Seminar in Mathematics and Climate
Special Class with New Orleans Artist Dawn DeDeaux
Modeling Coastal Wetland Loss in Louisiana
February 20, 2018

Your task: Using the 2016 U.S. Geological Survey (USGS) report "Land Area Change in Coastal Lousiana (1932 to 2016)" (Couvillion, B. R., Beck, H., Schoolmaster, D., and Fischer, M.) as a source, generate a model to estimate the amount of land loss on the coast of Louisiana over the next 50–100 years.

Here are some questions and suggestions to get you started:

1. What are the key quantities to be measured by your model? Which quantities are variables that change with time and which are parameters? Carefully define your variables and parameters in words, and be sure to include units!

2. What physical processes are you going to include in your model? How do these interact with your variables and with each other?

3. What impacts due to human activity are you going to include? How will they be incorporated?

4. If you build a model using differential equations, what time scale are you going to use for t? (weeks, months, years, etc.)

5. What statistics, data, and/or figures in the USGS report seem most significant to you? How will they be incorporated into or reflected by your model?

6. Consider the graph of land area loss shown in Figure 2. What would you say about the signs of the first and second derivative for the red curve?

7. Now consider the red curve in Figure 4. How does this curve relate to your previous answer? What is the significance of the minimum of this curve? What point are the author's trying to make by including this figure? How does this effect your model?

8. Don't be overly concerned if your model has too many equations, variables, and parameters. Eventually, you may need to reduce the size of your model in order to perform numerical computations or to apply analytic techniques (e.g., bifurcation theory). This is known as *model reduction*.