

PREDICTION OF SEASONAL TROPICAL CYCLONE ACTIVITY AFFECTING NYS

Work Unit 1.3: Enhancements to Long Lead Forecasting

Edmund Chang, Hyemi Kim, Albert Yau,
and Minghua Zhang
Stony Brook University



RESILIENCY INSTITUTE FOR
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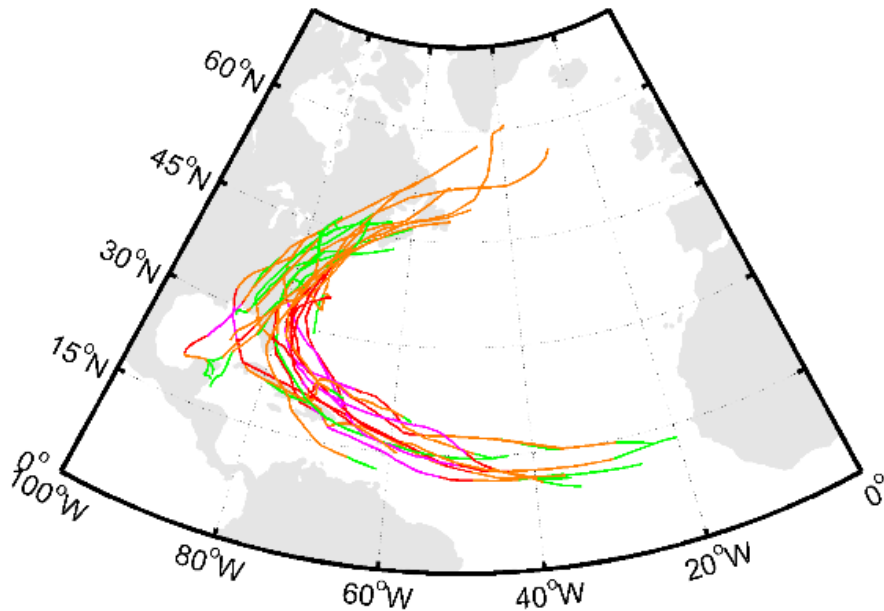
BACKGROUND

- Tropical cyclones crossing New York State (e.g. Irene) can cause substantial damages



Irene impacts: Photos from Globe and Mail and National Geographic

Tracks of all TCs that crossed New York State (1979-2013)



Color relates to maximum wind speed

Green: < 34 kts

Orange: 34-63 kts

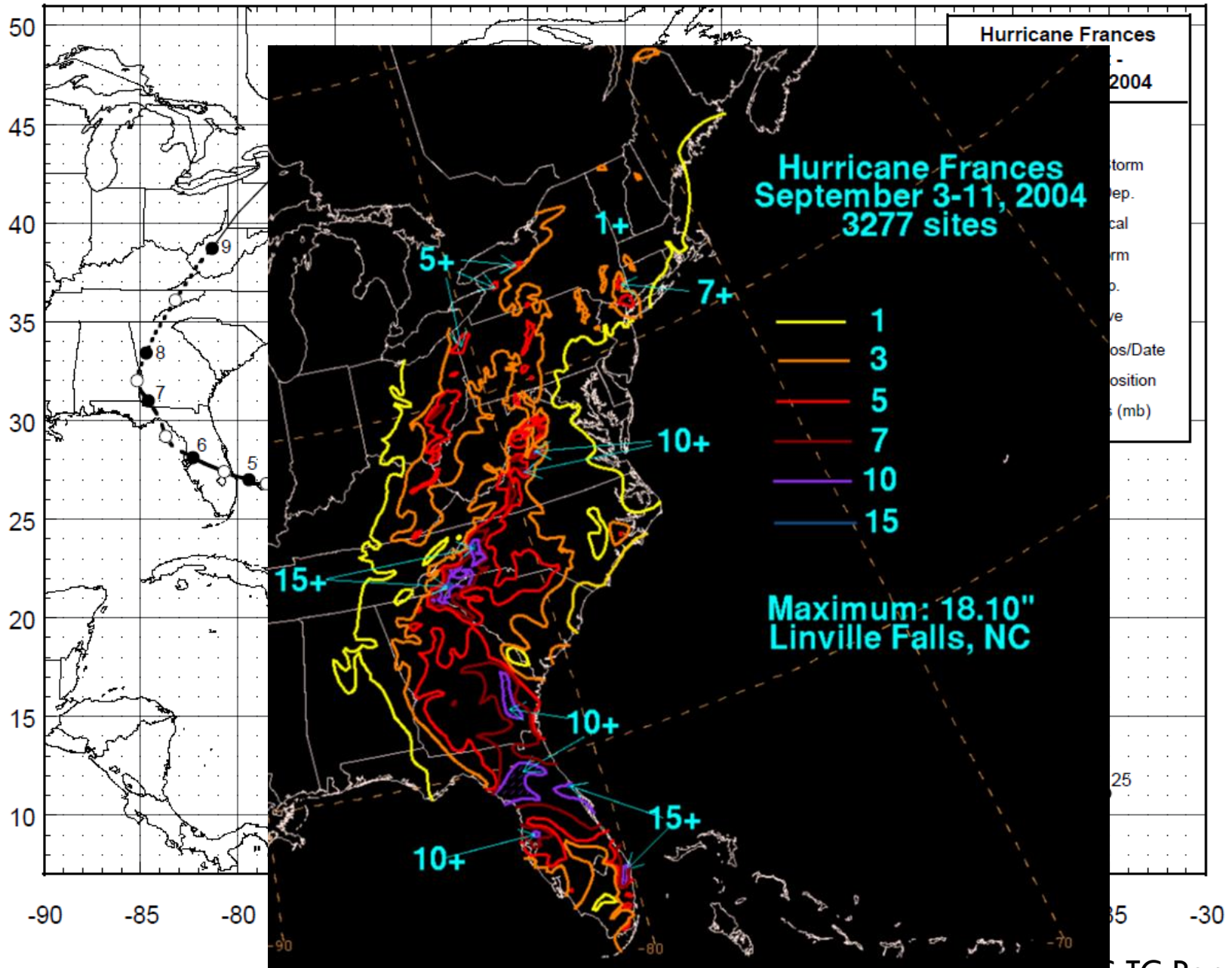
Red: 64-95 kts

Purple: > 95 kts

During 1979-2013

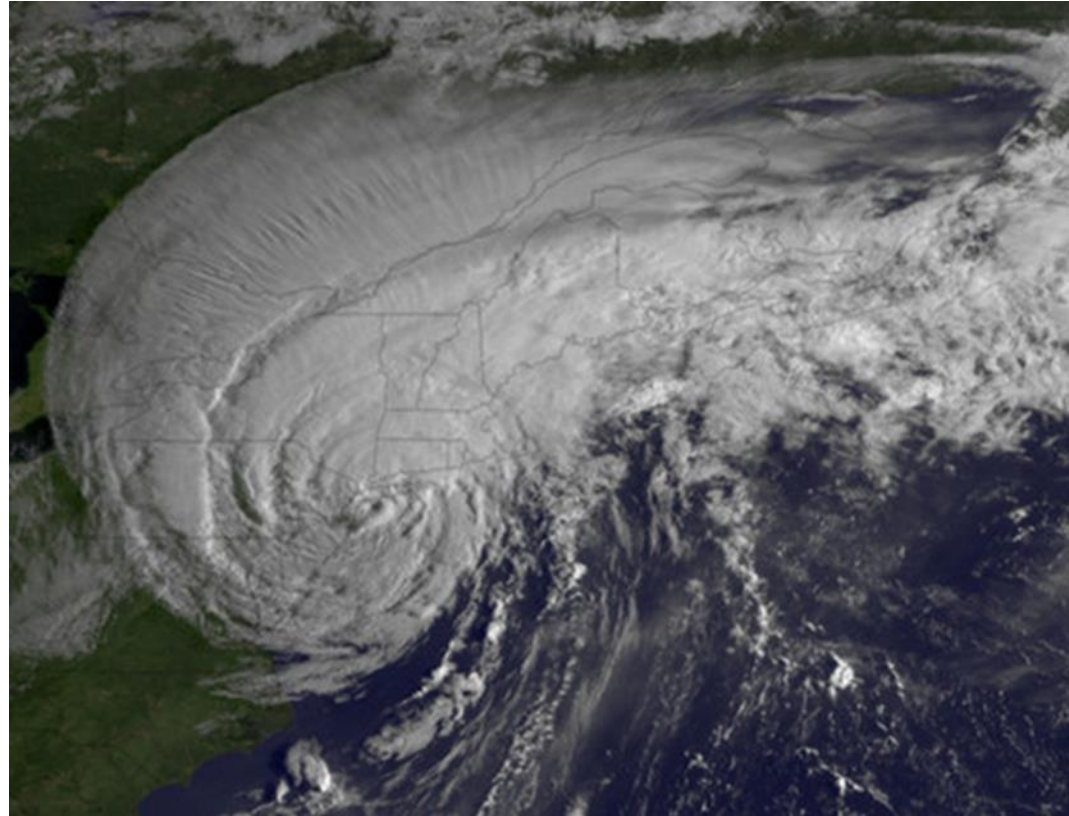
- 18 TCs passed over New York State during any time of their lifecycle
- 1 hurricane (Gloria 1985), 7 TSs, 3 TDs, 7 ETs
- All but 2 (1 TS, 1 TD) provided high impact weather
 - Heavy precip, high winds, storm surge

Hurricane Frances (2004): Extratropical when crossing NYS



PROJECT SCOPE

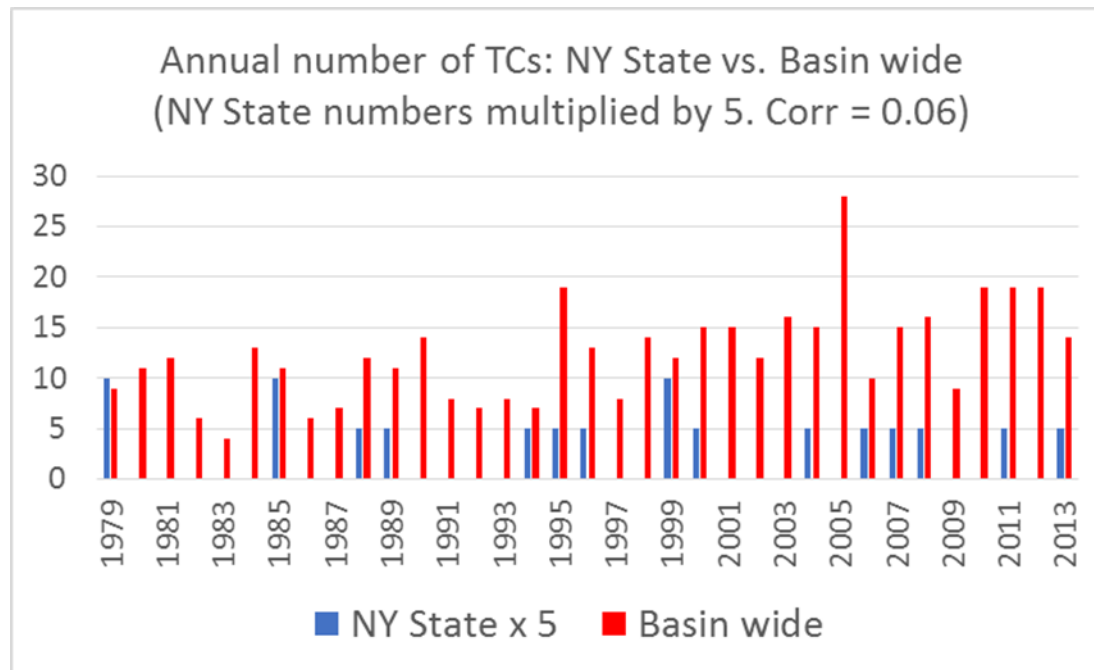
- Evaluate existing seasonal prediction models
- Develop new seasonal prediction models if necessary



RESULTS

Evaluate Existing Seasonal TC Predictions

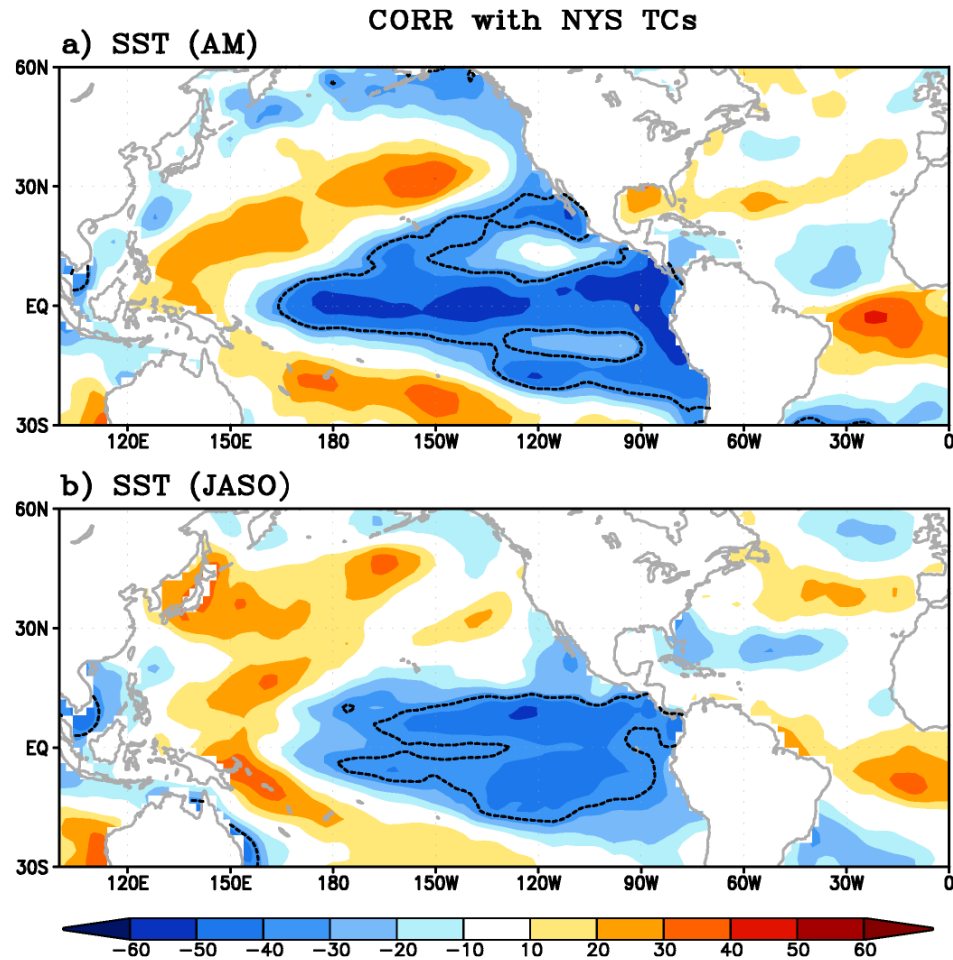
- NOAA and Colorado State University: Basin-wide
- NYS statistics not correlated with basin-wide statistics
 - Even perfect basin-wide forecasts not useful for NYS
- Hence new seasonal prediction models need to be developed



PHYSICAL BASIS FOR SEASONAL TC PREDICTION

Seasonal number of TCs crossing NYS significantly correlated with Pacific SST anomalies

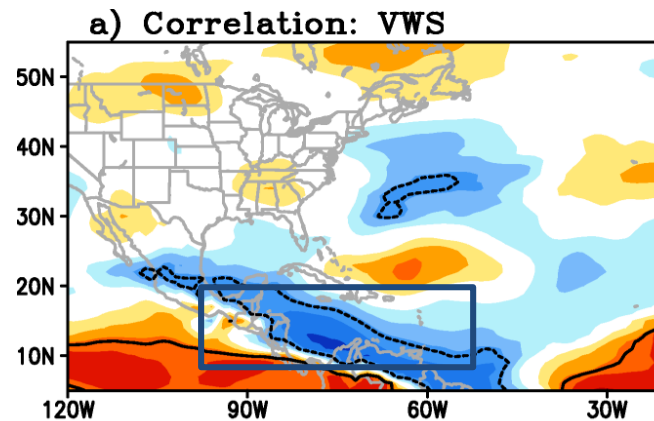
- For both pre-season (April-May) and concurrent (June-Oct) SSTA



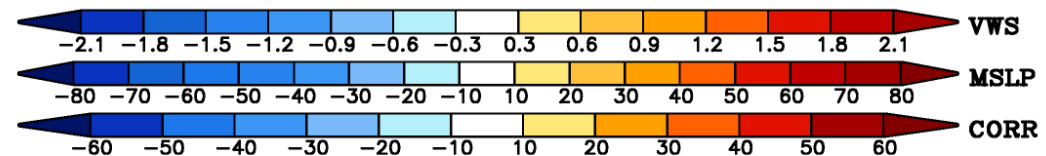
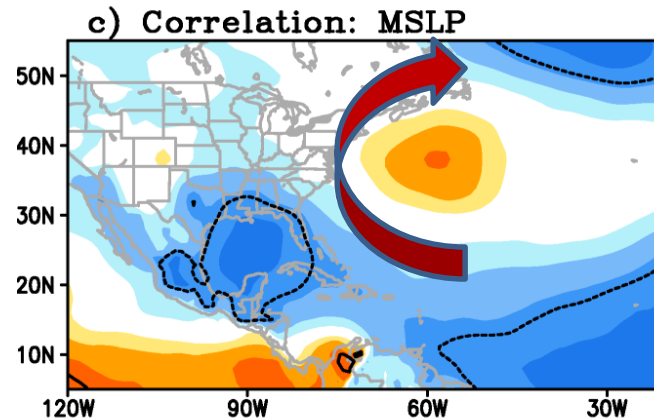
SST data: NOAA ERSSTv3b

Correlation between
number of TCs and
Jun-Oct seasonal
mean:

Vertical wind shear



Sea level pressure



Associated with below average SST over tropical Pacific:

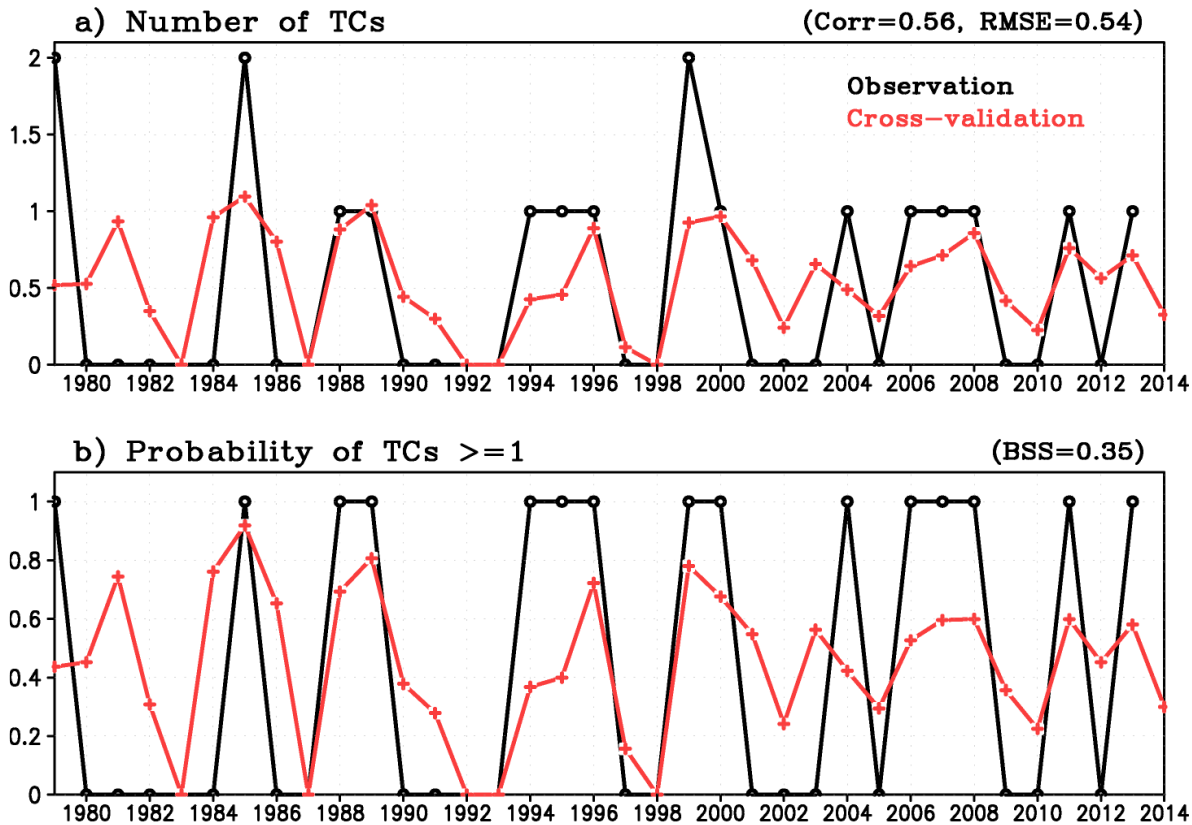
- Reduced vertical wind shear over the Caribbean Sea
- Increased steering current that favors more recurving storms

STEPWISE PATTERN PROJECTION METHOD

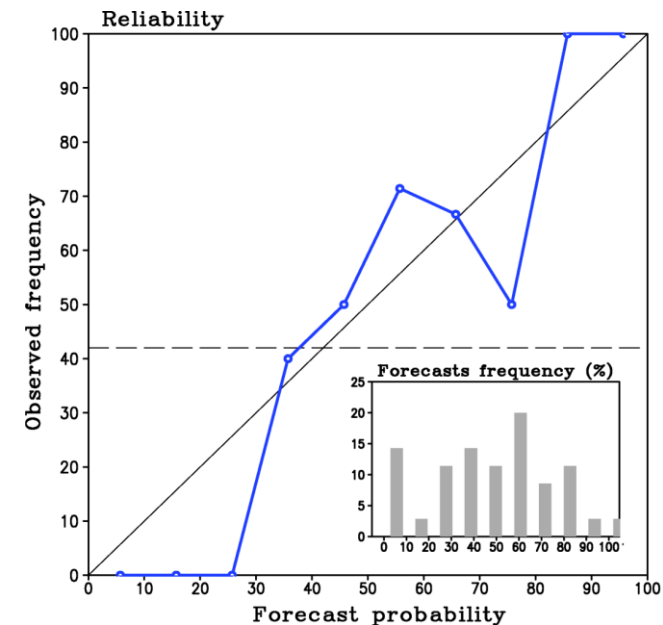
- Use pre-season (April-May) SSTA as predictor (either observed or predicted)
- Training period:
 - Pattern (P) derived from correlation between actual observed number of NYS TCs with SSTA during independent training period
- Forecast period:
 - Pattern P projected onto observed or predicted SSTA to predict number of TCs affecting NYS
- See Final Report or Kim et al. (2014, Weather and Forecasting, in press) for more details

PURE STATISTICAL PREDICTION

- Use observed Apr-May SSTA as predictor
- Can be issued in early June

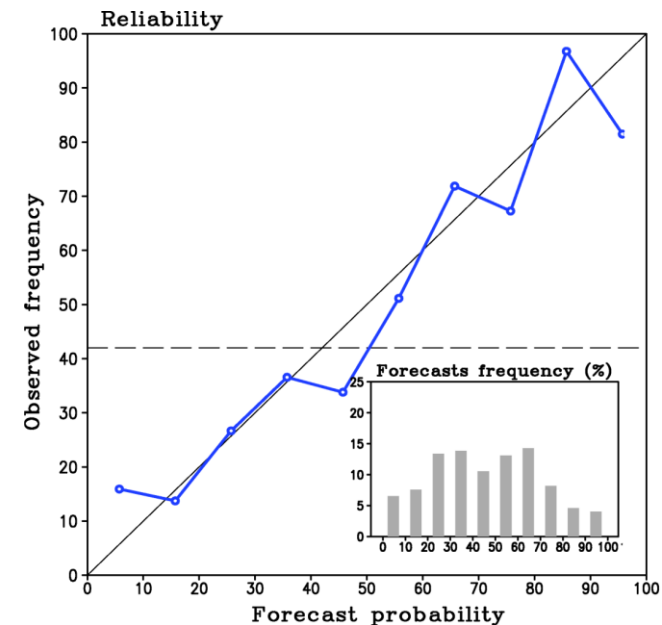
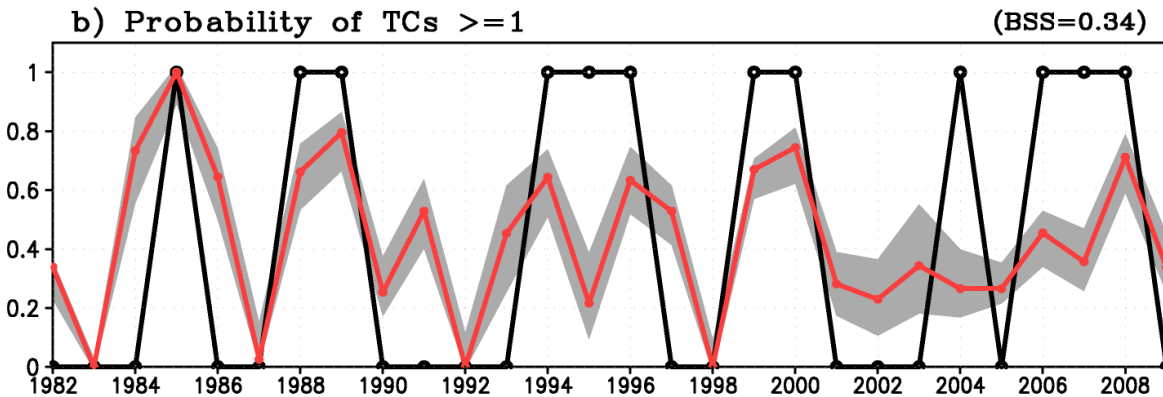
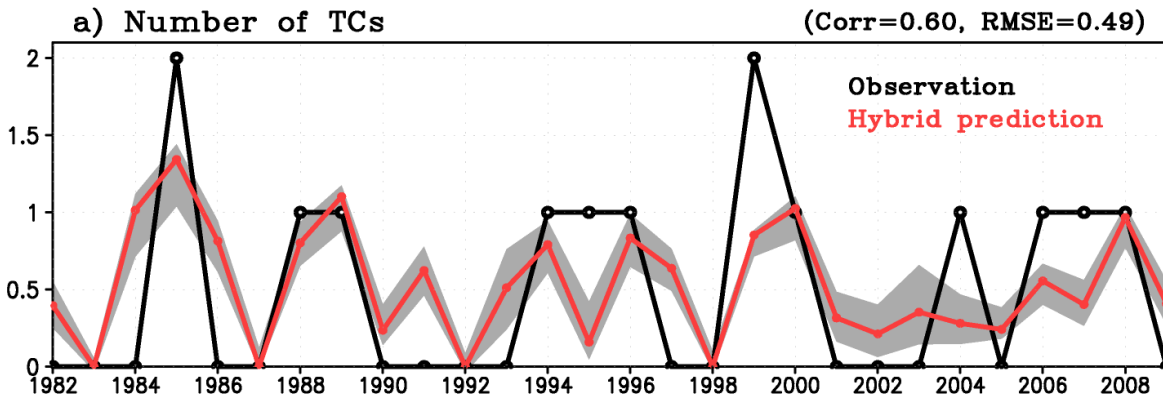


Leave-One-Out Cross
Validation
Variance explained: 33%



HYBRID STATISTICAL-DYNAMICAL PREDICTION

- Use CFSv2 predicted Apr-May SSTA as predictor
- Ensemble of 24 forecasts made between January 11 and February 5
- Can be issued before mid February

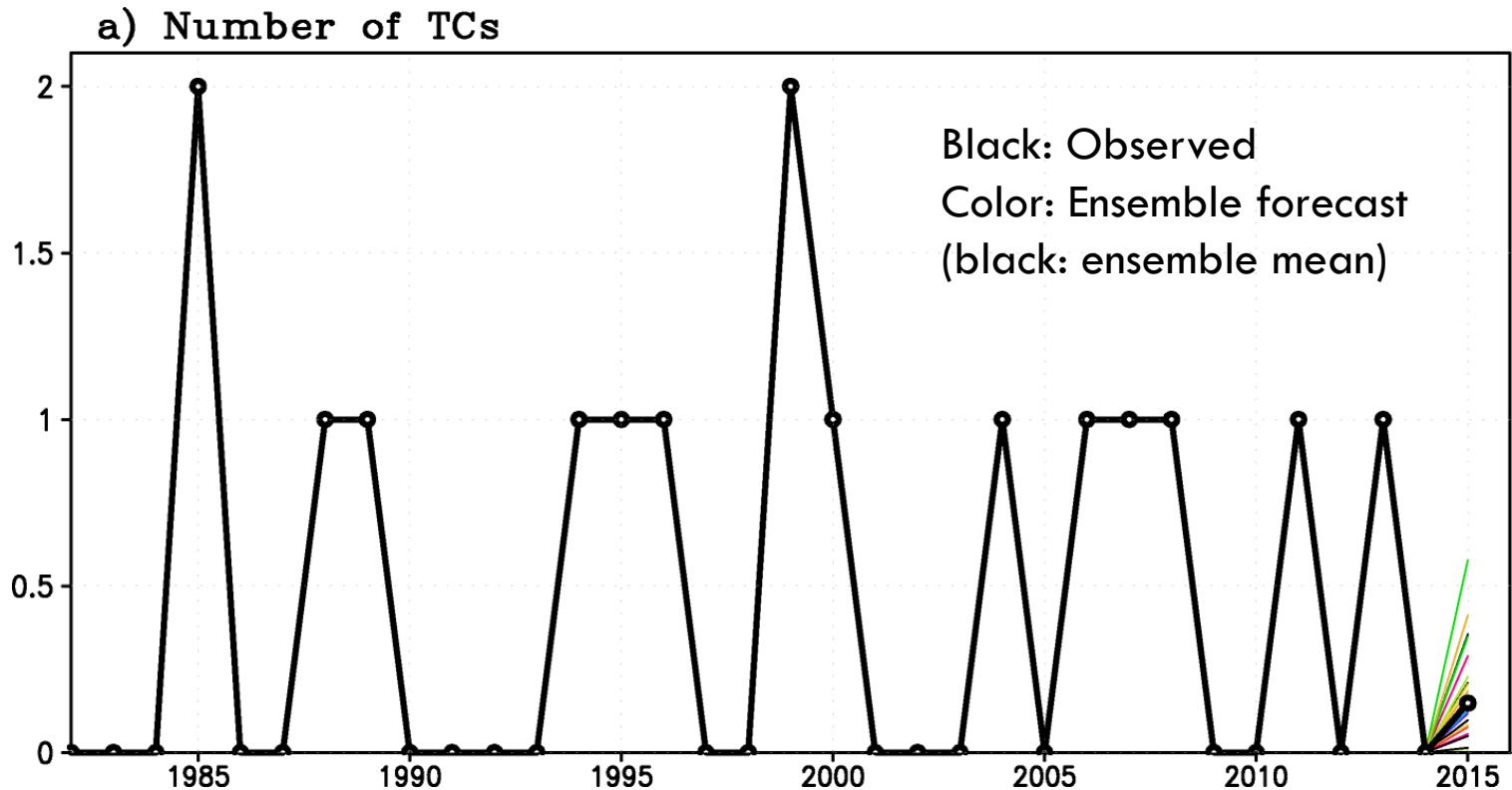


- **Statistical prediction for 2014**

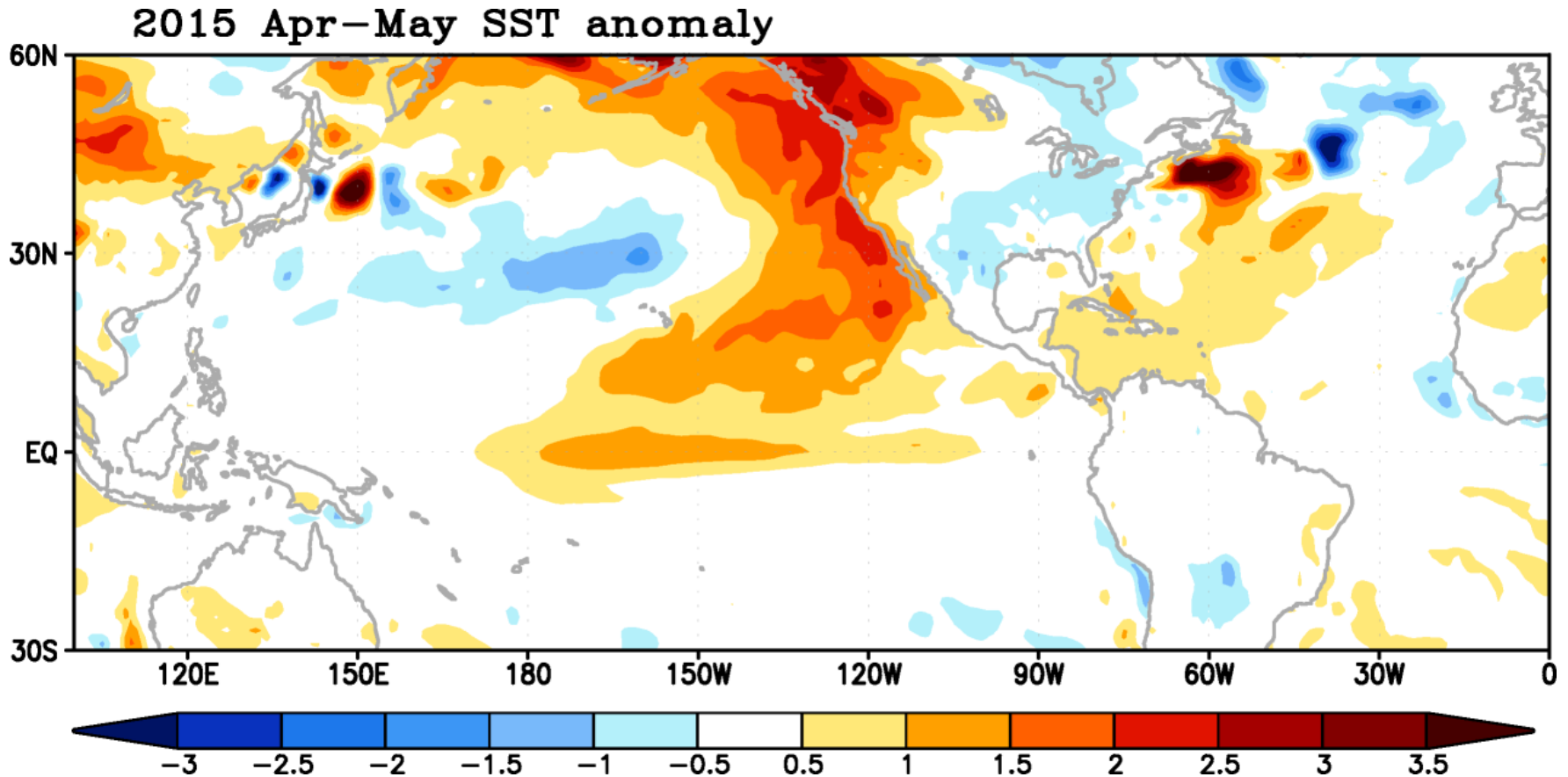
- Forecast based on observed Apr-May SSTA
- Number of TCs crossing NYS: 0.33
- Probability of 1 or more TCs crossing NYS: 30%
- Climatology: 0.51 and 43%
- Actual observed activity: 0 TCs
- Prediction of below average TC activity is validated

NYS TC prediction for 2015

- Predictor: CFSv2 predicted Apr-May SSTA
- Forecasts are issued at Feb with 32 ensembles generated from Jan IC.
- **Number of TCs crossing NYS: 0.15 (Clim: 0.51)**
- **Probability of 1 or more TCs crossing NYS: 19% (Clim: 43%)**



CFSv2 Predicted SST anomaly for 2015 Apr-May



CONCLUSIONS

- Novel statistical and hybrid statistical-dynamical models have been developed to predict number of TCs crossing New York State
- Statistical model based on observed April-May SST
 - Can be issued in early June
- Hybrid model based on NOAA CFSv2 predicted April-May SSTA
 - Can be issued before mid February
- 2014 forecast of below average activity validated
- 2015 preliminary forecast: Below average activity

