Increasing accuracy of offshore wind resource assessment with high-resolution satellite imagery in the US East Coast

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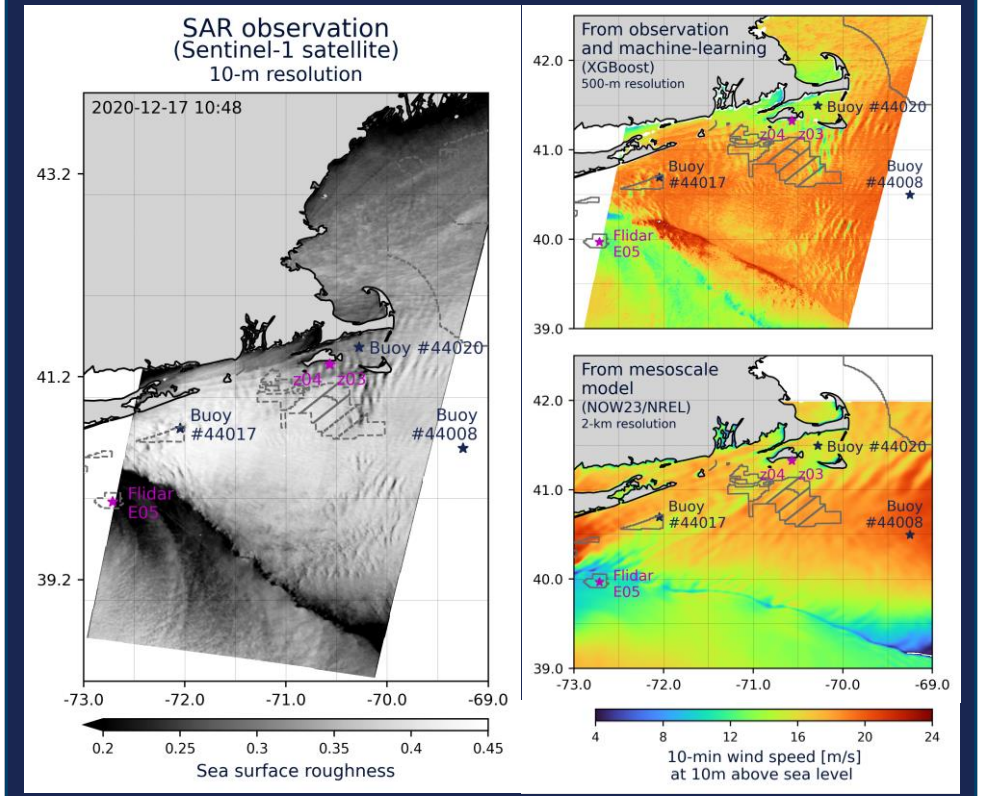
Introduction

Accurate offshore wind resource assessment is challenging due to scarcity of measurements, specially at hub height. The unique coverage, representativeness, and resolution of **Synthetic-Aperture Radar** (SAR) observations bring great benefits such as identifying **spatial heterogeneities** in wind fields in **coastal /offshore** regions (characterization of wind conditions), hence helping in **early screening** of development zones and designing **lidar measurement campaigns**.

Method

1. Derivation of surface wind fields from SAR utilizing our expertise as official provider for the **European Space Agency**.
2. Vertical extrapolation of those fields up to 300m with **machine-learning** algorithms based on supplementary *in situ* data.
3. Incorporation of large **training dataset** with 88 US NDBC buoys and 12 offshore lidar buoys in North Sea.

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



OFFSHORE WINDPOWER

SARWind in North American Clean Energy

4. Validation with **over 28 lidars** in US (East and West coasts), China, Denmark, Germany, the Netherlands, Belgium, and France.

Results

- **Finer resolution** of wind flow patterns obtained with **SAR observations** compared to **mesoscale model that lacks precision** due to various assumptions/approximations.
- Significant error reduction:
  - Mesoscale models: 4% error
  - SAR-derived method: **2% error**
- Impact on the gross annual energy production: 4%.
- Method can be applied worldwide with no need for *in situ* observations thanks to satellite coverage.

Discussion

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

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

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