MP Dynamics

$$\frac{\partial(\pi_s - \pi_t)}{\partial t} + \int_{\eta_t}^{\eta_s} \nabla \cdot (\underline{\delta\pi \boldsymbol{V}})\, d\eta = 0 \tag{3}$$

$$\frac{\partial(\delta\pi\theta_m)}{\partial t} + \nabla \cdot (\underline{\delta\pi \boldsymbol{V}}\theta_m) + \delta\left(\frac{\partial \pi}{\partial \eta}\dot{\eta}\theta_m\right) = \delta\pi S(\theta_m) \tag{4}$$

$$\frac{\partial u_n}{\partial t} + \zeta_p \delta\pi u_t + \frac{\overline{\partial KE}}{\partial n} + \dot{\eta}\frac{\overline{\partial u_n}}{\partial \eta} = \mathcal{L}\left[-\frac{1}{\rho_d}\frac{\partial p}{\partial n} - \frac{\delta p}{\delta \pi}\frac{\partial \phi}{\partial n}\right] + S(u_n) \tag{5}$$

$$\frac{\partial w}{\partial t} + \boldsymbol{V} \cdot \nabla w + \dot{\eta}\frac{\partial w}{\partial \eta} = \mathcal{L}g\frac{\partial p}{\partial \pi} - g + S(w) \tag{6}$$

$$\frac{\partial \phi}{\partial t} + \boldsymbol{V} \cdot \nabla \phi + \dot{\eta}\frac{\partial \phi}{\partial \eta} = \overline{wg} + S(\phi) \tag{7}$$

$$\frac{\partial \phi}{\partial \pi} = -\alpha_d \tag{8}$$

$$p = p_0\left(-\frac{R_d \delta\pi\theta_m}{p_0 \delta\phi}\right)^{\gamma} \tag{9}$$

$$\frac{\partial(\delta\pi q_i)}{\partial t} + \nabla \cdot (\boxed{\delta\pi \boldsymbol{V}}q_i) + \delta\left(\frac{\partial \pi}{\partial \eta}\dot{\eta}q_i\right) = \delta\pi S(q_i) \tag{10}$$

Model Control Unit
- Replace routines in the Dynamics module with those in the MP Dynamics module as add-ons

Dynamics
- Change the precision level of dynamics data

Physics-Dynamics Coupling
- Accommodate precision changes of some variables

MP Dynamics
- Mixed-precision dynamics code

Infrastructure
- Extend parallel data-exchange functions and some other functions to support reduced-precision
- Add precision control variable

Other components
Physics, land, data management, keep intact

- Model variables represented by underlined symbols denote single-precision operands.
- Black dashed boxes indicate using double-precision variables for computation, but the tendency is saved as single precision.
- Black solid box indicates using single-precision variables for computation, but the result is saved as double precision.
- Gray shading indicates that this variable is diagnosed mostly from single-precision variables.
- Other model variables in black represent original double-precision operands without modification.