Regression Testing

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What is regression testing?

The purpose of regression testing is to confirm that a recent program or code change has not adversely affected existing features.

When do we do it?

Whenever we make a change.

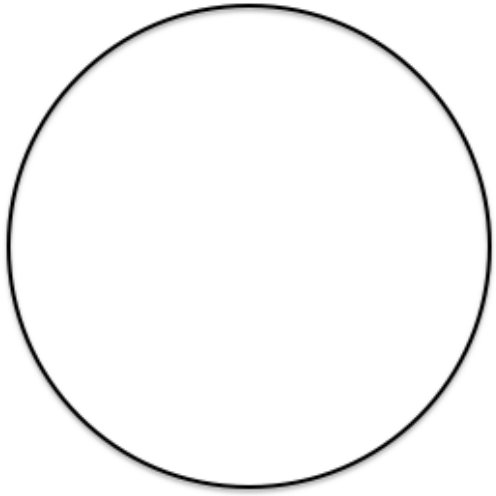
How do we do it?

There are various ways:

- Re-run existing test cases
- Exploratory testing
- Automated execution and assertion of acceptance criteria

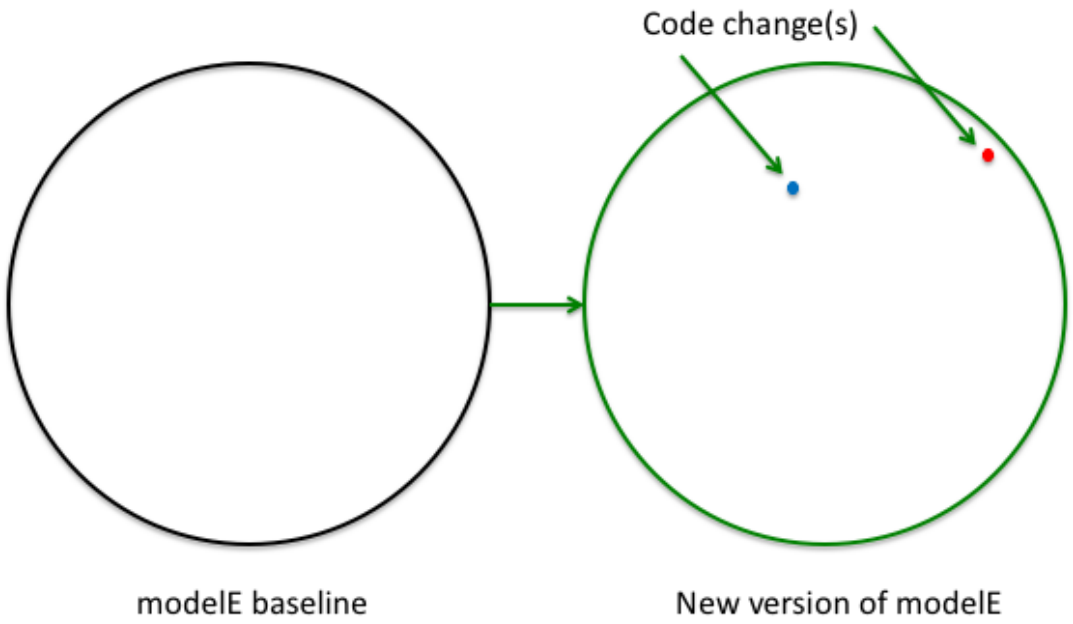
Aim for maximum code coverage

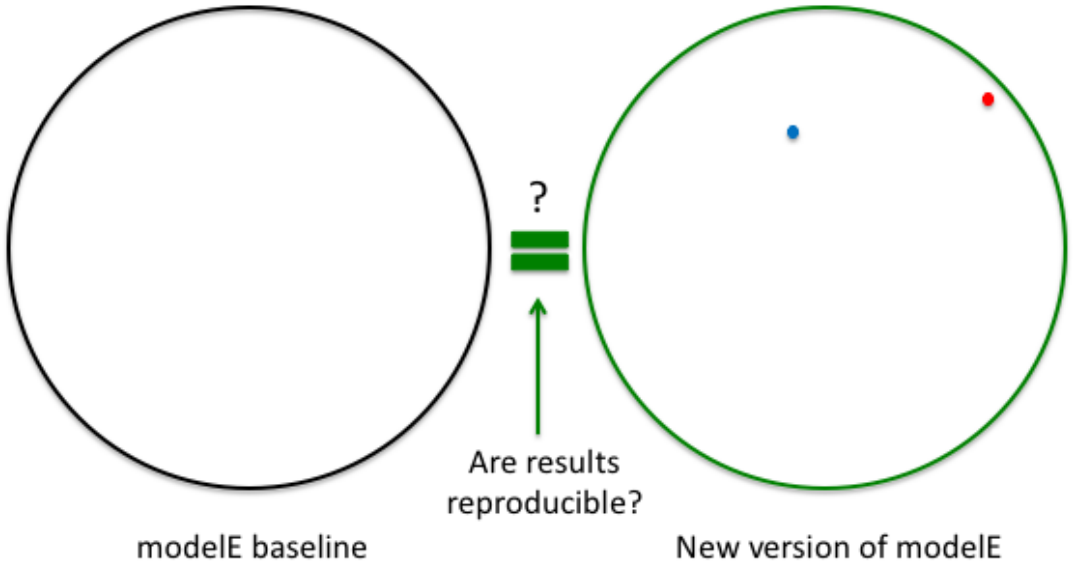
Example: GISS modelE

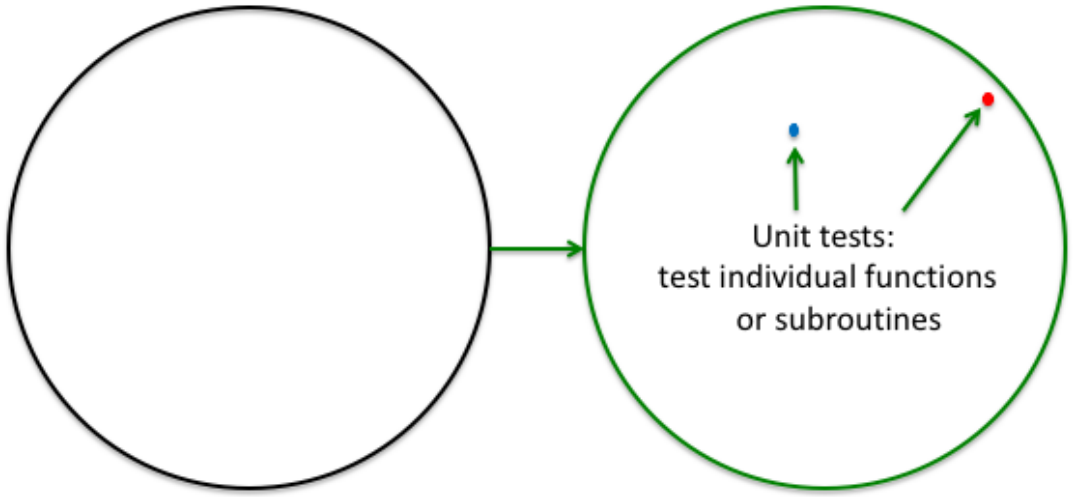


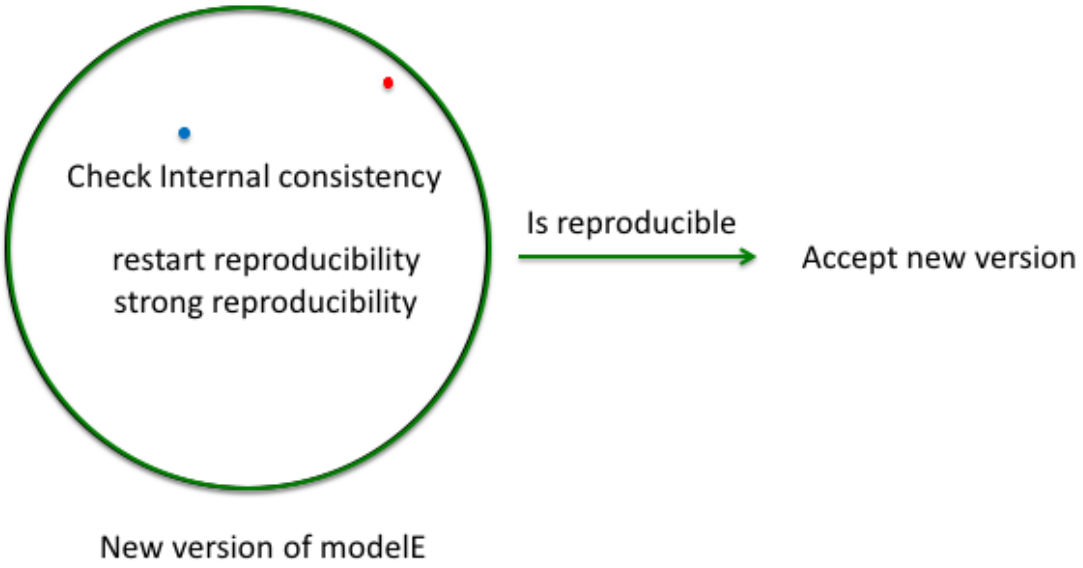
modelE baseline

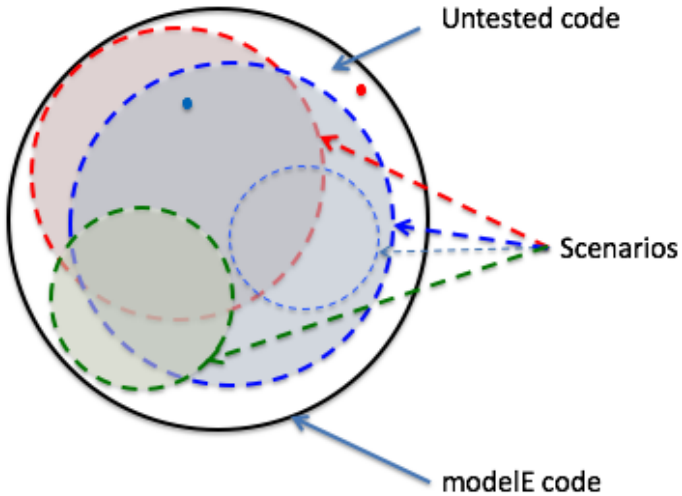
*https://www.giss.nasa.gov/tools/modelE/


Code change(s)
modelE baseline
New version of modelE


?
Are results reproducible?
modelE baseline
New version of modelE


Unit tests:
test individual functions
or subroutines
modelE baseline
New version of modelE


Check Internal consistency
restart reproducibility
strong reproducibility
Is reproducible
Accept new version
New version of modelE



- Other recommendations[1]:
  - Test with multiple compiler vendors
  - Multiple modes (serial and MPI)
  - Multiple NPEs

[1] Increases *cost*

Results

```
Regression testing of modelE E2.1_branch branch
Repository: /discover/nobackup/ccruz/devel/modelE.clones/simplex/E2.1_branch
================================================================================
Branch: E2.1_branch  --  Build type: release
================================================================================
                                                          -REPRODUCIBILITY
              RUNDECK  COMPILER    MODE    RUN    UNT    BAS    RST    NPE
================================================================================
               E1oM20  gfortran     mpi      +      -      +      +      +
               E1oM20  gfortran  serial      +      -      +      +      -
               E1oM20     intel     mpi      +      -      +      +      +
               E1oM20     intel  serial      +      -      +      +      -
           E4TcadC12  gfortran     mpi      +      -      3      6      3
           E4TcadC12  gfortran  serial      +      -      +      3      -
           E4TcadC12     intel     mpi      +      -      +      3      +
           E4TcadC12     intel  serial      +      -      +      3      -
               E6F40  gfortran     mpi      +      -      +      +      +
               E6F40  gfortran  serial      +      -      +      +      -
               E6F40     intel     mpi      +      -      +      +      +
               E6F40     intel  serial      +      -      +      +      -
     E6TlernerpsvF40  gfortran     mpi      +      -      +      3      +
     E6TlernerpsvF40  gfortran  serial      +      -      +      3      -
     E6TlernerpsvF40     intel     mpi      +      -      +      3      +
     E6TlernerpsvF40     intel  serial      +      -      +      3      -
        E6TmatrixF40  gfortran     mpi      +      -      +      1      -
        E6TmatrixF40     intel     mpi      +      -      +      1      -
           E6TomaF40  gfortran     mpi      +      -      +      4      -
           E6TomaF40     intel     mpi      +      -      +      4      -
        E6TomaF40int  gfortran     mpi      +      -      +      4      -
        E6TomaF40int     intel     mpi      +      -    455      8      -
 E6TtomasF40clim2000  gfortran     mpi      +      -      +      4      -
 E6TtomasF40clim2000     intel     mpi      +      -      +      4      -
           E6TvsdF40  gfortran     mpi      +      -      +      +      +
           E6TvsdF40  gfortran  serial      +      -      +      +      -
           E6TvsdF40     intel     mpi      +      -      +      +      -
           E6TvsdF40     intel  serial      +      -      +      +      -
          E6TwisoF40  gfortran     mpi      +      -      +      4      -
          E6TwisoF40  gfortran  serial      +      -      +      4      -
          E6TwisoF40     intel     mpi      +      -      +      4      -
          E6TwisoF40     intel  serial      +      -      +      4      -
           E_AR5_C12  gfortran     mpi      +      -      3      3      3
           E_AR5_C12  gfortran  serial      +      -      3      +      -
           E_AR5_C12     intel     mpi      +      -      +      +      -
           E_AR5_C12     intel  serial      +      -      +      +      -
                EM20  gfortran     mpi      +      -      +      +      +
                EM20  gfortran  serial      +      -      +      +      -
                EM20     intel     mpi      +      -      +      +      +
                EM20     intel  serial      +      -      +      +      -
      ENINT2.1otrac     intel     mpi      +      -      -      -      -
              LLF40  gfortran     mpi      +      -      +      +      -
              LLF40  gfortran  serial      +      -      +      +      -
              LLF40     intel     mpi      +      -      +      +      +
              LLF40     intel  serial      +      -      +      +      -
            SGP4TESTS  gfortran  serial      +      -      +     F*      -
            SGP4TESTS     intel  serial      +      -      +     F*      -
================================================================================
Time taken = 01:18:14
================================================================================
Legend:
-------
+    : success
C    : created baseline
Fb   : build failure
F1   : 1hr run-time failure
Fr   : restart run-time failure
F*   : expected failure
U    : unexpected system failure
NUM  : number of reproducibility differences
-    : not available
Notes:
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intel compiler version: 14.0.3.174
gfortran compiler version: 4.9.1
Results in: /discover/nobackup/ccruz/regTesting/modelE/E2.1_branch/results/E2.1_branch
================================================================================
Commits from last day:
d90f0bd - Gary L. Russell, 9 hours ago : Merging master with LAKES2.F90 commit.
1c51258 - Gary L. Russell, 10 hours ago : LAKES2.F90 differs from LAKES.f by the following:
```

Results

```
Regression testing of NU-WRF Charney patch 1 code base
Repository: /discover/nobackup/ccruz/devel/nu-wrf/code/nu-wrf
--------------------------------------------------------------------------------
Branch: develop  --  Build type: release
--------------------------------------------------------------------------------
         BUILD and/or RUN NAME                COMPILER         RESULT   BASELINE
--------------------------------------------------------------------------------
                  chem                      intel-sgimpt        b+        -
                  kpp                       intel-sgimpt        b+        -
                  scm                       intel-sgimpt        b+        -
                  wrf                       intel-sgimpt        b+        -
       chem_3iceg_2014rad_gocart            intel-sgimpt        r+        vF
       chem_3iceh_2014rad_gocart            intel-sgimpt        r+        vF
        chem_4ice_2014rad_gocart            intel-sgimpt        r+        vF
     chem_4ice_2014rad_merra2aero           intel-sgimpt        r+        vF
      chem_4ice_2014rad_merraero            intel-sgimpt        r+        vF
   chem_4ice_2014rad_offline_gocart         intel-sgimpt        r+        vF
            chem_casaco2                    intel-sgimpt        r+        vF
           chem_erod_dyn                    intel-sgimpt        r+        vF
         chem_erod_dynclimo                 intel-sgimpt        r+        vF
           chem_erod_mdb                    intel-sgimpt        r+        vF
         chem_gfed4_gocart                  intel-sgimpt        r+        vF
          chem_gfed_gocart                  intel-sgimpt        r+        vF
        kpp_gfed4_gocartracm                intel-sgimpt        r+        vF
        kpp_gfed_gocartracm                 intel-sgimpt        r+        vF
         wrf_3iceg_2014rad                  intel-sgimpt        r+        vF
      wrf_3iceg_2014rad_lake_shi            intel-sgimpt        r+        vF
         wrf_3iceh_2014rad                  intel-sgimpt        r+        vF
          wrf_4ice_2014rad                  intel-sgimpt        r+        vF
          wrf_4ice_2017rad                  intel-sgimpt        r+        vF
          wrf_arw_katrina                   intel-sgimpt        r+        vF
            wrf_arw_post                    intel-sgimpt        rF        -
            wrf_arw_rip                     intel-sgimpt        r+        C
           wrf_arw_simple                   intel-sgimpt        r+        vF
      wrflis_nldas2_lis_spinup              intel-sgimpt        r+        vF
     wrflis_noah33_modis_merra2             intel-sgimpt        r+        vF
  wrflis_noah36_justtsk_modis_merra2        intel-sgimpt        r+        vF
      wrflis_noah36_modis_gdas              intel-sgimpt        r+        vF
 wrflis_noah36_modis_gdas_lis_spinup        intel-sgimpt        r+        vF
     wrflis_noah36_modis_merra2             intel-sgimpt        r+        vF
wrflis_noah36_modis_merra2_lis_spinup       intel-sgimpt        r+        vF
    wrflis_noah36_modis_merraland           intel-sgimpt        r+        vF
      wrflis_noah36_umd_merra2              intel-sgimpt        r+        vF
      wrflis_noah36_usgs_merra2             intel-sgimpt        r+        vF
             wrflis_scm                     intel-sgimpt        r+        vF
--------------------------------------------------------------------------------
Time taken = 05:35:48
--------------------------------------------------------------------------------
Legend:
-------
+   : task success
F   : task failure
C   : created baseline
b   : _build_ task
r   : _run_ task
v   : _verification_ task
-   : Not available
Notes:
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intel compiler version: 17.0.4.196
gnu compiler version: 5.2
Results in: /discover/nobackup/projects/nu-wrf/regression_testing/gitrepo/results/
--------------------------------------------------------------------------------
Commits from last day:
f7c31c9c - Carlos Cruz, 13 hours ago : Check for Python version and abort if unsupported.
3f7b3594 - Carlos Cruz, 3 days ago : Major GSDSU revision (by T. Matsui)
--------------------------------------------------------------------------------
```