

Runoff coupling field on CNRM-CERFACS IPCC coupled model

Why ?

For long-term runs like IPCC centenal simulations, an as-closed-as-possible water budget is mandatory to avoid dramatic drift on sea level or global salinity.

With increasing resolution, a manual definition of river basin becomes impossible. We proposes to add a river routing model to the standard coupled configuration, and simply define the two OASIS interpolations between this new model, ocean and atmosphere.

River runoff climatology could strongly differ from observations and drive regional biases like Mediterranean, China or Artic sea freshning. Therefore, we strongly suggest, in addition to techniques described below, not to couple row field but anomalies (taking care of global flux conservation).

How ?

Between ARPEGE water tank discharges and NEMO river mouths, an OASIS interface has been developed using a river routing model called TRIP.

TRIP collects and routes runoff to the river mouth(s) for all the major rivers.
See Web page: <http://hydro.iis.u-tokyo.ac.jp/~taikan/TRIPDATA/TRIPDATA.html>

We need two OASIS interpolations to transfer information from ARPEGE to TRIP (water tank overflowing) and from TRIP to NEMO (river mouth discharge).

The first one is a simple SCRIP nearest-neighbour transformation (see namcouple field 17), followed by a global conservation operation.

The second one uses the SCRIP gaussian interpolation. The main runoff interpolation characteristic consists on the masks of both source and target grid : for TRIP, all grid points are masked except any points contiguous to coastal line (land points). For NEMO, all grid points are masked except any points contiguous to coastal line (oceanic points).

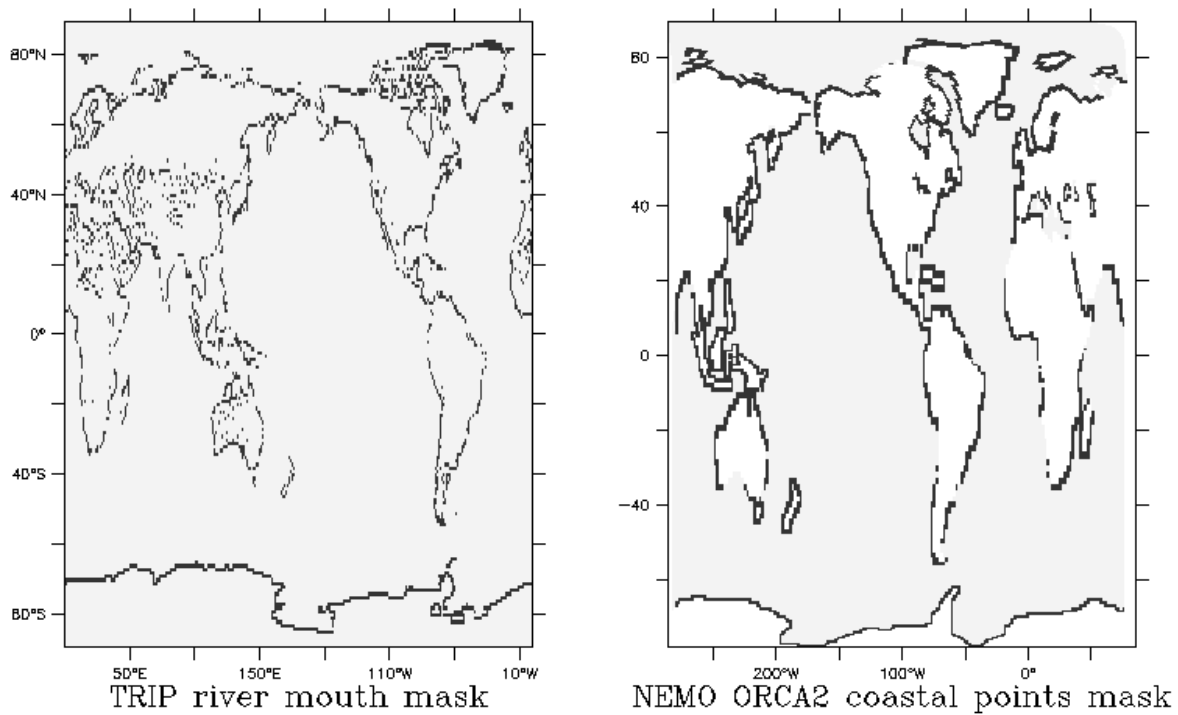


Fig 1: Runoff TRIP and NEMO masks (unmasked points are in black)

For anomaly coupling case, it is necessary to drain off water on NEMO grid points defined on the runoff_1m_nomask.nc forcing file (provided by LOCEAN in NEMO standard input files package), because anomaly calculations have to be done on grid points where forced climatology is available. In this case, masked points can overflow the line coast (particularly near biggest rivers like Amazon).

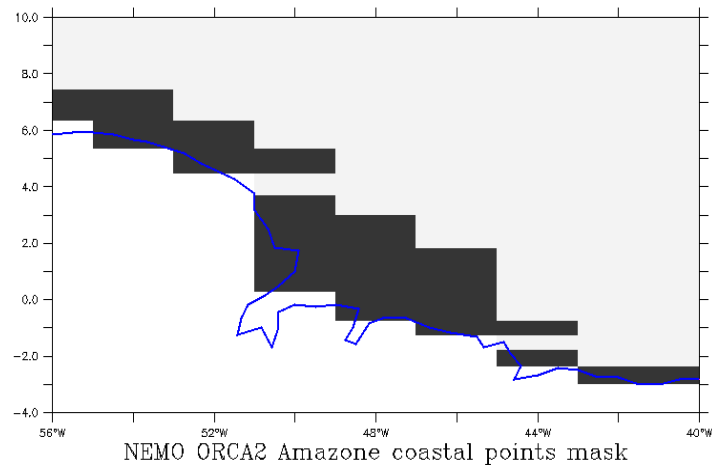


Fig 2: NEMO runoff mask around Amazon (unmasked points are in black)

Due to mismatch between coastal masks of TRIP (land points) and NEMO (sea points), a gaussian interpolation, followed by a global conservation operation, are necessary. At each river mouth, we spread the runoff value on several oceanic grid points, simulating initial surface advection and conserving observed localization.

Gaussian weights have to be tuned according to respective source and target grids resolution. Be careful that, with a too sharp distribution, too few target points are intersected by interpolation and runoff is shared uniformly on the whole grid (during the global conservative operation). With a too smooth distribution, too many target points are intersected by interpolation and runoff initial advection is over-estimated.

Namcouple

```
#####  
# Field 17 : Runoff flux (should be delivered to TRIP in mm/day)  
#  
CORUNOFF TRRUNOFF 372 _cpl_freq_ 4 atm.nc EXPORTED  
c127 trip LAG=+_lag_atm_  
P 0 P 0  
#  
CHECKIN SCRIPR CONSERV CHECKOUT  
INT=1  
DISTWGT D SCALAR LATLON 20 4  
GLOBAL  
INT=1  
#  
#####  
# Field 18 : Runoff Trip (sent to NEMO river mouth grid)  
#  
SORIVERS O_Runoff 32 _cpl_freq_ 5 trip.nc EXPOUT  
trpe rne1 LAG=+10800  
P 0 P 2  
CHECKIN BLASOLD SCRIPR CONSERV CHECKOUT  
INT=1  
1.1574E-5 0  
GAUSWGT LR SCALAR LATLON 10 6 10.  
GLOBAL  
INT=1  
#
```

Grid names:

c127: ARPEGE grid. Ocean grid points are masked
trip: TRIP grid. Ocean grid points are masked (standard mask)

trpe: TRIP grid: All grid points are masked except any points contiguous to coastal line (land points)
rne1: NEMO grid: All grid points are masked except any points contiguous to coastal line (oceanic points)

Needed files

Special masks have to be created on ARPEGE t127, TRIP and NEMO ORCA1 grids (c127, trpe and rne1)

Those variables are available on masks_runoff.nc file. See ftp:

ftp://ftp.cerfacs.fr/pub/globc/exchanges/maisonna/IPCC_AR5/masks_runoff.nc

Warning: areas and grids files must contain variables related to those new grids. They must be identical to ARPEGE, TRIP and NEMO standard variables (copy those variables and add them to areas.nc and grids.nc files)

TRIP input files and Oasis areas, grids and masks variables on TRIP grid are also available. See ftp:
ftp://ftp.cerfacs.fr/pub/globc/exchanges/maisonna/IPCC_AR5/trip_input_package.tgz

For TRIP sources (including OASIS3 coupling interface) see:

ftp://ftp.cerfacs.fr/pub/globc/exchanges/maisonna/IPCC_AR5/trip_oasis3_code.tgz

All TRIP sources belonging to Tokyo University. You can not use it without notice:
<http://hydro.iis.u-tokyo.ac.jp/~taikan/TRIPDATA/TRIPDATA.html>

Reférence: T. Oki and Y. C. Sud, 1998: Design of Total Runoff Integrating Pathways (TRIP) - A global river channel network. *Earth Interactions*, 2.

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