Benchmark 2: Input Data Files for Modeling of Hirota Bay

This document describes the input data files for the Hirota Bay, Rikuzentakata case study used in Yamashita et al. (2022).

Data Format for Uniform Grid Data files

All data files described below are the z data format files with uniform grid. The following Matlab codes in each DEM directory plot any z data format file:
`plot_z_crescent_0p3sec_501x361.m` at `/crescent_city/DEM/`
`plot_z_hirota_0p2sec_1567x1387.m` at `/hirota/DEM/`

To plot the other z data format files using these m files, you may need to change the following parameters.

(1) Essential parameters to run the code
Line 8: input file name, `z_file`

Line 14: the number of gird points along the longitude, `ix(-)`
Line 15: the number of grid points along the latitude, `jy(-)`

Line 18: grid space, d`x(°)`

Line 22: longitude at the west end, `xmin(°)`
Line 24: latitude at the south end, `ymin(°)`

(2) Optional parameters
Line 30: increment to plot z data, `inc(-)`

Line 51: vertical exaggeration, `zFC(-)`

Line 55: minimum value for the colorbar, `zminC(m)`
Line 56: maximum value for the colorbar, `zmaxC(m)`

Line 106: change the light angle

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- Nested-grid Setup (in `/hirota/`)
  `hirota_4GN_setup_2023_0601.xlsx` shows the nested-grid setup to model Hirota Bay including the grid points, space, and coverage of each computational domain.

- DEM data (m) (in `/hirota/DEM`)
  Domain 1: `hirota_30sec_685x613_2018_02_DDGW.dat`
  Domain 2: `hirota_6sec_481x391_2018_02_DDGW.dat`
  Domain 3: `hirota_1.2sec_1261x1081_2018_02_DDGW.dat`
  Domain 4: `hirota_0.2sec_1567x1387_2018_02_sml.dat`

- Manning's roughness coefficient (in `/hirota/`)
  Domain 4: `hirota_0.2sec_1567x1387_n_edit_ver1_sml.dat`
  The coefficient obtained from the following data is used in hydrodynamic model, while the constant value of 0.03 $m^{-1/3}s$ is used in sediment transport model.

- Land-use Map (in `/hirota/`)
  Domain 4: `lc_0002_rztt_sml.dat`
  The above roughness coefficient is based on the land-use map as showed in Table 1 (Yamashita et al., 2016). A visualization of the map may be seen in Figure 3 in the following URL: https://www.tandfonline.com/doi/abs/10.1142/S0578563416400155.

Table 1 Definition of land-use map

ID (Int)	Land-use Type	Manning's Roughness Coefficient		Sediment Source	Ground Elevation
		hydrodynamic model	Sediment transport model		
-1	Building/House	0.040	0.03	Non-erodible	DEM
0	Water Body	0.025	0.03	Erodible	DEM
1	Arable Land	0.020	0.03	Non-erodible	DEM
2	Paved Surface etc.	0.025	0.03	Non-erodible	DEM
3	Coastal Forest	0.030	0.03	Erodible	DEM
4	Bare Ground/Broken Dike	0.025	0.03	Erodible	DEM
5	Submerged Breakwater	0.025	0.03	Non-erodible	DEM
6	Robust Building	0.040	0.03	Non-erodible	**DSM**

- Initial Deposition Thickness (cm) (in `/hirota/`)
  Domain 4: `init_sand25deg_0002_rztt_sml4.dat`
  The initial sediment layer, which is assumed to be 20 m thick, tapers off over a 25° gradient to the boundaries of non-erodible surfaces.

- Tide level: -42.0 cm

References

Yamashita, K., Sugawara, D., Takahashi, T., Imamura, F., Saito, Y., Imato, Y., Kai, T., Uehara, H., Kato, T., Nakata, K., Saka, R. and Nishikawa, A. (2016). Numerical simulations of large-scale sediment transport caused by the 2011 Tohoku earthquake tsunami in Hirota Bay, southern Sanriku coast. Coastal Engineering Journal, 58 (4), 1640015, doi:10.1142/S0578563416400155.

Yamashita, K., Yamazaki, Y., Bai, Y., Takahashi, T., Imamura, F., and Cheung, K.F. (2022). Modeling of sediment transport in rapidly-varying flow for coastal morphological changes caused by tsunamis. *Marine Geology,* 449, 106823, doi:10.1016/j.margeo.2022.106823.