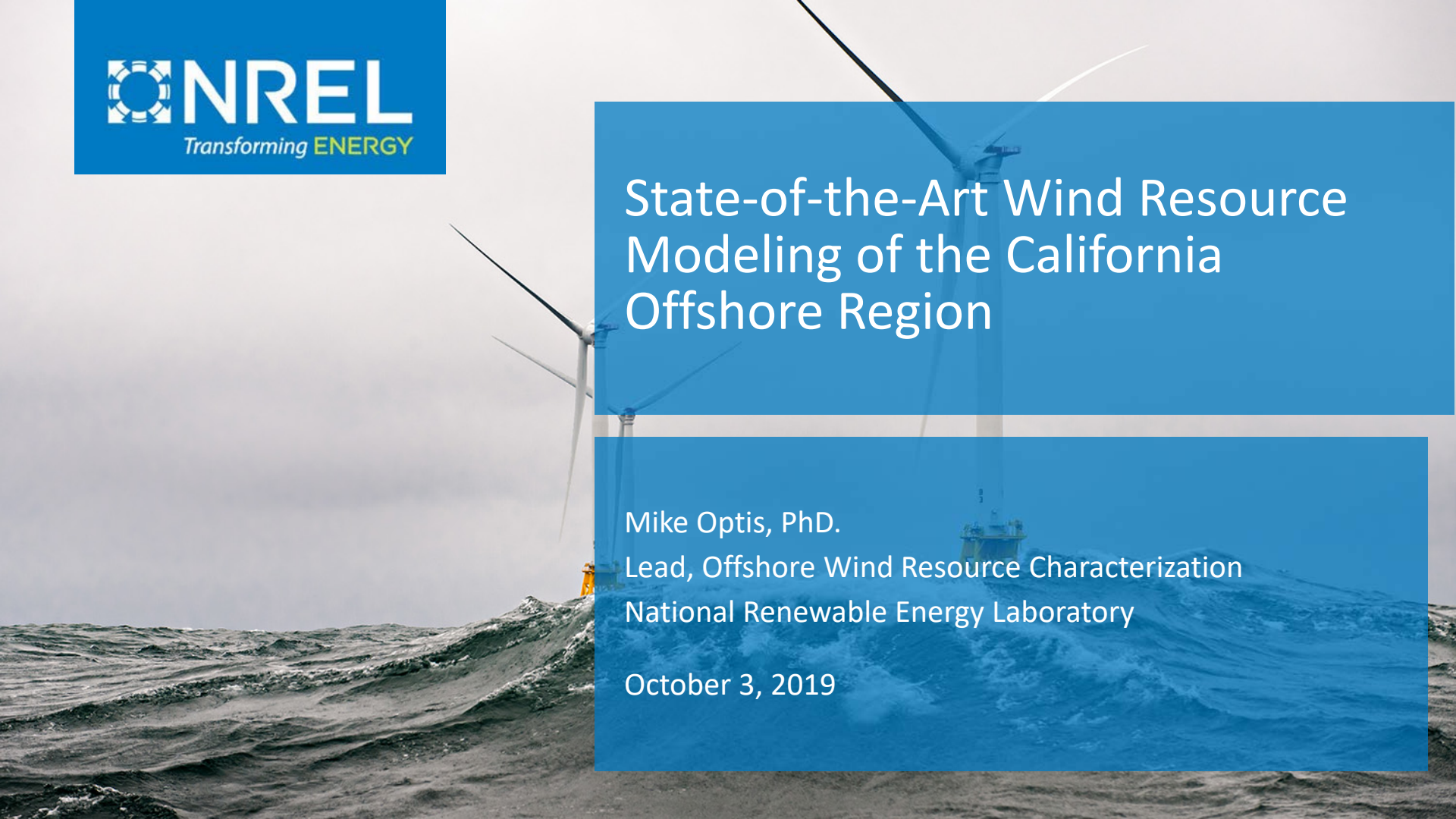
DOCKETED	
Docket Number:	19-IEPR-07
Project Title:	Electricity Sector
TN #:	229918
Document Title:	State-of-the-Art Wind Resource Modeling of the California Offshore Region
Description:	Presentation by Mike Optis, National Renewable Energy Laboratory (via WebEx)
Filer:	Raquel Kravitz
Organization:	National Renewable Energy Laboratory
Submitter Role:	Public Agency
Submission Date:	10/1/2019 3:58:23 PM
Docketed Date:	10/1/2019



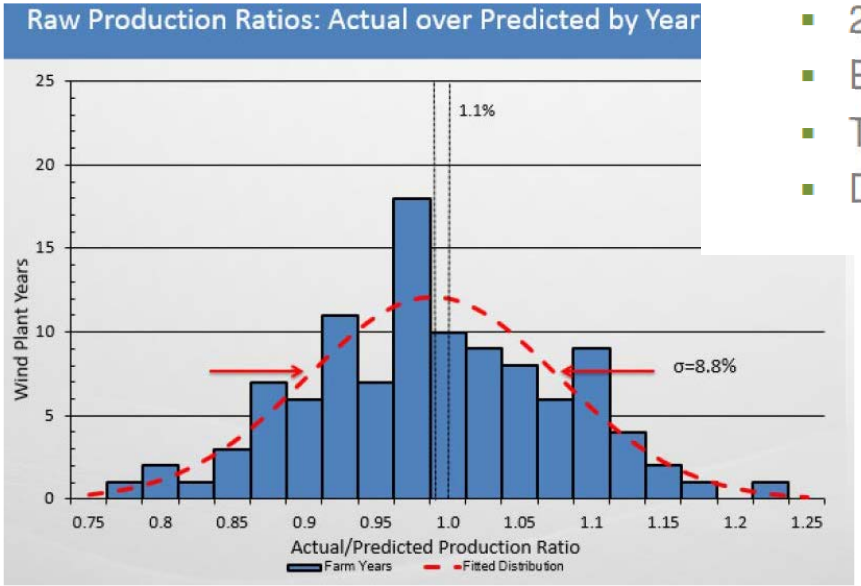
State-of-the-Art Wind Resource Modeling of the California Offshore Region

Mike Optis, PhD.
Lead, Offshore Wind Resource Characterization
National Renewable Energy Laboratory

October 3, 2019

Getting the Resource Right Matters

Presentation from EDF Renewables at AWEA WRA 2015:



EDF Renewables, AWEA WRA 2015 Presentation

- Recent example #1:
  - 200MW project
  - Energy estimate uncertainty ~ 7%
  - Two consultant estimates were 3% different on P50 AEP
  - Difference in project NPV… **$17MM**

And this is onshore!

- Smaller turbines
- More history/experience
- More measurements

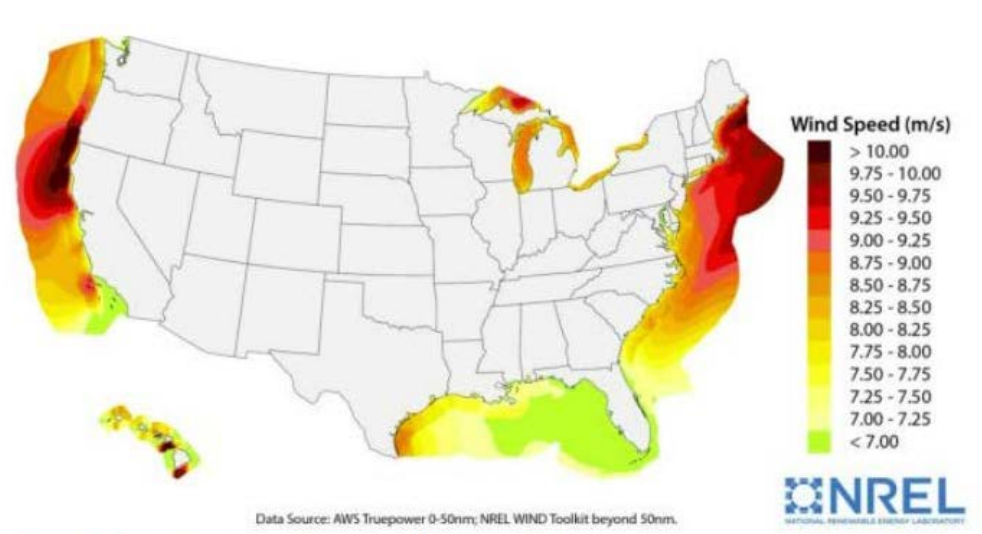
Offshore Measurement Challenges

National Data Buoy Center, 2019

National Data Buoy Center, 2019

The U.S. offshore wind resource (especially CA) is not well characterized

Modelling Challenges



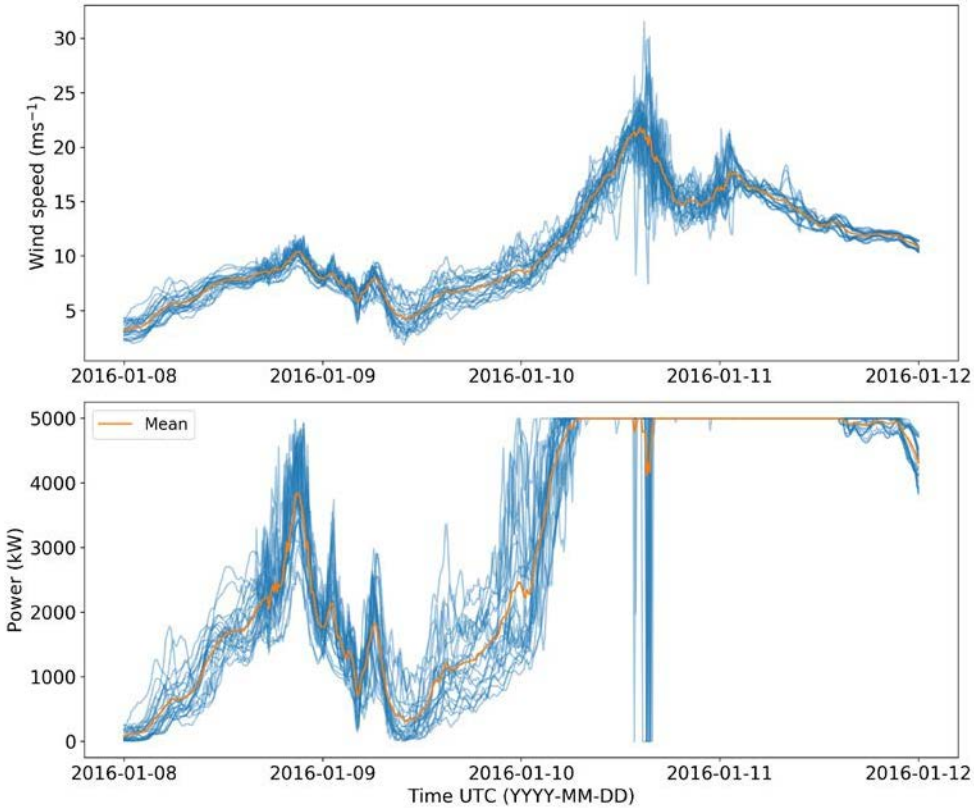
2016 offshore wind resource map (Source: NREL)

- NREL's WIND Toolkit (2013)
- Weather Research and Forecasting (WRF) Model
- 7 years of timeseries data
- **Not validated offshore**

Model Sensitivity

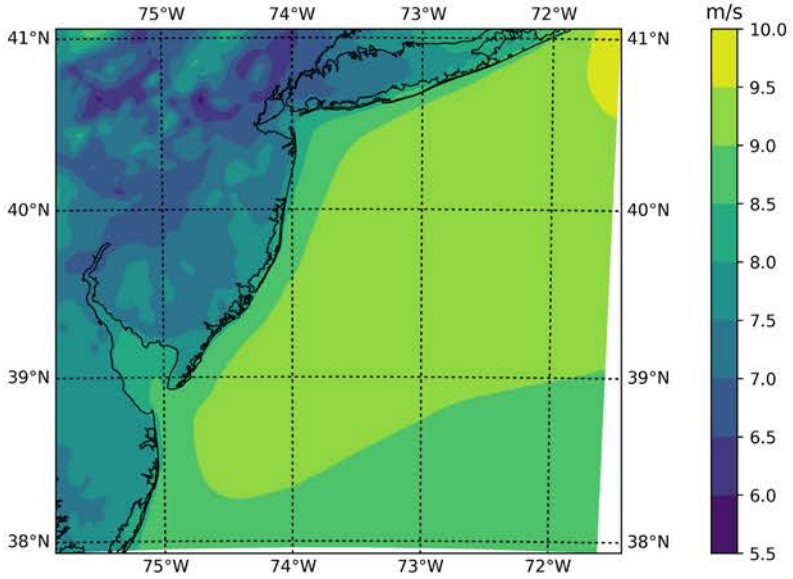
- WIND Toolkit is a single model run
- High variability depending on model inputs and setup
- **Ensemble approach allows quantification of uncertainty**

Sample output from New Jersey Offshore Pilot Study

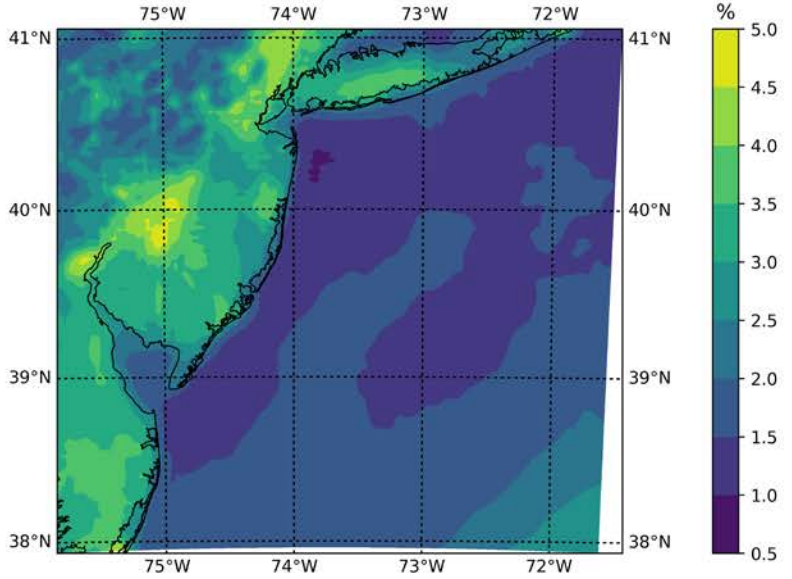


Next-Generation Dataset

Mean 100-meter Annual Average Wind Speed



100-meter Annual Average Wind Speed Uncertainty



- Ensemble approach piloted in New Jersey offshore area
- Lessons learned from New European Wind Atlas

Offshore California Dataset

https://www.boem.gov/All-States-Poster/

- **First large-scale, long-term production runs for next-generation wind resource dataset**
- 20-year wind resource data set
- 2-km spatial , 5-minute time resolution
- 1-year ensemble run (~24 members)
- Uncertainty extrapolated to all 20 years through machine learning

More Extensive Validation

- Buoys and coastal measurements will form basis of validation
- **Emergence of floating lidar is a game-changer**
- We will explore private/public sources for more state-of-the-art offshore measurements

http://axystechnologies.com/windsentinel-ready-us-navy-validation-floating-lidar/

Thank You

www.nrel.gov

This work was authored by the National Renewable Energy Laboratory, operated by Alliance for Sustainable Energy, LLC, for the U.S. Department of Energy (DOE) under Contract No. DE-AC36-08GO28308. Funding provided in part by the U.S. Department of Energy. The views expressed in the article do not necessarily represent the views of the DOE or the U.S. Government. The U.S. Government retains and the publisher, by accepting the article for publication, acknowledges that the U.S. Government retains a nonexclusive, paid-up, irrevocable, worldwide license to publish or reproduce the published form of this work, or allow others to do so, for U.S. Government purposes.