

Observing and Analyzing Global Offshore Wind Farms from the Space

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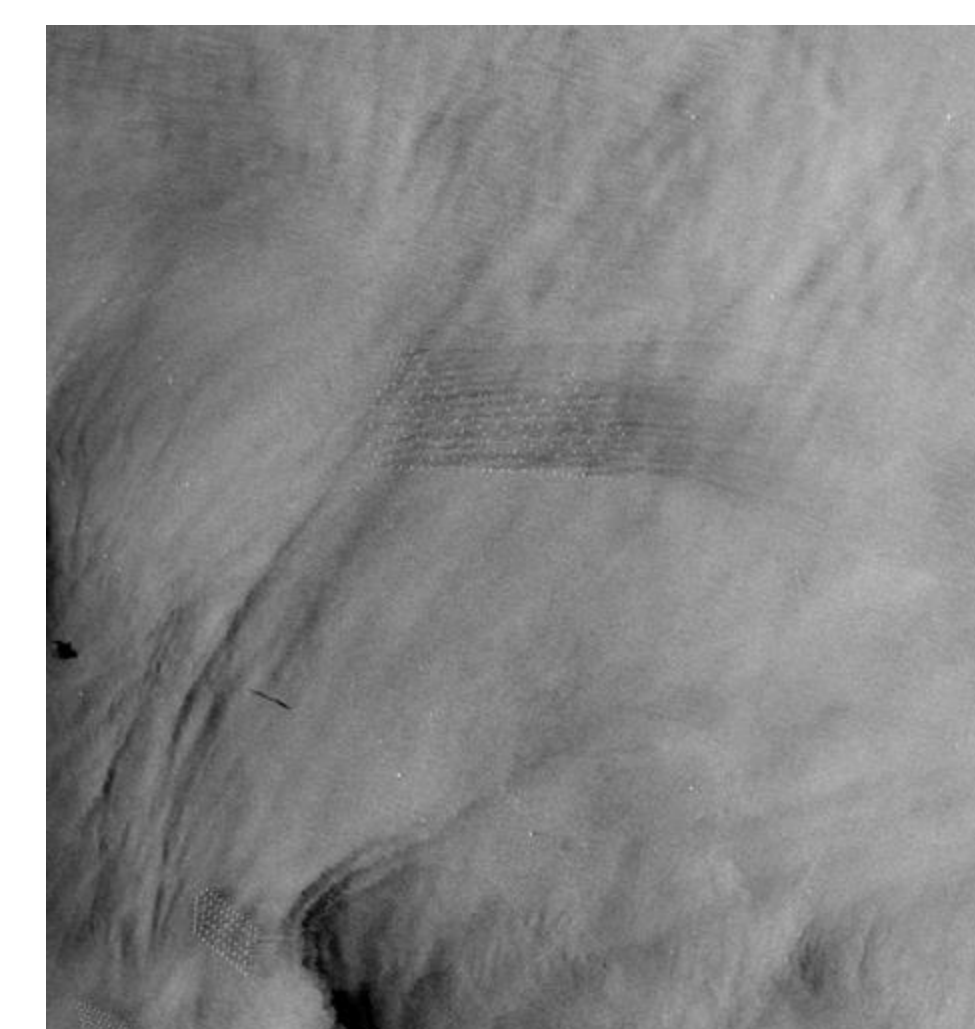
[1] Insights on Wind Farms from Above

“**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.

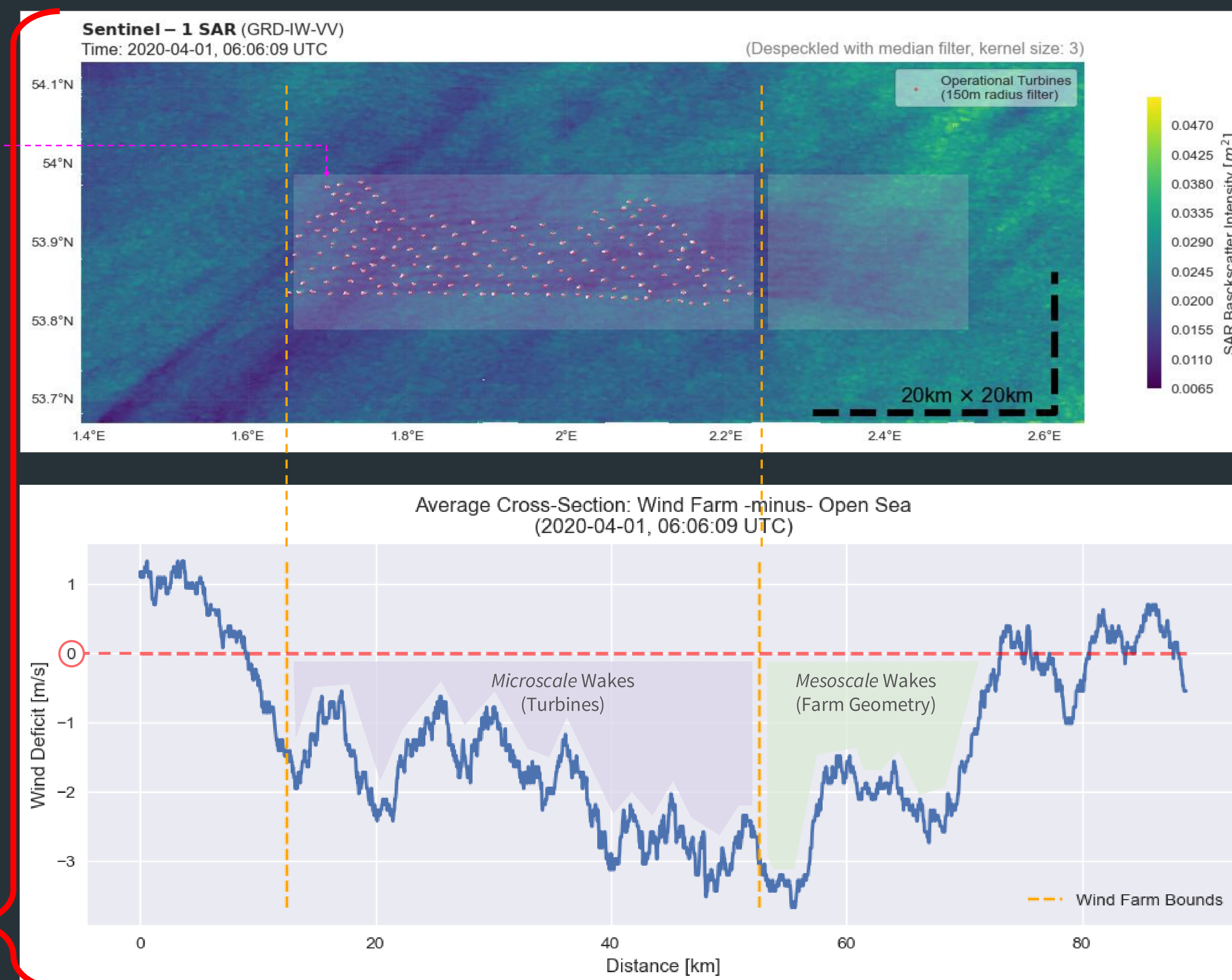


“Somewhere, something incredible is waiting to be known.” – Carl Sagan

(takeaway:)



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



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

