Variables description

3 types of variables:

Scale factors

The ‘size’ of grid cells

Coordinates

The positions of the grid cells

Mask

Distinction between land and ocean

Available files and variables

Product on standard grid (PGS):

« XXX_coordinates.nc »

Scales factors variables: e1t,e2t,e3t

Coordinate variables: longitude, latitude, depth

« XXX_mask_bathy.nc »

Land-ocean mask: mask

NEMO ocean code reference manual

Product on native grid (PGN):

« mesh_hgr.nc » (horizontal)

Scales factors variables: e1t,e2t, e1u, e2u,..

Coordinate variables: glamt, gphit, glamu,...

« mesh_zgr.nc » (vertical)

Scales factors variables: e3t,...

Coordinate variables: gdept, gdepw,...

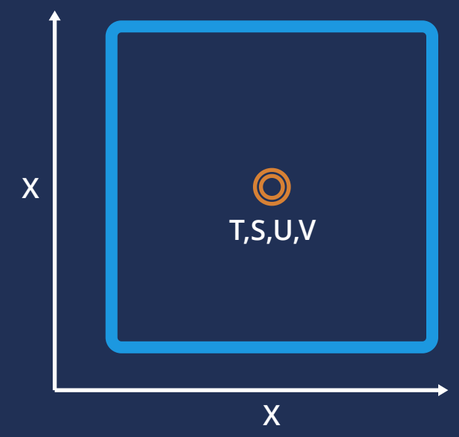
« mask.nc »

Land-ocean mask: tmask,umask, vmask

Horizontal grid cell description

Product on standard grid (PGS):

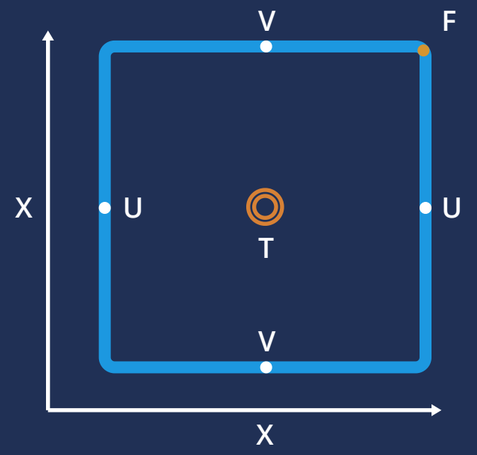
Arakawa A-grid



The variables are all centered on the grid cell center

Product on native grid (PGN):

Arakawa C-grid



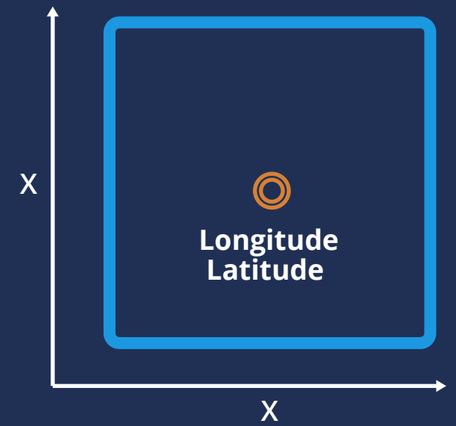
The variables are not all centered on the grid cell center

T: temperature, salinity, sea ice parameters

U : zonal velocity V : meridional velocity

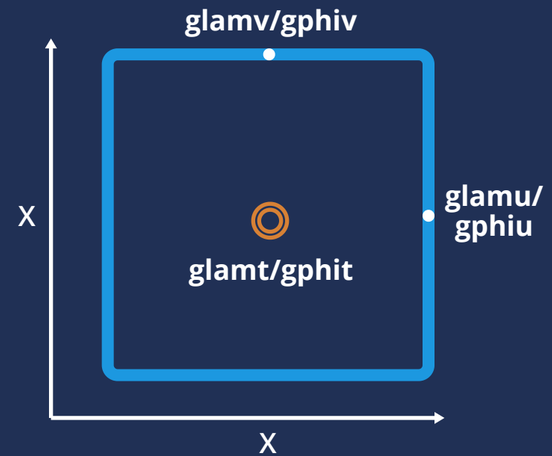
Horizontal coordinates

Product on standard grid



On set of longitudes/latitudes for grid cells center

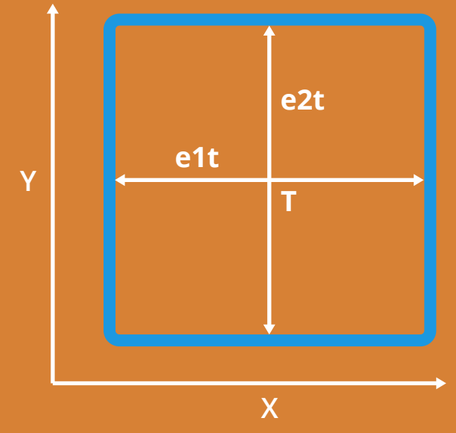
Product on native grid:



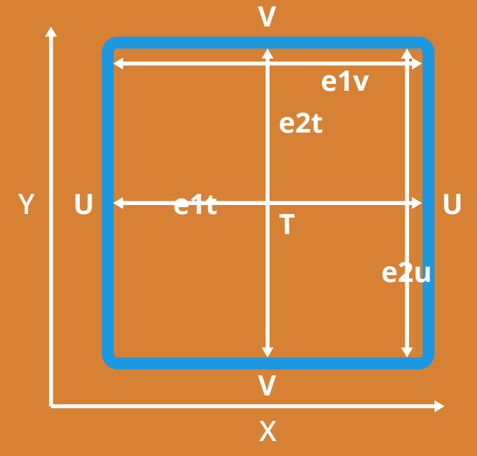
3 sets of longitudes/latitudes

Horizontal scale factors

Product on standard grid (PGS)



Product on native grid (PGN):



Scale factors: « enx »

where: n=1 for a size in the zonal direction

n=2 for a size in the meridional direction

where: x=T,U,V : the intervale is centered on ‘x’

Vertical Z-grid description

Depth

T: cells center

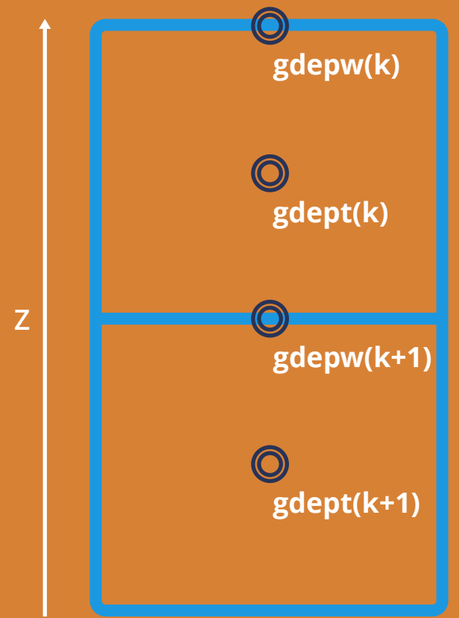
W: cells interfaces

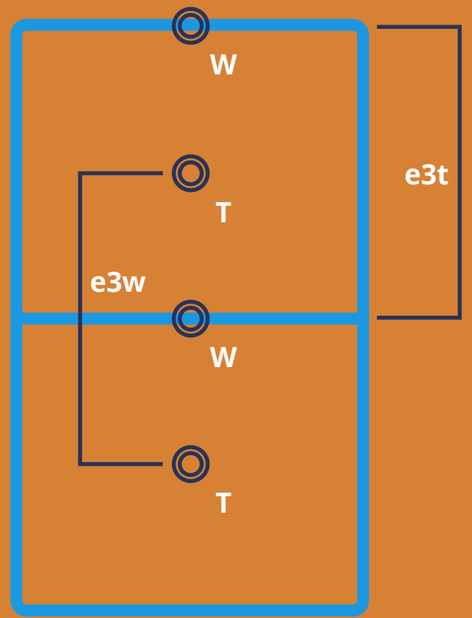
Scale factors

E3: 3 for Z direction

W for centered on W

T for centered on T





Be careful:

In NEMO OGCM, depth are defined with an analytical function and vertical scale factors are defined with its derived function.

That's why:

e3t(k) =/ gdepw(k+1) - gdepw(k)

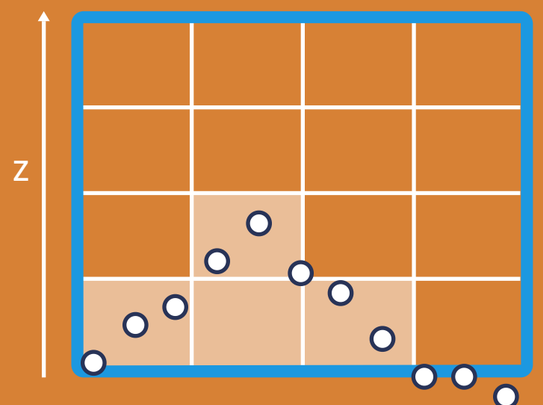
AND

e3w(k) =/ gdept(k+1) - gdept(k)

Vertical Z-grid

Product on standard grid:

Uses a Z vertical grid

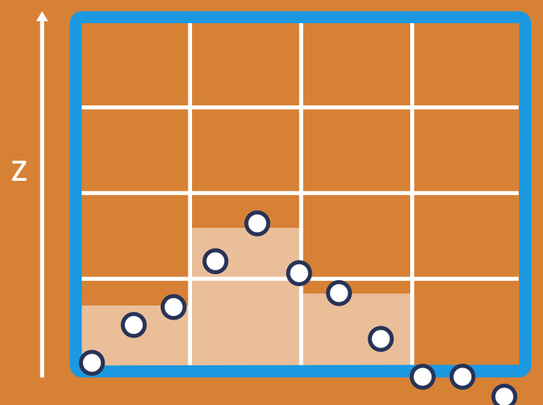


Real Bathymetrie

All the points have the same vertical grid

Product on native grid:

Uses a ZPS vertical grid



All the points have the same vertical grid

BUT

- the last ocean level is adapted to the bathymetrie

- So its thickness is different compare to the others at the same level

Vertical scale factors or depth reconstruction: Z vertical grid (PGS) case

e3t are 3D scale factors

depth are the 1D vertical depths at T points

All the points have the same vertical grid

So the 1D vertical depth profile can be applied for all points from horizontal grid to reconstruct 3D depth.

Example:

domain size: jpi,jpj,jpk (X,Y,Z directions)

-Read depth in static file: 1D vertical scale factor profil

-declare a 3D array for vertical scale factors: depth3d(jpi,jpj,jpk)

-implementation:

```
DO ji=1,jpi ! Loop in X direction
DO jj=1,jpj ! Loop in Y direction
Apply the 1d profile
depth3d(ji,jj,1:jpk)=depth(1:jpk)
END DO
END DO
```

Vertical scale factors or depth reconstruction: ZPS vertical grid (PGN) case

e3t_1d and e3w_1d:

the 1D vertical scales factors at T and W points

gdept_1d and gdepw_1d:

the 1D vertical depths at T and W points

mbathy:

an horizontal 2D array containing the last ocean level at each point of the horizontal grid

e3t_ps, e3w_ps:

horizontal 2D arrays containing the scale factors at the last ocean level for each point of the horizontal grid

hdept, hdepw:

horizontal 2D arrays containing the depth at the last ocean level for each point of the horizontal grid

All the points don't have the same vertical grid

The 1D vertical scale factor profils and depth are applied for all points from horizontal grid to reconstruct 3D scale factors and depth

AND we apply a correction to the last ocean (identified by mbathy) with the e3t_ps, e3w_ps, hdept, hdepw.

Example:

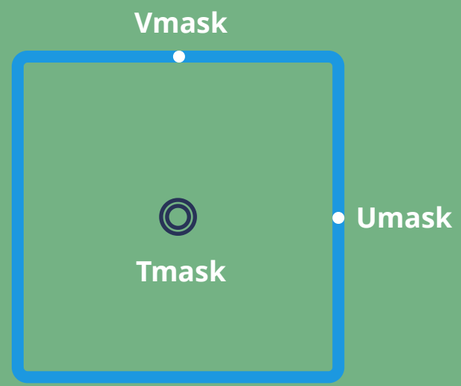
domain size: jpi,jpj,jpk (X,Y,Z directions)
-Read e3t_1d in static file: 1D vertical scale factor profil
-read mbathy: the last ocean cell level
-read e3t_ps: the last ocean cell thickness
-declare a 3D array for vertical scale factors: e3t(jpi,jpj,jpk)

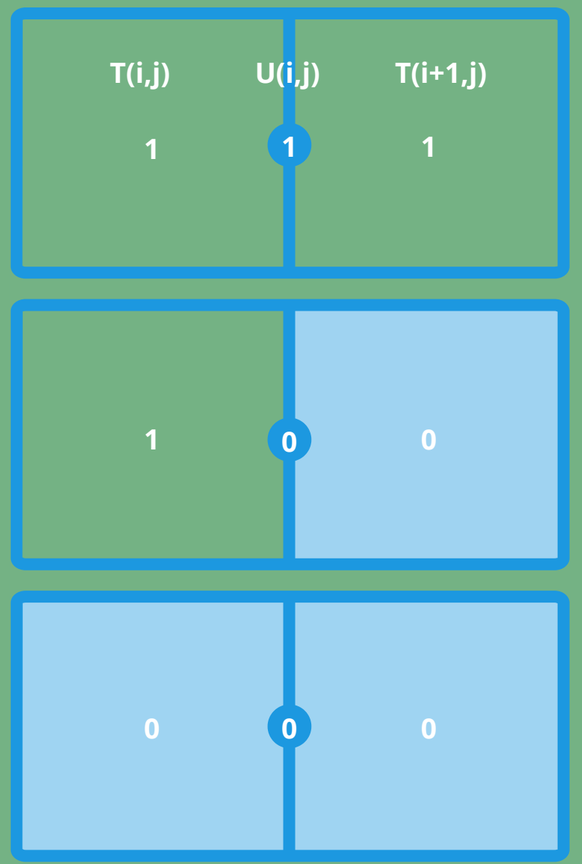
-implementation:
DO ji=1,jpi ! Loop in X direction
DO jj=1,jpj ! Loop in Y direction
e3t(ji,jj,1:jpk)=e3t_1d(1:jpk). Apply the 1d profile
e3w(ji,jj,1:jpk)=ewt_1d(1:jpk) Apply the 1d profile
ik=mbathy(ji,jj) Last ocean cell level
IF(ik .GE. 1)THEN where we are on ocean and not on land
e3t(ji,jj,ik)=e3t_ps(ji,jj) apply the correction
e3w(ji,jj,ik+1)=e3t_ps(ji,jj) apply the correction
END IF
END DO
END DO

Mask

For PGS (A-grid), the mask (var=???????) is the same for all variables

For PGN (C-grid), mask is not the same for all variables:





The u and v mask can be seen as a « wall » between the ocean and land.

The value is computed as :

U(i,j) = T(i,j) * T(i+1,j)

V(i,j) = T(i,j) * T(i,j+1)

legend: 0 = land; 1 = ocean