



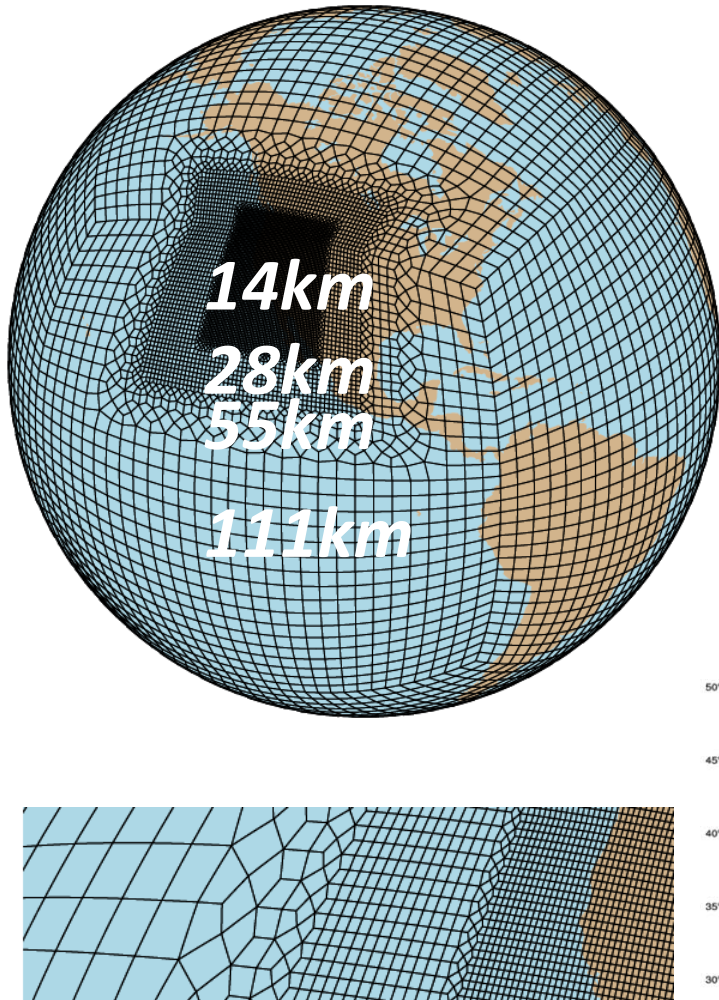
The future of wind energy in California: Future projections in Variable-Resolution CESM

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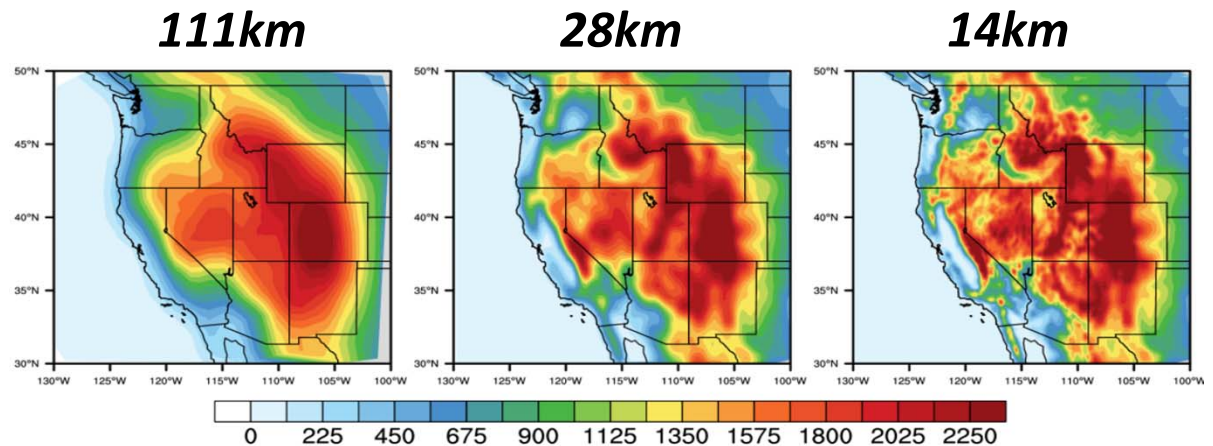
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DNV GL

Variable-Resolution CESM (VR-CESM)

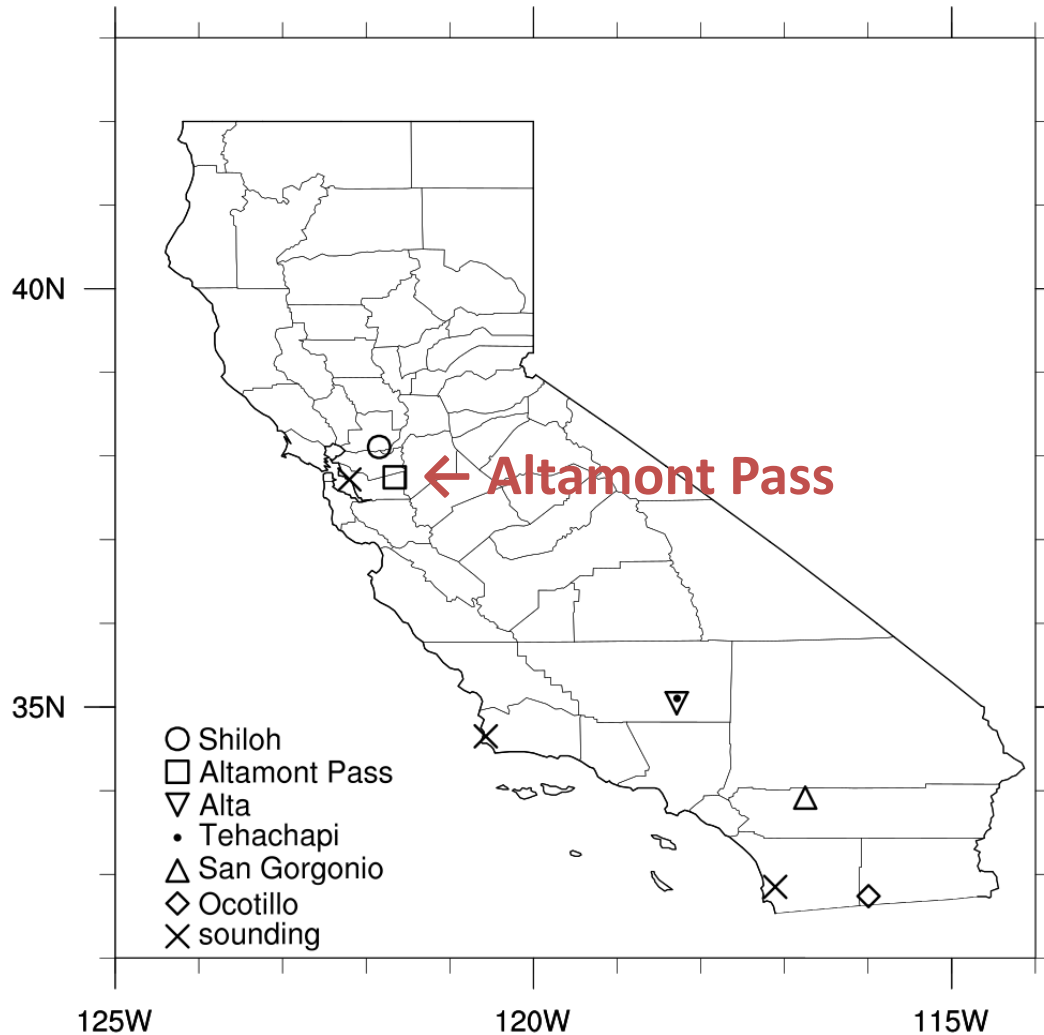


- 30 times faster compared to global uniform 14km resolution
- Connects regional and global modeling communities
- Increased resolution in specified areas (better represents topography)



(Courtesy of Alan Rhoades)

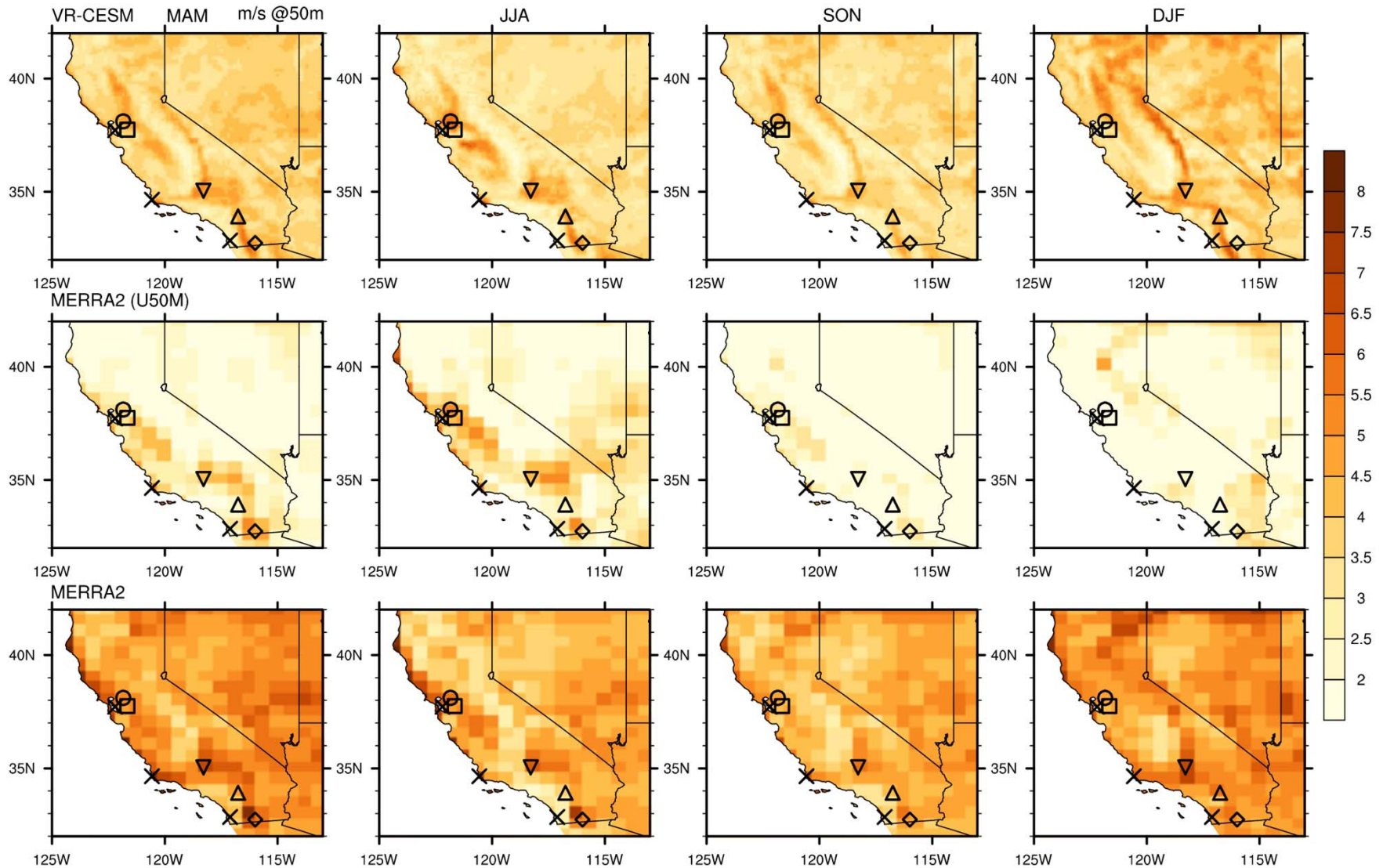
Wind Energy in California



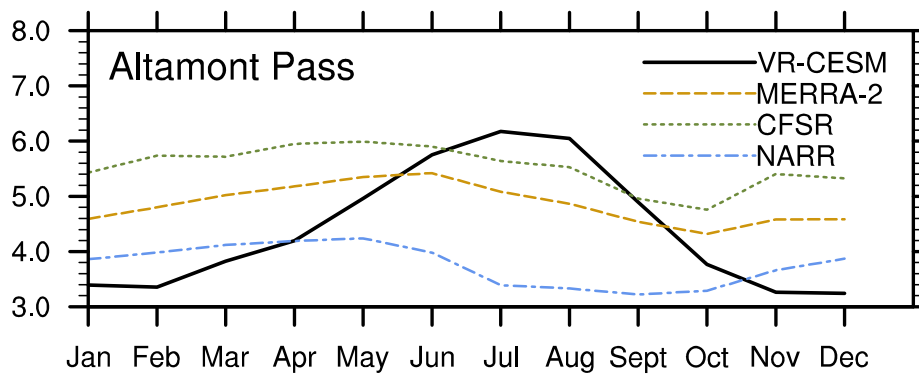
- Historical and mid-century timeframe: 1980-2000, 2030-2050
- 6 wind farm locations
- Hub height wind speed at **50m**, 80m, and 140m
- Interpolation method:

level above hub height
↓
hub height
(logarithmic interpolation)
↑
level below hub height

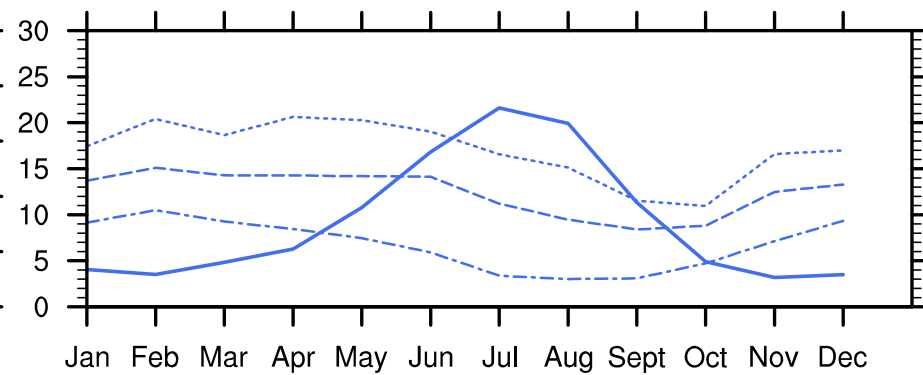
Historical Intercomparison of 50m Wind Speed



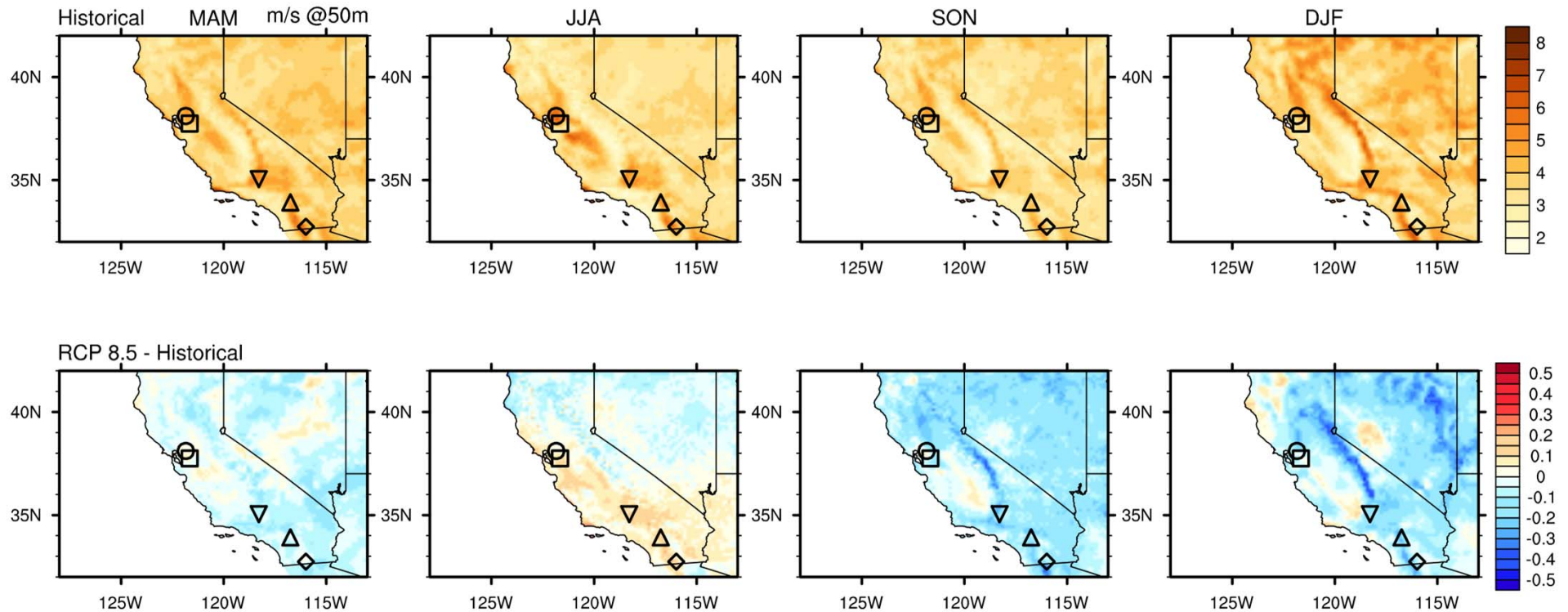
Wind Speed (m/s)



Capacity Factor (%)

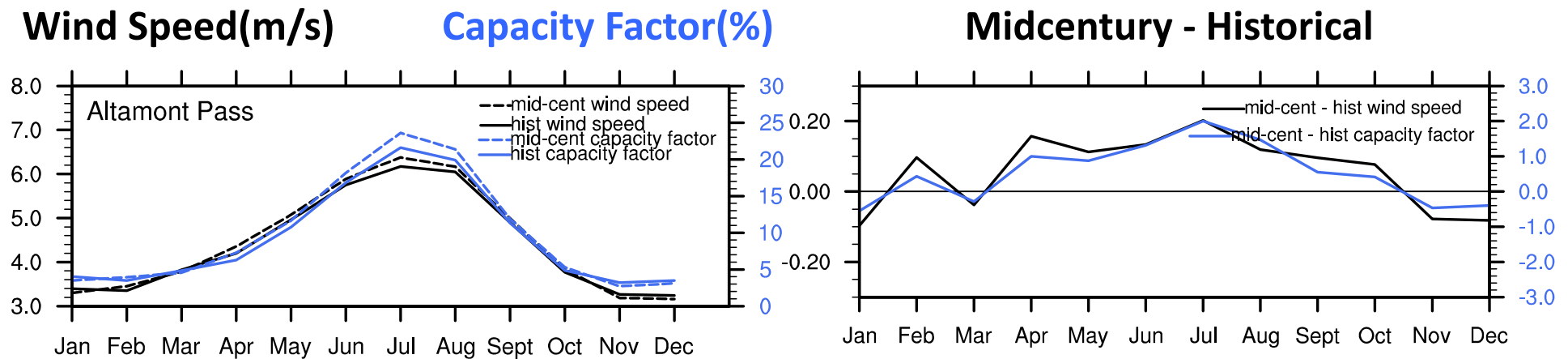


RCP8.5 2030-2050 Projection from VR-CESM



- ↓ trend in most areas under RCP8.5, especially in SON and DJF
- ↑ trend in Central Valley, and in JJA

RCP8.5 2030-2050 Projection from VR-CESM



- Altamont Pass: ~500 MW capacity in size
 - **JJA: 2.52% wind speed ↑ 8.29% capacity factor ↑**
Roughly 40MW less capacity needed, worth ~\$40 million
 - **DJF: 0.83% wind speed ↓ 4.16% capacity factor ↓**
Roughly 20MW more capacity (cost ~\$20 million) needed to compensate for capacity factor decrease in DJF

Future Work

- Incorporate Weather Research and Forecasting (WRF) Model with high resolution (4km) into model intercomparison
 - Cluster analysis to understand wind patterns, and the associated meteorological background
 - Large-scale meteorological impact on localized extreme wind
 - Correlations with ENSO, PDO, NAO, etc..
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Thank you for listening!

Questions or Comment:

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