Incorporating GSW-C 'efiring-simplify' branch within GSW-R

Dan Kelley, Dalhousie University

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Abstract. The GSW-R branch "newc" incorporates the GSW-C branch "efiring-simplify" cleanly, after adding two new arguments to the R version of the `gsw_geo_strf_dyn_height_1` function. All existing check values (covering 217 functions) continue to work properly, on multiple machine architectures and both the release and development versions of R.

1. Procedure

1.1 Update GSW-C to efiring-simplify

```
cd ~/git/GSW-C
git checkout master
git checkout -b efiring-simplify master
git pull https://github.com/efiring/GSW-C.git simplify
```

1.2 Copy the relevant files

I think these are the relevant files. Perhaps E Firing can comment?

```
cd ~/git/GSW-R
cp ~/git/GSW-C/gsw_internal_const.h .
cp ~/git/GSW-C/gsw_oceanographic_toolbox.c .
cp ~/git/GSW-C/gswteos-10.h .
```

1.3 Test whether the saar.rda data file needs to be updated

Since this is built up from the `gsw_data_v3_0.nc` file from GSW-Fortran, we merely need to check that this file has not changed, and

```
md5 ~/git/GSW-C/gsw_data_v3_0.nc
md5 ~/git/GSW-Fortran/test/gsw_data_v3_0.nc
```

reveals that to be the case, both values being `dacb3f981e8e710ac2e83477701b39051`. Thus, there is no need to rebuild the `data/saar.rda` file used by GSW-R.

1.4 Code changes

I had to modify `gsw_geo_strf_dyn_height_1` to accept new args `p_ref` and `interp_method`. This involved minor changes, as below (focusing only on files I altered):

```
git diff HEAD^1 --stat
 R/gsw.R                          |    9 +-
 src/wrappers.c                   |    4 +-
```

1.5 Build and test-value checks

The updated GSW-R builds and tests cleanly on the author's MacOS R-release, Apple LLVM 8.0.0 (clang-800.0.42.1) system, as well as on the following, as checked by `rhub::check_for_cran()`: (1) Ubuntu Linux 16.04 LTS, R-release, GCC; (2) Debian Linux, R-devel, GCC ASAN/UBSAN; (3) Fedora Linux, R-devel, clang, gfortran; and (4) Windows Server 2008 R2 SP1, R-devel, 32/64 bit.

Note that these tests involve (a) doc-code alignment on parameter names and order and (b) numerical tests of check values from the Matlab webpages. The tests are quite extensive, e.g.

```
git grep expect_|wc
    217    1079   19936
```

indicates that several hundred variables are checked. The number of check values is likely about 3 to 5 times that; it depends on how many check values are given for each variable on the Matlab webpages.

2. Conclusion

Updating GSW-R to accept the new GSW-C code from the "efiring-simplify" branch was a simple process. Fairly extensive build-tests (with various compilers, OSs, and R versions) suggest that GSW-R users will not be affected by the switch. The only exception is for users who employ `gsw_geo_strf_dyn_height_1`, but since this broken before (even segfaulting at one point), it seems reasonable to assume that its users will welcome the change (and improvement).

PS. GSW-R users would probably like to know whether they get the same results for `gsw_geo_strf_dyn_height_1` as GSW-Python users get. Perhaps E Firing can supply such values, so I could incorporate them in the docs (and thus, automatically, in the test suite).