Advection of zonal velocity

Pressure Gradient

Friction

Coriolis Force Negligible on equator

x = longitude (degrees) u = Eastward sea water velocity (meters/ second)

y = latitude (degrees) v = Northward sea water velocity (meters/ second)

z = depth (meters) w = Upward sea water velocity (meters/ second)

**Calculating term:** Longitude indexing variable = j

*j*

*j - 1*

*j +1*

lon (j=1)

120.25o

lon (j=320)

279.75o

**Δx**

Δx is a constant regardless of where we are spatially

in the gridded data so for calculations, using:

Δx = 111320 meters

**Units:**

**Note**: when using central differencing method, you need data flanking your point of interest. This is not possible at the edge of the domain. Therefore, we start the ‘for loop’ at j = 2 and end it at j = 319.

**Calculating term:**

Latitude indexing variable = k

**Δy**

lat (k=1)

-4.75o

lat (k=20)

4.75o

*k*

*k +1*

*k - 1*

Δy is a **NOT** constant everywhere

but treating it as such:

Δy = 110574 meters

**Units:**

**Note**: (see Note above) we start the ‘for loop’ at k = 2 and end it at k = 19.

**Calculating term:**

Depth indexing variable = d

**Δ*zd-1***

depth (d=20)

579.31 m

depth (d=1)

5.01 m

*d*

*d - 1*

*d +1*

is **NOT** constant everywhere

the calculation is below

**Units:**

**Note:** (see Notes above) we start the ‘for loop’ at d = 2 and end it at d = 19.

**Calculating :**

**Dz1= 10.06 m**

depth2 = 15.07 m

depth1 =5.01 m

depth3 = 25.28 m

depth4 = 35.76 m

depth20 = 579.31 m

...

**Dz2= 10.21 m**

**Dz3= 10.48 m**

**Dz = diff(depth)**

**length(Dz) = 19**

depth

length(depth) = 20

**z = Dz(1:end-1)+Dz(2:end)**

**length(z) = 18**

**z 1= 20.27 m**

**z 2= 20.69 m**

...

...

**Note**: when indexing z, use d-1. Example: When calculating the term for depth(2) use z(1). This is because there is no Dz or z for the surface and last depth (due to central differencing approach) and thus the number of elements is reduced going from ‘depth’ to Dz to z.

**Calculating F*x* term**:

Second depth indexing variable = dd

z = Dz(1:end-1)+Dz(2:end)

length(z) = 18

z 1= 20.27 m

z 2= 20.69 m

...

...

dudz =

length(dudz) = 18

**Units:**

**Note**: there are 18 elements in the dudz vector (2 fewer than the depth vector). See notes above regarding central differencing method yields 2-fewer points. Ergo the ‘for loop’ starts at dd = 2 and ends at dd = 17.

**Calculating term**:

Trade

Winds

PGF

*j*

*j - 1*

*j +1*

lon (j=1)

120.25o

lon (j=320)

279.75o

**Δx**

Δlon

**Units:**

**Note**: Pressure gradient is constant through depth…

On the Equator (no Coriolis term):

Unit conversion to

Unit Conversion for trend in velocity, which is in