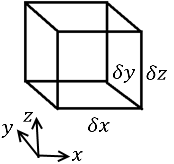
**Y-Component of the Momentum Equation**

Second Law of Motion; Sum of forces acting on a fluid element is equal to the rate of change of momentum of the element:

Expressed in a *per unit volume* basis:

Where is evaluated with respect to the following free-body diagram:



The sum of forces on the North and South faces is:

The sum of forces on the East and West faces is:

The sum of forces on the Top and Bottom faces is:

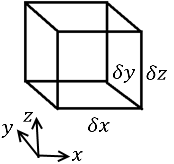
Combining equations 2-4, substituting in 1a and accounting for other body forces () contributing to , yields (on a *per unit volume* basis);

**Z-Component of the Momentum Equation**

Similarly,

Expressed in a *per unit volume* basis:

Where is evaluated with respect to the following free-body diagram:



The sum of forces on the Top and Bottom faces is:

The sum of forces on the East and West faces is:

The sum of forces on the North and South faces is:

Combining equations 7-9, substituting in 6a and accounting for other body forces along the z-axis, () contributing to , yields (on a *per unit volume* basis);