Coupling BC plus internal wavemaker

I added tests for the coupling application in the GITHUB repository:
TMA_MAKER/TEST_couplingbc_wavemaker/

1) Coupling Cases
2) Preprocessing
3) Postprocessing

Four cases are provided for this specific application. The best solution so far involves using (u,v) coupling boundary conditions at the lateral boundaries (south and north) and adding a wavemaker and sponge layer offshore (Cases 3 and 4). Adding tidal elevation is challenging because the sponge layer disrupts the conditions. A new development may be needed to use full hydrodynamic boundary conditions derived from a large-domain model.

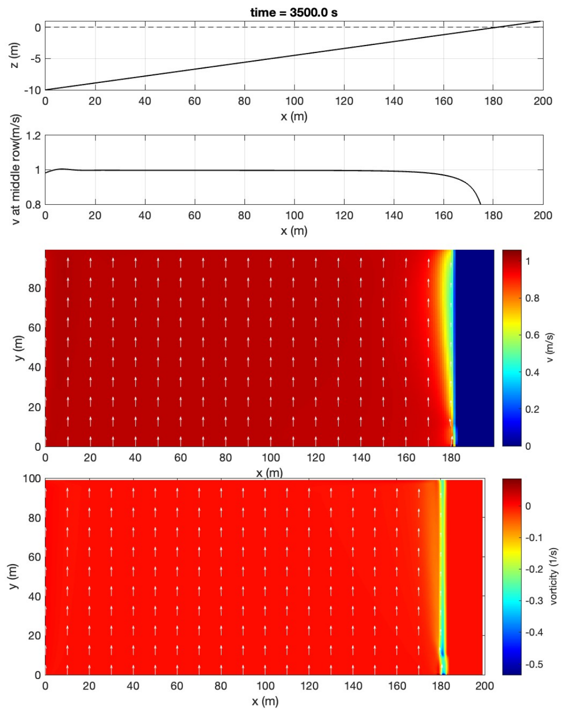

Figure 1: CASE 1: Constant slope with constant v at lateral boundaries.

CASE 1: Constant slope with constant v at lateral boundaries

The computational domain 200m long (East-West) and 100m wide (South-North). The slope start from $x = 0$ with slope of 0.055, so that there are dry points at the east boundary (see Figure 1 top pannel). A constant velocity $v = 1m/s$ is specified at the south and north boundaries. The coupling file can be generated using /preprocessing/A1_A_B.m. Set $southfine(ipoint, 2, ti) = 1.0$ and $northfine(ipoint, 2, ti) = 1.0$.

The test is used to examine the x-distribution of v inside the domain. Because the water depth decreases on shore, the smaller v velocity is expected in shallower water depth (refer to the theory of open channel flow). The second panel in Figure 1 shows the v-distribution along x at $y = 50m$ (middle). The spatial distribution of v is shown in the third panel. The bottom pattern shows the vertical vorticity, indicating strong shear at the shoreline.

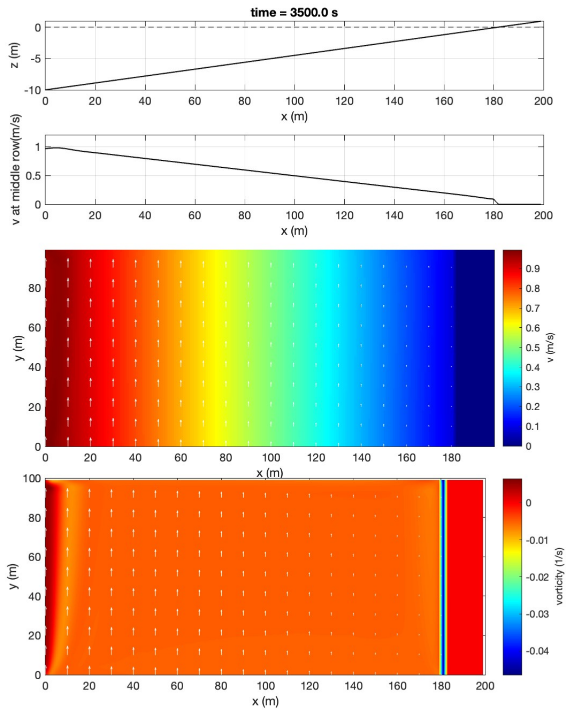

Figure 2: CASE 2: Constant slope with varying constant v at lateral boundaries.

CASE 2: Constant slope with varying constant v at lateral boundaries

The same as CASE 1, except a linear distribution of v from $1m/s$ to 0 across-shore. Use the same matlab file and set $southfine(ipoint, 2, ti) = 1.0 * (npoints(3) - ipoint)/(npoints(3) - 1)$; $northfine(ipoint, 2, ti) = 1.0 * (npoints(4) - ipoint)/(npoints(4) - 1)$; to generate coupling.txt. The second panel shows v cross-shore distribution at $y = 50m$ (middle). Note that $v = 0$ at all dry points. Compare Case 1, strong shear is only shown at very narrow area (bottom panel) due to the small v near the shoreline.

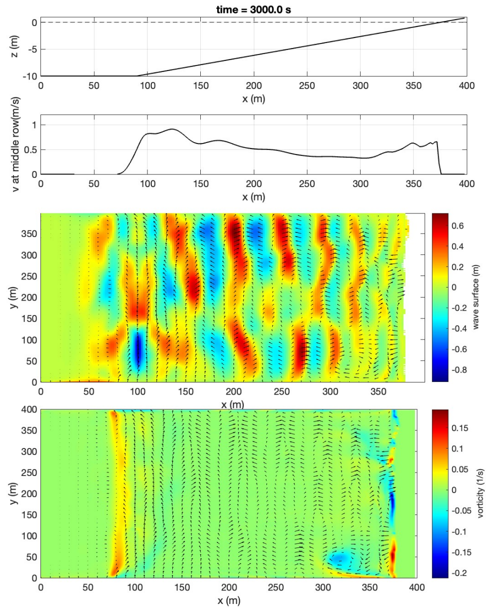

Figure 3: CASE 3: Constant slope with varying constant v at lateral boundaries, plus a wavemaker

CASE 3:Add a wavemaker

Based on Case 1 or Case 2, we can adda wavemake at x=100m, and a sponge layer at the west boundary
WAVEMAKER = WK_IRR
DEP_WK = 10.0
Xc_WK = 100.0
Yc_WK = 200.0
Ywidth_WK = 390.0
FreqPeak = 0.125
FreqMin = 0.05
FreqMax = 0.3
Hmo = 1.0
GammaTMA = 5.0
ThetaPeak = 15.0
Sigma_Theta = 10.0

Sponge_west_width = 80.0 NOTE: the width of the wavemaker needs to be specified smaller than domain width. Ywidth_WK = 390.0

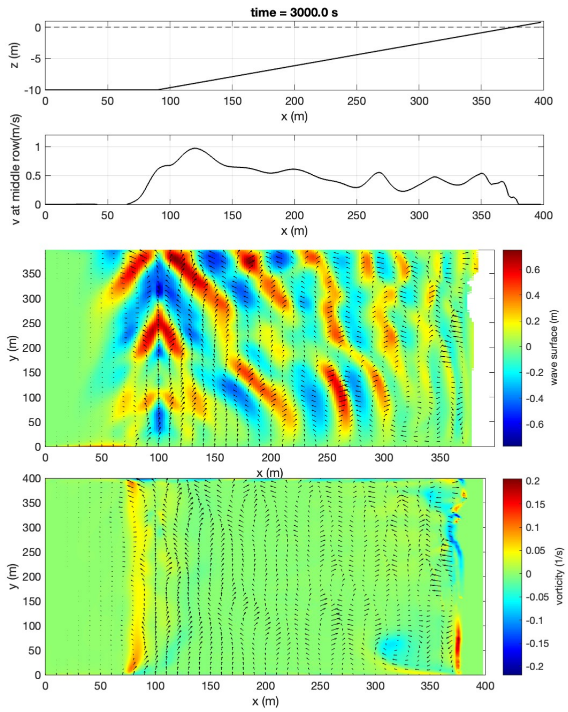

Figure 4: CASE 4: oblique incidence

CASE 4: Oblique incidence

Base on CASE 3, modify
ThetaPeak = 15.0
You should see wave diffraction at the southern boundary and reflection from the northern boundary. It's hard to avoid!