Title: Capacity Building to Support the Machine Learning-Based Detection of Floods and other Natural Hazard Impacts in the Department of Environmental, Earth and Geospatial Sciences at North Carolina Central University

Institution: North Carolina Central University

City/State: Durham, North Carolina

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Summary: According to NASA, the most prevalent natural hazards are floods and storms, which make up more than 70% of all natural hazards (NASA 2020). In North Carolina, many of our most marginalized communities suffer disproportionately from the impact of storms and flooding and are less resilient to major flooding events and hazards compared to their more affluent counterparts. Research on Social Vulnerability Indices utilizing geospatial data and imagery analysis as applied to all hazards in general (Lawal and Arokoyui 2015, Tasnuva et al. 2021), but also flooding (Aroca-Jimenez et al. 2017, Tate et al. 2021), environmental hazards and air quality (Agency for Toxic Substances and Disease Registry 2021, Lee 2015), earthquakes (Lestari and Sakti 2021), volcanoes (Hicks and Few 2015, Maharani et al. 2016), tornados in Alabama (Forbes et al. 2018), hurricanes (Bjarnadottir et al. 2011, Flanigan et al. 2011, Rickless et al. 2021) and wildfires in North Carolina (Anderson and Sugg 2019) underscore the application of quantitative indices to measure a community's vulnerability, or potential for loss (Cutter 2003). Combining these multi-scale (temporal, spatial) imagery and spatial data (socioeconomics, building footprints, etc.) through analytic and more advanced AI and ML techniques could facilitate tangible and significant change in the research community and ultimately our communities. Based on the use case "Machine Learning-Based Detection of Flood Extent and Impacts", this project will create the training, data resources and opportunities to use machine learning and artificial intelligence to identify and measure the impact of flood events and other natural hazards such as earthquakes, volcanoes, tornadoes, hurricanes, drought, landslides, and wildfires. The Nelson Memorandum published by the White House's Office of Science and Technology Policy (Executive Office of the President 2022) guides the equitable access to federally funded research results and the scientific data derived from or used to create results. It further reinforces a renewed dedication to the equitable and fair access to data resources and technologies. In response, this proposal creates a consortium of three minority serving institutions - North Carolina Central University (NCCU, consortium lead), Elizabeth City State University and University of Maryland Eastern Shore - that allocates time, technology, and personnel resources to define the needs to develop, deploy and catalog data and training

resources that will compose a robust and accessible data science infrastructure. This will in turn facilitate transformative and meaningful research as well as applications on the use of machine learning and artificial intelligence as applied to flood events and other natural hazard impacts. We plan to support fact-based science, protect, and improve life on earth while broadening participation diversity in an inclusive, mentoring, and collaborative environment. Furthermore, there exists a widening skills gap aligned to data, technology, and their literacies which this proposal directly addresses as it also plans to support students, faculty, and partnerships in support of these activities. This proposal addresses the need for the use of the data sciences from the mathematical, information and computer sciences to flooding and other natural hazards that have social-economic-geographic-health-environmental repercussions which disproportionately affect underrepresented segments of the population. These underrepresented groups compose a large portion of the student bodies at the proposed consortium institutions and this grant opportunity will provide students and faculty at the PI's and partnering institutions with the data resources, education, research skills, acumen, and real-world work experiences to be competitive in academia, the workforce and/or graduate school.