MP Dynamics

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

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

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

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

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

$$\frac{\partial\phi}{\partial\pi} = -\alpha_d \quad (8)$$

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

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

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.