

Performance Index for EC-Earth3

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PI3

Reichler and Kim 2008 Performance Index package adapted for
EC-Earth3 tuning June 2013 j.vonhardenberg@isac.cnr.it

This package contains the scripts necessary to compute the RK PI metric starting from EC-Earth3 output (<https://dev.ec-earth.org/attachments/download/194/PI3.01.tar.gz>). It uses the output of the HiResClim postprocessor (https://dev.ec-earth.org/projects/ecearth3/wiki/PRACE_HiRes_project) to construct 2x2 degree remapped files for input to a modified version of the RK PI scripts by Xueli Wang (KNMI). For convenience a copy of the HiResClim postprocessor is included, if you do not already have your own.

Contents

hiresclim - a copy of the HiResClim postprocessor

LIB - the scripts and sources for the PI calculation

Climate_obs_data - the climatological obs data (the same as for the original PI RK package)

Prerequisites

- 1) a recent version of CDO (tested with CDO 1.5.5)
 - 2) GRADS (tested with grads 2.0.a9)
 - 3) The HiResClim postprocessor also needs a working copy of cdftools (<http://servforge.legi.grenoble-inp.fr/projects/CDFTOOLS>) and of the NEMO mask file for the ORCA1L46 resolution (see the HiResClim page for instructions)
 - 4) A fortran compiler (tested with gfortran and ifort)
- * Ferret is not needed anymore

Configuration

Modify directory definitions to adapt to your machine layout in the following files:

- 1) hiresclim/master-post.sh (the HiResClim postprocessor master). This script is called by the main driver postall.sh
- 2) post2x2.sh (This script takes the output of the ECE3 postprocessor and remaps it to 2x2 degrees+some unit conversions)
- 3) PI_all.csh (This is the main driver for the PI index calculation)
- 4) global_mean.sh (computes global means of radiative variables + a few selected variables)

Usage

1) HiResClim postprocessing (if you do not have it yet)

`./postall.sh` is a driver which runs the HiresClim postprocessing for a range of years. Usage: `./postall.sh EXP YEARSTART YEAREND`.

Example: `./postall.sh itr1 2100 2130` will postprocess raw ECE3 output and copy it to directories defined in `hiresclim/master-post.sh` for experiment `io01`

- the copy of the HiresClim postprocessor included here is identical to the original, only the `master-post.sh` here has been adapted for a different directory layout/machine

2) Conversion to 2x2 degrees (based on CDO)

Usage: `./post2x2.sh EXP YEARSTART YEAREND` Example:

`./post2x2.sh itr1 2100 2130` Will take the output of the previous step and will create the `MSL_mon_2x2.nc` etc. files needed by the RK PI toolkit.

Usage (contd.)

3) Computation of the RK index (based on CDO+grads+fortran)

Example: `./PI_all.sh itr1` will take the output of the previous step (for experiment io01) and will create two files `PI.txt` and `gmt.txt` in a working directory.

4) Computation of global means: Example: `./global_means.sh itr1 2100 2130` The output is written in a textfile in the chosen output subdirectory

Notes

The main changes with respect to the original RK PI scripts are the following:

- all necessary unit conversions are now performed in the `post2x2.sh` script
 - Ferret is not used anymore, all done in CDO. Fluxes are regridded using `remapcon` (conservative remapping for extensive variables). Also for other (intensive) atmospheric variables we use `remapcon` (we want the area averages over 2x2 to be correct). Ocean variables use `remapbil` (`remapcon` does not work with ORCA).
- Tried also using `remapbil` for all intensive variables: only minimal changes in the final PI (slightly worse).
- hard-coded paths have been removed from the scripts+fortran sources + minor update to fortran syntax to allow wider compatibility

Notes (contd.)

- the original scripts were using the ECE v2 land-sea masks. Updated.
- the RK PI scripts do NOT rely on the availability of an external ocean mask files, the mask is recovered directly from the salinity files (checked identical)
- This is for the non-PrepIFS model. For now removed the PrepIFS scripts, this package contains only what is strictly needed.
- Added ssrd and strd to HiresClim postprocessor

Example

- ▶ PI3 is available at: /cfu/pub/scripts/PI3

```
masif@meili:/cfu/pub/scripts/PI3$ ll
total 56K
drwxr-sr-x 2 masif cfu 4.0K Jun 14 2013 doc
-rwxr-xr-x 1 masif cfu 1.7K Jun 14 2013 PI_all.csh
-rwx----- 1 masif cfu 3.7K Jun 29 2013 post2x2.sh
-rwx----- 1 masif cfu 296 Jul 1 2013 postall.sh
drwxr-sr-x 2 masif cfu 4.0K Jul 2 2013 Climate_obs_data
-rwxr-xr-x 1 masif cfu 5.5K Jul 2 2013 global_mean.sh
-rw-r--r-- 1 masif cfu 4.1K Jul 2 2013 README.txt
drwxr-sr-x 2 masif cfu 4.0K Feb 7 12:38 LIB
drwxr-sr-x 2 masif cfu 4.0K Feb 26 16:35 hiresclim
-rwxrwxr-x 1 masif cfu 8.5K Mar 5 17:21 PI3.cmd
```

- ▶ User require to copy the **PI3.cmd** at some appropriate location and then launch it like as given below:
- ▶ Usage: ./PI3.cmd EXP SDATE MEMBER YEARSTART YEAREND
- ▶ Example: ./PI3.cmd m02h 19900101 fc0 1990 1999

Example (contd.)

- ▶ The m02h was EC-Earth 3.0.1 experiment with T255L91-ORCA1L46-LIM3 configuration by using **ecearth3-spin** template (this new set of template is essential for producing first the pp-tools formatted output as designed by Klaus Wyser from SMHI before using the PI3 package modified and adopted for EC-Earth3 by Jost von Hardenberg from CNR).

```
masif@meili:/cfu/scratch/masif/ecearth3/pi3/m02h$ cat m02h_19900101_fc0_1990-1999_gmt.txt
t2m 42.2075 0.42237
msl 2.50449 3.48703
qnet 18.3039 105.417
tp 21.6924 0.415593
ewss 8.99797 0.000128286
nsss 5.68709 8.23025e-05
SST 17.5305 0.118539
SSS 0.103925 3.0116
SICE 0.0226784 0.1309
```

Example (contd.)

```
masif@meili:/cfu/scratch/masif/ecearth3/pi3/m02h$ cat m02h_19900101_fc0_1990-1999_PI.txt
  T weighted mean is :4173.798
  U weighted mean is :25.062
  V weighted mean is :112.671
  Q weighted mean is :1085298253.215
Total Performance Index is: 38.447327
Partial PI (no Qnet, taux, tay, SST, SSS, SICE) is 15.865357
```

Example (contd.)

```
masif@meili:/cfu/scratch/masif/ecearth3/pi3/m02h$ cat m02h_19900101_fc0_1990-1999_Global_Mean_Table.txt
```

TOA net SW	240.346	242.6	239.4
TOA net LW	-241.153	-242.7	-238.5
Net TOA	-0.806442	-0.1	0.9
Sfc Net SW	162.391	163.1	161.2
Sfc SW Down	188.402	186.4	184
Sfc SW Up	-26.011	-23.3	-23
Sfc Net LW	-61.8708	-61.5	-63
Sfc LW Down	328.349	335.8	333
Sfc LW Up	-390.22	-397.3	-396
SH Flux	-18.6315	-18.3	-17
LH Flux	-80.1247	-82.7	-80
Net Sfc	1.76439	0.6	0.9
Variable	units	m02h	
Air T at 2 m	K	286.01	
Tot Cl Cover	0-1	0.640211	
MSLP	Pa	101109	
Tot Precip	mm/day	2.79787	
SST	°C	17.3461	
SSH	m	-0.0223008	
SSS	psu	34.5866	