Collocation and validation tools
for the DRAKKAR ensemble of simulations

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This document describes a set of programs used for the validation of DRAKKAR model outputs. The simulations are evaluated against hydrographic observations (temperature/salinity profiles from ENSEMBLES/ENACT) and altimetric data (sea level anomalies from AVISO).

First, the model ouputs are sub-sampled like actual observations to build altimetric and hydrographic synthetic data. Then, real and "synthetic" observations and more integral quantities (mixed layer depth, heat and salt contents) are compared over various regions, periods and timescales.

The programs are sorted by category : ENSEMBLES/ENACT (evaluation with T/S profiles), AVISO (evaluation with SLA satellite products) and MODEL (treatment of model outputs before collocation or for comparing collocated with full model outputs). Most calculation programs are written in Fortran 90, others in Matlab. Ocean Data View, Chart and Maltab are used for the visualisation.

We note the use of tools developed in the MEOM research team (LEGI, Grenoble) : CDF-TOOLS (J.M. Molines), cdfop (J.M. Brankart) and SESAM (J.M. Brankart, C.E. testut and L. Parent).

At the moment, several simulations have been processed with these tools : ORCA025-G70, ORCA05-G70, ORCA05-G50, ORCA1-R70 and ORCA2-G70.
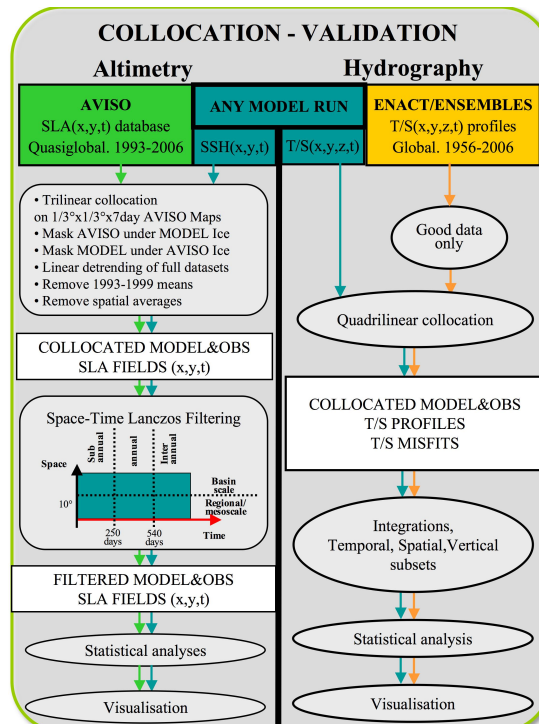
1 ENSEMBLES/ENACT

The ENSEMBLES/ENACT (european project) database includes hydrographic observations (T/S profiles) collected throughout the global ocean, most by buoys, XBT, CTD, ARGO floats, etc... The data are available from 1956 to present and in a NetCDF format.

For details, see the website : http ://www.hadobs.org/.

1.1 Calculation

1.1.1 Collocation

opa2ens.f90

Purpose : collocation of DRAKKAR simulated T/S on observed T/S profiles.

Inputs : OPA files (each 5 days) and ENSEMBLES/ENACT profiles merged in monthly files.

Outputs : collocated simulated and observed T/S profiles merged in monthly files.

Usage : opa2ens.x < namelist.txt (nomenclatures of input and output files, dates of OPA files, and of the beginning and the end of ENS files, reajustement of dates, periodicity of the ORCA grid).

Associated routines : cdfio.f90 (CDFTOOLS), mod_opa.f90, mod_ens.f90, mod_math.f90.

Associated script : script_loc_ens.csh.

Concatenation : annual_concat.csh (monthly files into annual files).

opam2ens.f90

Purpose : collocation of Levitus or DRAKKAR model climatology on observed T/S profiles.

Inputs : files of monthly means on grid ORCA (dated to the 15 of each month) and EN-SEMBLES/ENACT profiles merged in monthly files.

Outputs : collocated simulated and Levitus observed T/S.

Usage : opam2ens.x < namelist.txt (nomenclatures of input and output files, dates of OPA files, and of the beginning and the end of ENS files, periodicity of grid).

Associated routines : cdfio.f90 (CDFTOOLS), mod_opa.f90, mod_ens.f90, mod_math.f90.

Associated script : script_loc_ens_LEV.csh (climatology of Levitus), script_loc_ens_CLIMopa.csh (climatology of the model).

1.1.2 Integrated quantities

heat_salt_contents.f90/HCSC.f90

Purpose : compute the heat and salt contents between hmin and hmax of the collocated simulated and observed T/S files.

Input : monthly file of collocated simulated and observed T/S.

Output monthly file of collocated simulated and observed HC/SC.

Usage : HCSC.x input.nc hmin hmax dhmax

Associated routine : mod_enscol.f90

Associated script : calcul_HCSC.csh

Concatenations : concat_HCSC_annual.csh (monthly files into annual file), concat_HCSC_period.csh (into interannual file).

calcul_MLD.f90 (mod_ens.f90,dens1d.f90)

Purpose : compute the Mixed Layer Depth according to a criterion of temperature (0.2°C) or density (0.03).

Input : monthly file of collocated simuluted and observed T/S or of collocated climatology(Levitus or model)/ENSEMBLES files.

Output : monhtly file of simulated and observed MLD.

Usage : calcul_MLD.x input.nc type_criterion val_criterion surf_ref_depth

Associated routines : mod_enscol.f90 dens1d.f90

Associated script : calcul_MLD.csh or calcul_MLD_clim.csh

Concatenations : concat_MLD_month_period.csh (monhtly files into file containing the same month over an interannual period), concat_MLD_saison.csh (monhtly files into seasonal file over year and pentades).

heat_salt_contents_mld.f90

Purpose : compute the heat and salt contents between hmin and MLD.

Input : collocated simuluted and observed T/S monhtly file, and associated MLD file, computed before.

Output : monhtly file of simulated and observed HC/SC(mld)

Usage : heat_salt_contents_mld.x input1.nc input2.nc

Associated routine : mod_enscol.f90

Associated script : calcul_HCSC_mld.csh

Concatenations : concat_HCSC_mld_month_period.csh (monhtly files into file containing the same month over an interannual period), concat_HCSC_mld_annual.csh (monhtly files into annual file), concat_HCSC_mld_saison.csh (monhtly files into seasonal file over a year), concat_HCSC_mld_saison_pentade.csh (seasonal files a year into seasonal files over pentades).

HCSC_TS_mld.f90

Purpose : compute the heat and salt contents, temperature and salinity integrated between hmin and MLD.

Input : collocated simuluted and observed T/S monhtly file, and associated MLD file.

Output : monhtly file of simulated and observed HC/SC(mld).

Usage : HCSC_TS_mld.x input1.nc input2.nc hmin dhmax

Associated routine : mod_enscol.f90

Associated script : calcul_HCSC_TS_mld.csh, calcul_HCSC_TS_mld_clim.csh (for collocated climatology(Levitus or model)/ENSEMBLES files).

Concatenations : concat_HCSC_TS_mld_month_period.csh, concat_HCSC_TS_mld_month_period_clim.csh (monhtly files into file containing the same month over an interannual period), concat_saison_period.csh, concat_HCSC_TS_mld_saison_clim.csh, concat_HCSC_TS_mld_saison_pentades_clim.csh (monhtly files into seasonal file over a period and into interannual over this period).

pdfmens_MLD_HCSC_TS_ARGO_ORCA05(025).f90

Purpose : monthly analysis : plot median and percentiles 17% and 83% of the PDF of monthly MLD,HC,SC,T,S as a function of months, at global scale.

Inputs : OPA HC/SC(mld) files, collocated simulated and observed HC/SC,T/S(mld) file (monthly files merged over a period).

Outputs : PDFmldT02_ORCA025-G70_month_1998-2004_ARGO_comp/col/obs/bias/pos.txt.

Usage : pdfmens_MLD_HCSC_TS_ARGO_ORCA05(025).x input1.nc input2.nc < namelist.txt

Associated routines : cdfio.f90 (CDFTOOLS), mod_opa_MLD_HCSC.f90, mod_ens_MLD_HCSC_TS.

Associated script : script_pdfmens_ARGO.csh

calcul_isoT.f90,calcul_isopycn.f90

Purpose : compute the deptht corresponding to an isotherm or isopycn given in argument.

Input : monthly file of collocated simulated and observed T/S profiles.

Output : monthly file of isotherm or isopycn.

Usage : calcul_isoT(isopycn).x input.nc val

Associated routines : mod_ens.f90,dens1d.f90

Associated script : calcul_ISO.csh

Concatenation : concat_ISO_month_period.csh (monthly files into files containing the same month over a interannual period).

1.1.3 Extraction of ARGO floats

extract_ARGO.f90

Purpose : extraction of ARGO profiles from monthly T/S collocated MODEL/ENSEMBLES files.

Input : monthly file of collocated simulated and observed T/S.

Output : monthly file of collocated simulated and observed (only ARGO floats) T/S.

Usage : extract_ARGO.x input.nc

Associated routine : mod_ens.f90

Associated script : extract_ARGO.csh

Concatenation : concat_ARGO_period.csh (into annual and interannual files)

extract_ARGO_HCSC.f90

Purpose : extraction of ARGO profiles from monthly HCSC collocated MODEL/ENSEMBLES files.

Input : monthly file of collocated simulated and observed HC/SC.

Output : monthly file of collocated simulated and observed (only ARGO floats) HC/SC.

Usage : extract_ARGO_HCSC.x input.nc

Associated routine : mod_ens_opa_HCSC.f90

Associated script : extract_ARGO_HCSC.csh

Concatenation : concat_HCSC_ARGO_period.csh (into annual and interannual files).

extract_ARGO_MLD.f90

Purpose : extraction of ARGO profiles from monthly MLD collocated MODEL/ENSEMBLES files.

Input : monthly file of collocated simulated and observed MLD.

Output : monthly file of collocated simulated and observed (only ARGO floats) MLD.

Usage : extract_ARGO_MLD.x input.nc

Associated routine : mod_ens.f90

Associated script : extract_ARGO_MLD.csh

Concatenation : concat_MLD_month_period_ARGO.csh (over period).

extract_ARGO_HCSCmld.f90

Purpose : extraction of ARGO profiles from monthly HC/SC(mld) collocated MODEL/ENSEMBLES files.

Input : monthly file of collocated simulated and observed HC/SC within MLD.

Output : monthly file of collocated simulated and observed (only ARGO floats) HC/SC within MLD.

Usage : extract_ARGO_HCSCmld.x input.nc

Associated routine : mod_ens_opa_HCSCmld.f90

Associated script : extract_ARGO_HCSCmld.csh

Concatenation : concat_HCSCmld_ARGO_period.csh

1.1.4 CDFTOOLS

The work with DRAKKAR model outputs made me to develop some programs, which will be included in the CDFTOOLS.

cdfmltmask.f90

Purpose : mask of perpetual Levitus file (monhtly means) + group T and S in the same file.

Inputs : ORCA2 : Levitus file containing the 12 monthly means which are not masked on ORCA2 grid. ORCA025 : monhtly Levitus files which are not masked on ORCA025 grid.

Outputs : monthly masked Levitus files.

Usage : cdfmltmask.x input.nc mask.nc votemper/vosaline T

Associated routine : cdfio.f90

Associated script : mask_levitus_mens_orca2.csh, mask_levitus_mens_orca025.csh

cdfmoy

Purpose : product monthly climatology of DRAKKAR model : monthly means over annual and interannual period of DRAKKAR files

Associated routine : cdfio.f90

Associated script : cdfmoy.ll,cdfmoy-inter_modif.ll (Jean-Marc), cdfmoy_mensT_ORCA2.csh (for ORCA2)

1.2 Illustration

1.2.1 Ocean Data View

Ocean Data View a software package for the interactive exploration, analysis and visualization of oceanographic and other geo-referenced profil or sequence data. Here, we use it for the visualization of surface data (heat and salt contents, mixed layer depth...) at global scale.

For details, see the website : http ://odv.awi.de/.

HCSC of collocated model/ENSEMBLES files

anim_HCSC.csh (HCSC.cmd, HC(SC)_config.cfg)

fig_HCSC_period.csh (HCSC_period.cmd, HC(SC)_config.cfg)

anim_HCSC_pentades.csh (HCSC_pentades.cmd, HCSC_zone_config.cfg)

HCSCobs_diff_config.cfg

MLD of collocated model/ENSEMBLES files

anim_MLD.csh

HC/SC,T/S(mld) of collocated model/ENSEMBLES files

anim_HCSC_mld_month.csh (HCmld_config.cfg, SCmld_config.cfg)

anim_HCSC_mld.csh (HCmld_config.cfg, SCmld_config.cfg)

anim_HCSC_mld_saison.csh

anim_HCSC_TS_mld.csh (HCSC_TS_mld_config.cfg, diff_TS_mld_config.cfg)

Isotherm, isopycn

anim_ISO.csh

1.2.2 Matlab

distrib_HC_SC.m

Purpose : plot the distributions of the global or regional HC/SC biases.

Input : collocated simulated and observed HC/SC merged into annual file.

Output : plots (jpg,ps).

prog_HCSC_MLD_TS_ENS-OPA_NNATL.m

Purpose : monthly analysis : plot median and percentiles 17% and 83% of the PDF of monthly MLD,HC,SC,T,S as a function of months, in different region of the North Atlantic.

Input : HC,SC,T,S(mld) of "full" model, collocated model and observations merged into monthly files over an interannual period.

Output : ASCII files (mat) and plots (jpg,ps).

bias_HCSC_MLD_TS_ENS-OPA_NNATL.m

Purpose : compute and plot error of observability (median(collocated model) - median(full model)), and medians and percentiles 17% and 83% of the model biases (collocated model-observations).

Input : ASCII files (mat) created by prog_HCSC_MLD_TS_ENS-OPA_NNATL.m

Output : plots (jpg).

bias_HCSC_MLD_TS_ENS-OPA_GLOB.m

Purpose : compute and plot medians and percentiles 17% and 83% of the model biases, at the global scale, for each month. One plot for one month.

Input : ASCII files (mat) created by pdfmens_MLD_HCSC_TS_ARGO_ORCA05(025).f90

Output : plots (jpg,ps).

bias_HCSC_MLD_TS_ENS-OPA_GLOB_4months.m

Purpose : idem but plot 4 months. One plot for one month.

bias_HCSC_MLD_TS_ENS-OPA_GLOB_bis.m

Purpose : idem but plot 12 months on the same plot. One plot for 12 months.

error_HCSC_MLD_TS_ENS-OPA_GLOB.m

Purpose : compute and plot error of observability (median(collocated model) - median(full model)) at the global scale, for each month. One plot for one month.

Input : ASCII files (mat) created by pdfmens_MLD_HCSC_TS_ARGO_ORCA05(025).f90

Output : plots (jpg,ps).

error_HCSC_MLD_TS_ENS-OPA_GLOB_4months.m

Purpose : idem but plot 4 months. One plot for one month.

error_HCSC_MLD_TS_ENS-OPA_GLOB_bis.m

Purpose : idem but plot 12 months on the same plot. One plot for 12 months.

prog_HCSC_MLD_TS_ENS-OPA_saison_NNATL.m

Purpose : seasonal analysis : plot median and percentiles 17% and 83% of the PDF of sesaonal LD,HC,SC,T,S as a function of years, in differents regions of the North Atlantic.

Input : HC,SC,T,S(mld) of the full model, the collocated model and the observations merged into monthly files.

Output : plots (jpg,ps).

prog_HCSC_MLD_TS_ENS-OPA_saison_pentades_NNATL.m

Purpose : seasonal analysis over pentades : plot median and percentiles 17% and 83% of the PDF of sesaonal MLD,HC,SC,T,S merged into pentades, as a function of pentades, in differents regions of the North Atlantic.

Input : seasonal files merged into pentades of HC,SC,T,S(mld) of the full model, the collocated model and the observations.

Output : plots (jpg,ps).

distrib_misfits_TS.m

Purpose : plot the distributions of T/S biais at global or regional scale

Input : collocated simulated and observed T/S merged into annual collocated files.

Output : plots (jpg,ps).

distrib_misfits_TS_ARGO.m, distrib_misfits_T/S_reg_ARGO.m

Purpose : plot distribution of T/S biases at global and regional scales, respectively, only for the ARGO profiles.

Input : collocated simulated and observed T/S merged into annual files and where ARGO floats are extracted.

Output : plots (jpg,ps).

distrib_HC_SC_ARGO.m

Purpose : plot the distributions of HC/SC biases only for ARGO profiles.

Input : collocated simulated and observed HC/SC merged into annual files and where ARGO floats are extracted.

Output : plots (jpg,ps).

2 AVISO

The AVISO altimetric database provides weekly and gridded (Mercator $1/3°x1/3°$ grid) sea level anomalies $(SLA(x,y,t))$ at quasi-global scale. The NetCDF files are available from 1993 to present.

For details http ://www.jason.oceanobs.com/html/donnees/produits/hauteurs/global/msla_fr.html.

2.1 Calculation

2.1.1 Collocation

grid_orca2merc(_ORCA1/_ORCA2).f90

Purpose : collocation of ORCA grid on Mercator grid : compute the weigths w1,w2,w3,w4 necessary to compute the equivalent model at the observation point.

Input : AVISO file and OPA file.

Output : collocated grids file.

Usage : grid_orca2merc.x < list.txt (nomenclatures of input files (OPA and AVISO) and output file (collocated grid), periodicity of ORCA grid).

Associated routines : cdfio.f90 (CDFTOOLS), mod_opa.f90, mod_math.f90, mod_aviso.f90, mod_loc(_ORCA1).f90.

opa2aviso.f90

Purpose : collocation and interpolation of DRAKKAR SSH on AVISO SLA (Mercator grid).

Input : collocated grids file (created by grid_orca2merc(_ORCA1/_ORCA2).f90), AVISO weekly files (SLA) and OPA files (each 5 days, original or "without" ice).

Output : weekly collocated simulated SSH and observed SLA (with a common ice mask) files. Note : these files have to be corrected (script_correction.csh), see after...

Usage : opa2aviso.x < list.txt (nomenclatures of OPA and AVISO input files and of the output file, dates of OPA and AVISO files, name of the collocated grid file, reajustement)

Associated routines : cdfio.f90 (CDFTOOLS), mod_lin.f90, mod_opa.f90, mod_aviso2.f90

Associated script : script_grid_and_opa2aviso.csh (if the collocated grids file does not exist yet)/ script_opa2aviso.csh

temporal_moy_aviso.f90,sla_minus_moyt.f90

Purpose : compute the temporal mean over 1993-1999 at each point (x,y) then remove the temporal mean : SLA(obs)=SLA(obs)-SLAmoy(obs) and SLA(mod)=SSH(mod)-SSMmoy(mod).

Input : output files created by opa2aviso.f90.

Output : collocated simulated and observed SLA files.

Associated script : 1rst operation of script_correction.csh.

convert_formatcdf.f90

Purpose : conversion into SESAM NetCDF format.

Input : collocated simulated and observed SLA files.

Output : collocated simulated and observed SLA files at SESAM format.

Associated script : 2nd operation of script_correction.csh.

metric_aviso.f90, spatial_mean_aviso.f90, sla_minus_meanxy.f90

Purpose : compute the global spatial mean at each snapshot then remove the spatial mean : SLA = SLA - SLAmeanxy.

Input : previous files

Output : corrected files (no trend XY).

Associated script : 3rd operation of script_correction.csh.

opa2aviso_bathy.f90

Purpose : collocation and interpolation of DRAKKAR bathymetry on AVISO bathymetry (Mercator grid)

Input : the file of collocation of ORCA grid on Mercator grid (created by grid_orca2merc(_ORCA1/_ORCA2).f9 and model bathymetry file.

Output : collocated bathymetry file.

Usage : opa2aviso_bathy.x ¡ list_opa2aviso_bathy.txt (nomenclature of OPA file and name of the collocated grid file)

Associated routines : cdfio.f90 (CDFTOOLS), mod_opa.f90

Associated script : script_opa2aviso_bahty.csh

2.1.2 cdfop.x

filtwinlanc

Purpose : spatial filering (Lanczos 2D).

Usage : cdfop.x filtwinlanc N filein.cdf fileout.cdf var1 ... varN N1 ... NN

Associated routines : initlanc2d.f, ufiltlanc.f

Associated script : spatial_filtering.csh

filttwinlanc

Purpose : temporal filering (Lanczos 1D)

Usage : cdfop.x filttwinlanc N filein.cdf fileout.cdf var1 ... varN N1 ... NN

Associated routine : initlanc.f

Associated script : temporal_filtering.csh (brute → BF, GE → GEBF), temporal_filteringBFMFHF.csh (brute → BF,MF,HF), temporal_filteringMFHF.csh (MF,HF à partir de BF)

Others filters

filtwin : cdfop.x filtwin N filein.cdf fileout.cdf var1 ... varN N1 ... NN

filtlanczos : cdfop.x filtlanczos N fileout.cdf var1 ... varN Ncoup1...NcoupN (Ncoup=longueur d'ondes de coupure en nombre de points de grille)

Statistics : tcor, tvar

Purpose : compute statistics of the filtered (BF,MF,HF) or not signal : temporal correlation, temporal variance, temporal variance (model) / temporal variance (AVISO), log10[temporal variance (model) / temporal variance (AVISO)] temporal variance (filtered signal) / temporal variance (not filtered signal) temporal standard deviation temporal standard deviation (filtered signal) / temporal standard deviation (not filtered signal)

Input : file merged over all the period (created during the filtering)

Usage :
- cdfop.x tcor 2 filein.cdf fileout.cdf var1 var2
- cdfop.x tvar N filein.cdf fileout.cdf var1 ... varN

Associated script : stat.csh

calcnorm

Purpose : compute the norme of simulated and observed modes and projection of model states on the observed modes (global or regional)

Usage : cdfop.x calcnorm N filein.cdf var1 ... varN (compute the norm and print time and norm on the screen)

Associated script : normode_projeof.csh

projeof

Purpose : projection of model states on observed modes (vctXXX.cdf)

Usage : cdfop.x projeof 2 vctXXX.cdf state.cdf SLAaviso SLAmodel (print : time projCl(k) lambda(k)

Associated script : normode_projeof.csh

mask

Purpose : mask the statistic files with the global mask (ie over all the period), which is created by mask_global.csh (necessary for the compute of EOFs)

Associated script : stat_icemasktot.csh

Others

log10 : cdfop.x log10 N filein.cdf fileout.cdf var1 ... varN

interval : cdfop.x interval 1 filein.cdf fileout.cdf var1 ... varN valmin valmax (valmin¡values¡valmax=values if not spval)

extimidx : cdfop.x extimidx N filein.cdf fileout.cdf var1 ... varN indextime (N=number of variables without lon, lat, depth, time)

Scripts using cdfop.x

comp_cor-sign.csh : difference of the correlations of the 2 runs, only if at least one value of the 2 runs is significant

comp_cor.csh : difference of the (all) correlations of the 2 runs

2.1.3 SESAM

sesam_SLAaviso, sesam_SLAmodinterp

Purpose : compute of EOFs

Input : correced collocated simulated and observed SLA files.

Output : spatial modes (Netcdf files) and temporal amplitudes (ASCII files).

Associated script : mask_global.csh (mask at global scale) then eof.csh (global or regional EOFs)

2.1.4 Others

Cumulated inertia

Purpose : cumulated inertia, which is computed during the calculation of EOFs and stored in the file sesam.output

Associated script : cumul_inertie.csh

nearest_point.f90

Purpose : compute the temporal series at a geographic point or at a latitude.

Associated script : data_pointfixe.csh or extract_latfixe.csh

2.2 Illustration

2.2.1 Chart

AVISO and model SLA

Purpose : annual *.gif and animation over all the period

Associated script : film_av_mod.csh

Principal spatial modes of AVISO and model SLA

Purpose : plot global or regional EOFs of filtered or not filtered signals.

Associated script : fig_av_mod_EOFS.csh, fig_av_mod_EOFS_2.csh, fig_av_mod_EOFS_3.csh

Statistics of observed and simulated SLA (filtered or not)

Purpose : plot the statistics (the second version keeps only the significant corrrelations)

Associated script : fig_stat_temp_brute.csh, fig_stat_temp_brute_mask(2).csh, fig_stat_temp_filt.csh, fig_stat_temp_filt_mask(2).csh

Difference between correlations of 2 runs

Purpose : plot the difference of the correlations

Associated script : fig_comp_cor-sign_filt_mask2.csh

2.2.2 Matlab

apl_eof.m

Purpose : AVISO temporal amplitude superposed to model temporal amplitude for the 4 first modes

proj_eof_1run.m, proj_eof_2runs.m, proj_eof_3runs.m, proj_eof_4runs.m

Purpose : plot the model projections and the AVISO amplitudes on the same illustration, for the 4 first modes.

DrawTaylor.m

Purpose : diagrams of Taylor of ...

proj_eof_NAO_1run.m, proj_eof_NAO_2runs.m, proj_eof_NAO_3runs.m, proj_eof_NAO_4runs.m

Purpose : plot the superposition of the NAO index + amplitude of the mode 1 of AVISO in NATL + the projections of the runs on the observed mode1 in NATL, and compute and plot the lagged correlation(NAO index,PC1).

stat_proj_eof_4regions.m

Purpose : plot diagrams with correlations and % variances of amplitudes (AVISO) vs projections (model) of the 4 first modes in 4 regions (NATL,GS,pac-eq,indien) for the LF signal of the runs ORCA025-G70,ORCA05-G70 and ORCA2-G70.

stat_proj_eof_lagNAO.m

Purpose : plot the diagram of lagged correlations between NAO and data(AVISO,ORCA025-G70,ORCA05-G70 et ORCA2-G70) for the LF signal in NATL and Gulf Stream, and for the LS-LF signal in NATL.

cumul_inertie.m

Purpose : plot the superposition of the cumulated intertia : model // AVISO ; no filtered // BF ; modes ; regions

diff_cor_lat.m, cor_lat.m

Purpose : plot the correlation as a function of the latitude

cor_dist_coast.m, corsig_dist_coast.m

Purpose : plot the correlation as a function of the distance from the coast

std_lat.m, ratio_var_lat.m

Purpose : plot the std and the $\log(var(mod)/var(obs))$ as a function of the latitude.

analyse_DATA_GEBF_GE_brute.m

Purpose : plot the temporal series at a geographic point : superposition not filtered/LS /LS-LF

3 MODEL

3.1 CDFTOOLS

cdfmxlhcsc.f90

Purpose : compute the MLD (possibility of 3 criteria) and the HC/SC within the MLD at global scale.

Input : OPA file (grid T) (each 5 days)

Usage : cdfmxlhcsc.x input.nc type_criterion val_criterion

Associated script : calcul_HCSC_MLD_opa_files.csh

Concatenations : concat_HCSC_MLD_OPA_month.csh (into file containing the same month over a period), concat_HCSC_MLD_OPA_saison.csh (into seasonal files over a year and pentades).

Zoom : zoom over a region from lon, lat (zoom_ HCSC_MLD_opa_files.csh)

cdfmxlhcsc_hmin.f90

Purpose : compute the MLD (possibility of 3 criteria) and the HC/SC integrated between hmin and MLD

Input : OPA file (grid T) (each 5 days)

Usage : cdfmxlhcsc_hmin.x input.nc type_criterion val_criterion hmin

Associated script : calcul_HCSC_MLD_opa_files.csh

Concatenations : concat_HCSC_MLD_hmin_OPA_month.csh (into file containing the same month over a period), concat_HCSC_MLD_hmin_OPA_saison.csh (into seasonal files over a year), concat_HCSC_MLD_hmin_OPA_saison_pentades.csh (into seasonal files over a year and pentades).

Zoom : zoom over a region from lon, lat (zoom_ HCSC_MLD_hmin_opa_files.csh), zoom over a region in the ij index ORCA space (zoom_ij_ HCSC_MLD_hmin_opa_files.csh)

Concatenations : concat_HCSC_MLD_hmin_OPA_month(_zoom).csh

cdfmoy.f90

Purpose : monthly and seasonal means of HC/SC,MLD files at global scale

Associated script : cdfmoy_HCSC.csh

3.2 Others

modif_OPA_files.f90

Purpose : modification of OPA files such as we keep only the variable SSH and SSH(ice>0.05) = missing value

Input : OPA file (grid T, SSH) (each 5 days)

Output : OPA file which contains only SSH (without ice)

Usage : modif_OPA_files.x filein.nc fileout.nc

Associated script : modif_opa_files.csh, modif_opa_filesORCA1.csh, modif_opa_filesORCA2.csh