Increasing Accuracy of Offshore Wind Resource Assessment with High-Resolution Satellite Imagery

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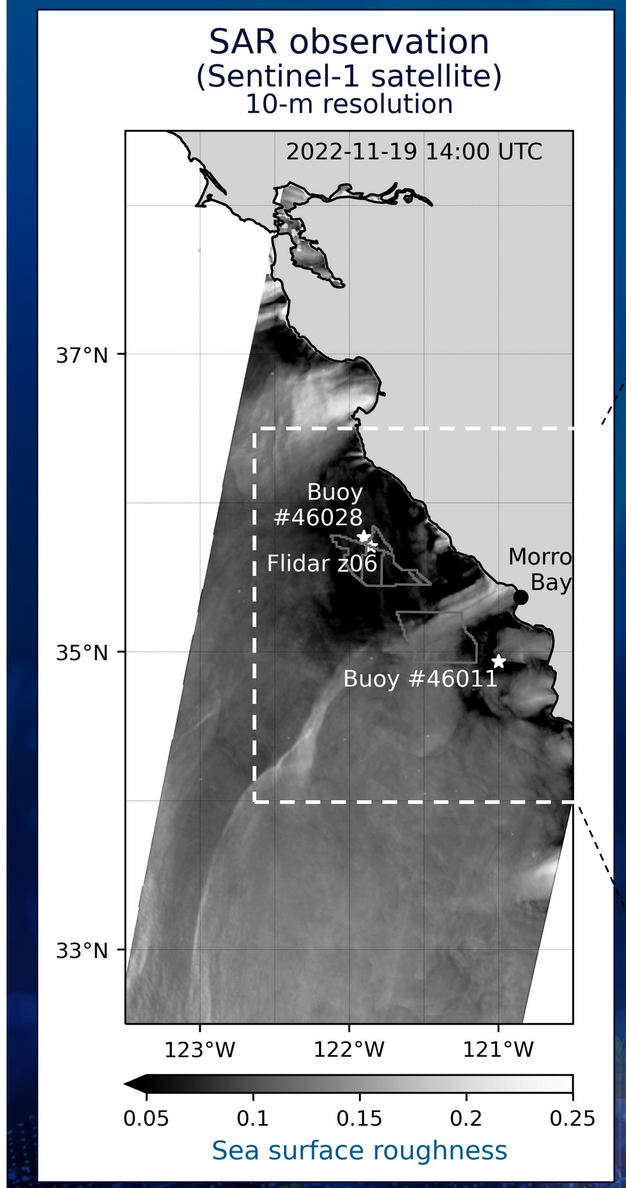
Intro

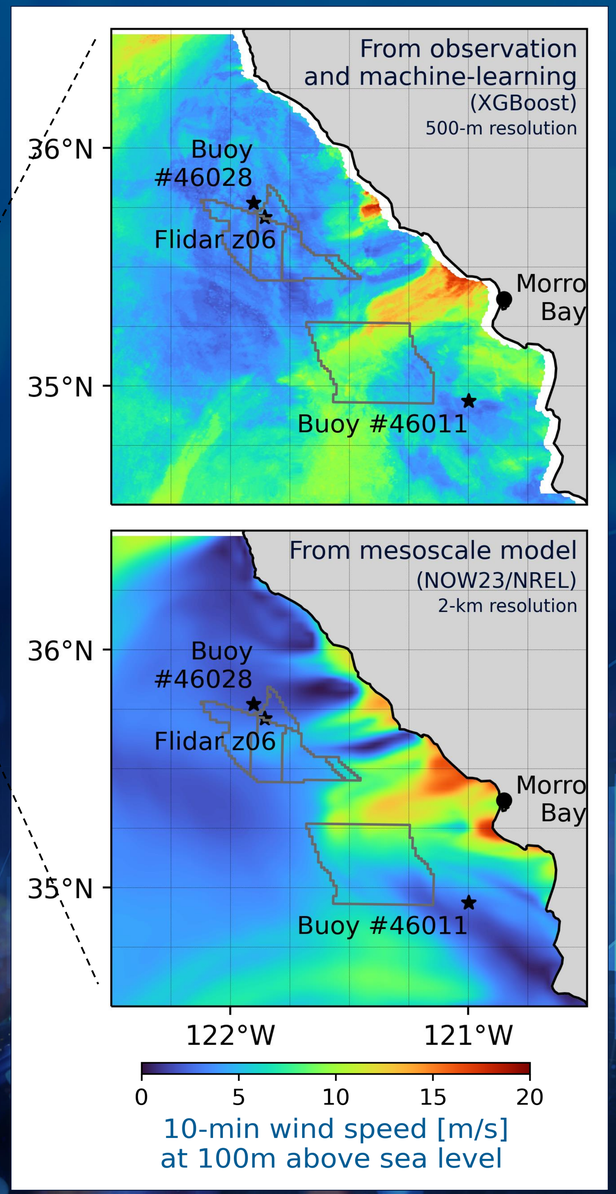
Offshore wind resource assessment is a challenge due to scarcity of measurements at hub height. The unique coverage, precision and resolution from Synthetic-Aperture Radar (SAR) measurements bring great benefits such as wind atlases with **spatial heterogeneities** for the characterization of wind conditions in **coastal/offshore** regions, hence helping in **early screening** of development zones and designing **lidar campaigns**.

Method

1. Surface wind field from SAR thanks to our expertise as official provider for the **European Space Agency**.
2. Vertical extrapolation from 40m up to 300m with **machine-learning** algorithms based on insitu data.
3. Large **training dataset** with 88 US NDBC buoys and 12 offshore lidars in North Sea.



Direct observation of air-sea interactions and land-sea transition impacting offshore wind projects



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Results

- **Validation over 28 lidars** in US (East and West coasts), China, Denmark, Germany, the Netherlands, Belgium, France:
  - Mesoscale models: 4% error
  - SAR-derived method: **2% error**
- Impact on the gross annual energy production: 4%
- Can be applied **worldwide** with no insitu observations thanks to satellite technology.

Discussion

- **Wake effects** of single turbines or large clusters can be seen on SAR imagery.

References

De Montera et al. 2022 Wind Energ. Sci. 7 1441-53

Cathelain et al. 2023 J. Phys.: Conf. Ser. 2505 012027

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