Observing and Analyzing Global Offshore Wind Farms from the Space

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[1] Insights on Wind Farms from Above

"Wakes" are the area behind turbines where wind is more slow/turbulent. Studying these with satellite data enables:

- Informing turbine placement to ***maximize energy output***.
- Accurate ***cost-benefit analysis*** for long-term viability and financial returns.
- ***Protecting local ecosystems***, both above and below water.
- Providing ***policymakers*** with broad-scale empirical evidence.

[2] How Satellite Radar ("SAR") Sees What Others Don't

(Example SAR Image)

"Synthetic Aperture Radar" (SAR) data measures the **sea-surface texture**, which itself is influenced by low-level winds (including wakes!). Although we have to manually derive wind speeds, we gain:

- ***Extremely high resolution*** (10m/pixel),
- Data regardless of ***nighttime*** or ***adverse weather*** conditions, and
- ***Massive perspective*** (~250km/image).

⇒ Altogether, this paints an *exciting* picture! — If we can implement robust quantitative/computational metrics, there are *terabytes* of data across various OWF's to compare results and get big-picture insights.

[3] Novel Approach

Put simply, traditional methods (GMFs) of converting SAR data → wind speed require *a priori* knowledge of wind direction, which often creates issues with limited sampling diversity and spatial resolution…

⇒ Our approach takes advantage of the ***inherent anisotropy constraint*** in wake analysis (i.e. unidirectionality) to more accurately ***isolate and quantify wind speed deficits***. This allows for a ***larger subset of SAR images*** to be used, improving statistical certainty. *(see right for example)*

We're currently applying this to large (Hornsea Project One, Anholt, and Horns Rev) offshore wind farms.

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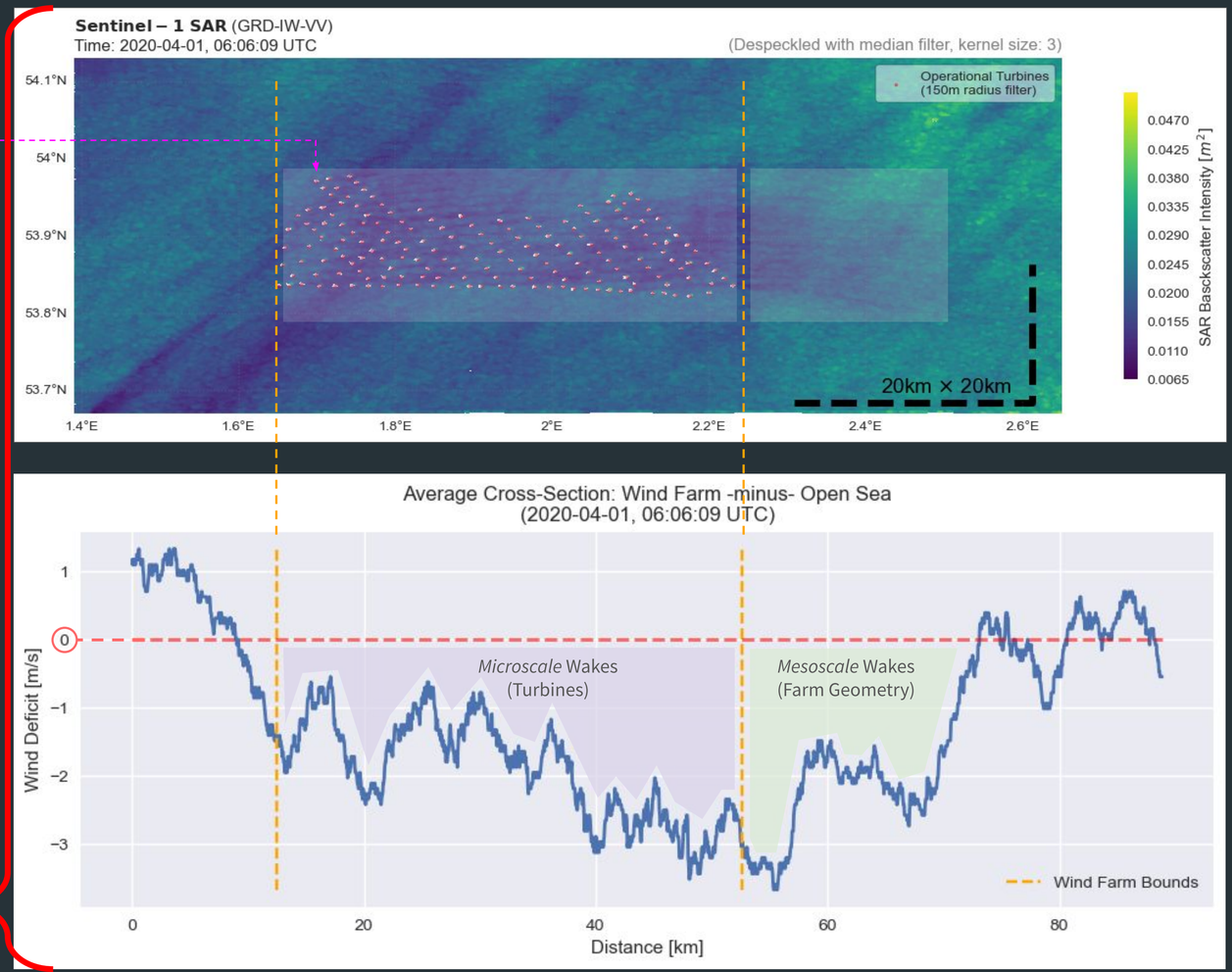
"Somewhere, something incredible is waiting to be known." – Carl Sagan

(takeaway:)

Satellite Radar Data lets us *quantify* and *compare* **large-scale wake structures** to optimize OWF layout**s**.



For our code/data, scan the QR code or visit: bit.ly/WakesFromSpace