MOHID Whish list

Numerics

- Faster: Lagrangian and Eulerian => paralelisation
- Data Assimilation

2-Way Nesting

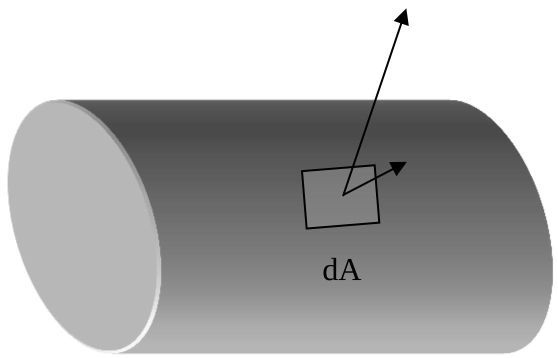
- Increases speed and Assimilation learning

Assimilation/Nudging/Relaxation

- Assimilation is the act of modifying a solution using external data. The scarcer is data, the most difficult assimilation is.
- Assimilation of gridded data is easy and gets different names

Advection – Diffusion Equation and Code Structure

{The rate of accumulation of a property inside a control volume} =
{what flows in minus what flows out}+{Production minus Consumption}



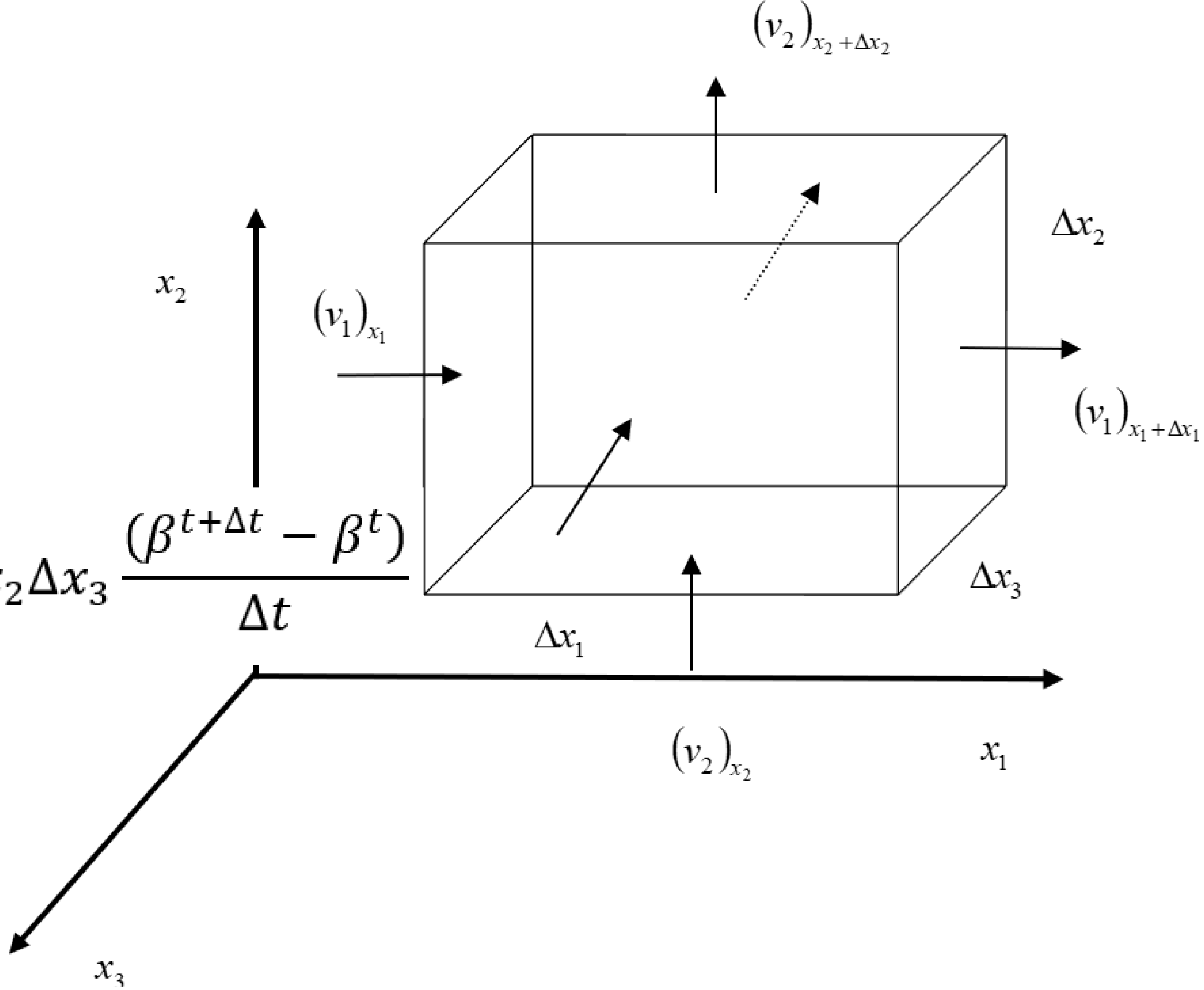
$$\frac{\partial}{\partial t}\left(\iiint_{Vol} \beta dVol\right) = -\iint_A \beta(\vec{v}.\vec{n})dA - \iint_A -\vartheta\left(\vec{\nabla}\beta.\vec{n}\right)dA + Sources - Sinks$$

- This equation was easy to obtain, it is easy to understand, but it is not useful to get results because the integrals very seldom have a solution.

Algebraic Equation

$Vol = \Delta x_1 \Delta x_2 \Delta x_3$ ➢ Constant in time

$A_k = \Delta x_i \Delta x_j$



$$\frac{\partial B}{\partial t} = \frac{\partial}{\partial t}\left(\iiint_{Vol} \beta dVol\right) = \frac{B^{t+\Delta t} - B^t}{\Delta t} = \Delta x_1 \Delta x_2 \Delta x_3 \frac{(\beta^{t+\Delta t} - \beta^t)}{\Delta t}$$

$$\Phi_{adv} = -\iint_A \beta(\vec{v}.\vec{n})dA = \Delta x_2 \Delta x_3\left[(\beta v_1)_{x_1} - (\beta v_1)_{x_1+\Delta x_1}\right]$$

$$+\Delta x_1 \Delta x_3\left[(\beta v_2)_{x_2} - (\beta v_2)_{x_2+\Delta x_2}\right]$$

$$+\Delta x_1 \Delta x_2\left[(\beta v_3)_{x_3} - (\beta v_3)_{x_3+\Delta x_3}\right]$$

Differential Equation

$$\frac{\partial \beta}{\partial t} + \frac{\partial \beta v_i}{\partial x_i} = \vartheta \frac{\partial^2 \beta}{\partial x_i^2} + sources - sinks$$

- Or,

$$\frac{\partial \beta}{\partial t} = -\frac{\partial}{\partial x_i}\left(\beta v_i - \vartheta \frac{\partial \beta}{\partial x_i}\right) + sources - sinks$$

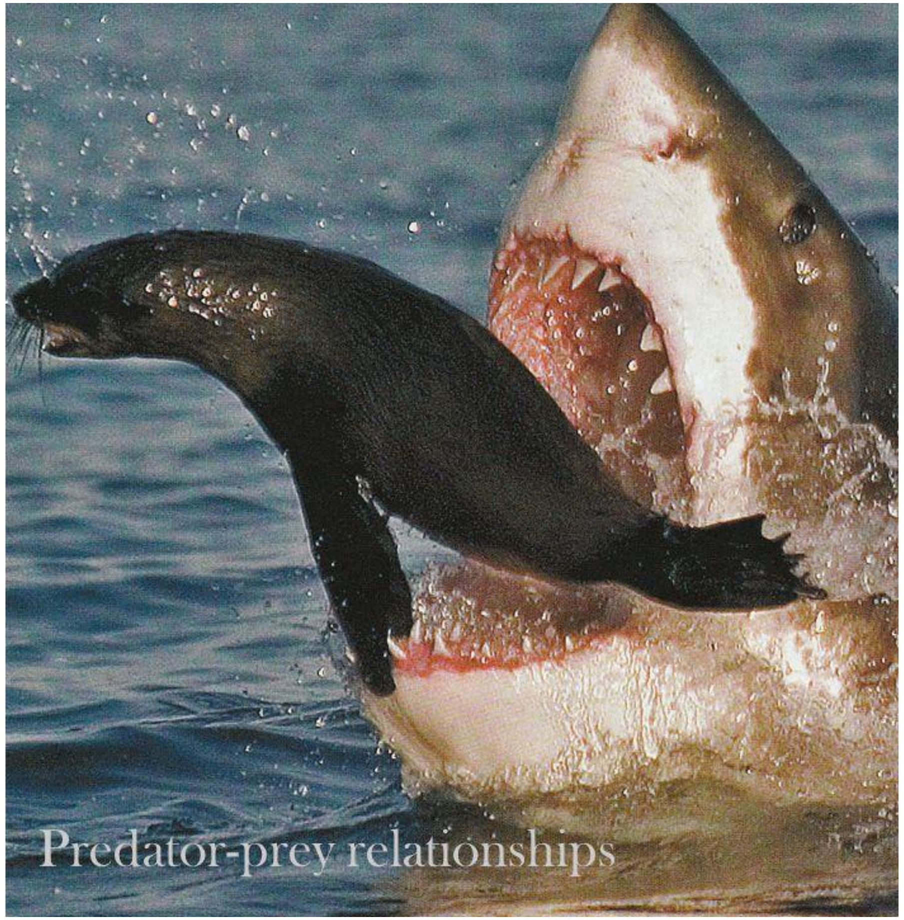
- If incompressible flow the divergence of the velocity is zero and the equation becomes:

$$\frac{\partial \beta}{\partial t} + v_i \frac{\partial \beta}{\partial x_i} = \vartheta \frac{\partial^2 \beta}{\partial x_i^2} + sources - sinks$$

- If the control volume was moving at the flow velocity, the relative velocity would be zero and there would be no advection => Lagrangian formulation

- Source/Sink code must be share by both formulations!!!

Source/Sinks



Who took this decision?

In the code, predation is done in the predator subroutine/module and not in the prey subroutine/module!!!

What happens the prey?

- It is respired!
- What is that?
- CO2 + H2O + PO4+ …. +Detritus
- What happens to the detritus?
- ….

How to implement this?

Subroutines/Modules should describe activities of specific functional groups. NH4 has no activity and thus should have no subroutine!

Fractionated Time-Step is **A** numerical support for that. It is better than the explicit algorithm (stability and accuracy)

$$\frac{\partial P}{\partial t} = \frac{P^{t+\Delta t} - P^{t}}{\Delta t} = \frac{P^{t+\Delta t} - P^{*}}{\Delta t} + \frac{P^{*} - P^{**}}{\Delta t} + \frac{P^{**} - P^{t}}{\Delta t}$$

In MOHID we also have an implicit algorithm