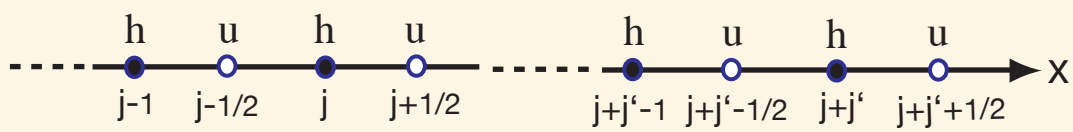
# MULTI-POINT SPACE-CENTERED 2-LEVEL EXPLICIT SCHEMES

# FOR LINEARIZED 1D SHALLOW-WATER EQUATIONS

$$\frac{\partial h}{\partial t} = -H\frac{\partial u}{\partial x} \qquad \frac{\partial u}{\partial t} = -g\frac{\partial h}{\partial x}$$

1D C-grid




For the continuity equation: forward

$$h_j^{n+1} = h_j^n - \frac{H\Delta t}{\Delta x}\left[a_0\left(u_{j+1/2}^n - u_{j-1/2}^n\right) + \sum_{j'=1}^{J} a_{j'}\left[\left(u_{j+j'+1/2}^n - u_{j+j'-1/2}^n\right) + \left(u_{j-j'+1/2}^n - u_{j-j'-1/2}^n\right)\right]\right]$$

For the momentum equation: $\alpha = 0$ : forward $\alpha = 1/2$ : trapezoidal $\alpha = 1$ : backward

$$u_{j-1/2}^{n+1} = u_{j-1/2}^n - \frac{g\Delta t}{\Delta x}\left\{\begin{array}{l} \alpha\left[a_0\left(h_j^{n+1} - h_{j-1}^{n+1}\right) + \sum_{j'=1}^{J} a_{j'}\left[\left(h_{j+j'}^{n+1} - h_{j+j'-1}^{n+1}\right) + \left(h_{j-j'}^{n+1} - h_{j-j'-1}^{n+1}\right)\right]\right] \\ +(1-\alpha)\left[a_0\left(h_j^n - h_{j-1}^n\right) + \sum_{j'=1}^{J} a_{j'}\left[\left(h_{j+j'}^n - h_{j+j'-1}^n\right) + \left(h_{j-j'}^n - h_{j-j'-1}^n\right)\right]\right] \end{array}\right\}$$