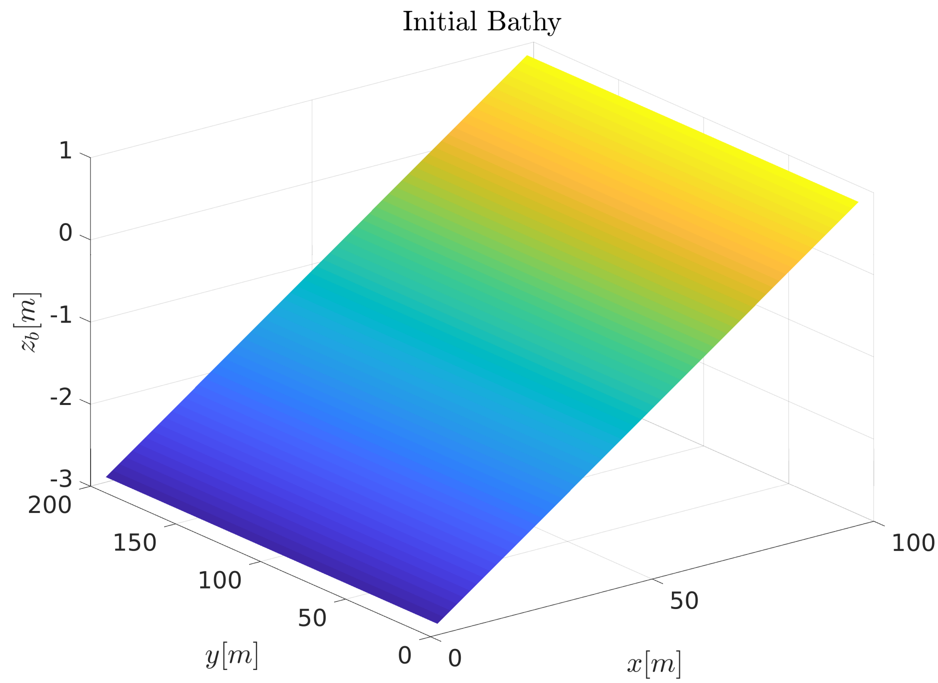

Figure 1: Planar profile

A simple planar profile is utilized, as shown in Fig 1. Normally incident waves of $H_{rms} = 1m$ and $T = 8s$ are run for 3 hours. With

```
WAVE_INDUCED_SED_TRANS                OFF
```

and using the Lund-CIRP formulation, the transport field is shown in Fig 2. In this simulation without wave-driven impacts, transport is in accordance with simple current advection. The red box depicted in the field will act as a control volume for a rough check. Twice integrating the sand conservation statement in x, y and again in time results in a time series for volume in the box where changes in volume are balanced by the cumulative sum total of transport across the boundary. Figure 3 shows the time-series of box volume as a solid red line and the total cumulative transport across boundaries as a dashed red line. The analysis is somewhat simplified, herein, using low-order numerical integration in time and space, and so the expectation is that the red lines are approximately coincident, as shown.

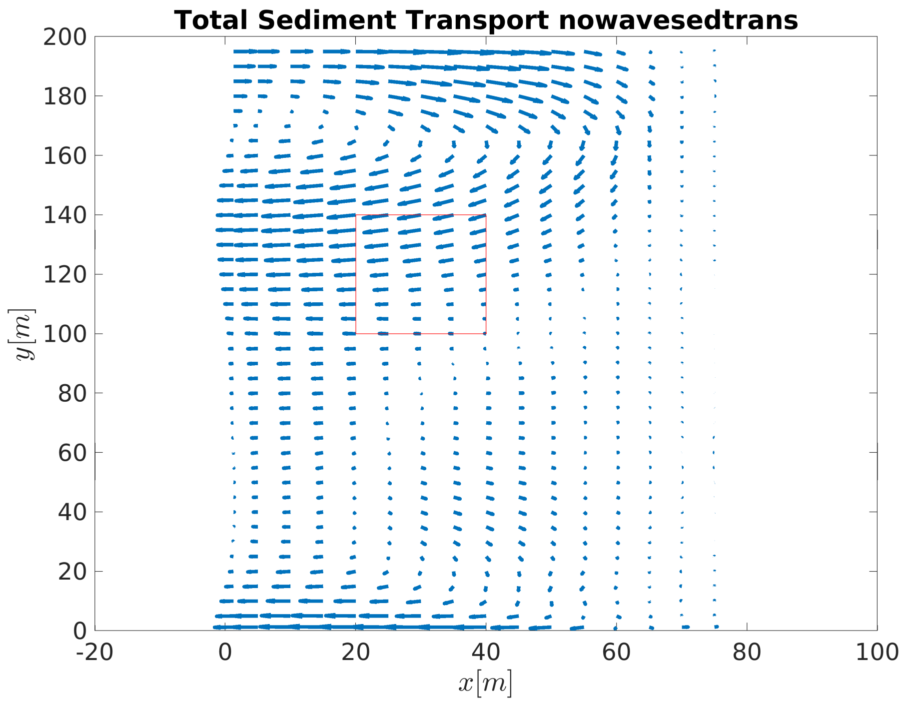

Figure 2: Transport field

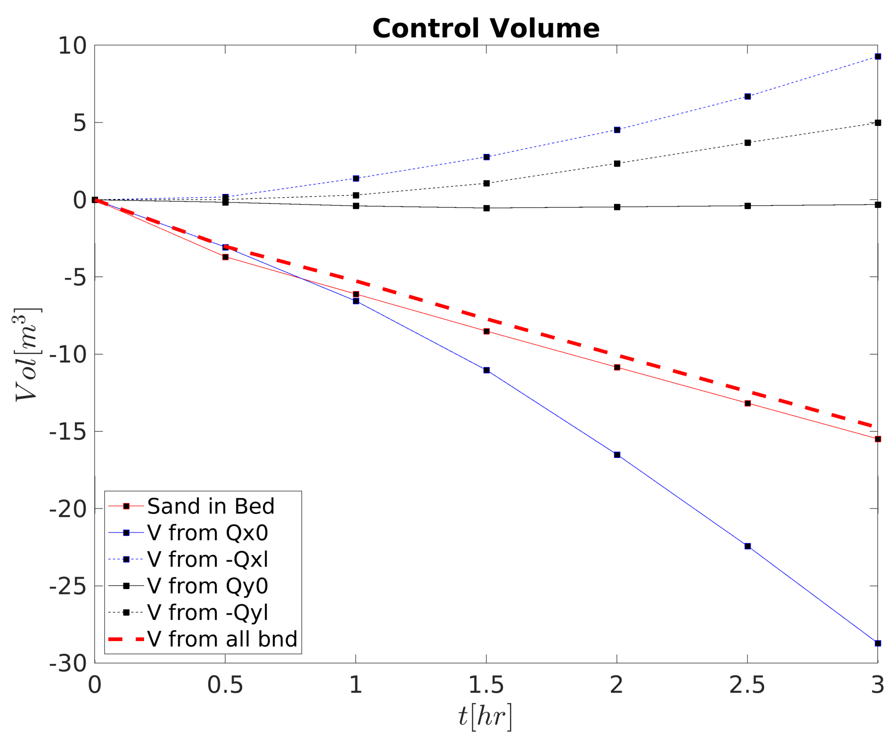

Figure 3: Control Volume

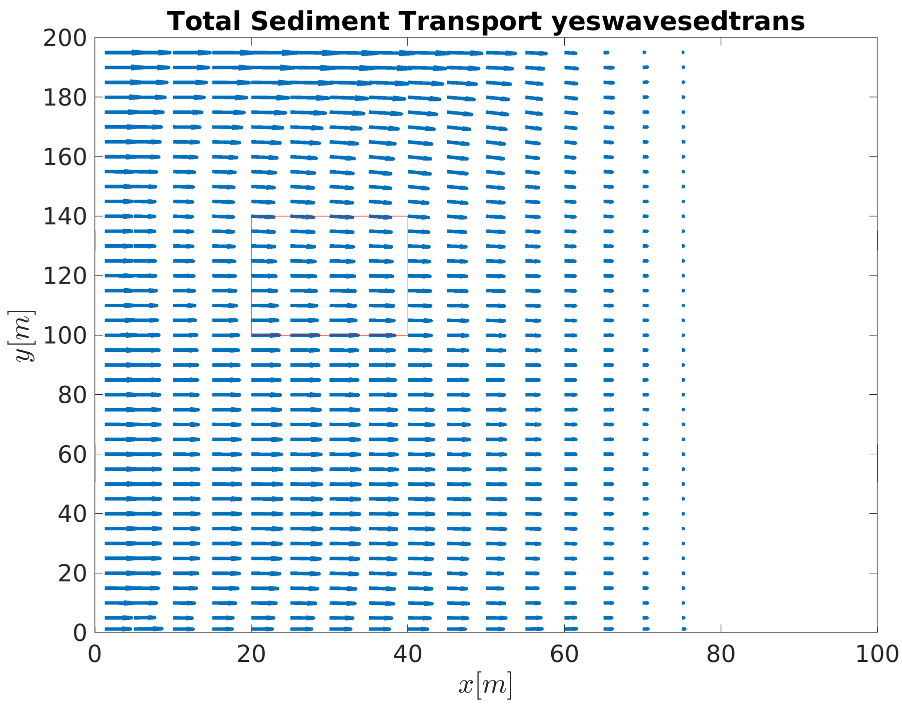

Figure 4: Transport field

Alternatively, with

```
WAVE_INDUCED_SED_TRANS                  ON
```

the transport field is shown in Fig 2 where wave-driven transport is exaggerated and onshore. The analogous control volume analysis is provided in Fig 5, where the difference in volume and boundary flux are obvious.

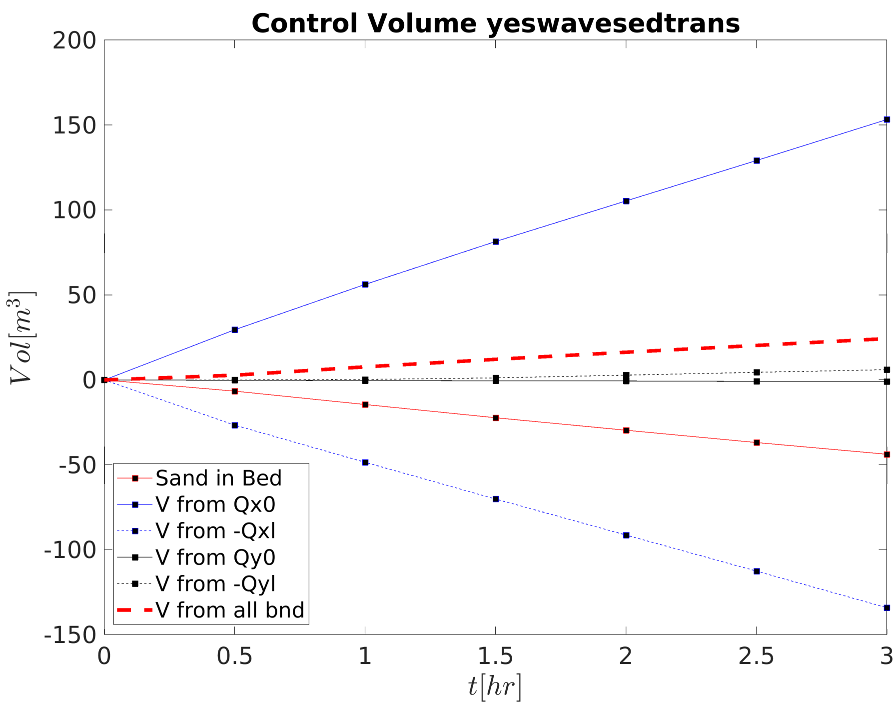

Figure 5: Control Volume

1 CMS Formulation

The `NET` formulation of the CMS model has an time-dependent sed balance, provided here in one dimension,

$$\frac{\partial\, hc}{\partial t} + \frac{\partial\, q_s}{\partial x} = \alpha \omega_f \left\{ c_* - c \right\} \tag{1}$$

where $q_s = Uhc$ is the advective transport. The sand conservation statement for a steady concentration field is given

$$(1-p)\frac{\partial\, z_b}{\partial t} = -\frac{\partial\, q_s}{\partial x} \tag{2}$$

resulting in

$$(1-p)\frac{\partial\, z_b}{\partial t} = \alpha \omega_f \left\{ c - c_* \right\} \tag{3}$$

2 CMS Formulation Proposed

Returning to the sand conservation statement for a steady concentration field

$$(1-p)\frac{\partial\, z_b}{\partial t} = -\frac{\partial\, q_s}{\partial x} - \frac{\partial\, \tilde{q}}{\partial x} \tag{4}$$

where the transport is decomposed into a suspended portion and a wave-driven component $\tilde{q}$. It is proposed that we retain the suspended balance and enforce the gradient of the wave driven transport

$$(1-p)\frac{\partial\, z_b}{\partial t} = \alpha \omega_f \left\{ c - c_* \right\} - \frac{\partial\, \tilde{q}_i}{\partial x_i} \tag{5}$$

now provided in two dimensions. This, essentially, presupposes that the wave-driven component reacts instantaneously to the forcing and enforces mass-conservation of a wave-driven transport vector. Implementation will require returning to the formulation in `sediment.f90` and parsing out the advection and the additional terms, e.g. bedload, wave-related transport, swash transport, etc.