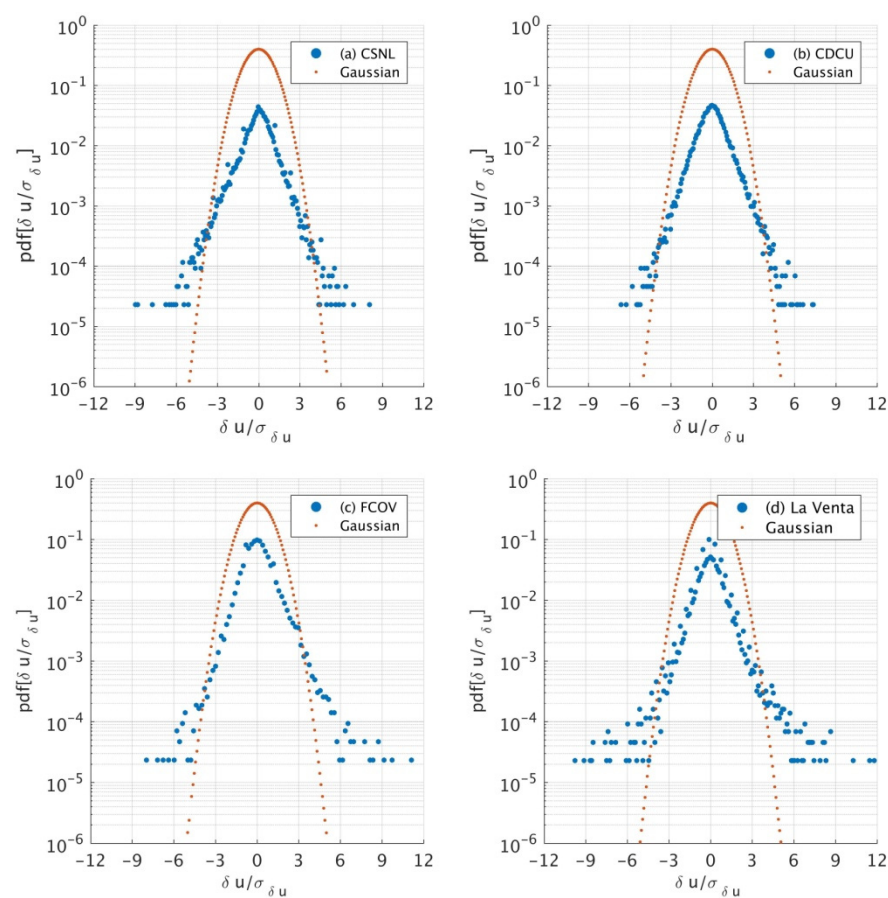


# Supplementary Materials: Wind-Ramp Predictability

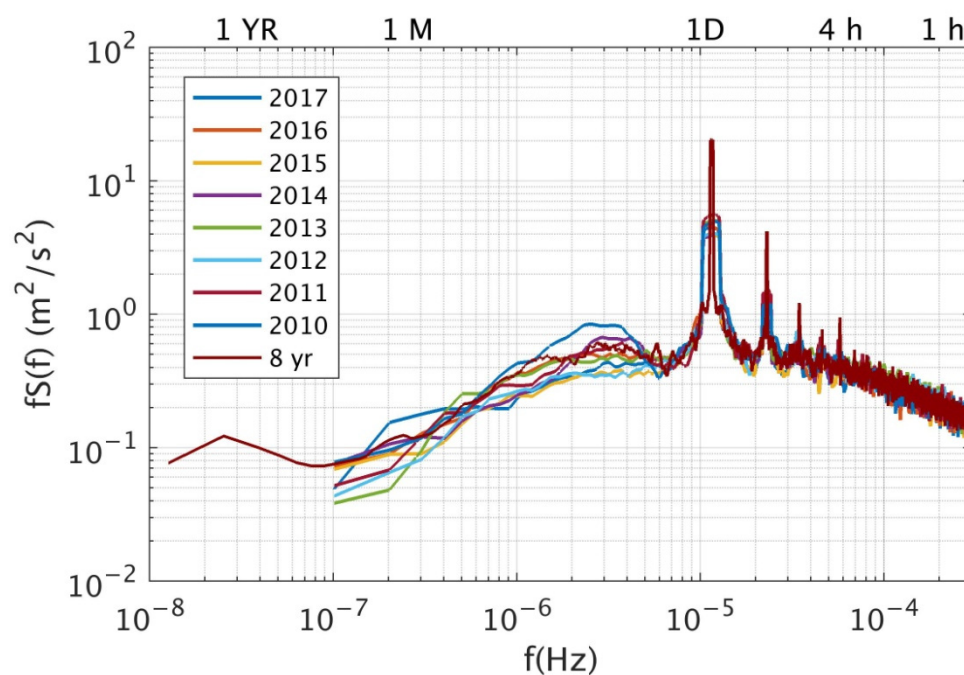
Karla Pereyra-Castro <sup>1</sup> and Ernesto Caetano <sup>2,\*</sup>

**Table S1.** List of abbreviations.

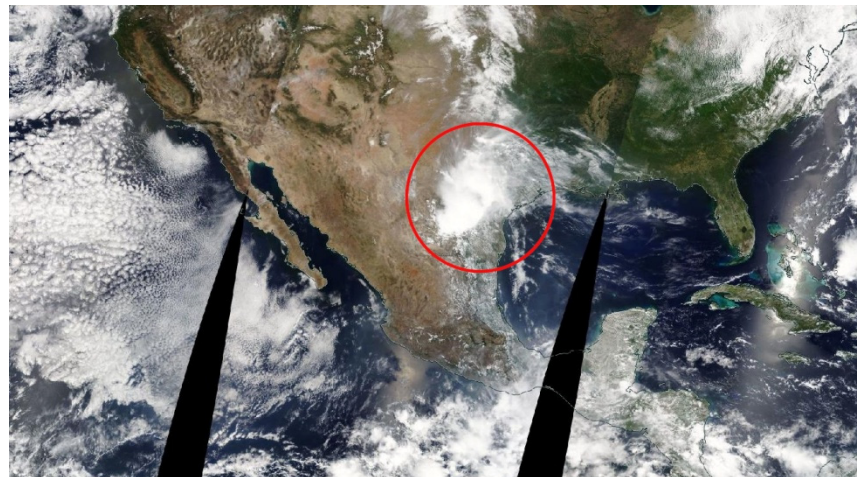
| Abbreviation | Definition                                      |
|--------------|---|
| NWP          | Numerical Weather Prediction                    |
| WFIP         | Wind Forecast Improvement Project               |
| PBL          | Planetary Boundary Layer                        |
| RAP          | Rapid Refresh Model                             |
| NAM          | North American Mesoscale Forecast System        |
| FCOV         | Francisco Villa                                 |
| LVEN         | La Venta  |
| CSNL         | Cabo San Lucas                                  |
| CDCU         | Ciudad Cuauhtémoc                               |
| NCEP         | National Centers For Environmental Prediction   |
| NOAA         | National Oceanic and Atmospheric Administration |
| WRF          | Weather Research and Forecasting                |
| PDF          | Probability density function                    |
| TP           | True Positive                                   |
| FN           | False Negative                                  |
| FP           | False Positive                                  |
| POD          | Probability of Detection                        |
| FAR          | False Alarm Rate                                |
| FBIAS        | Frequency bias                                  |
| CSI          | Critical success ratio                          |
| QM           | Quantile mapping                                |
| CDF          | Cumulative distribution function                |
| DJF          | December-January-February                       |
| MAM          | March-April-May                                 |
| JJA          | June-July-August                                |
| SON          | September-October-November                      |
| MCS          | Mesoscale Convective Systems                    |
| CFP          | Cold front over Plateau                         |
| CFT          | Cold front over Tamaulipas                      |



**Figure S1.** Probability density functions (PDF) of wind ramps ( $\delta u$ ) from (a)CSNL, (b) CDCU, (c) FCOV and (d) LVEN. The wind increment and decrements values are normalized by the corresponding standard deviations.



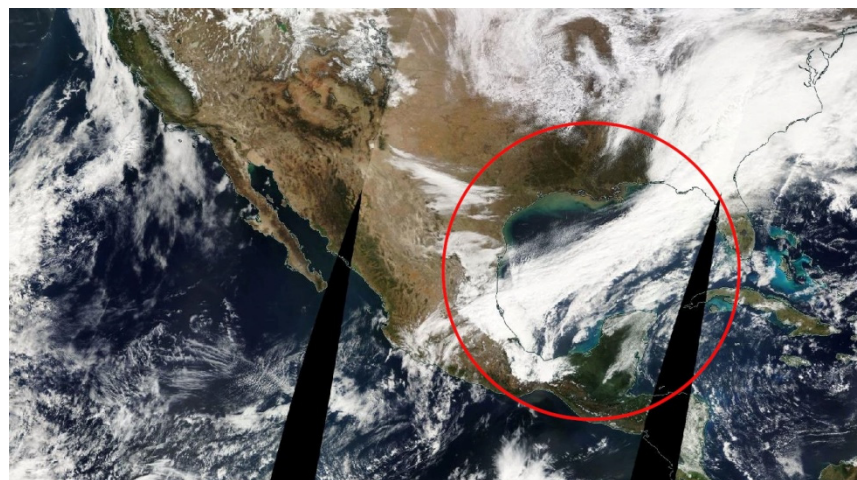
**Figure S2.** Annual smoothed frequency-weighted spectra  $fS(f)$  of horizontal wind speed for Ciudad Cuauhtemoc (CDCU).



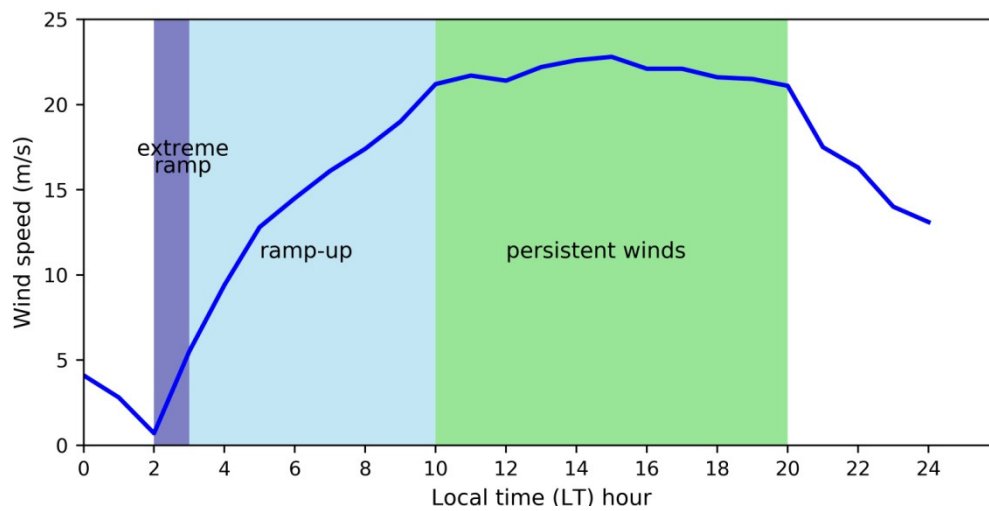
**Figure S3.** Cold fronts affecting Mexico in 24 May 2013. A cold front is seen as a curving line of clouds in the MODIS Corrected Reflectance imagery.



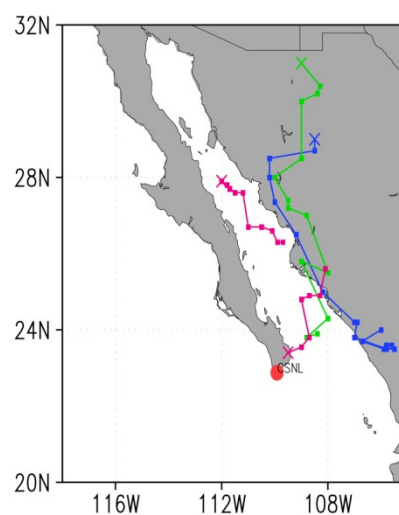
**Figure S4.** Cold fronts affecting Mexico in 1 March 2010. A cold front is seen as a comma clouds in the MODIS Corrected Reflectance imagery.



**Figure S5.** Cold fronts affecting Mexico in 11 February 2006. A cold front is seen as a comma clouds in the MODIS Corrected Reflectance imagery.

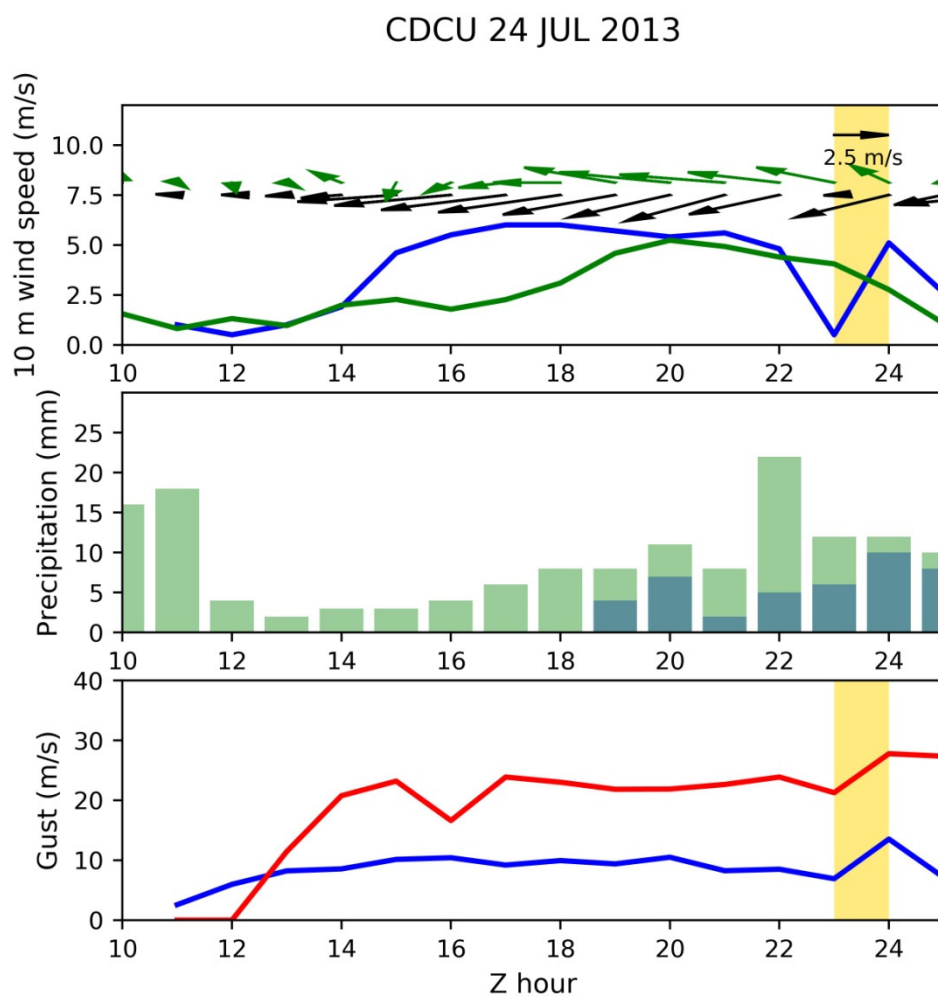


**Figure S6.** Example of extreme wind ramp event and the consecutive persistent winds.

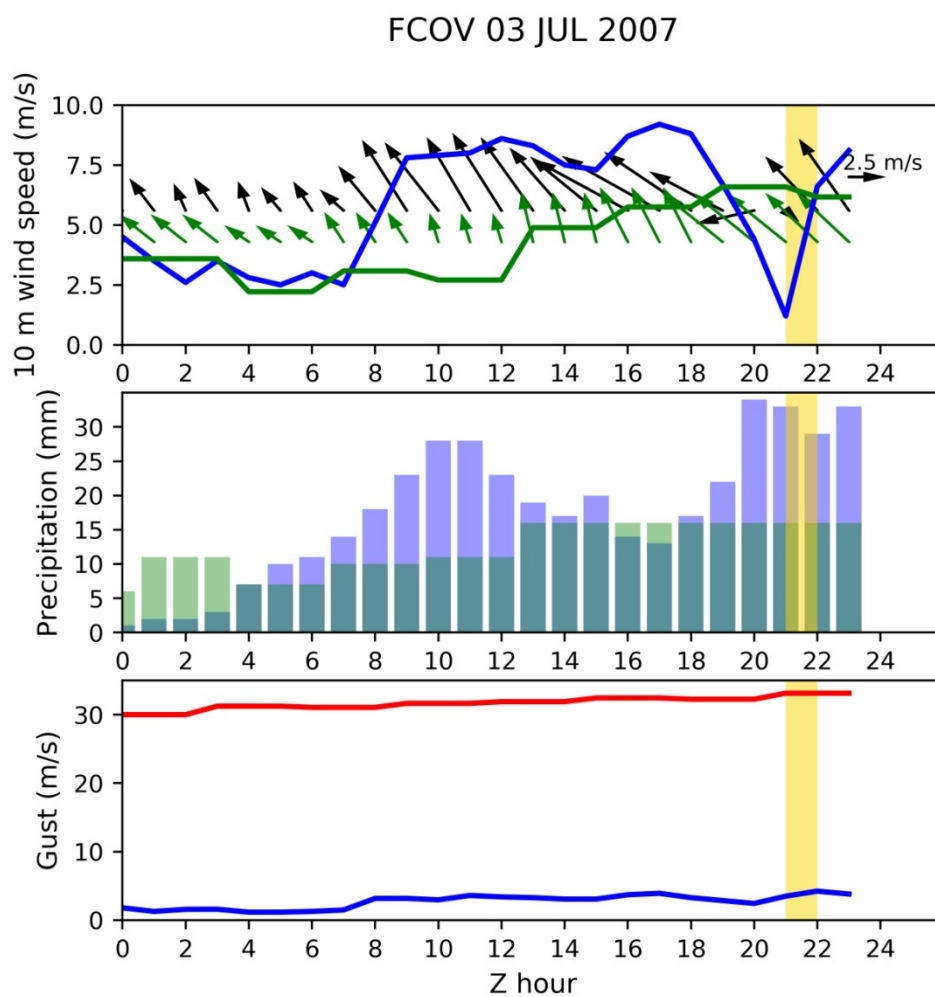


**Figure S7.** Storm trajectory at 01 August 2013 calculated with the maximum precipitation in core of the storm using a) CMORPH data (magenta line), b) 00:00 Z NAM initialization forecast (blue line) and c) 06:00 Z NAM initialization forecast (green line). The end of the track is indicated with a cross.

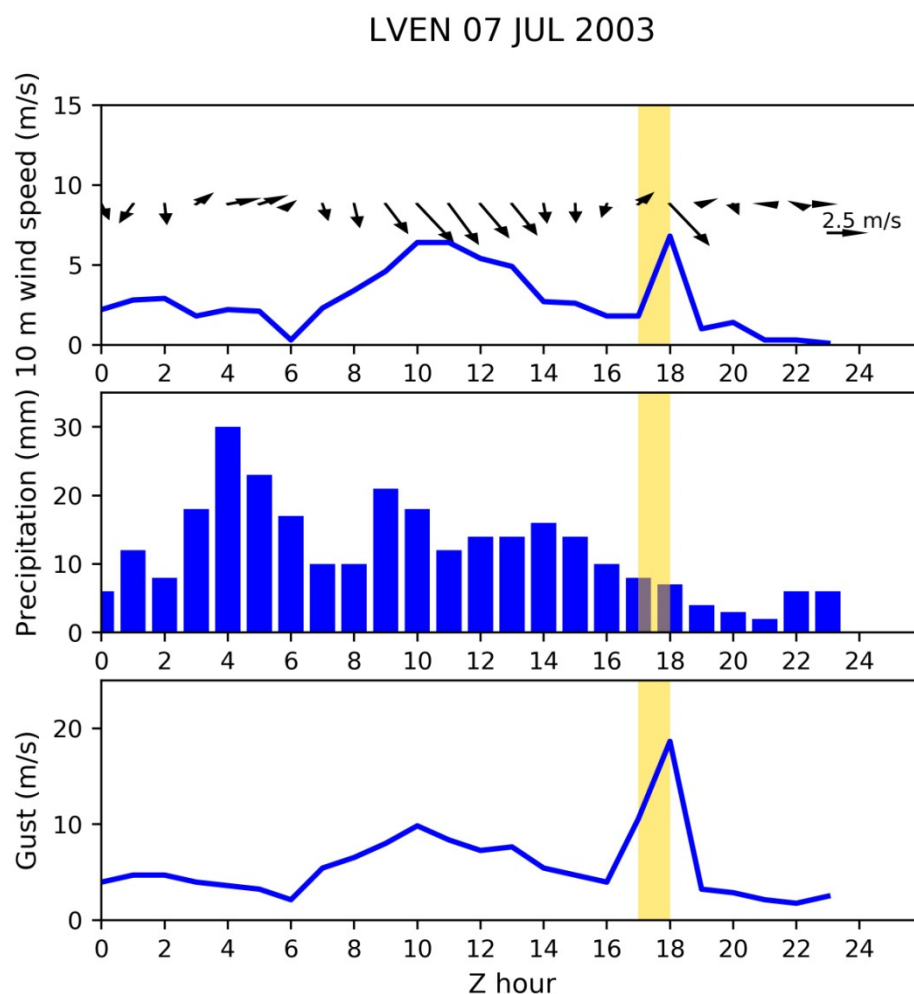




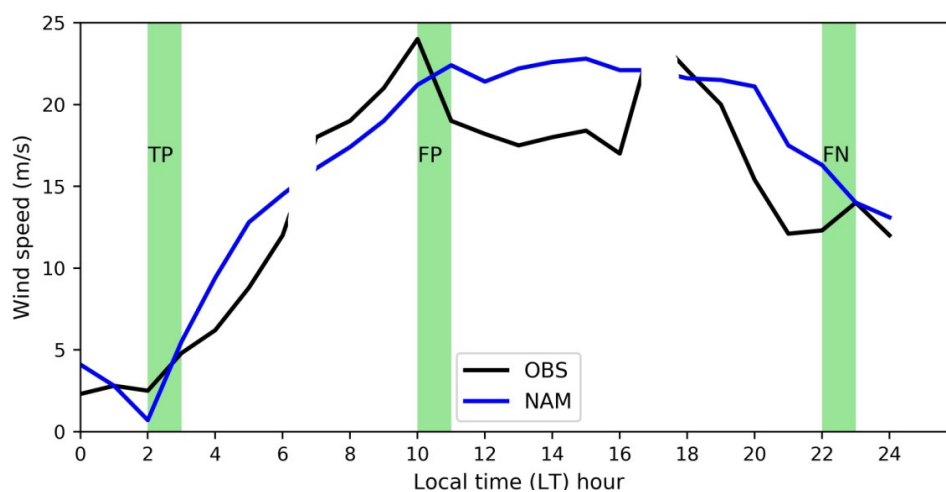
**Figure S8.** Meteogram at CDCU for a storm at 00:00 Z 25 July 2013. Wind ramp timing is shaded in yellow. CMORPH maximum precipitation in the center of the storm is in blue bars. Estimated wind gust in the storm is in red line and observed wind gust at CDCU is in blue. Forecasted wind speed, wind vector and precipitation are in green.



**Figure S9.** Meteogram at FCOV for a storm at 22:00 Z 03 July 2007. Wind ramp timing is shaded in yellow. CMORPH maximum precipitation in the center of the storm is in blue bars. Estimated wind gust in the storm is in red line and observed wind gust at FCOV is in blue. Forecasted wind speed, wind vector and precipitation are in green.



**Figure S10.** Meteogram at LVEN for a storm at 18:00 Z 07 July 2003. Wind ramp timing is shaded in yellow. CMORPH maximum precipitation in the center of the storm is in blue bars. Observed wind gust at LVEN is in blue.



**Figure S11.** Example of wind ramps. Wind ramp observed and predicted (TP), wind ramp predicted by NAM but not observed (FP), and wind ramp observed but not predicted by NAM (FN). Events occurred in different days.

**Table S2.** Derived contingency table indexes wind NAM forecast (non-corrected), bias corrected and quantile mapping (QM) corrected for CDCU.

| Interval           |                       | POD   | FAR   | FBIAS |
|--------------------|-----------------------|-------|-------|-------|
| (-1.5 to -0.5) m/s | NAM forecast          | 0.200 | 0.749 | 0.800 |
|                    | Simple bias corrected | 0.229 | 0.757 | 0.941 |
|                    | QM corrected          | 0.258 | 0.764 | 1.090 |
| (-2.5 to -1.5) m/s | NAM forecast          | 0.079 | 0.899 | 0.438 |
|                    | Simple bias corrected | 0.137 | 0.881 | 0.852 |
|                    | QM corrected          | 0.101 | 0.894 | 1.280 |
| (0.5 to 1.5) m/s   | NAM forecast          | 0.205 | 0.756 | 0.840 |
|                    | Simple bias corrected | 0.239 | 0.758 | 0.985 |
|                    | QM corrected          | 0.251 | 0.760 | 1.06  |
| (1.5 to 2.5) m/s   | NAM forecast          | 0.050 | 0.873 | 0.435 |
|                    | Simple bias corrected | 0.098 | 0.880 | 0.819 |
|                    | QM corrected          | 0.117 | 0.881 | 0.990 |

**Table S3.** Derived contingency table indexes wind NAM forecast (non-corrected), bias corrected and quantile mapping (QM) corrected for CSNL.

| Interval           |                       | POD   | FAR   | BIAS  |
|--------------------|-----------------------|-------|-------|-------|
| (-1.5 to -0.5) m/s | NAM forecast          | 0.182 | 0.807 | 0.940 |
|                    | Simple bias corrected | 0.267 | 0.817 | 1.460 |
|                    | QM corrected          | 0.203 | 0.807 | 1.050 |
| (-2.5 to -1.5) m/s | NAM forecast          | 0.040 | 0.968 | 0.940 |
|                    | Simple bias corrected | 0.074 | 0.936 | 0.938 |
|                    | QM corrected          | 0.059 | 0.939 | 1.280 |
| (0.5 to 1.5) m/s   | NAM forecast          | 0.167 | 0.729 | 0.615 |
|                    | Simple bias corrected | 0.214 | 0.743 | 0.835 |
|                    | QM corrected          | 0.205 | 0.738 | 0.775 |
| (1.5 to 2.5) m/s   | NAM forecast          | 0.024 | 0.895 | 0.289 |
|                    | Simple bias corrected | 0.082 | 0.908 | 0.891 |
|                    | QM corrected          | 0.071 | 0.904 | 0.754 |