

BDA Project: Hurricane forecasting in Stan

José Miguel Ramírez & Jonas Lindblad
Aalto University

Hurricane introduction

- ▶ Destructive storms occurring in the late summer and fall in the northern hemisphere's tropical region.



Hurricane introduction

- ▶ Destructive storms occurring in the late summer and fall in the northern hemisphere's tropical region.
- ▶ Classified by their wind intensity at the eye wall.



Hurricane introduction

- ▶ Destructive storms occurring in the late summer and fall in the northern hemisphere's tropical region.
- ▶ Classified by their wind intensity at the eye wall.
- ▶ They can cause extreme levels of flooding and destroy many buildings.



Hurricane introduction

- ▶ Destructive storms occurring in the late summer and fall in the northern hemisphere's tropical region.
- ▶ Classified by their wind intensity at the eye wall.
- ▶ They can cause extreme levels of flooding and destroy many buildings.
- ▶ Monetary damages and loss of lives increase with an almost exponential character as a function of storm intensity.



Hurricane forecasting basics

- ▶ Forecasters predict two quantities: track and intensity

Hurricane forecasting basics

- ▶ Forecasters predict two quantities: track and intensity
- ▶ Two kinds of models: *dynamical* and *statistical*

Hurricane forecasting basics

- ▶ Forecasters predict two quantities: track and intensity
- ▶ Two kinds of models: *dynamical* and *statistical*
 - ▶ Dynamical: simulate the laws of physics

Hurricane forecasting basics

- ▶ Forecasters predict two quantities: track and intensity
- ▶ Two kinds of models: *dynamical* and *statistical*
 - ▶ Dynamical: simulate the laws of physics
 - ▶ Statistical: estimate based on historical data

Hurricane forecasting basics

- ▶ Forecasters predict two quantities: track and intensity
- ▶ Two kinds of models: *dynamical* and *statistical*
 - ▶ Dynamical: simulate the laws of physics
 - ▶ Statistical: estimate based on historical data
- ▶ Dynamical vs. statistical: good at long- and short-range forecasts respectively

Hurricane forecasting basics

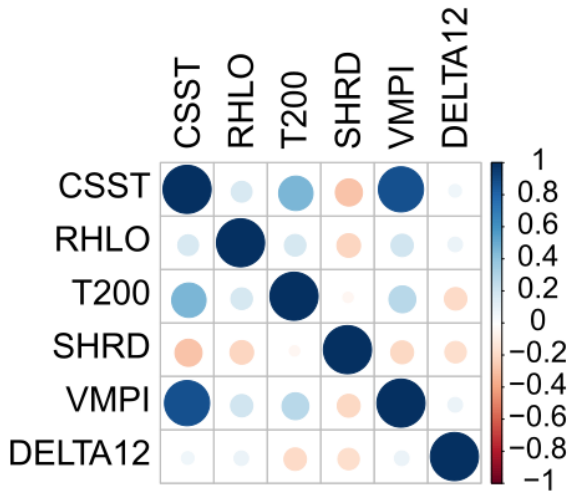
- ▶ Forecasters predict two quantities: track and intensity
- ▶ Two kinds of models: *dynamical* and *statistical*
 - ▶ Dynamical: simulate the laws of physics
 - ▶ Statistical: estimate based on historical data
- ▶ Dynamical vs. statistical: good at long- and short-range forecasts respectively
- ▶ *Rapid intensification*: forecasted better by dynamical models

Hurricane forecasting basics

- ▶ Forecasters predict two quantities: track and intensity
- ▶ Two kinds of models: *dynamical* and *statistical*
 - ▶ Dynamical: simulate the laws of physics
 - ▶ Statistical: estimate based on historical data
- ▶ Dynamical vs. statistical: good at long- and short-range forecasts respectively
- ▶ *Rapid intensification*: forecasted better by dynamical models
- ▶ This project: a *statistical* model for *intensity*

Hurricane forecasting basics: the SHIPS data

Hurricane forecasting basics: our selection



Intensity change predictive model

Model: limitations

Model: posterior predictive checking

Model: variables to use

Model: marginal posteriors of coefficients

Model: margin of SHRD and CSST

Forecasting

Forecasting: model comparison

Forecasting: what about the NHC?

Problems to solve & development ideas

Conclusions & contact info

Additional information

R Markdown

This is an R Markdown presentation. Markdown is a simple formatting syntax for authoring HTML, PDF, and MS Word documents. For more details on using R Markdown see <http://rmarkdown.rstudio.com>.

When you click the **Knit** button a document will be generated that includes both content as well as the output of any embedded R code chunks within the document.

Slide with Bullets

- ▶ Bullet 1

Slide with Bullets

- ▶ Bullet 1
- ▶ Bullet 2

Slide with Bullets

- ▶ Bullet 1
- ▶ Bullet 2
- ▶ Bullet 3

Slide with R Output

```
summary(cars)
```

##	speed	dist
##	Min. : 4.0	Min. : 2.00
##	1st Qu.:12.0	1st Qu.: 26.00
##	Median :15.0	Median : 36.00
##	Mean :15.4	Mean : 42.98
##	3rd Qu.:19.0	3rd Qu.: 56.00
##	Max. :25.0	Max. :120.00

Slide with Plot

