On September 1, 2021, New York City saw devastating and fatal flash flooding as the post-tropical storm that once was Hurricane Ida swept through the Northeast. Although this storm lost its tropical characteristics, it still packed a punch with rain rates near or above 3 inches per hour and rainfall totals exceeding 10 inches in parts of Pennsylvania and New Jersey. The high rain rates and the short time frame in which the rain fell combined with the high aerial coverage of impervious surfaces in the densely populated areas in and around the Philadelphia and New York City metropolitan areas led to devastating impacts. These urban areas as well as their highly populated suburbs faced excessive freshwater flooding from this storm, leading to 49 direct fatalities mostly in northern New Jersey and New York.

Despite many advances in precipitation forecasting in recent years, flash flooding remains the number one cause of storm-related deaths in the United States. The short time scale and typically more localized nature of the rainfall leading to flash floods combined with the nuances of each location’s hydrology make this an especially challenging forecast issue. Furthermore, because flash floods typically occur within a short period of time of heavy rainfall, people are often left with little time to react to the situation.

Urban areas are particularly susceptible to flash flooding due to their increased area of impervious surfaces and their limited drainage systems. Therefore, when heavy rain falls over an urbanized area, the impacts can be far greater than if the rain had fallen in a more rural location. Additionally, the high population density in urban areas places more people at risk. As urban areas in the United States are projected to continue to grow, the need for accurate and timely urban flash flood forecasting is becoming more and more necessary.