This research aims to support transportation infrastructure protection planning against sea level rise, providing a general framework for different decision-making cases. The case study focuses on San Francisco Bay area, for a 0.5m sea level rise that is expected in 2054 and may increase travel time by 37%. The hydrodynamics in the Bay Area are affected by the shoreline protection strategy, and closure of a highway link in one county affects traffic delays in other counties due to queue spillback and traffic re-routing. Thus, protection decisions made by a county have potential impacts on several other counties, and therefore counties must consider other counties’ actions. The first scenario is a centralized decision maker who selects the levee installation strategy that minimizes the total delays occurring in the transportation system under inundation, accounting for budget constraints, hydrodynamic interactions within the shoreline, as well as traffic dynamics in the network. A simulation-based optimization model is designed to minimize delays and the results show that the optimal strategies vary according to the available budget, and that there exist relatively critical shorelines to protect in order to reduce the traffic disruptions. The second scenario is where decision makers around the area under consideration act separately, taking into account all the aforementioned dynamics as well as accounting for the influence of other agencies’ actions. A third scenario is analyzed, where each competitive decision-maker can consider cooperation to minimize its traffic delay, so its behavior can be defined as co-opetitive. We develop an integrated game-theoretical decision-making framework to represent multiple co-opetitive decision-makers’ behavior. We define necessary conditions for forming coalitions for multiple co-opetitive decision-makers, as well as cost-distributing rules and incentive negotiation processes within each coalition.

Ilia has just received her Ph.D. in Transportation Planning & Engineering from New York University. Her research focuses on highway infrastructure protection against sea level rise, using game theory to represent decision-makers’ behavior. This is a multi-disciplinary NSF funded project, applied in the San Francisco Bay area (http://riser.berkeley.edu/), that takes into account how the hydrodynamics interact with the protection strategy, the resulting changes on the transportation network, drivers’ reaction and decision makers’ behavior. Except for environmentally managed transportation systems, Ilia is also interested in supply chain management and applied optimization, as her Masters dissertation focused on the design of an optimization model that integrates inventory, distribution and production of perishable products.