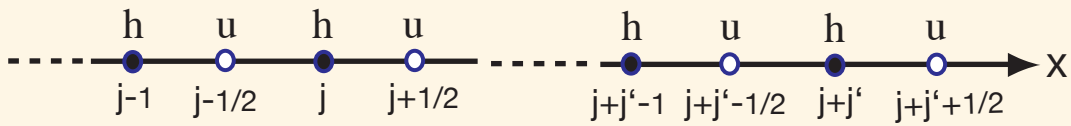
NONLINEAR 1D SHALLOW-WATER MODEL WITH THE MFB SCHEME

$$\frac{\partial h}{\partial t} = -\frac{\partial}{\partial x}(hu)$$

$$\frac{\partial u}{\partial t} = -\frac{\partial}{\partial x}\left(u^2/2 + gh\right)$$

1D C-grid



$$h_j^{(n+1)} = h_j^{(n)} - \frac{\delta t}{d}\sum_{j'=-J}^{J} a_{j'}\left[\overline{h}_{j+j'+1/2}^{(n)} u_{j+j'+1/2}^{(n)} - \overline{h}_{j+j'-1/2}^{(n)} u_{j+j'-1/2}^{(n)}\right]$$

$$u_{j+1/2}^{(n+1)} = u_{j+1/2}^{(n)} - \frac{\delta t}{d}\sum_{j'=-J}^{J} a_{j'}\left[\overline{K}_{j+j'+1}^{(n)} - \overline{K}_{j+j'}^{(n)}\right] - \frac{\delta t}{d}\sum_{j'=-J}^{J} a_{j'}\left[\Phi_{j+j'+1}^{(n+1)} - \Phi_{j+j'}^{(n+1)}\right]$$

where

$$\overline{h}_{j+j'+1/2}^{(n)} = \frac{1}{2}\left(h_{j+j'+1}^{(n)} + h_{j+j'}^{(n)}\right)$$

$$\overline{K}_{j+j'}^{(n)} = \frac{1}{2}\left[\tfrac{1}{2}\left(u_{j+j'+1/2}^{(n)}\right)^2 + \tfrac{1}{2}\left(u_{j+j'-1/2}^{(n)}\right)^2\right]$$

$$\Phi_{j+j'}^{(n+1)} = g\, h_{j+j'}^{(n+1)}$$