

A New Approach for Grid-Wide Wind Measurement with Embedded Optical Fibers

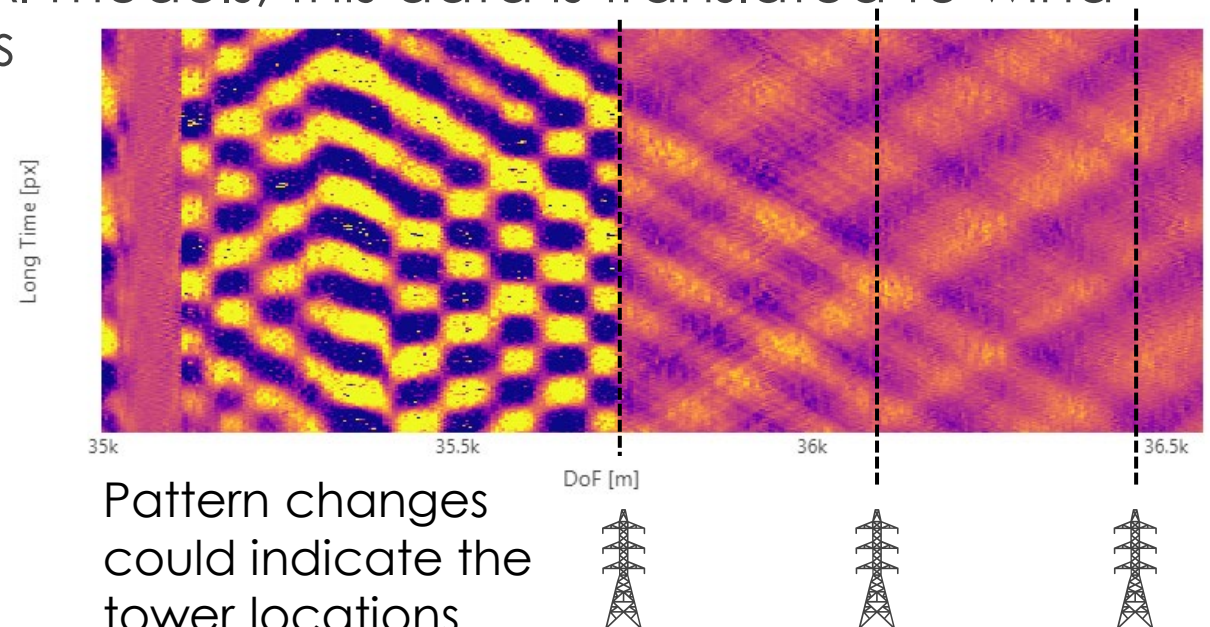
Tiffany Menhorn, VP North America

June 2025

Using the Grid to Monitor itself



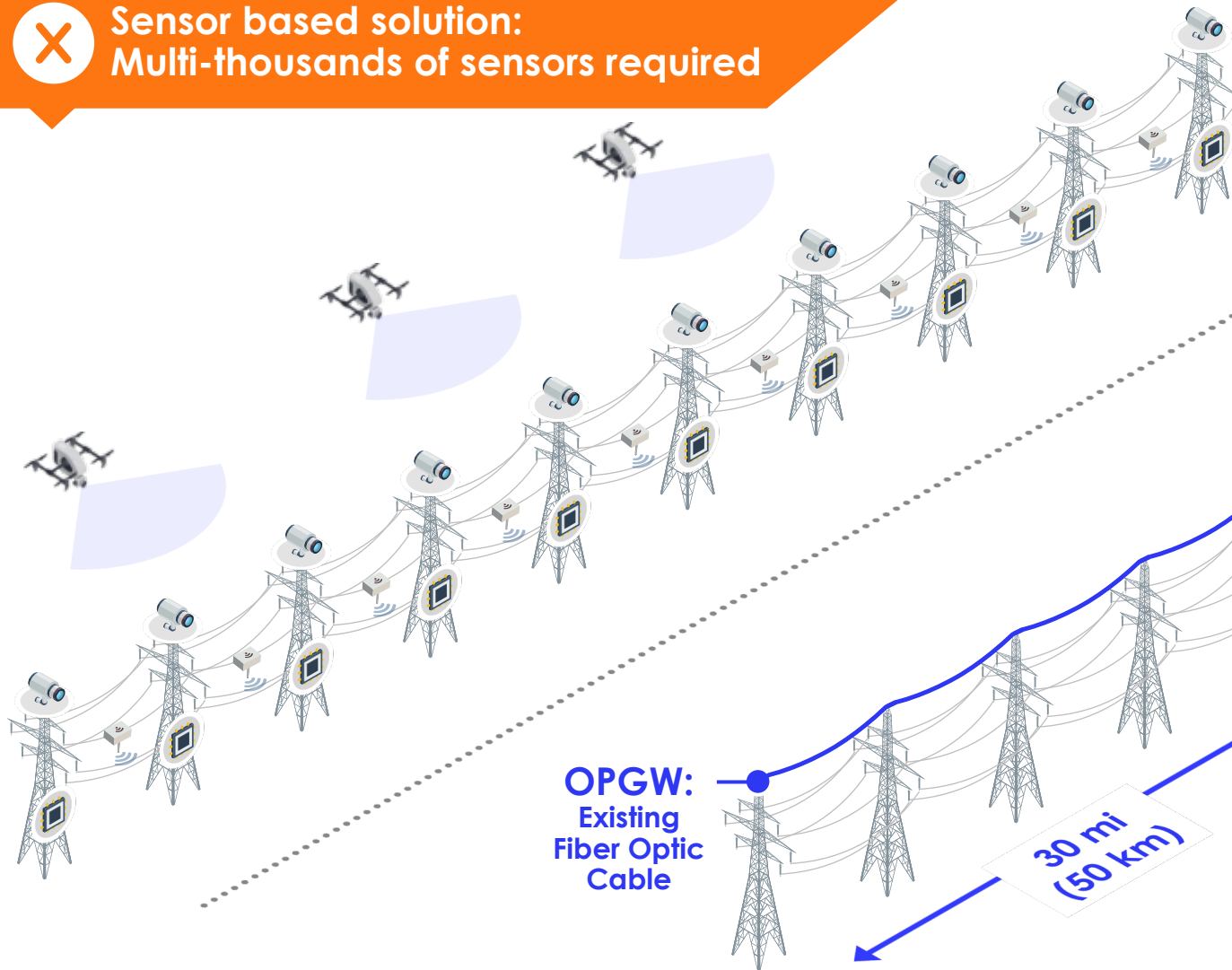
- Optical Ground Wire (OPGW) runs on top of transmission
- Utilizing optical fiber sensing we monitor everything
- The image below shows raw data
 - The colors depict the vibration frequencies of the wire
- Using AI models, this data is translated to wind metrics



Pattern changes
could indicate the
tower locations



Sensor based solution:
Multi-thousands of sensors required



OPGW:
Existing
Fiber Optic
Cable

30 mi
(50 km)

Substation
Based
Beacon
Unit

30 mi
(50 km)

Command &
Control Interface

PrismaPower:
Sensor-free solution



**prisma
photonics**

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The PrismaPower™ Suite



PrismaCapacity

- Dynamic Line Rating (DLR)
- Ambient Adjusted Rating (AAR)



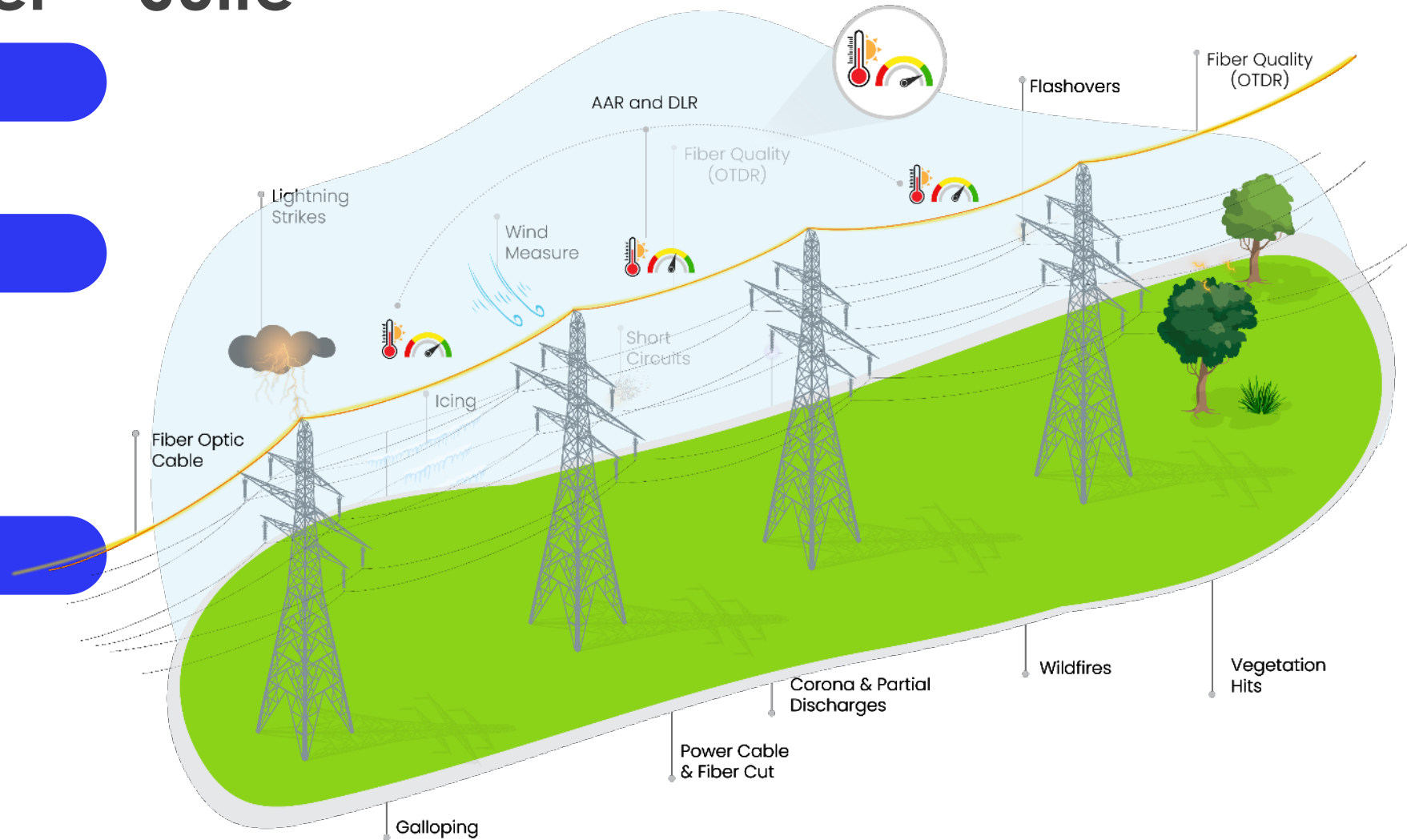
PrismaClimate

- Galloping
- Wire tension
- Extreme winds
- Icing
- Lightning strike
- Wildfires

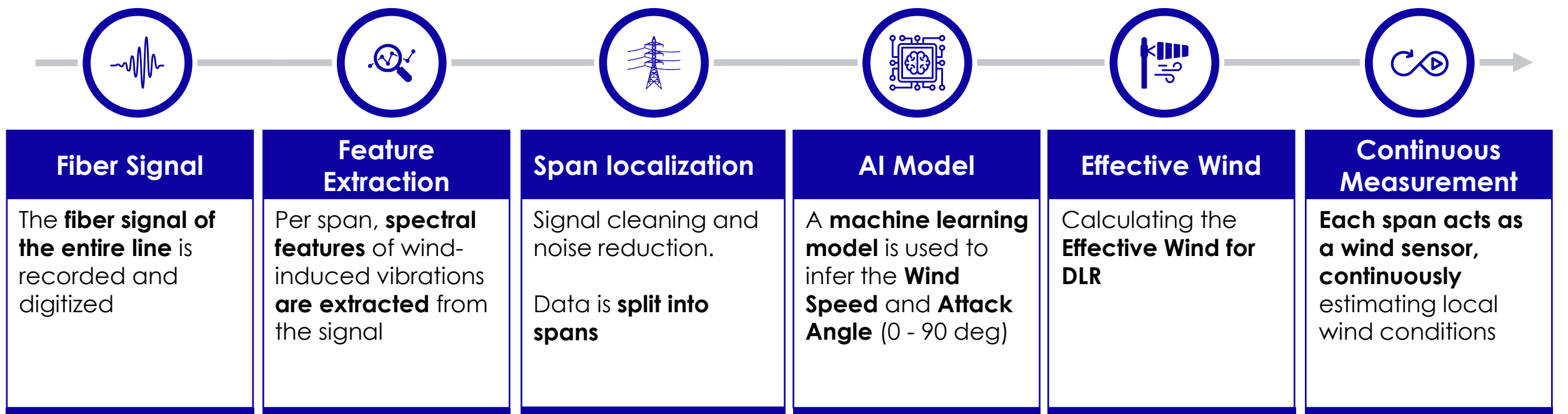


PrismaCircuit

- Short circuits
- Flashovers
- Partial discharge & Corona
- Fiber cut
- Fiber quality (OTDR)
- Vandalism
- Tower climbing
- Vegetation hits

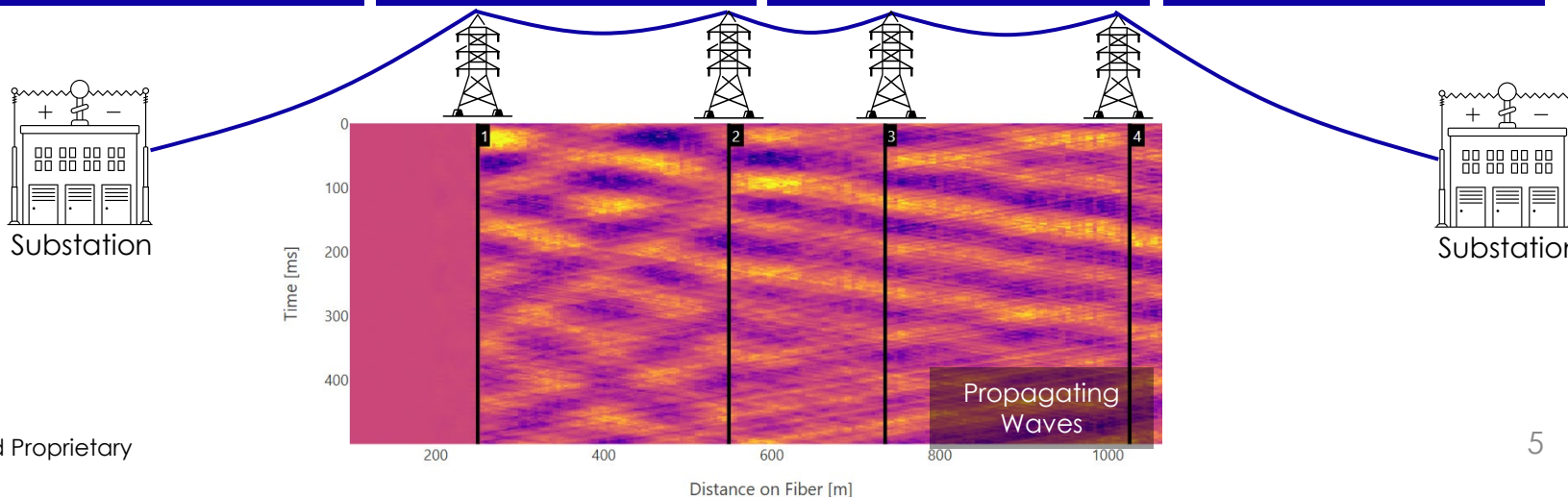
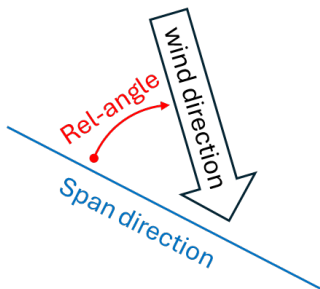


From Optical Fiber to Wind Metrics



Wind Attack Angle

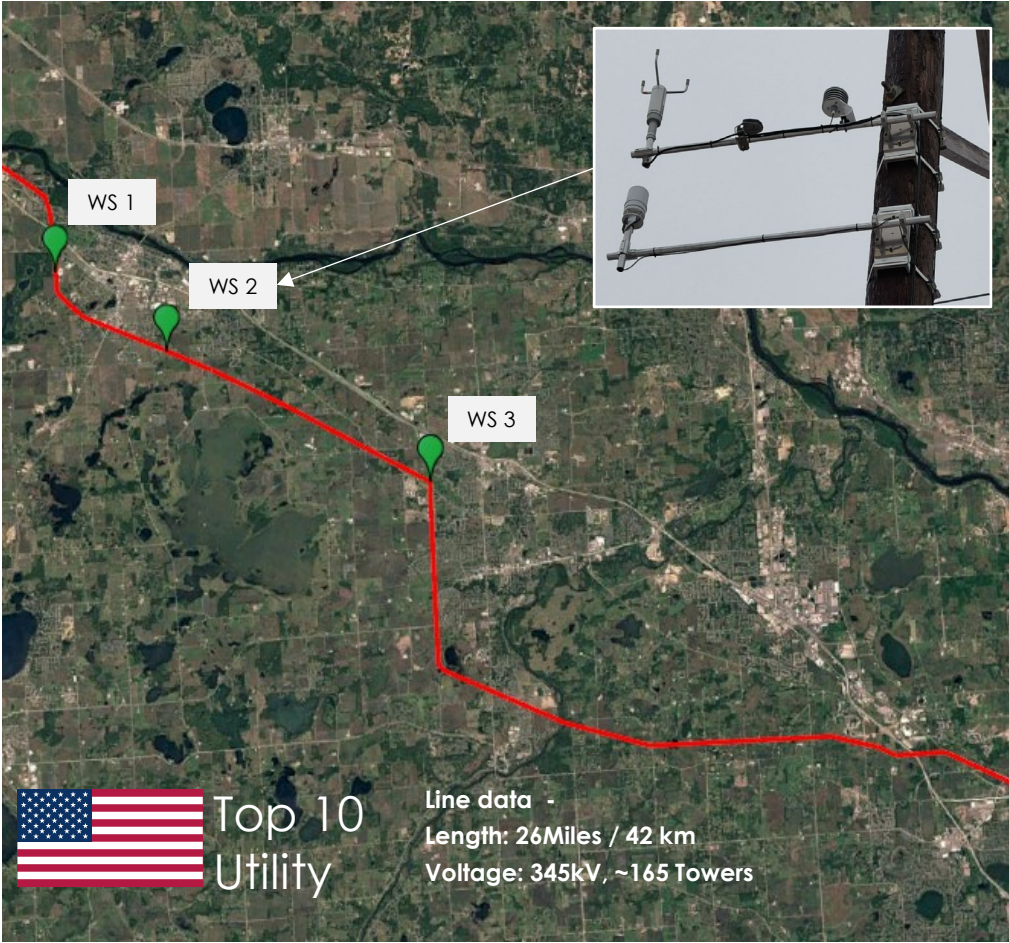
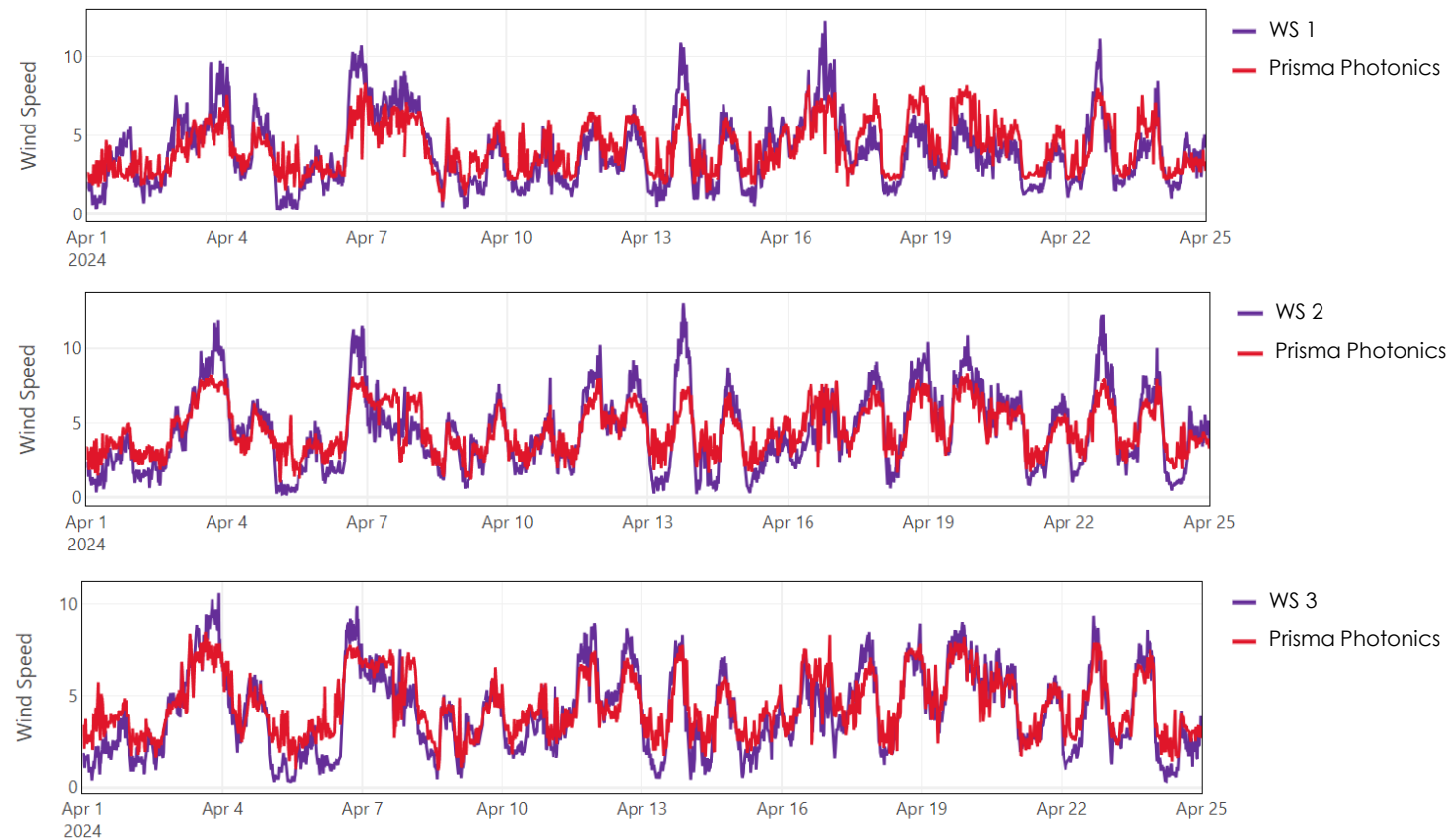
- The angle between the wind direction and the orientation of the power line
- Used directly in the DLR model
- Can be derived from wind direction



Validating Accuracy

Measuring wind accurately on every span

Compared to anemometers in different places along a 26mi line, there is a strong correlation with fiber-based wind readings



European TSO, Coastline to Mountain

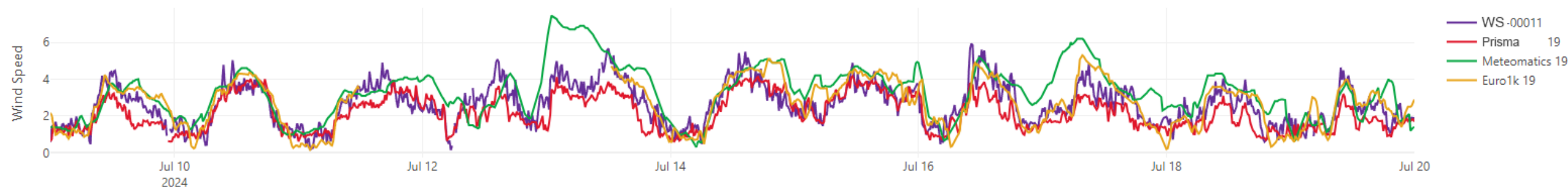
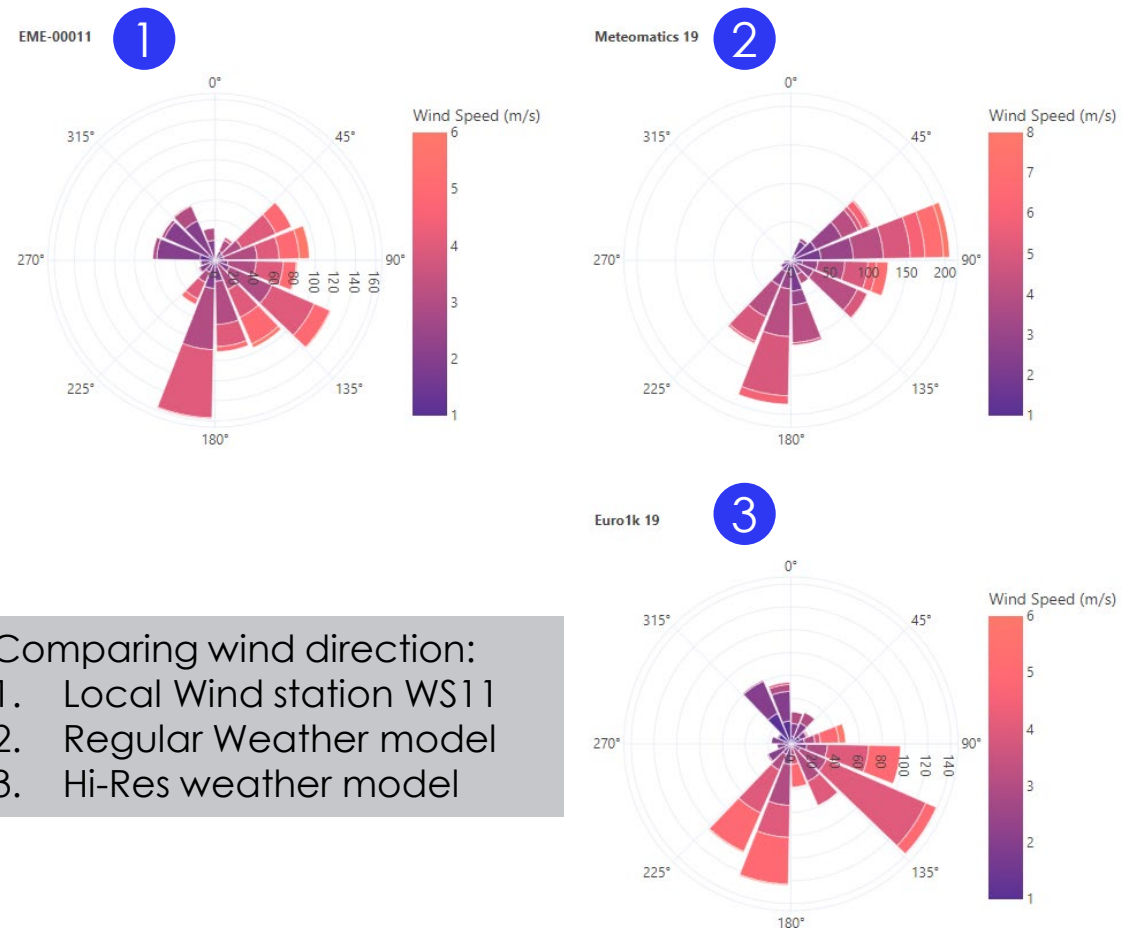
- PrismaPower™ deployment in European TSO
- Out of 20 miles, 5 miles are equipped with wind stations crossing coastal areas and into a hill range with deep valleys
- TSO installed multiple wind stations on specific towers to validate PrismaPower
 - These are marked as WS (Weather Station)
 - WS-11 location is near the coastline
 - WS-12 location is in a valley in the hills
 - WS-14 location is in a valley



WS-11 – Coastline Oriented

Weather data from Coastline area, over several months:

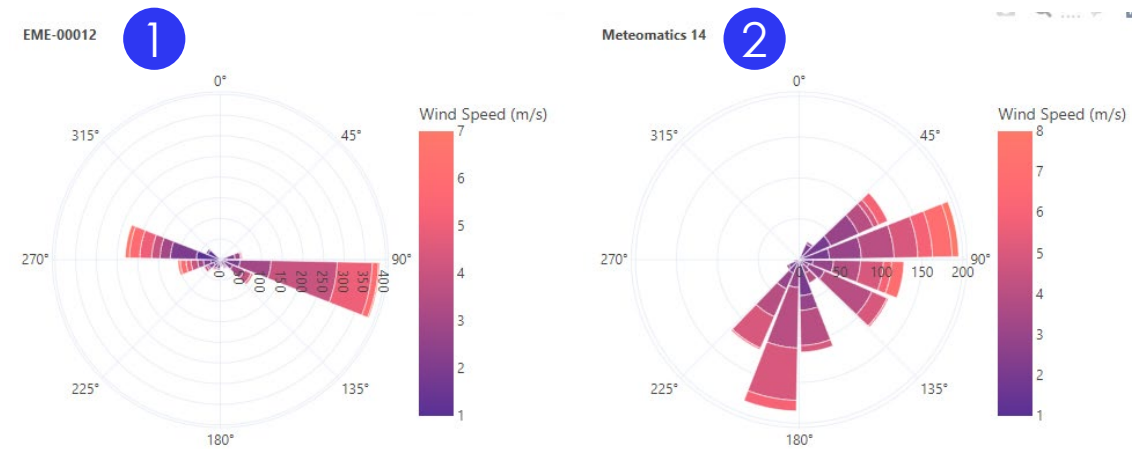
- **Wind direction** of tower-mounted WS11 ① is the ground truth
- Regular weather model ② is not perfect
- High resolution model ③ is more similar to the ground truth
- Looking at **Wind speed**, Fiber-based readings are similar to local station ① and ③



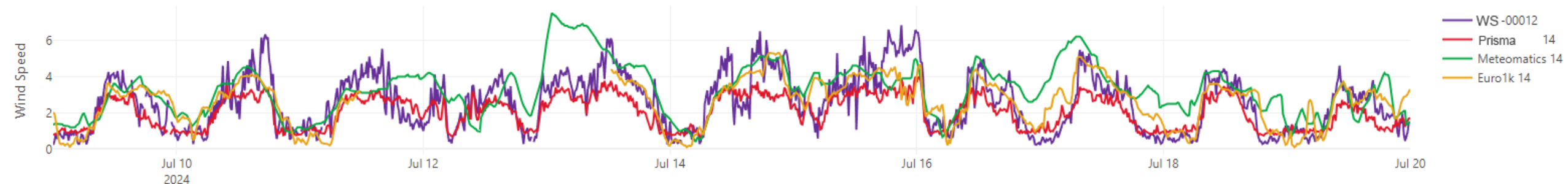
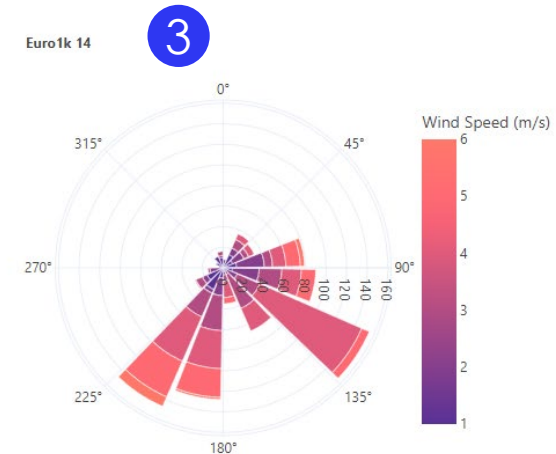
WS-12 – Valley Oriented Wind

Readings were taken over several months in a **valley** oriented east–west.:

- Wind direction of WS12 ① West-East along the valley – Ground truth
- Both models ② and ③ are not local enough and **miss that altogether!**
- Looking at Wind speed, Fiber-based readings are similar to local station ① and ③

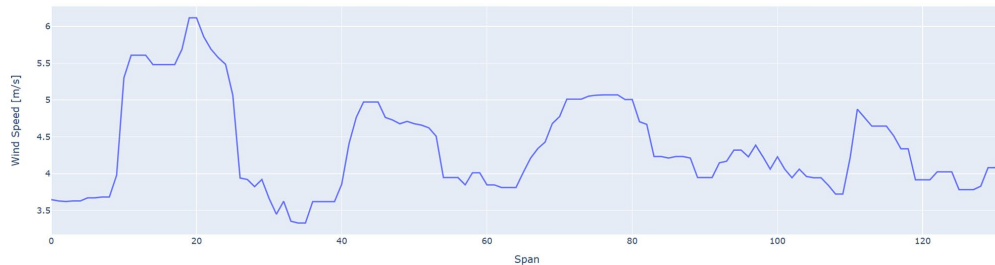


Comparing wind direction:
1. Local Wind station WS12
2. Regular Weather model
3. Hi-Res weather model



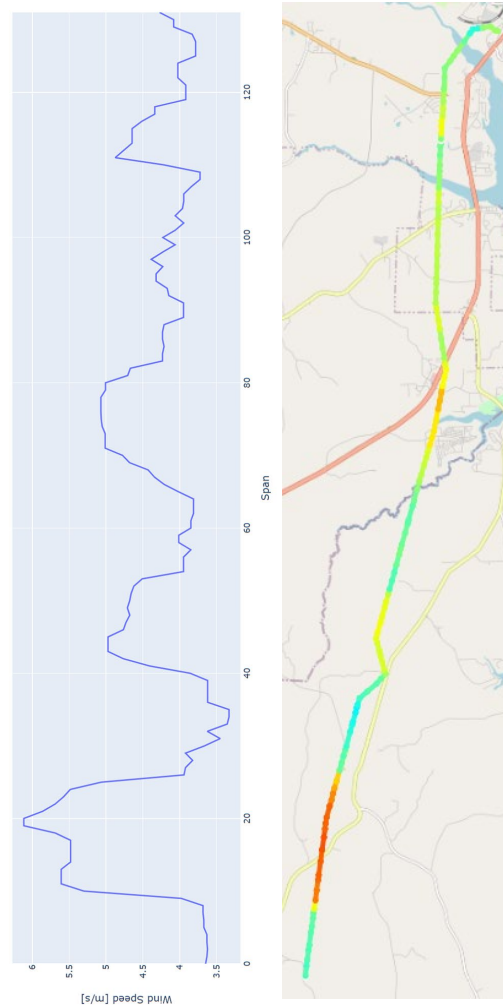
Fiber Sensing Wind tested – Speed and Angle

- Effective wind measurement in a PrismaPower in the U.S.
- Fiber based wind measurement on every span – 1 hour snapshot



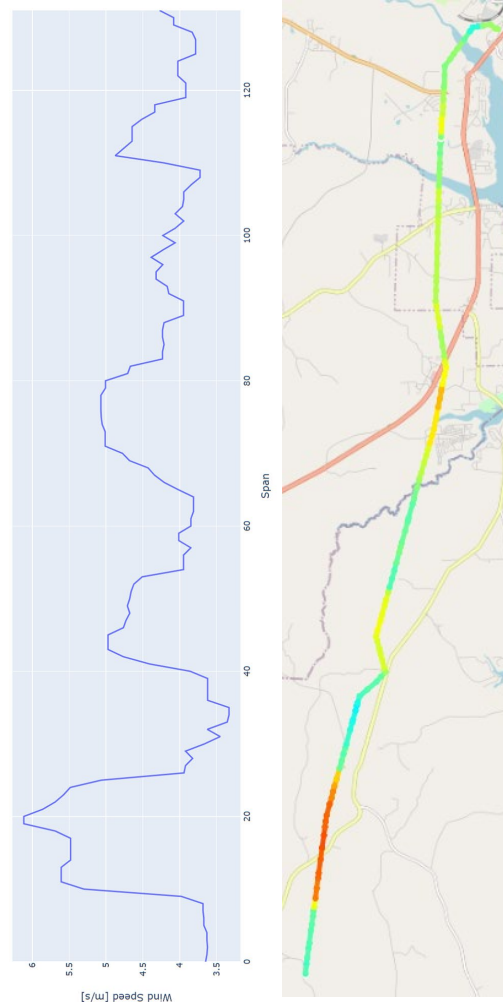
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- The spans are color coded by the wind speed
- The variance over short distances is impressive



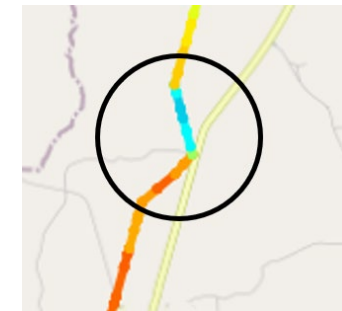
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Wind Speed

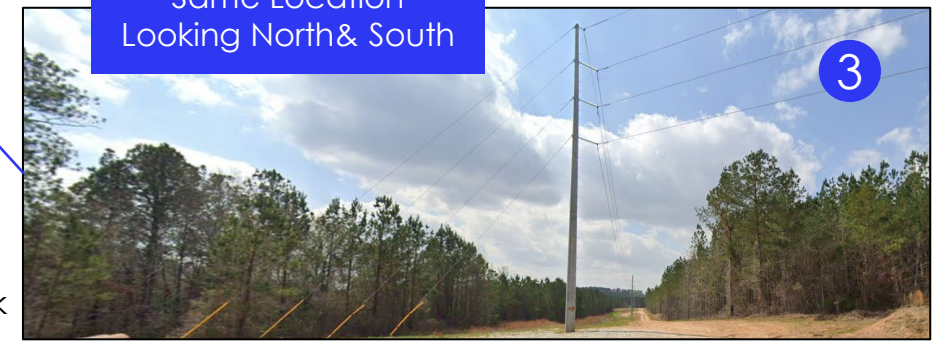
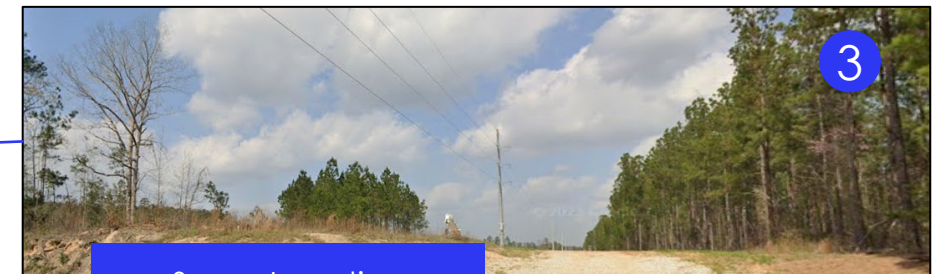
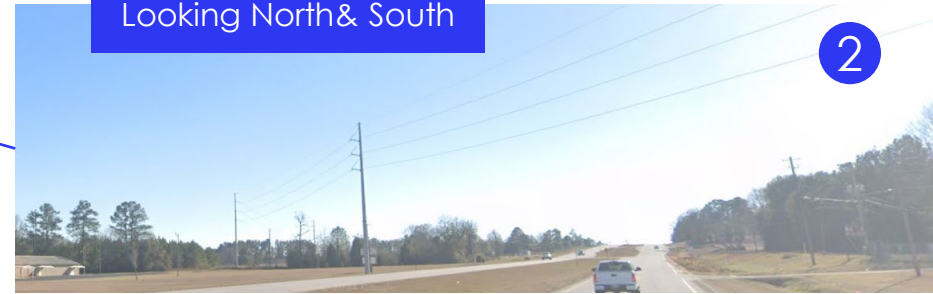
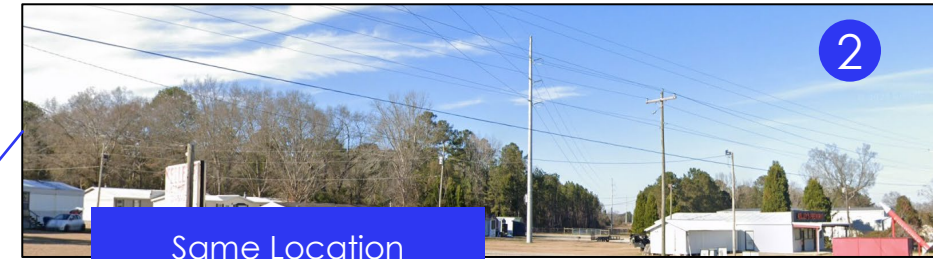
- Adding wind angle
- A bend in the line shows two speeds
- Same wind attacks the line in two angles



Wind Angle

Land Cover & Impacts

1. Open land with minimal tree coverage allows for strong wind speeds
2. Open land on one side of the line and trees on the other – allows for irregular winds
3. Trees on either side of line plus in a valley – allows partial blocking of the wind



The Longest-Range Wind Monitor

- Wind varies span by span — only localized data delivers true accuracy
- With fiber sensing, the grid monitors itself
- Feeding real-time, local wind data into DLR models enables safe and reliable ratings



Questions, please? 

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THANK YOU

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