**1. Project Plan**

**(10 points, due Monday 30th March)**

**Write up a 1-2 page project plan that will include:**

* **a short paragraph explaining the background to your problem.**

Tidal flooding frequency and intensity is increasing along with sea level rise. Despite the attention to problems these events cause in infrastructure and economics, little is known about water quality impacts caused by tidal flooding events. Materials accumulating on areas prompt to be impacted by inundation could be carried on the retreating water. The amount and nature of these components might affect the biochemical cycles in the adjacent body of water.

* **a description of what your target variable is, and an explanation of why you need to build a model to estimate it.**

Nutrients carried on retreating flood waters might affect the biochemical cycles on the adjacent body of water (i.e. algal bloom occurrence). Therefore, constraint this potential nonpoint source of nutrients is critical to understand coastal ecosystems impacted by recurrent tidal flooding events.

Nutrient measurements are difficult to make in natural environments, specially in estuarine systems. The variability in the nutrient itself (i.e. changes through the water column and through the day) and changes in other variables (i.e. salinity) make nutrient monitoring complicated. These cause measurements to be scarce, temporally and spatially.

Building a model that could predict nutrient concentrations based in weather parameters (i.e. precipitation) is of highly interest. This could allow to fill the gaps in which nutrient data is not available to be match with other biochemical variables with a higher temporal and/or spatial distribution (i.e. chlorophyll).

* **a list of the other variables you will use to estimate your target.**

Precipitation

This can increase the value of water level (inundation), but could also modify nutrients concentration.

Wind speed

Sustained winds can push water within the basins, promoting higher water levels.

Wind direction

Depending on the direction of the winds hitting the lower Chesapeake Bay, water level can be increased or diminished

Water level

The value of water level can be associated to different scenarios of inundation along the perimeter of the Lafayette river and, potentially, the amount of nutrients carried on the retreating water to the adjacent system.

* **a description of the datasets that you will use.**

Precipitation and wind (speed and direction) data come from the Norfolk International Airport (<https://www.ncdc.noaa.gov/cdo-web/cart>). The data consist of daily averages from 1946 to 2020. Includes other variables like snowfall, multiday-precipitation total, peak gust wind speed, etc.

Water level data comes from NOAA’s station at Sewells point (<https://tidesandcurrents.noaa.gov/waterlevels>). Hourly height water level data is constant since 1944. Other parameters, like water temperature and conductivity, are available since around the year 2000.

Nutrient data comes from the Virginia Estuarine and Coastal Observing System (<http://vecos.vims.edu/>). There are two stations with similar data available, one at the “mouth” (Norfolk Yacht and Country Club) and one at the “head” (next to the Zoo) of the system. Data goes from the beginning of 1998 to the end of 2018. However, data is more consistent from the years 2000 to 2017.

* **some thoughts on how this project will feed into, and hopefully benefit, your thesis research.**

During my PhD, I have been doing measurements in flood water along the perimeter of the Lafayette river. However big our efforts have been, as happens targeting nonpunctual sources, spatial and temporal gaps remain. I want this machine learning project to be a bigger picture comparison to the relationships that I am seeing with my measurements. If things work properly and measurements match the observed with the model, we could make nutrient inputs estimations in other areas affected by tidal flooding.