Static files description

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3 types of variables:

- scale factors: the ‘size’ of grid cells
- coordinates: the positions of the grid cells
- mask: distinction between land and ocean.
<table>
<thead>
<tr>
<th>Available files and variables</th>
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**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

**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
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
Product on standard grid
On set of longitudes/latitudes for grid cells center

Product on native grid:
3 sets of longitudes/latitudes

- **glamv/gphiv**
- **glamu/gphiu**
- **glamt/gphit**
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 interval is centered on ‘x’

Product on standard grid (PGS)

Product on native grid (PGN):
**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:
- $e_{3T}(k) \neq g_{depw}(k+1) - g_{depw}(k)$
- $e_{3W}(k) \neq g_{dept}(k+1) - g_{dept}(k)$
Vertical Z-grid

Product on standard grid:
Uses a Z vertical grid:

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 compared 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:**

```plaintext
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 profiles 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:

- implementation:

  ```
  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)
  
  e3t(jpi,jpj,1:jpk)=e3t_1d(1:jpk). Apply the 1d profile
  e3w(jpi,jpj,1:jpk)=w3t_1d(1:jpk). Apply the 1d profile
  
  ik=mbathy(jpi,jpj) Last ocean cell level
  
  IF (ik .GE. 1) THEN where we are on ocean and not on land
  e3t(jpi,jpj,ik)=e3t_ps(jpi,jpj) apply the correction
  e3w(jpi,jpj,ik+1)=e3t_ps(jpi,jpj) apply the correction
  END IF
  ``
  ```
The u and v mask can be seen as a « wall » between the ocean and land.

The value is computed as:

\[
U(i,j) = T(i,j) \times T(i+1,j) \\
V(i,j) = T(i,j) \times T(i,j+1)
\]

For PGS (A-grid), the mask (\(\text{var}=???????)\) is the same for all variables.

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

Legend: 0 = land; 1 = ocean