frequently Asked Questions

[FAQ](#)

[Community Forum](#) - first point of contact for the Consortium

## Repository Information

**CICE**

[CICE github repository](#)

[CICE releases](#) and related information (documentation, DOI, etc.)

[CICE tags](#)

[CICE version 5 and prior](#)

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# Consortium Community Forum

NCAR  
CGD

DiscussCESM

ForumsWhat's newMembers

duvivie

New postsFind threadsWatchedSearch forumsMark forums read

Forums > Sea Ice >

## CICE Consortium

The CICE Consortium is a group of stakeholders and primary developers of the Los Alamos sea ice model (CICE), formed to maintain the current CICE model for existing and maintain new research and development, and to accelerate scientific sea ice model development and its transfer into operational use. Sea ice modeling and development Details and documentation available at <https://github.com/CICE-Consortium>

D

Thread title

B

**CESM\_postprocessing ice\_averages missing grid files** postprocessing

bengtsjolen · Jan 25, 2020

Edit

Replies: 2  
Views: 27

M

**SST restoring** cice consortium

marte\_maq · Jan 9, 2020

Edit

Replies: 1  
Views: 63

W

**Inquiry about seaice thickness output with timeseries.csh** cice consortium

wangxiong · Dec 26, 2019

Edit

Replies: 2  
Views: 76

M

**Help a college student!** cice consortium

Mal · Dec 14, 2019

Edit

Replies: 1  
Views: 104

Y

**Question about the default forcing data on Github** cice consortium

Yeo-jeong · Dec 10, 2019

Edit

Replies: 4  
Views: 128

W

**CICE case with RI 99 scheme init vertical profile error** cice consortium

Replies: 2



# Consortium Github – CICE

CICE-Consortium / CICE

Unwatch 11 Unstar 20 Fork 53

Code Issues 42 Pull requests 3 Actions Projects 6 Wiki Security Insights Settings

Development repository for the CICE sea-ice model [Edit](#)

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662 commits 3 branches 0 packages 5 releases 1 environment 14 contributors

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

duviver cleaning up minor documentation (#397) Latest commit 0011980 yesterday

.github	Updating a few documentation issues (#364)	5 months ago
cicecore	fsd2 (#394)	8 days ago
configuration	Add conda environment to run on personal computers (#393)	7 days ago
doc	cleaning up minor documentation (#397)	yesterday
icepack @ 2fa887f	fsd2 (#394)	8 days ago
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.gitignore	Update zenodo json template and report_results script (#370)	3 months ago
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# Consortium Github – CICE

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[Manage topics](#)

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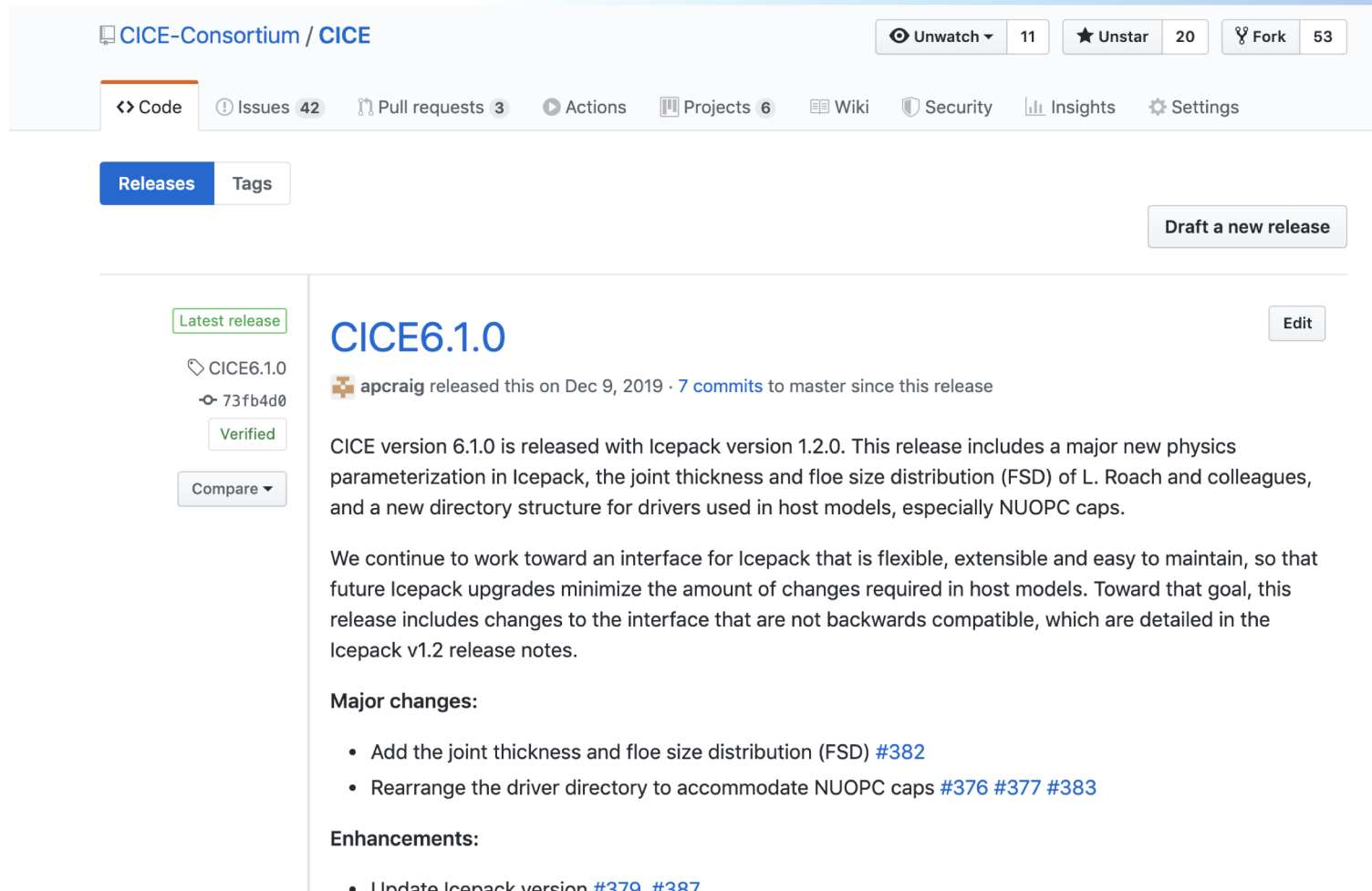
duvivial cleaning up minor documentation (#397) Latest commit 0011980 yesterday

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DistributionPolicy.pdf	Addina distribution policv as separate document	3 years ago





# Consortium Github – CICE



The screenshot displays the GitHub interface for the CICE-Consortium / CICE repository. At the top, navigation links include Code, Issues (42), Pull requests (3), Actions, Projects (6), Wiki, Security, Insights, and Settings. On the right, there are buttons for Unwatch (11), Unstar (20), and Fork (53). Below the navigation bar, the 'Releases' tab is selected, showing a list of releases. The latest release, CICE6.1.0, is highlighted with a green 'Latest release' badge. It was released by 'apcraig' on Dec 9, 2019, with 7 commits to master since the release. The release description states: 'CICE version 6.1.0 is released with Icepack version 1.2.0. This release includes a major new physics parameterization in Icepack, the joint thickness and floe size distribution (FSD) of L. Roach and colleagues, and a new directory structure for drivers used in host models, especially NUOPC caps. We continue to work toward an interface for Icepack that is flexible, extensible and easy to maintain, so that future Icepack upgrades minimize the amount of changes required in host models. Toward that goal, this release includes changes to the interface that are not backwards compatible, which are detailed in the Icepack v1.2 release notes.' The release also lists major changes and enhancements.

**Latest release**

CICE6.1.0  
73fb4d0  
Verified  
Compare

**CICE6.1.0** Edit

apcraig released this on Dec 9, 2019 · 7 commits to master since this release

CICE version 6.1.0 is released with Icepack version 1.2.0. This release includes a major new physics parameterization in Icepack, the joint thickness and floe size distribution (FSD) of L. Roach and colleagues, and a new directory structure for drivers used in host models, especially NUOPC caps.

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**Major changes:**

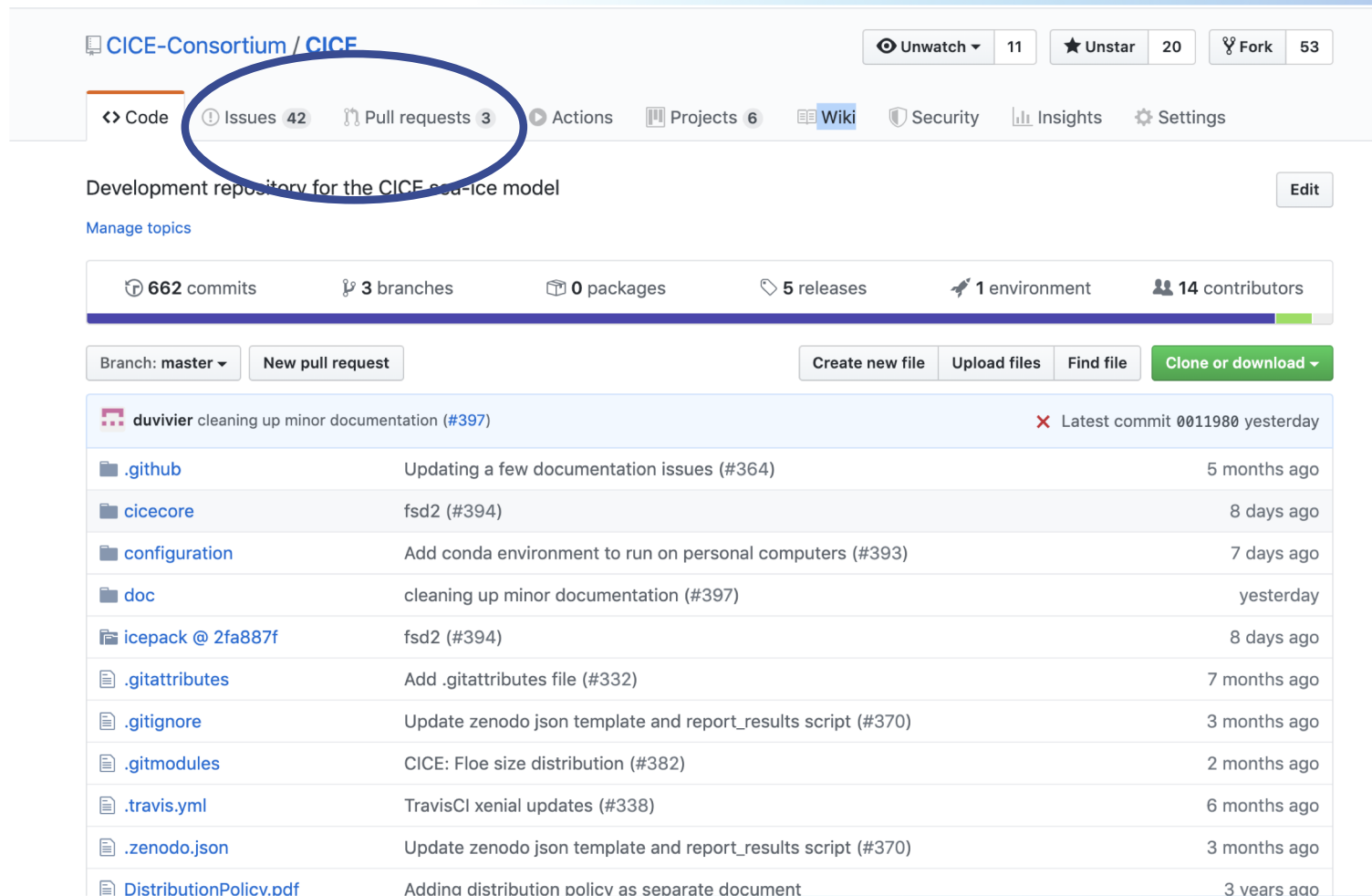
- Add the joint thickness and floe size distribution (FSD) [#382](#)
- Rearrange the driver directory to accommodate NUOPC caps [#376](#) [#377](#) [#383](#)

**Enhancements:**

- Update Icepack version [#379](#). [#387](#)



# Consortium Github – CICE



CICE-Consortium / CICE

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DistributionPolicy.pdf	Addina distribution policv as separate document	3 years ago





# Consortium Github – CICE

CICE-Consortium / CICE

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Code Issues 42 Pull requests 3 Actions Projects 6 Wiki Security Insights Settings

Label issues and pull requests for new contributors [Dismiss](#)

Now, GitHub will help potential first-time contributors [discover issues](#) labeled with [good first issue](#)

[Go to Labels](#)

Filters is:issue is:open Labels 20 Milestones 0 [New issue](#)

<input type="checkbox"/>	42 Open ✓ 113 Closed	Author	Label	Projects	Milestones	Assignee	Sort
<input type="checkbox"/>	<a href="#">default forcing parameters in namelist</a> #390 opened on Dec 11, 2019 by eclare108213						
<input type="checkbox"/>	<a href="#">Add CONTRIBUTING.md</a> <a href="#">Documentation</a> <a href="#">Priority: High</a> <a href="#">Type: Feature</a> #384 opened on Dec 5, 2019 by phil-blain						
<input type="checkbox"/>	<a href="#">CICE and Icepack Namelist Documentation</a> <a href="#">Documentation</a> <a href="#">Priority: Low</a> #375 opened on Oct 25, 2019 by apcraig						2
<input type="checkbox"/>	<a href="#">forcing data</a> <a href="#">Documentation</a> #374 opened on Oct 25, 2019 by Yukai12345						8
<input type="checkbox"/>	<a href="#">Modernize MPI interface</a> <a href="#">Priority: Medium</a> <a href="#">Software Engineering</a> #363 opened on Sep 18, 2019 by phil-blain						7



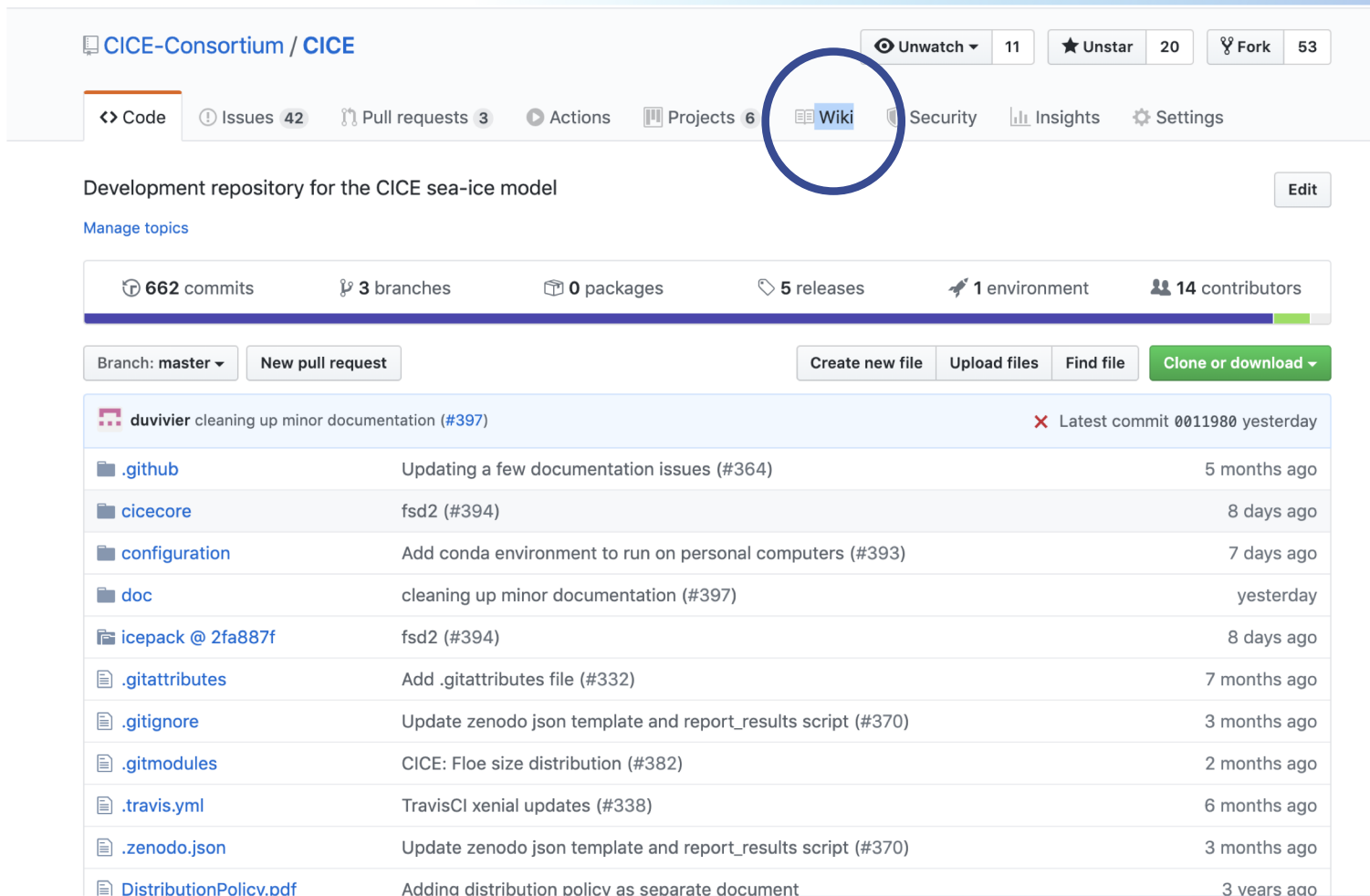
# Consortium Github – CICE

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# Consortium Github – CICE



**CICE-Consortium / CICE**

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Code Issues 42 Pull requests 3 Actions Projects 6 **Wiki** Security Insights Settings

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<b>.zenodo.json</b>	Update zenodo json template and report_results script (#370)	3 months ago
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# Consortium Github – CICE

## Welcome to the **CICE** wiki!

This repository contains the CICE sea ice numerical model starting with version 6.

[LICENSE.pdf](#)

CICE is now licensed for use through the CICE Consortium.

[Icepack](#)

The column physics portion of the CICE code, 'Icepack', is kept in a separate repository. CICE includes Icepack as a git submodule.

[CICE-svn-trunk wiki](#)

Information for CICE prior to version 6.

## Releases

[CICE Version Index](#)

Numbered CICE releases since version 6, including documentation. Each release is available as branches in this repository or as tarballs.

[CICE Recent-Changes](#)

Information about developments on the master branch since the last numbered release.

## More information

The [Community Forum](#) is the first point of contact for the Consortium to discuss model development including bugs, diagnostics, and future directions.

See the [Resource Index](#) and pages listed at right for further information.

► Pages **6**

[CICE Home](#)

[CICE Releases](#)

[CICE Recent Changes](#)

[CICE Input Data](#)

[Resource Index](#)

Clone this wiki locally

<https://github.com/CICE->



# Consortium Github – CICE

## CICE Version Index

Elizabeth Hunke edited this page on Dec 9, 2019 · 37 revisions

[Edit](#)[New Page](#)

version	release page	repository	documentation	DOI	
master		<a href="#">repo</a>	<a href="#">html, pdf</a>		
CICE6.1.0 2019-Dec-09	<a href="#">release</a>	<a href="#">repo</a>	<a href="#">html, pdf</a>	10.5281/zenodo.3568214	t c
CICE6.0.2 2019-Oct-16	<a href="#">release</a>	<a href="#">repo</a>	<a href="#">html, pdf</a>	<a href="#">10.5281/zenodo.3516944</a>	t c
CICE6.0.1 2019-Jul-25	<a href="#">release</a>	<a href="#">repo</a>	<a href="#">html, pdf</a>	10.5281/zenodo.3351684	t c
CICE6.0.0 2018-Dec-03	<a href="#">release</a>	<a href="#">repo</a>	<a href="#">html, pdf</a>	10.5281/zenodo.1900639	t c
CICE6.0.0.alpha 2018-Mar-22	<a href="#">release</a>	<a href="#">repo</a>	<a href="#">html, pdf</a>	10.5281/zenodo.1205675	

► Pages 6

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<https://github.com/CICE->



The DOI links include citation instructions.

Releases prior to version 6: [CICE-svn-trunk](#)





# CICE documentation

CICE documentation »

**Next topic**  
1. Introduction - CICE

**This Page**  
[Show Source](#)

**Quick search**  
 [Go](#)

## CICE Documentation

- 1. Introduction - CICE
  - 1.1. About CICE
  - 1.2. Quick Start
  - 1.3. Acknowledgements
  - 1.4. Citing the CICE code
  - 1.5. Copyright
- 2. Science Guide
  - 2.1. Coupling With Other Climate Model Components
  - 2.2. Fundamental Variables
  - 2.3. Tracers
  - 2.4. Horizontal Transport
  - 2.5. Dynamics
- 3. User Guide
  - 3.1. Implementation
  - 3.2. Running CICE
  - 3.3. Testing CICE
  - 3.4. Case Settings
  - 3.5. Troubleshooting
- 4. Developer Guide
  - 4.1. About Development
  - 4.2. Dynamics
  - 4.3. Infrastructure
  - 4.4. Driver and Coupling
  - 4.5. Icepack
  - 4.6. Scripts
  - 4.7. Other things
- 5. Index of primary variables and parameters
- 6. References
- Search Page



# CICE 6 directory structure

## Table of Contents

- 3.1. Implementation
  - 3.1.1. Directory structure
  - 3.1.2. Grid, boundary conditions and masks
    - 3.1.2.1. Grid domains and blocks
    - 3.1.2.2. Tripole grids
    - 3.1.2.3. Vertical Grids
    - 3.1.2.4. Boundary conditions
    - 3.1.2.5. Masks
    - 3.1.2.6. Performance
  - 3.1.3. Initialization and coupling
  - 3.1.4. Choosing an appropriate time step
  - 3.1.5. Model output
    - 3.1.5.1. History files
    - 3.1.5.2. Diagnostic files
    - 3.1.5.3. Restart files

## Previous topic

[3. User Guide](#)

## Next topic

[3.2. Running CICE](#)

## This Page

[Show Source](#)

## Quick search

### 3.1.1. Directory structure

The present code distribution includes source code and scripts. Forcing data is available from the ftp site. The directory structure of CICE is as follows

#### **LICENSE.pdf**

license for using and sharing the code

#### **DistributionPolicy.pdf**

policy for using and sharing the code

#### **README.md**

basic information and pointers

#### **icepack/**

the Icepack module. The icepack subdirectory includes Icepack specific scripts, drivers, and documentation. CICE only uses the columnphysics source code under **icepack/columnphysics/**.

#### **cicecore/**

CICE source code

#### **cicecore/cicedynB/**

routines associated with the dynamics core

#### **cicecore/drivers/**

top-level CICE drivers and coupling layers

#### **cicecore/shared/**

CICE source code that is independent of the dynamical core

#### **cicecore/version.txt**

file that indicates the CICE model version.

#### **configuration/scripts/**

support scripts, see [Scripts](#)



# Consortium Github – CICE

CICE-Consortium / CICE

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<> Code Issues 42 Pull requests 3 Actions Projects 6 Wiki Security Insights Settings

Development repository for the CICE sea-ice model [Edit](#)

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662 commits 3 branches 0 packages 5 releases 1 environment 14 contributors

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# Consortium Github – Icepack

CICE-Consortium / Icepack

Unwatch 9 Star 12 Fork 48

Code Issues 15 Pull requests 3 Actions Projects 0 Wiki Security Insights Settings

Development repository for sea-ice column physics [Edit](#)

[Manage topics](#)

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duviver changing BB to forum (#292) ✓ Latest commit 82b5659 yesterday

.github	Updating PR template, doc links to PR info (#260)	8 months ago
columnphysics	Update tracer init/query routines and Update documentation (#289)	2 months ago
configuration	report_results.csh: add html anchors to hashes and machines (#290)	last month
doc	Update tracer init/query routines and Update documentation (#289)	2 months ago
.gitignore	update zenodo json template and report_results script (#278)	3 months ago
.travis.yml	update travisCI to xenial build environment (#265)	6 months ago
.zenodo.json	update zenodo json template and report_results script (#278)	3 months ago
DistributionPolicy.pdf	Moving distribution policy text from README.md to pdf file	3 years ago
LICENSE.pdf	correction to license file	14 months ago
README.md	changing BB to forum (#292)	yesterday
icepack.setup	Implement Floe Size Distribution (FSD) in Icepack (#281)	2 months ago



# Consortium Github – Icepack

## Welcome to the [Icepack](#) wiki!

This repository contains the Icepack sea ice column physics code, which was separated from the [CICE](#) sea ice numerical model after CICE v5.1.2 was released. CICE includes Icepack as a git submodule. Icepack is also downloaded automatically when CICE is cloned. However, we recommend making changes to Icepack via a separate repository rather than using the version linked as a CICE submodule, unless changes to CICE must also be made concurrently.

[LICENSE.pdf](#)

Icepack is licensed for use through the CICE Consortium.

## Releases

[Icepack Version Index](#)

Numbered Icepack releases, including documentation. Each release is available as branches in this repository or as tarballs.

[Icepack Recent Changes](#)

Information about developments on the master branch since the last numbered release.

Icepack releases are “functional releases” in the sense that the code runs, does not crash, passes various tests, and requires further work to establish its scientific validity. In general, users are *not* encouraged to use any of the CICE Consortium’s model configurations to obtain “scientific” results. The test configurations are useful for model development, but sea ice models must be evaluated from a physical standpoint in a coupled system because simplified configurations do not necessarily represent what is actually happening in the fully coupled system that includes interactive ocean and atmosphere components.

## More information

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<https://github.com/CICE->



# Icepack documentation

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# Icepack directory structure

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## 3.1.1. Directory structure

The present code distribution includes source code for the column physics, source code for the driver, and the scripts. Forcing data is available from the ftp site. The directory structure of Icepack is as follows. All column-physics filename have a prefix of `icepack_` and all driver files are prefixed with `icedrv_`.

**LICENSE.pdf**  
license for using and sharing the code

**DistributionPolicy.pdf**  
policy for using and sharing the code

**README.md**  
basic information and pointers

**columnphysics/**  
columnphysics source code, see [Icepack Column Physics](#)

**configuration/scripts/**  
support scripts, see [Scripts Implementation](#)

**configuration/driver/**  
icepack driver code, see [Driver Implementation](#)

**doc/**  
documentation

**icepack.setup**  
main icepack script for creating cases

A case (compile) directory is created upon initial execution of the script **icepack.setup** at the user-specified location provided after the `-c` flag. Executing the command `./icepack.setup -h` provides helpful information for this tool.

## 3.1.2. Grid and boundary conditions



- Questions?

