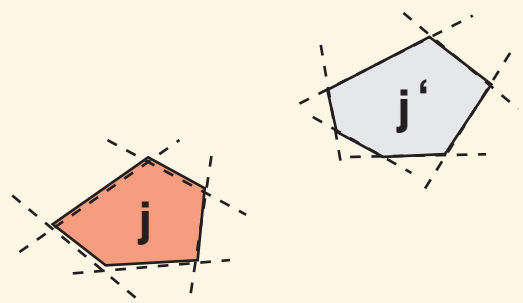
MULTI-POINT FORWARD BACKWARD SCHEME FOR LINEARIZED 2D SHALLOW-WATER EQUATIONS APPLIED TO AN IRREGULAR GRID

$$\frac{\partial h}{\partial t} = -H\,\delta$$

$$\frac{\partial}{\partial t}\delta = -g\,\nabla^2 h$$

$$\delta \equiv \nabla \cdot \mathbf{v}$$



$$h_j^{n+1} = h_j^n - H\Delta t \sum_{j'} a_{j,j'}\,\delta_{j'}^n \qquad \delta_j^{n+1} = \delta_j^n - g\Delta t \sum_{j'} a_{j,j'} \left(\nabla^2 h\right)_{j'}^{n+1}$$

Let $h_j^n = \hat{h}_m^n H_{j,j}^m \qquad \delta_{j'}^n = \hat{\delta}_m^n H_{j,j'}^m \qquad \left(\nabla^2 h\right)_{j'}^n = -\hat{h}_m^n m^2 H_{j,j'}^m$

where m^2 and $H_{j,j'}^m$ are an eigenvalue and corresponding eigenfunction of

$$\left(\nabla^2 H^m\right)_{j,j'} = -m^2 H_{j,j'}^m \quad \text{with} \quad H_{j,j'}^m = \begin{cases} 1 & \text{for } j' = 0 \text{ (normalization)} \\ 0 & \text{for } j' \text{ outside of the domain of dependence chosen} \end{cases}$$