

CODE FOR PEER REVIEW PURPOSES ONLY

This folder contains the code for generating components of the MDP/POMDP models, generating the input for the FRTDP solver, which is publicly available on GitHub (<https://github.com/trey0/zmdp>). The datasets used to simulate sea level rise (SLR) and surges are also publicly accessible (sources provided at the bottom), as also mentioned in the manuscript. Indicatively, the workflow for generating the MDP input for the coastal city setting application with the two floodwalls option, as described in the paper, using the provided code is outlined below:

Step 1: The SLR trajectories are simulated using the `slr_simulations.m` file. These simulations are used to generate the SLR state transitions in Step 2.

Step 2: The discrete-state transitions for Sea Level Rise (SLR) and storm surge are generated using the codes, as:

- (i) `slr_transitions.m` for SLR transitions
- (ii) `surge_transitions.m` for storm surge transitions

Step 3: After generating the SLR and surge transitions, the full transition model over the MDP state space is generated considering state-space augmentation with time and systems, using `transition_model_MDP.m` file.

Step 4: Generate the rewards for states in the different systems for all the actions in the application setting, along with social cost of carbon considerations, using the `rewards_with_scc_systems.m` file.

Step 5: After generating the rewards for the different systems, the rewards for the full MDP state space are generated using `rewards_model_MDP.m` file. This file calls `rewards_fp.m` file to shape the rewards in such a way so as to use the fast parser of the input file in the solver used.

Step 6: After generating the transitions and rewards components of the MDP model in the above steps, the MDP input file is generated using `inp_mdp_file_generator.m` file.

Step 7: The generated input is solved using the FRTDP solver. The solver is publicly available at: <https://github.com/trey0/zmdp>. The details related to the solver and the input file formats can be found in this GitHub.

Data sources:

The IPCC projection dataset (for Battery tide gauge in New York) used to simulate SLR models is publicly available at: <https://zenodo.org/records/6382554>

The dataset for SLR trends (for Battery tide gauge in New York) used to fit the noise present in the past SLR observations is taken from:

https://tidesandcurrents.noaa.gov/sltrends/sltrends_station.shtml?id=8518750

The dataset of annual extremes (for Battery tide gauge in New York) used to fit storm surges is taken from: https://tidesandcurrents.noaa.gov/est/est_station.shtml?stnid=8518750