Background

- An estimated 300-400 waterspouts occur each year in the waters surrounding the Florida Keys, of which approximately 40 are spotted and reported (remote sensing).
- During the wet season (summer months), the atmosphere is generally pseudo-barotropic.
- Waterspouts are reported on approximately 19% of wet season days.
- With little change in the atmospheric profile outside of tropical cyclones, how are days that are favorable for waterspout events differentiated from days which are not?

Question

- Is it possible to model the probability of a waterspout report on a given day during the wet season?

Reasoning:
- a) The probability of waterspout report is proportional to the probability of waterspout existence, i.e. $p(\text{report}) \sim p(\text{existence})$.
- b) The probability of waterspout existence is dependent on the environment.

Methodology

- Logistic regression: model probability of waterspout report as a function of predictor variables.
- Preliminary selection of predictor variables: require statistical significance in the difference of means between report vs. no report days; retain wind directions (surface and 100mb) as candidate predictors despite not necessarily satisfying this requirement.
- Examine single-predictor logistic regression for selected variables (example Fig 1).
- Final selection of predictor variables: Likelihood Ratio testing of multiple logistic regression models.

Data

- Nine years of 12Z (8am EDT) rawinsonde soundings at Key West (2006-2014) for the wet season months June - September (1080 days). 12Z was chosen for its predictive potential.
- The Key West sounding was considered representative of the Florida Keys due to its pseudo-barotropic environment.
- NWS Local Storm Reports for the Florida Keys archipelago were used to identify days which waterspout were reported.
- Waterspout events associated with tropical cyclones were removed.
- Waterspout(s) were reported on 208 of the 1080 days examined.
- 144 variables were pulled from each sounding.
- Data were separated into two sets - days with waterspout reports, and days with no reports.

Results

- Final model: 6 predictor variables (Fig 2).
- Model performance evaluated with 10-fold cross-validation; Results compared to Charleston Waterspout Index (CWI).
- Results make no statement about the performance of the Charleston Waterspout Index for the Charleston coastal environment.
- ROC curves (Fig 5).

Further Work

- Validate model predictions with an independent dataset (soundings and reports for 2014 and 2015).
- Examine the predictive value of 00Z soundings with similar methodology.
- Test the implicit assumption that the model is robust to subsetting (e.g. by calendar month and/or sub-seasonal flow regimes).