# MCV shallow water dynamic core on cubed-sphere grid

Shallow water equations on cubed-sphere grid

Where are the covariant wind vectors, and are the contravariant wind vectors. is the geopotential height. is the kinetic energy, is the absolute vorticity, is the relative vorticity, is the Coriolis parameter, is the Jacobian of transformation.

According to Chen(2018),

where

are the central angles on patches of the cube, and vary in

are defined as length of the arcs,

where is the radius of the earth.

On the curvilinear coordinate, converting contravariant vectors to covariant vectors by

where

We note .

Therefore

kinetic energy can be rewritten as

Considering the topography, the total geopotential height becomes

where , is the surface height.

The equations are able to be expressed as flux form

where

Then we have

where

setting

The shallow water equations become

Now we need to compute