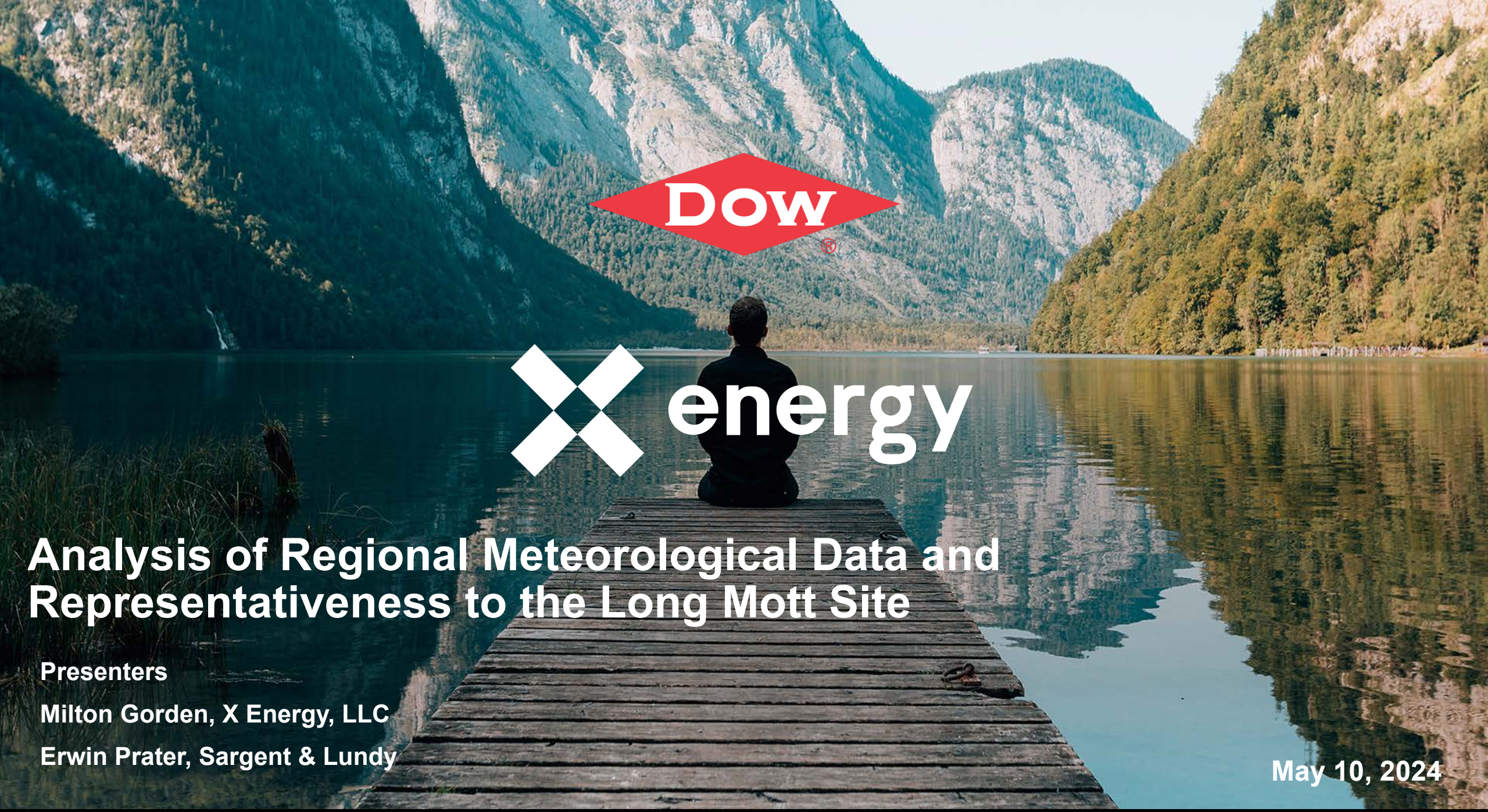

Analysis of Regional Meteorological Data and Representativeness to the Long Mott Site

Presenters

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Department of Energy Acknowledgement and Disclaimer

This material is based upon work supported by the Department of Energy under Award Number DE-NE0009040.

Agenda & Objectives

Agenda:

- Analysis of Regional Meteorological Data Sources Surrounding the Long Mott Site
- Meteorological Tower Installation and Overall Plan for Incorporation Into Construction Permit Application

Objectives:

- Obtain NRC Staff feedback on regional data validity for use in Project Long Mott PSAR and ER
- Obtain NRC Staff feedback on acceptability of approach and timeline for obtaining data from an onsite meteorological tower

Analysis of Regional Meteorological Data Sources Surrounding the Long Mott Site

energy

DOW

Background and Context

- To meet the intent of 10 CFR 100.20(c)(2) and the guidance contained in Regulatory Guide (RG) 1.23, an applicant must show that data meteorological data to be used in analyses that support a 10 CFR Part 50 Construction Permit Application is representative of site conditions

- RG 1.23: “The minimum amount of onsite meteorological data to be provided at the time of application (1) for a construction permit is a representative consecutive 12-month period; (2) for an operating license is a representative consecutive 24-month period, including the most recent 1-year period…”

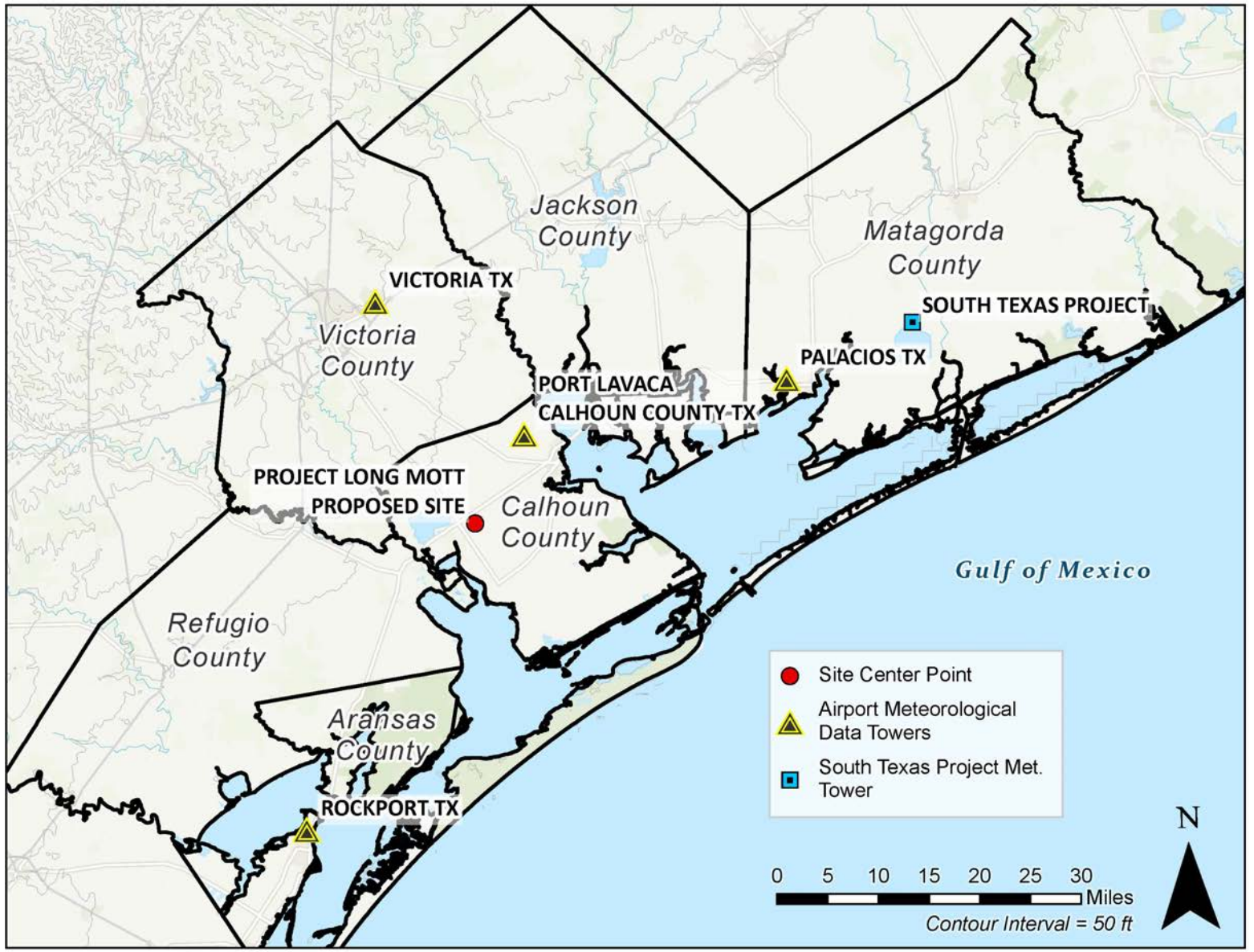
- Past pre-application engagements:
  - July 2023: Presented proposed locations for a met tower
  - January 2024: Proposed alternative approaches for using offsite sources of data for licensing the Xe-100, and to support Xe-100 operations

- As a follow-on, X-energy has developed correlations to show representativeness of offsite met data sources to the Long Mott Site

Regional Meteorological Data Sources

- Use meteorological data from the following regional airports to develop the PSAR until data are available from an onsite meteorological tower:
  - Rockport, TX (hourly, 1-minute, 5-minute data)
  - Victoria, TX (hourly, 1-minute, 5-minute data)
  - Port Lavaca/Calhoun County, TX (hourly data)
  - Palacios, TX (hourly, 1-minute, 5-minute data)
- The locations of the airports are in an approximate triangle across a six-county area with the X-energy/Long Mott facility near the middle
- All three airports and the South Texas Project are in the same general climate zone along the western Gulf Coast and the terrain is relatively flat and should experience similar meteorological conditions

Regional Meteorological Data Sources



Distance and Elevation in Relation to Nearby Facilities

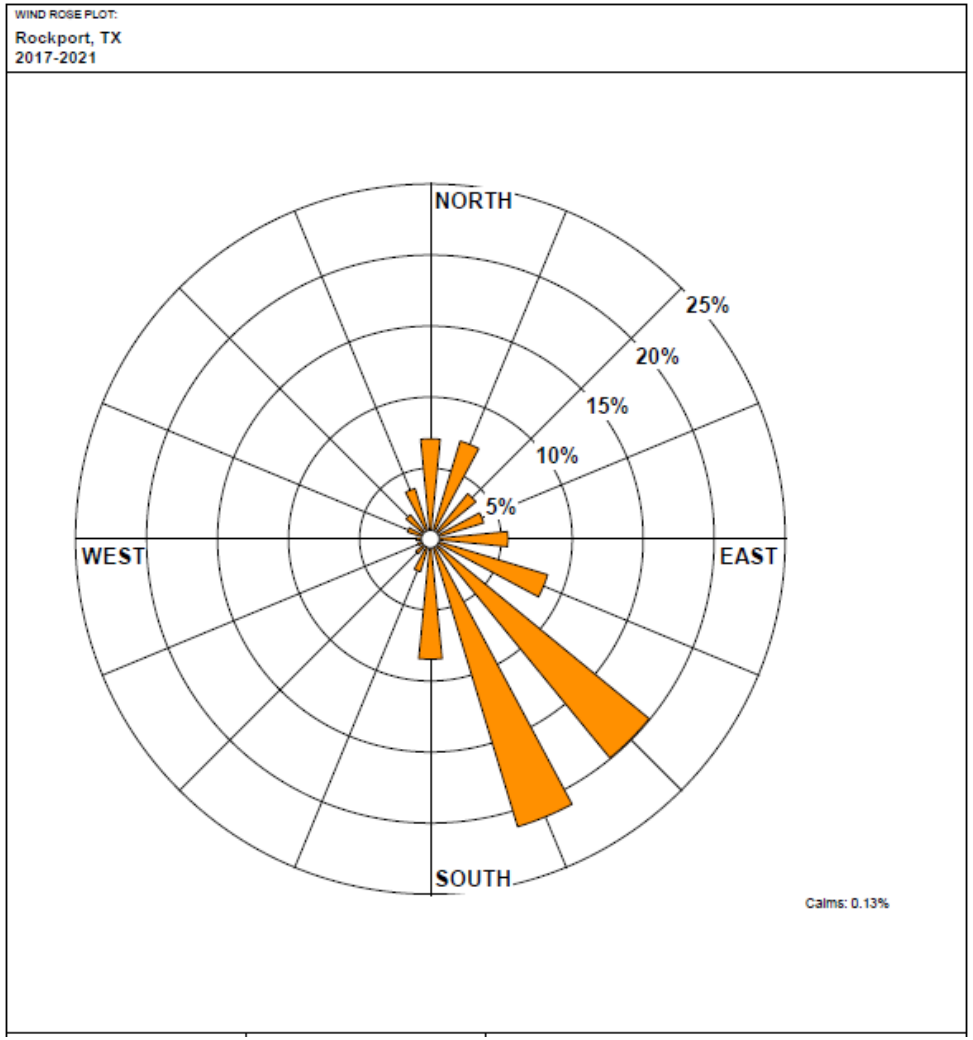
Facility	Approximate Distance from Site A – Miles (kilometers)	General Elevation above Sea Level - Feet (meters)
Xe-100 at Long Mott Site	n/a	27 (8)
South Texas Project (STP)	48 (77)	29 (9)
Rockport	34 (55)	25 (7.5)
Victoria Regional Airport	25 (40)	115 (35)
Port Lavaca Airport	10 (16)	30 (9)

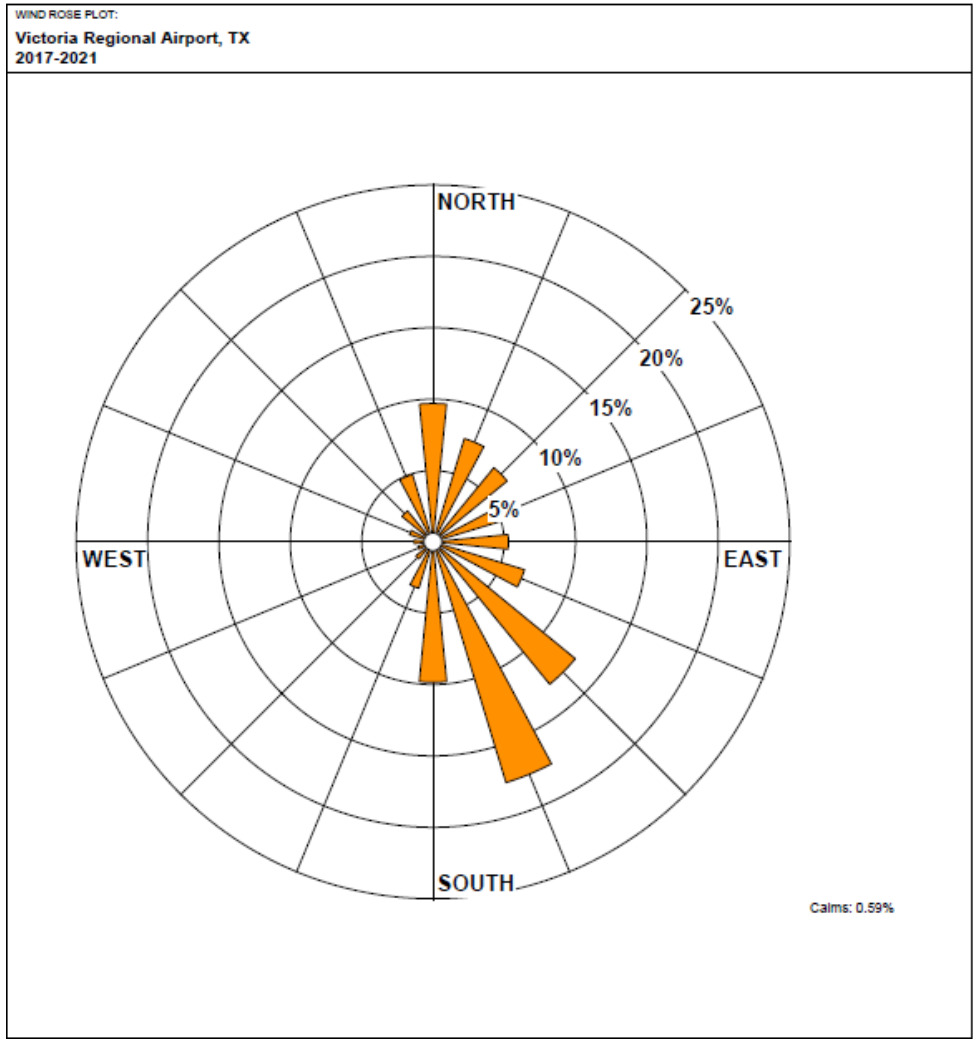
STP – Nearest operating Nuclear Power Plant. Two Westinghouse 1280 MWe Pressurized Water Reactors

Regional Meteorological Data Sources

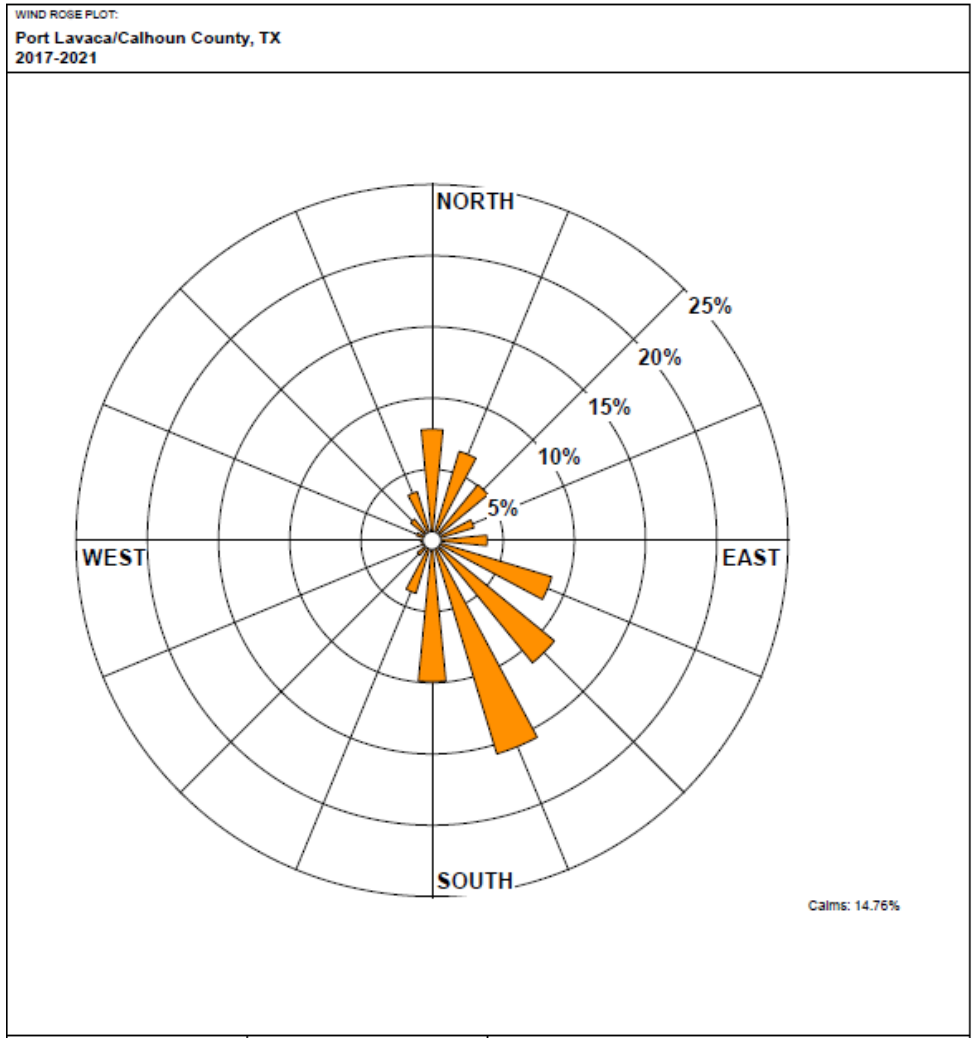
- Airport data support construction projects in Texas requiring air quality modeling
- The Texas Commission on Environmental Quality (TCEQ) specifies the required input airport data set by county (TCEQ, 2024a-c):
  - Rockport, TX (Calhoun, Refugio and Aransas counties) *(Long Mott site in Calhoun County)*
  - Victoria Regional airport , TX (Victoria and Jackson counties)
  - Palacios, TX (Matagorda county) *(STP in Matagorda County)*
- TCEQ provides model-ready data sets for use in USEPA-AERMOD air dispersion model:
  - Uses 1- and 5-minute averaged data to compute hourly averages
  - Wind direction are reported in 1-degree intervals in the 1-minute data
  - Most recent data are available for 2017-2021

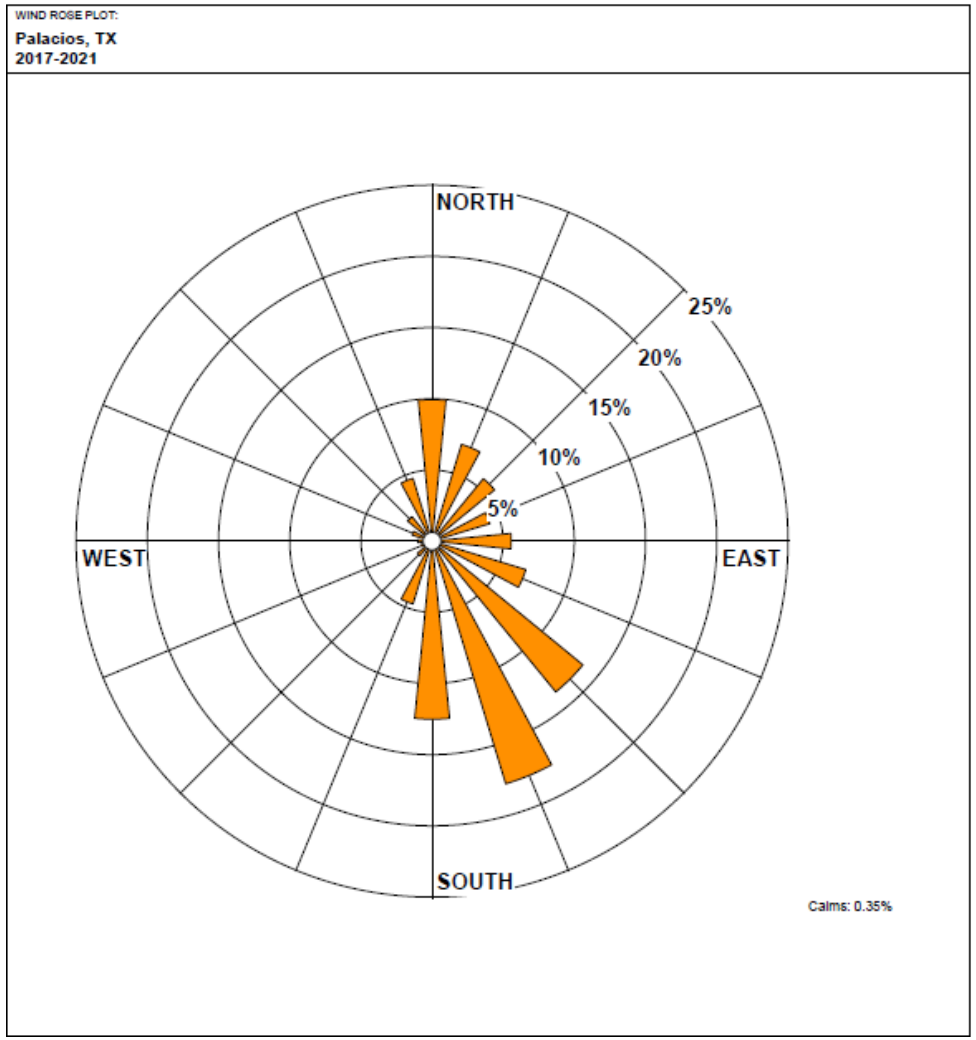
Regional Meteorological Data Sources – Wind Roses



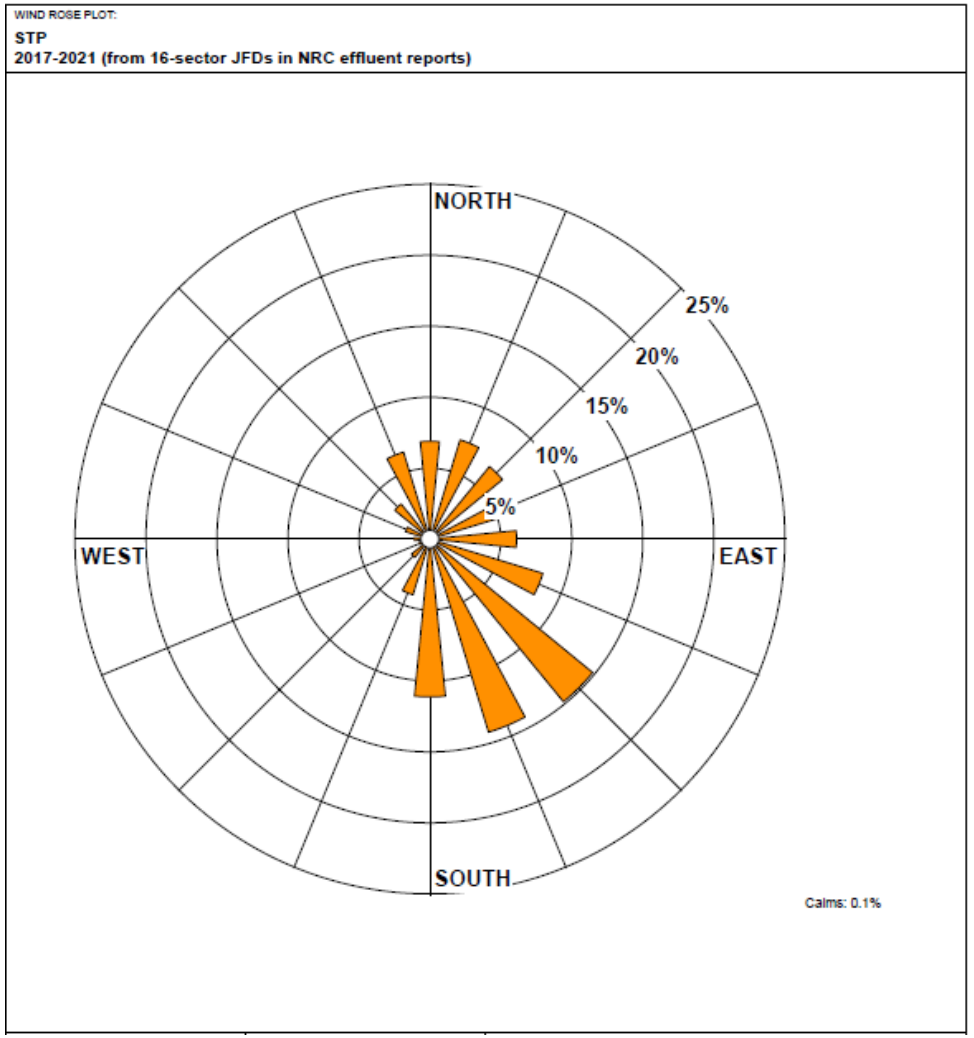


Regional Meteorological Data Sources – Wind Roses





South Texas Project – Wind Rose from Joint Frequency Distribution (2017-2021)



Source:
South Texas Project Electric Generating Station
Radioactive Effluent Release Reports 2017-2021.

Regional Meteorological Data Sources – Wind Roses

- Wind roses from all four regional airports surrounding the Long Mott Site and STP are similar:
  - Bimodal wind direction distributions:
    - South-southeasterly and northerly winds most frequent
    - Westerly winds relatively infrequent
- Quantitively compare airport wind and temperature data:
  - Use airport wind and temperature data from TCEQ input in USEPA AERMOD air dispersion model
  - Input data use high resolution (1-degree wind direction) hourly airport wind data
  - Joint data availability for wind speed, wind direction and temperature exceeded 96.8% for each year during 2017-2021, which exceeds availability criteria of 90% in RG 1.23

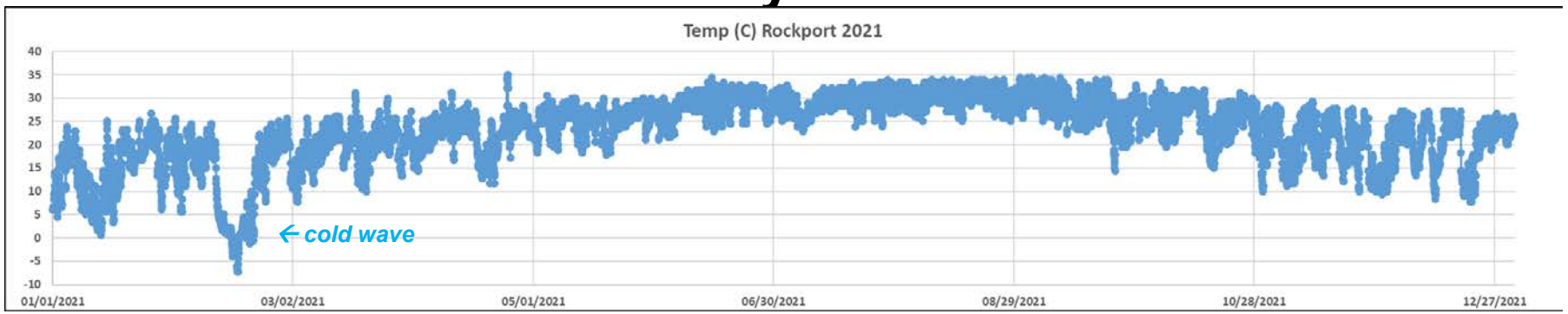
Regional Meteorological Data Sources – Correlation Analysis

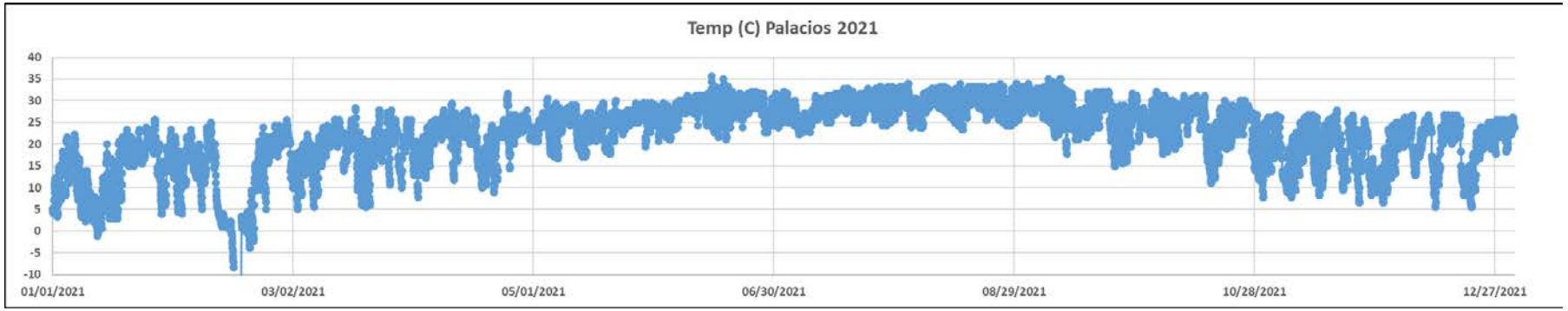
- Use linear correlation analysis to compare hourly wind speed/direction and temperature data among stations
- Use linear correlation function (r) (e.g., Freund, 1981):
  - r = 0 no correlation
  - r = 1 perfect positive correlation
  - r = -1 perfect negative correlation

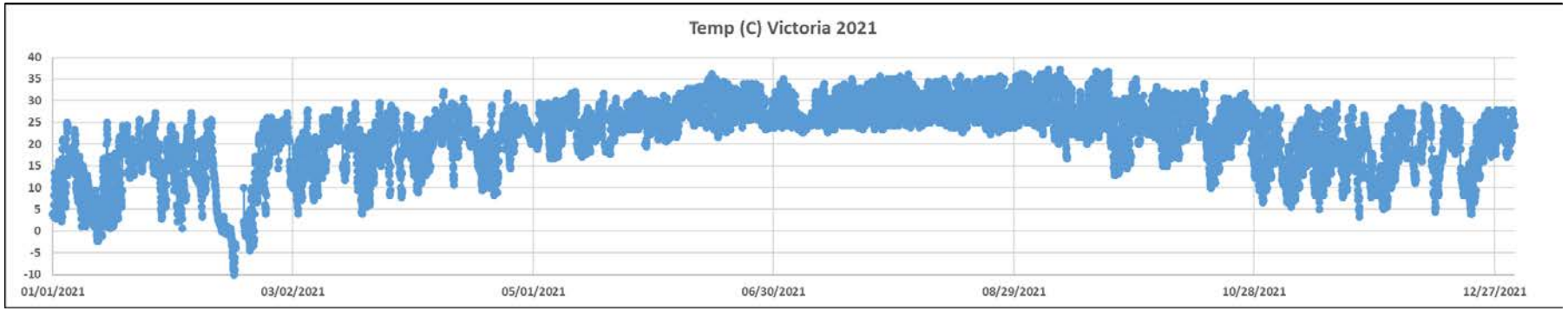
$$r = \frac{\sum_{i=1}^{n}(x_i-\bar{x})(y_i-\bar{y})}{\sqrt{\sum_{i=1}^{n}(x_i-\bar{x})^2 \sum_{i=1}^{n}(y_i-\bar{y})^2}}$$

- Examine data and compute the correlations:
  - Show examples of temperature, wind speed and wind direction components and their correlations from 2021
  - Repeat the analysis for 2017-2021

Regional Meteorological Data Sources – Correlation Analysis

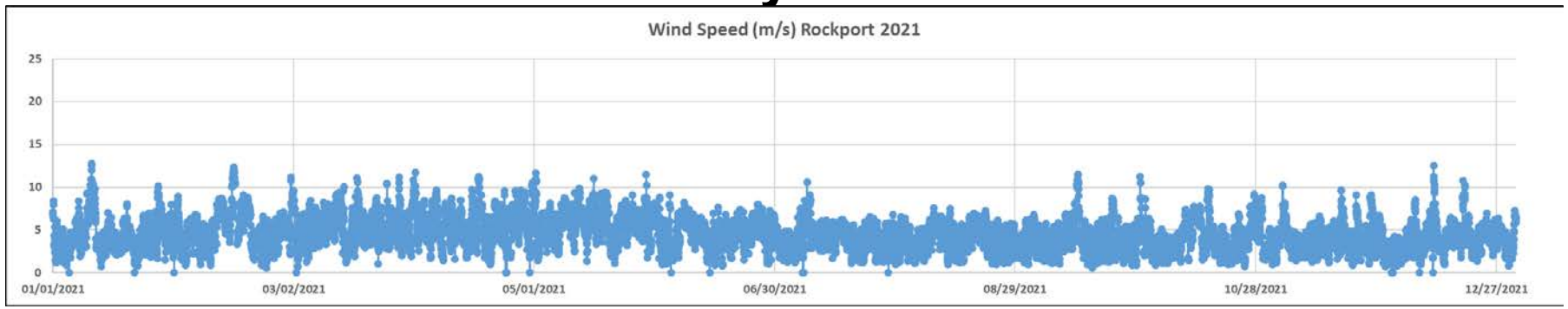


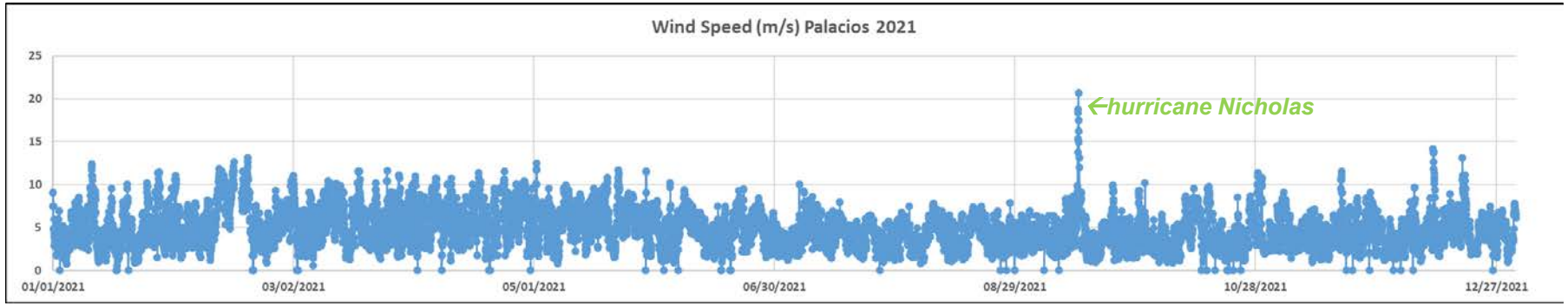


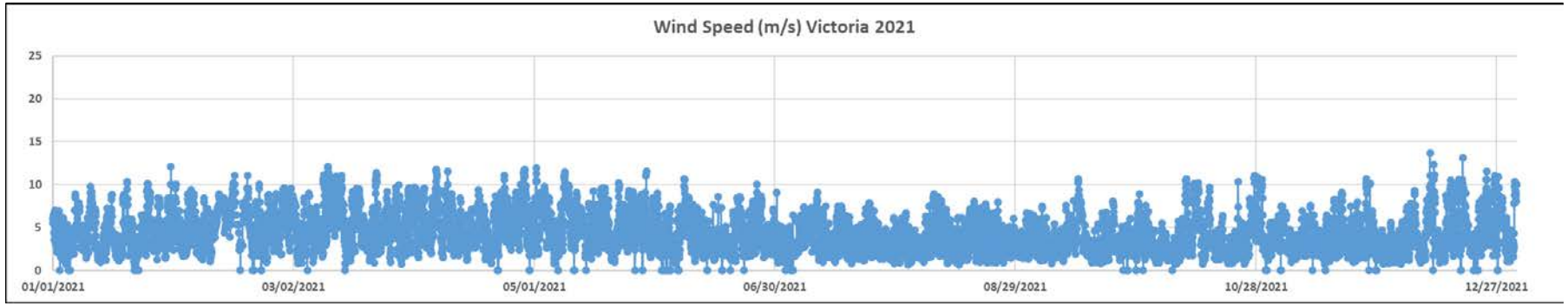


Correlation Matrix (temperature) - 2021			
	Rockport	Palacios	Victoria
Rockport	1.00	0.97	0.95
Palacios		1.00	0.97
Victoria			1.00

Regional Meteorological Data Sources – Correlation Analysis

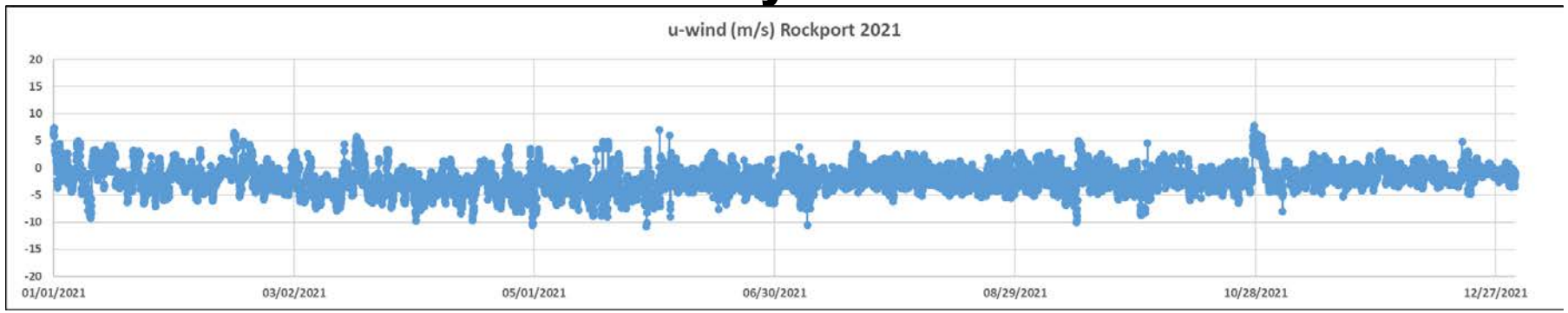


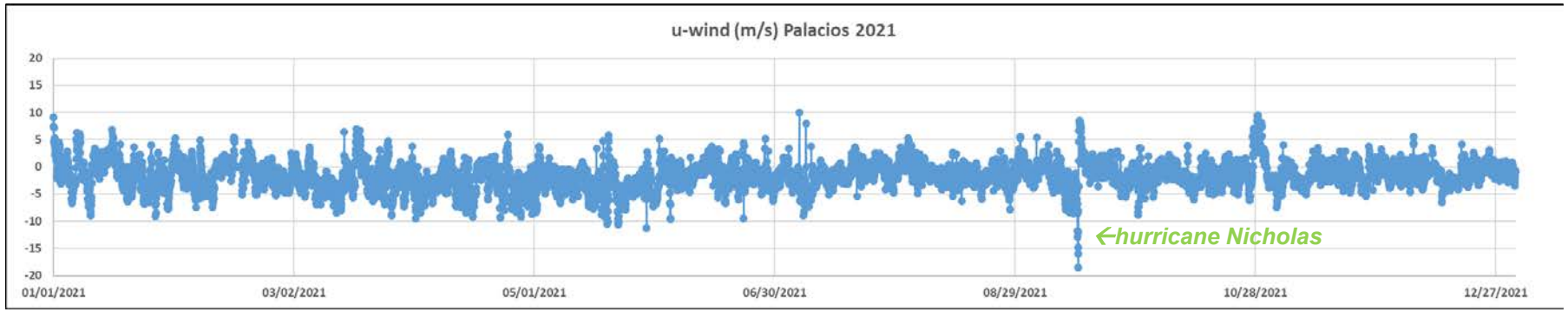


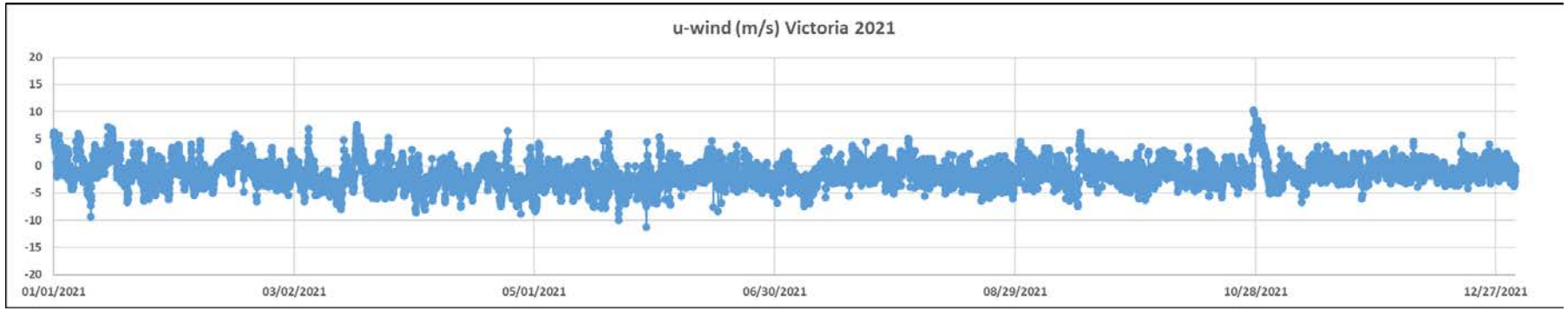


Correlation Matrix (wind speed) - 2021			
	Rockport	Palacios	Victoria
Rockport	1.00	0.76	0.69
Palacios		1.00	0.78
Victoria			1.00

Regional Meteorological Data Sources – Correlation Analysis

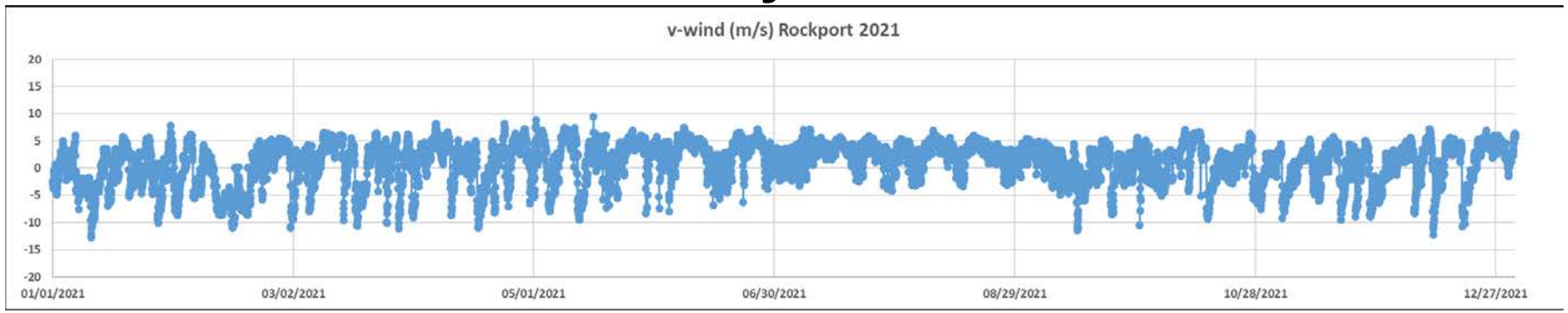


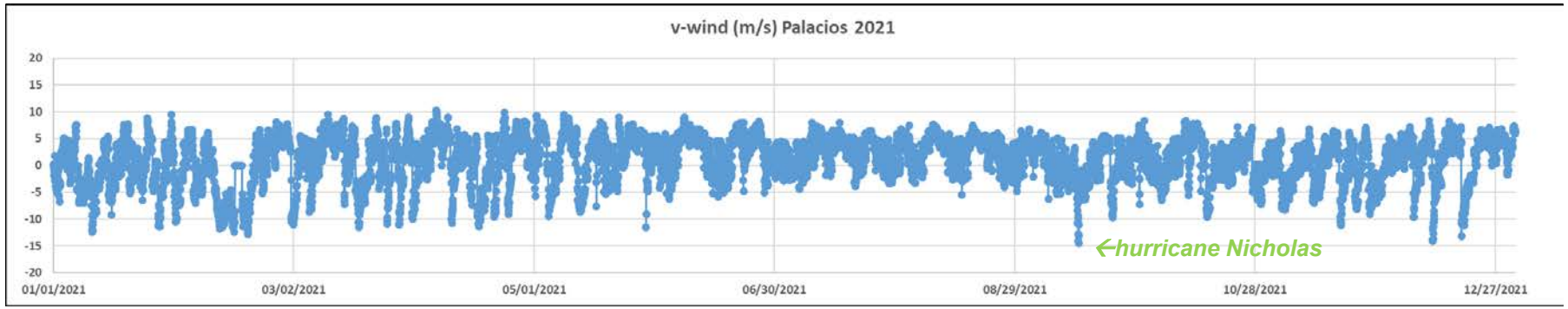


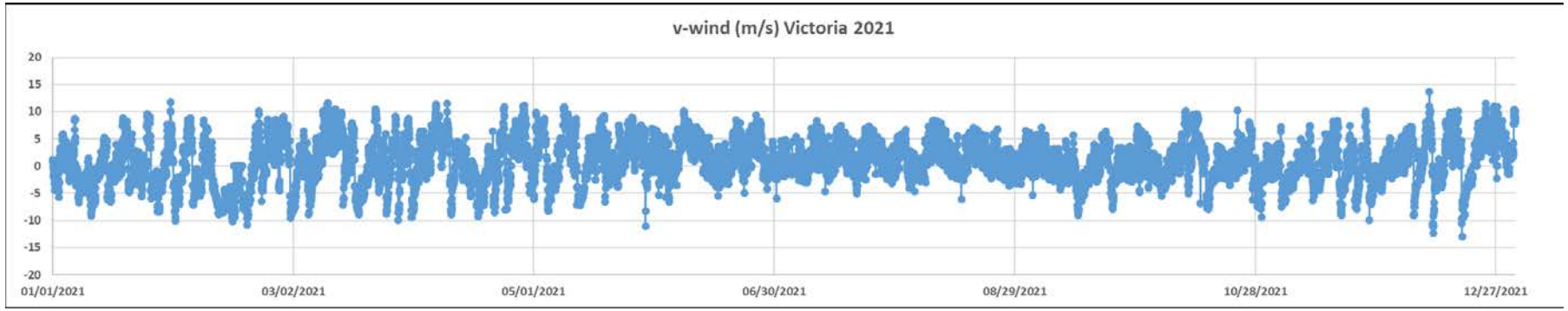


Correlation Matrix (u-wind component) - 2021			
	Rockport	Palacios	Victoria
Rockport	1.00	0.70	0.72
Palacios		1.00	0.78
Victoria			1.00

Regional Meteorological Data Sources – Correlation Analysis







Correlation Matrix (v-wind component) - 2021			
	Rockport	Palacios	Victoria
Rockport	1.00	0.89	0.81
Palacios		1.00	0.87
Victoria			1.00

Regional Meteorological Data Sources – Correlation Analysis

- Summarizing results from the correlation analysis for the 2021:
  - Air temperatures are highly correlated among the three airports (correlation >= 0.95)
  - Wind speeds are moderately correlated (correlation >= 0.69)
  - North-south (v) wind components are highly correlated (correlation >= 0.81)
  - East-west (u) wind components are moderately correlated (correlation >=0.70)
- All three airports are in the same general climate zone and the terrain is relatively flat along the coast, so moderate-high correlations among temperature, wind speed and wind direction components are expected
- Next step – repeat the analysis for 5 years (2017-2021)

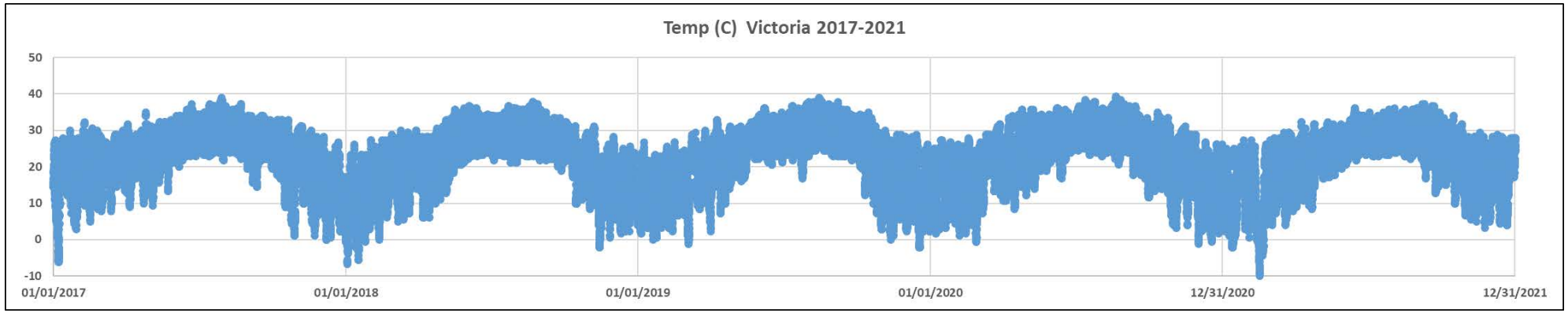
Regional Meteorological Data Sources – Correlation Analysis

Correlation Matrix (temperature) - 2017-2021			
	Rockport	Palacios	Victoria
Rockport	1.00	0.97	0.95
Palacios		1.00	0.97
Victoria			1.00

Correlation Matrix (wind speed) - 2017-2021			
	Calhoun	Matagorda	Victoria
Calhoun	1.00	0.76	0.70
Matagorda		1.00	0.78
Victoria			1.00

Correlation Matrix (u-wind component) - 2017-2021				
	Rockport	Palacios	Victoria	
Rockport	1.00	0.74	0.76	
Palacios		1.00	0.80	
Victoria			1.00	

Correlation Matrix (v-wind component) - 2017-2021				
	Rockport	Palacios	Victoria	
Rockport	1.00	0.90	0.84	
Palacios		1.00	0.88	
Victoria			1.00	



Conclusions

- Results from the correlation analysis for the 2017-2021 are similar to those for 2021:
  - Air temperatures are highly correlated among the three airports (correlation >= 0.95)
  - Wind speeds are moderately correlated (correlation >= 0.70)
  - North-south (v) wind components are highly correlated (correlation >= 0.84)
  - East-west (u) wind components are moderately correlated (correlation >=0.74)
- All three airports are in the same general climate zone and the terrain is relatively flat along the coast, so moderate-high correlations respectively among temperature, wind speed and wind direction components are expected
- Moderate and high correlations among the data sets support use of airport data to prepare the PSAR until data are available from an onsite meteorological tower
- Because both the Long Mott Site and the South Texas Project fall within the geographic area among these three airports, South Texas Project are representative of the Long Mott Site

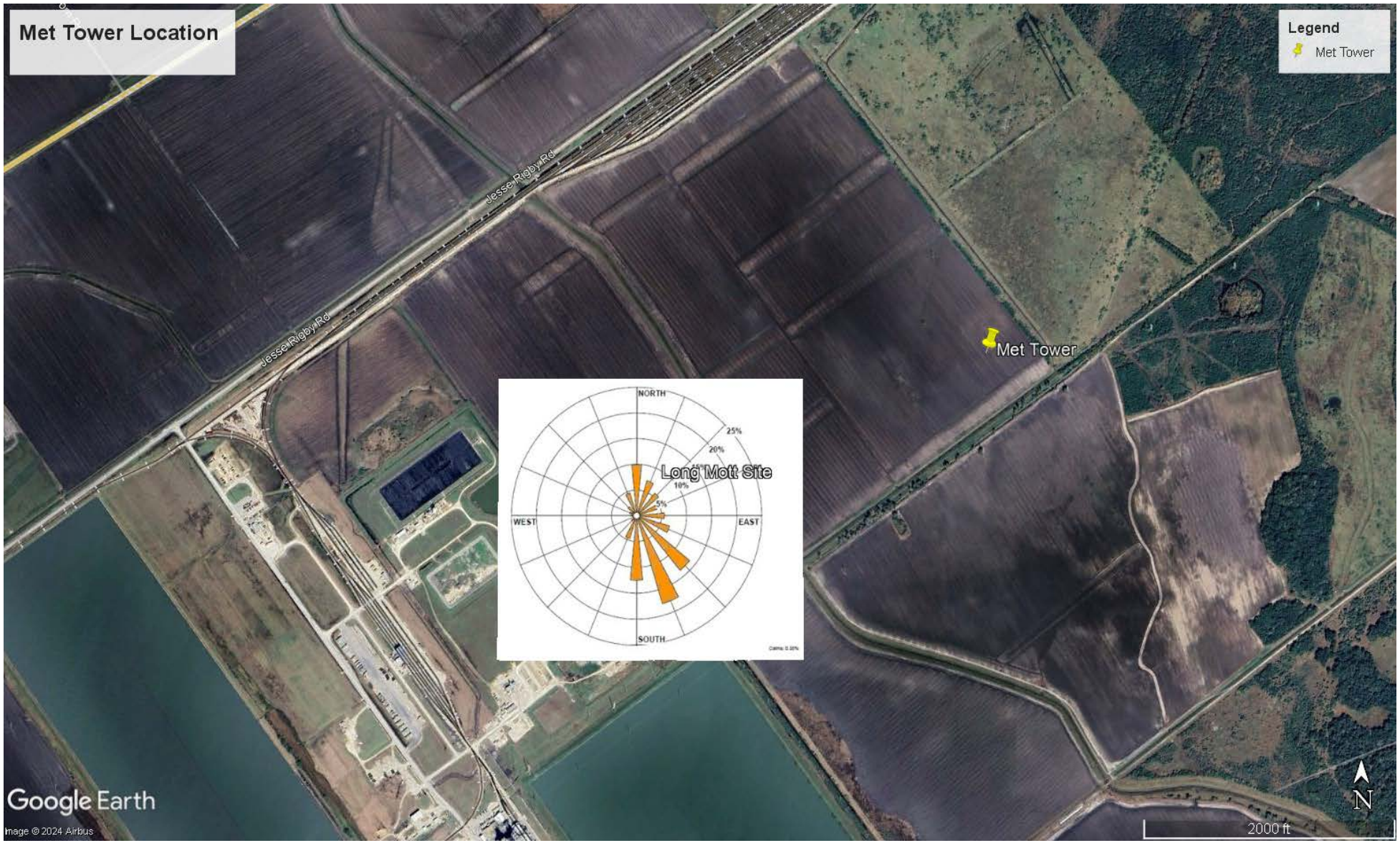
References

- Freund, J. 1981. Statistics A First Course. 3rd Edition. Prentice-Hall, Englewood Cliffs, New Jersey.
- 1. South Texas Project Electric Generating Station 2021 Radioactive Effluent Release Report. April 26, 2022. NRC ADAMS accession number: ML22116A251
- 2. South Texas Project Electric Generating Station 2020 Radioactive Effluent Release Report. April 19, 2021. NRC ADAMS accession number: ML21110A153
- 3. South Texas Project Electric Generating Station 2019 Radioactive Effluent Release Report. April 16, 2020. NRC ADAMS accession number: ML20107F798
- 4. South Texas Project Electric Generating Station 2018 Radioactive Effluent Release Report. April 25, 2019. NRC ADAMS accession number: ML19114A551
- 5. South Texas Project Electric Generating Station 2017 Radioactive Effluent Release Report. April 18, 2018. NRC ADAMS accession number: ML18115A137
- Texas Commission on Environmental Quality, 2024a. AERMOD Data Sets by County. https://www.tceq.texas.gov/permitting/air/nav/datasets.html
- Texas Commission on Environmental Quality, 2024b. Air Dispersion Modeling Team Initiative to Update Meteorological Data. Available from: https://www.tceq.texas.gov/permitting/air/nav/datasets.html
- Texas Commission on Environmental Quality, 2024c. County Meteorological Station information. https://www.tceq.texas.gov/permitting/air/nav/datasets.html

Meteorological Tower Installation and Data Collection and Use to Support Licensing

Meteorological Tower Location

- Located where possible impacts from Xe-100 are minimized, as shown in comparison to the wind rose
- Located more than 3,000 feet (914 meters) from tallest structure
- Site access will need to be addressed



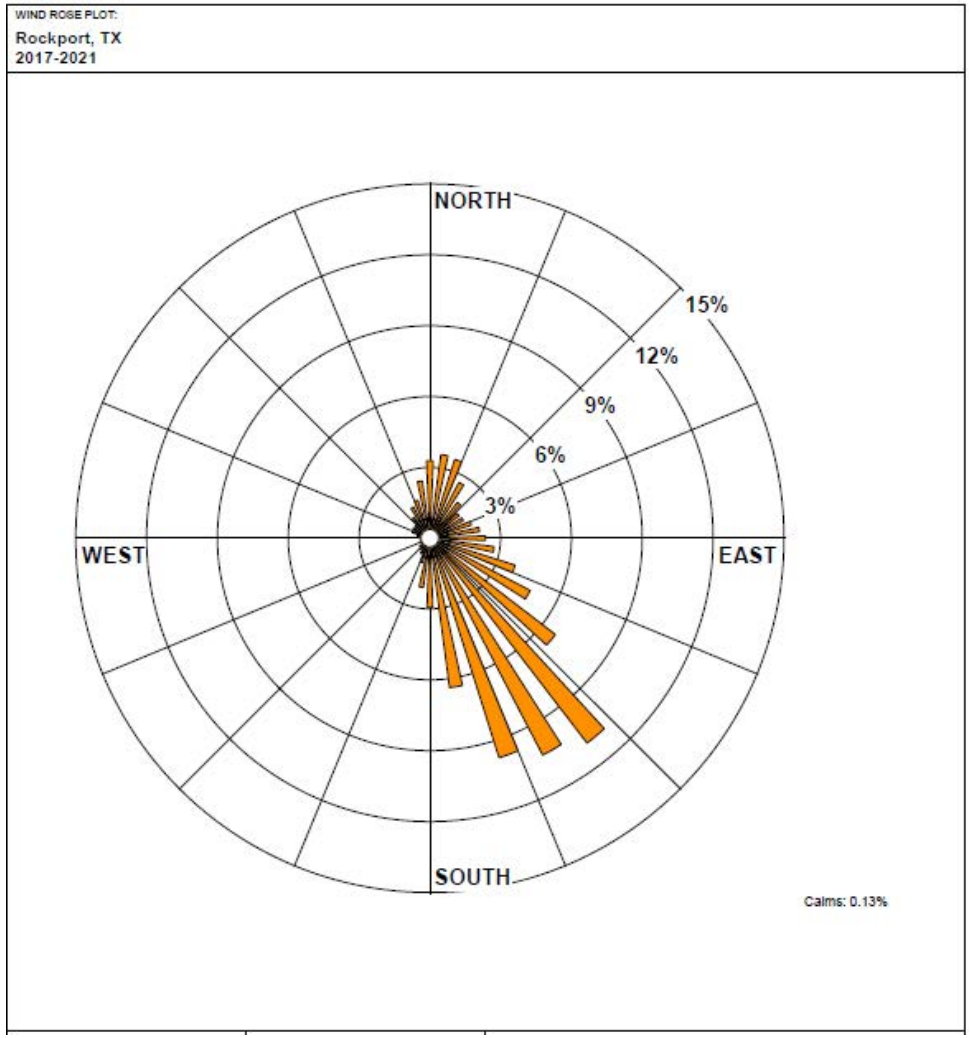
Meteorological Tower Procurement and Installation

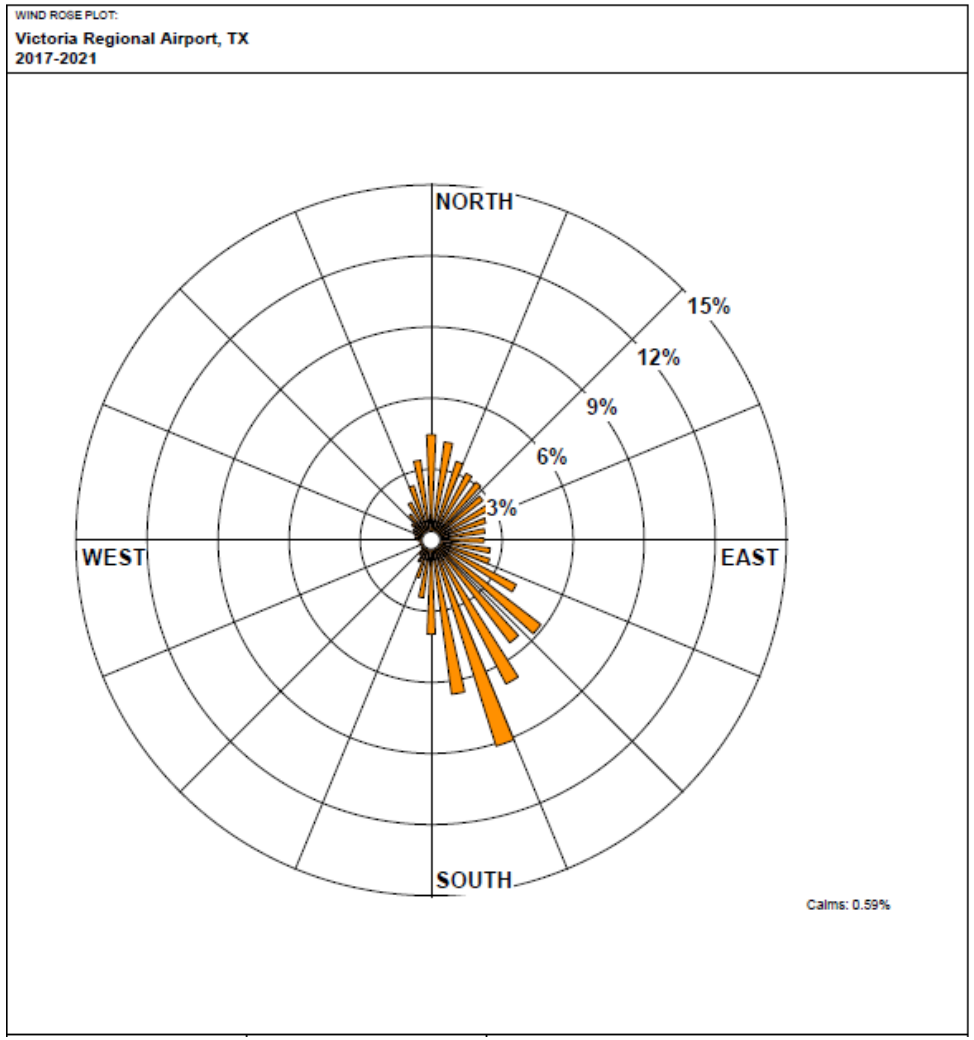
- Procurement in progress to obtain a contractor(s) to manage, design, procure parts, install, and maintain the tower. Specification for tower is complete
- Met tower will initially be solar-powered, with conversion to a power line source to support operations
- Met tower installation and configuration will be compliant with the guidance in RG 1.23 and will fall under ISO-9001, while the data collection will fall under NQA-1
- Plan is to for the Met tower to be installed and collecting data in September 2024
- There will be a Supplement to the Environmental Report and PSAR Chapter 2 approximately 6 months after initial submittal of the Construction Permit Application
- Met tower data collected to date will be included with the Supplement, with a comparison of onsite and regional data to support the determination of representativeness to the Long Mott Site
- At least two years of Met tower data will be included in the FSAR as part of the Operating License Application, which includes a revised Environmental Report

Questions and Comments

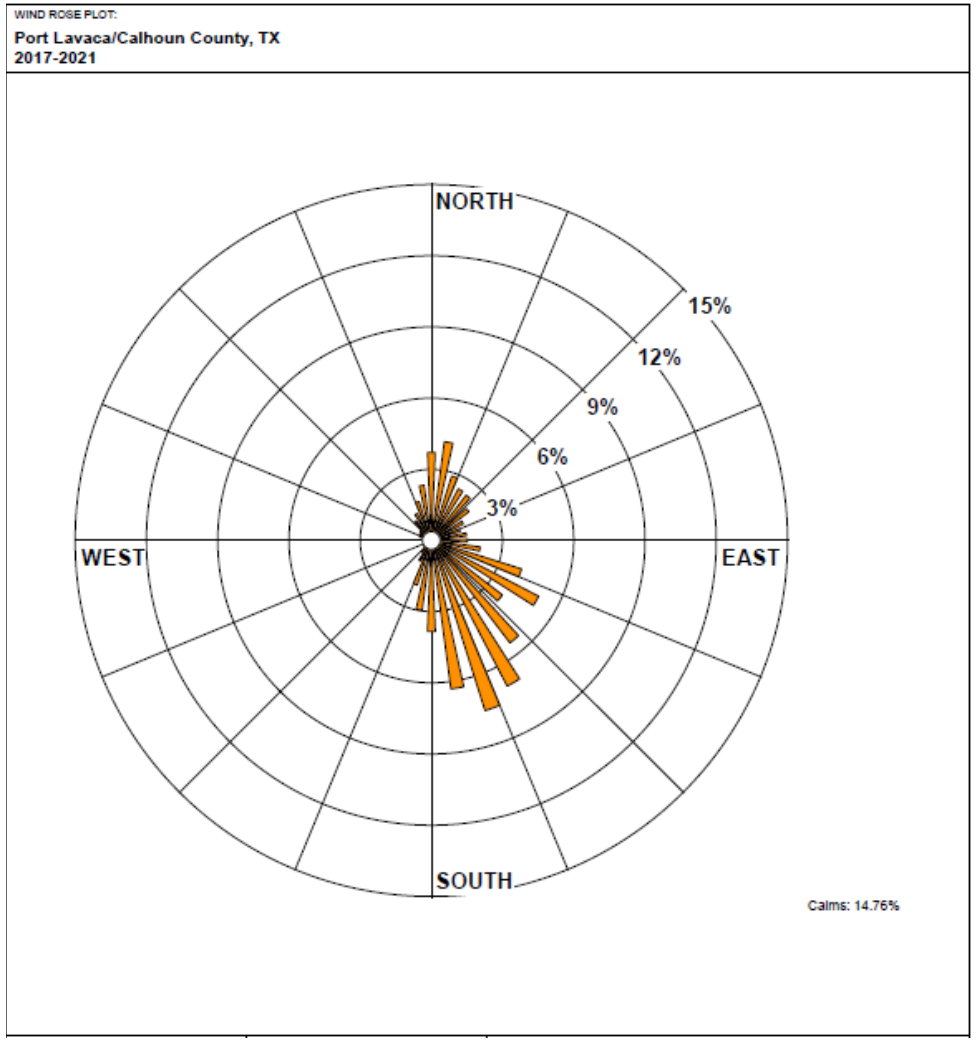
Appendix – See Following Slides

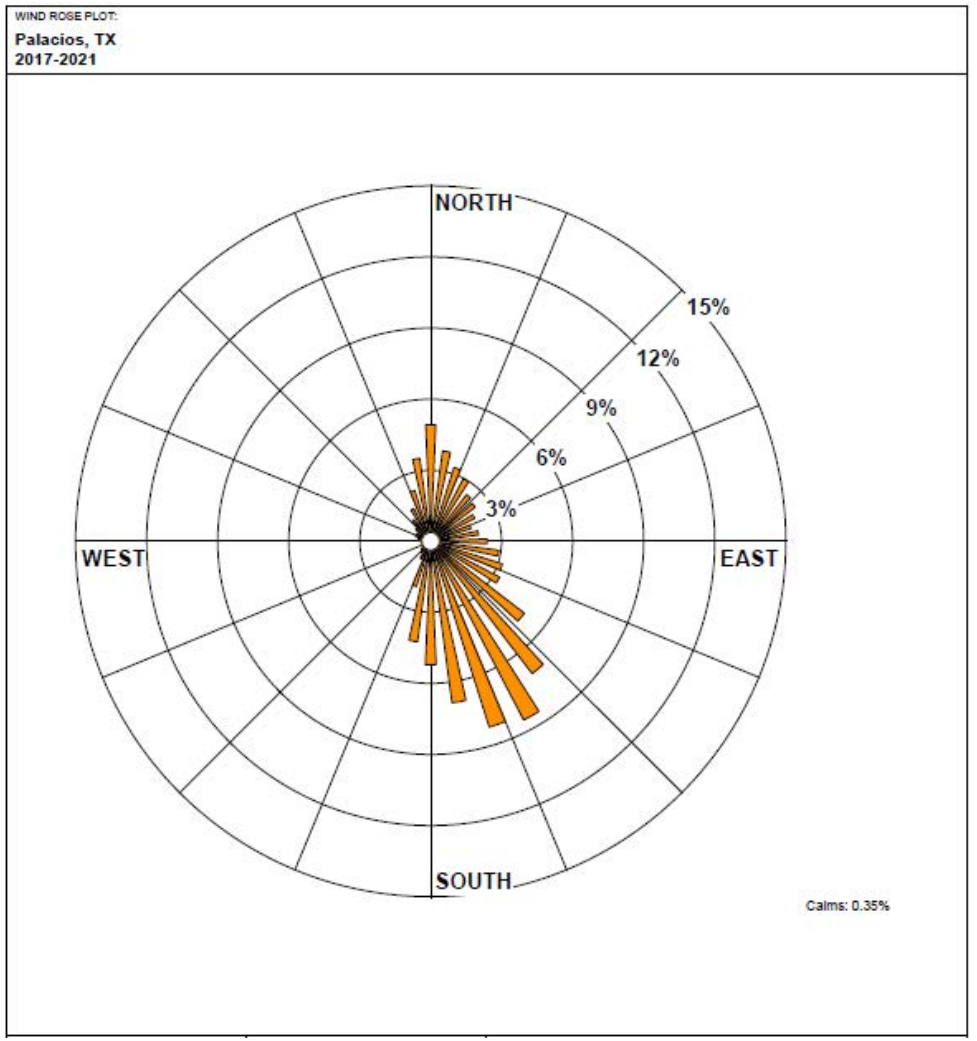
Regional Meteorological Data Sources – Wind Roses (36 Sector)





Regional Meteorological Data Sources – Wind Roses (36 Sector)





Correlation Formula

The correlation r between two variables x and y for samples x_i and y_i for i=1 to n is defined as (e.g., Freund, 1981):

$$r = \frac{\sum_{i=1}^{n}(x_i-\bar{x})(y_i-\bar{y})}{\sqrt{\sum_{i=1}^{n}(x_i-\bar{x})^2 \sum_{i=1}^{n}(y_i-\bar{y})^2}}$$

where $\bar{x}$ and $\bar{y}$ and the sample means.

Reference:

Freund, J. 1981. Statistics A First Course. 3rd Edition. Prentice-Hall, Englewood Cliffs, New Jersey.

Data Availability

Rockport				
Available data				
Year	Wind direction	Wind speed	Dry bulb temperature	Joint data availability
2017	98.00%	98.01%	97.80%	97.79%
2018	99.68%	99.73%	99.38%	99.34%
2019	99.51%	99.55%	99.38%	99.34%
2020	99.33%	99.36%	96.69%	96.61%
2021	99.76%	99.81%	99.59%	99.54%

Palacios				
Available data				
Year	Wind direction	Wind speed	Dry bulb temperature	Joint data availability
2017	99.94%	99.94%	99.93%	99.91%
2018	99.60%	99.65%	99.60%	99.47%
2019	99.94%	99.98%	99.82%	99.77%
2020	99.81%	99.85%	99.31%	99.13%
2021	98.94%	99.12%	99.10%	98.80%

Victoria				
Available data percentages				
Year	Wind direction	Wind speed	Dry bulb temperature	Joint data availability
2017	98.18%	98.18%	99.25%	98.06%
2018	99.47%	99.57%	99.95%	99.44%
2019	99.55%	99.62%	99.87%	99.50%
2020	99.23%	99.57%	99.82%	99.21%
2021	99.53%	99.73%	99.39%	99.29%