Land Ice Verification and Validation Kit

PISCEES project V&V team: Kate Evans, Pat Worley, Matt Norman, Adrianna Boghozian, ORNL
Steve Price and Matt Hoffman, LANL
LIVV kit strategy

- Provide verification test suite for CISM testing as standalone and within CESM
- Validation of production GIS, ANT runs to follow
- Python and NCL based code sits within CISM repo
- Based on glide dycore, but extensible to others with access to output format to parse/process
- Comes with build, submit, and LIVV set-up script designed for NERSC and OLCF platforms
- Mac and other platforms to follow
Basic Workflow on LCF systems

- Access to code on hopper/titan
  - Load the software environment specified in the script heading
  - Run the master build script. If successful, it will launch the submit scripts to the machines
  - Check for successful job completion

- Access to LIVV carver/lens
  - Load the software environment specified in the script heading
  - Copy the /higher-order directory from CISM to the scratch space
  - Specify several options in the script, such as website location, comment, whether to run tests or production evaluation
  - Execute the script, view the website
Title Page: Access Production or Test Suite output

Land Ice Validation package
Performed on 12-31-2012-12:07 PM
Test case comment: evaluating code and test suite for CISM2.0 release

Basic Test Suite Diagnostics
Production Configure Diagnostics
Production Output Diagnostics
Ice Thickness

For Additional Information:
Kate Evans
Oak Ridge National Laboratory
1 Bethel Valley Road
Oak Ridge, Tennessee 37831-6015
Email: evanskj at ornl dot gov

*Website location can be set as a subdirectory of a project*
Test Suite Diagnostics

Test Suite Descriptions

Diagnostic Dome 30 Test:
- Diagnostic Dome 30 Velocity Solver Details
- Diagnostic Dome 30 Case Details
- Diagnostic Dome 30 Plots

Evolving Dome 30 Test:
- Evolving Dome 30 Velocity Solver Details
- Evolving Dome 30 Case Details
- Evolving Dome 30 Plots

Circular Shelf Test
- Circular Shelf Velocity Solver Details
- Circular Shelf Case Details
- Circular Shelf Plots

Confined Shelf Test
- Confined Shelf Velocity Solver Details
- Confined Shelf Case Details
- Confined Shelf Plot

ISMIP HOM A 80km Test
- ISMIP HOM A 80km Velocity Solver Details
- ISMIP HOM A 80km Case Details
- ISMIP HOM A 80km Plots

ISMIP HOM C 80km Test
- ISMIP HOM C 80km Velocity Solver Details
- ISMIP HOM C 80km Case Details
- ISMIP HOM C 80km Plots

GIS 10km Tests
- GIS 10km Velocity Solver Details
- GIS 10km Case Details
- GIS 10km Plots

Velocity Solver Details
- Iteration count
- Nonlinear and Linear information in plot or list form

Case Details
- Relevant settings provided as a reference and comparison to the benchmark
- Changes from benchmark are highlighted in red with both values

Output plots for comparison to the benchmarks

Coming soon! Solver settings
Velocity Solver Information

- Nonlinear and average linear iteration count for each time step are presented.
- Coming soon! Separate plot showing the characteristics of the linear solver and preconditioner linear solver breakdown etc.
Test Configurations

Presented for each case and highlighted if different from the benchmark

Settings within the code are not incorporated

Settings to investigate in the code should be moved to runtime options

Dome 30 Case Details:

Configure file Settings

Output available from test run: thk usurf uvel vvel wvel vellnorm temp
Grid Size (vert by ew by ns): 10x30x30
Grid Spacing (ew by ns): 2000x2000
Start/End Time: 0.,10., Number of time steps = 10.0

Parameters

------------------------
flow_factor = 1
ice_limit = 0

Options

------------------------
dycore = 1
flow_law = 2
evolution = 3
temperature = 3

HO Options

------------------------
diagnostic_scheme = 1
which_ho_babc = 4
which_ho_elvs = 0
Test Configurations

- Presented for each case and highlighted if different from the benchmark
- Settings within the code are not incorporated
- Settings to investigate in the code should be moved to runtime options

**Dome 30 Case Details:**

Configure file Settings

Output available from test run: thk usurf uvel vvel wvel velnorm temp
Grid Size (vert by ew by ns): 10x30x30
Grid Spacing (ew by ns): 2000x2000
Start/End Time: 0.,10., Number of time steps = 10.0

Parameters
---------------
flow_factor = 1
ice_limit = 0

Options
---------------
dycore = 1
flow_law = 2
evolution = 3
temperature = 0 different than benchmark value: 3

HO Options
---------------
diagnostic_scheme = 1
which_ho_babc = 4
which_ho_efvs = 0
Plots of Test Results: Designed to catch differences

Circular Shelf Plot Details:
Difference from benchmark for a range of processor counts for a range of variables

GIS 10km Plot Details:
Difference from benchmark for a range of processor counts for a range of variables
Key to successful model long term development

- Tests that exercises as much of the code as possible (more relevant tests)
- Is easy to use (we are busy and will cheat in running the tests if it's hard or takes a long time)
- Provides information about the results and the model performance (solver data and scaling)
- What else?
Coming soon: Automated Regression testing

- We should have tests that run automatically to catch issues quickly

- HOMME developers are also setting this up as we speak (and they have been around for 10 years)

- Should we have some thing hooked up to CESM as well?
Next steps: Validation

or, “putting the V in V&V”

- Production runs of GIS (ANT is stubbed out) can be evaluated like a test case
- Variables, time steps, need to be added
- Plots of performance: scaling, solver behavior, parameter choices
- Large datasets require parallel performance, link to S-DAV, ESG, Visit, Paraview
50 year GIS Test SS Run

Job Output Diagnostics

Iteration Count for Nonlinear and Linear Solver

Number of Processors = 1500
Number of Nonlinear Iterations = 11, 8, 15, 21, 5, 17, 25, 5, 20, 17, 15, 150, 30, 16, 19, 20, 5, 15, 12, 11, 9, 5, 5, 5, 17, 180, 48, 37, 18, 14, 11, 4, 10, 4, 9, 4, 4, 4, 4, 24, 4, 20, 5, 21, 5, 5, 23.

***TIME STEPS WHICH FAILED TO CONVERGE

Working with SDAV to analyze ice2sea CISM runs

Residence time: a record of how far an ice particle travels

Visualizations created by Dave Pugmire, ORNL, SciDAC SDAV project
Connecting to CESM
(the model and the scientists)

- We want CESM users to measure the impact on CISM of changes made to the CESM, or SMB
- Making connections to AMWG, PCWG, LMWG
- How will CESM folks decide what options of CISM are best to use for their configurations?
  - Dycore choice
  - Resolution
  - Parameter settings
  - Processor layout
Segue to ice sheet movies. 
meantime …

Happy Birthday, Andy!