Low-frequency dynamic wake meandering: comparison of FAST.Farm and DIWA software tools

Irene Rivera-Arreba[1], Lene V. Eliassen[2], Erin E. Bachynski[1], Balram Panjwani[3]

[1] NTNU; [2] SINTEF Ocean; [3] SINTEF Industry

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Two frameworks: FAST.Farm and DIWA

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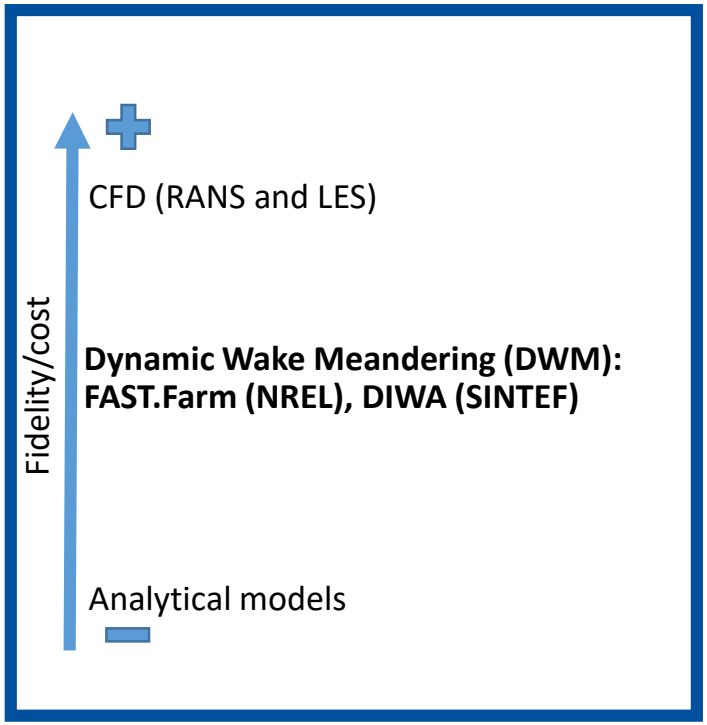
Dynamic Wake Meandering



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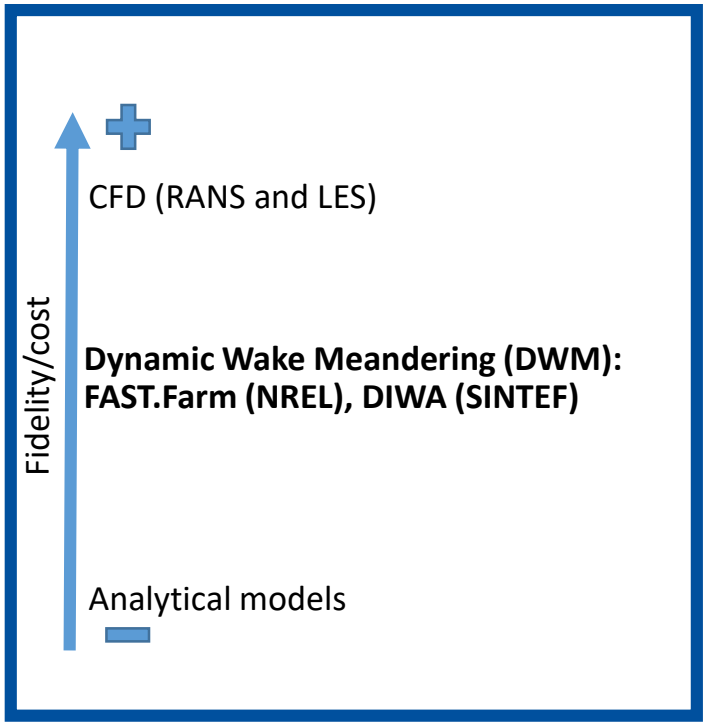

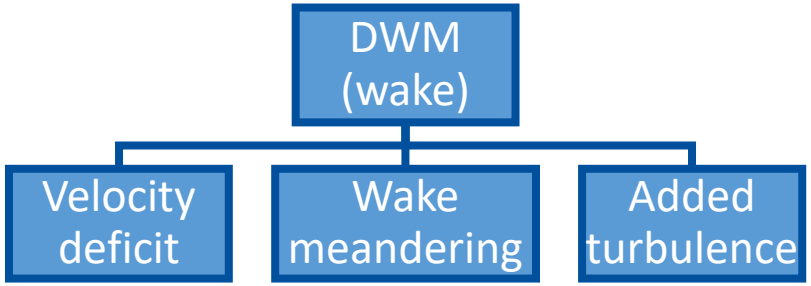

FAST.Farm and DIWA

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	FAST.Farm (NREL)	DIWA (SINTEF)
Wake shedding	The wake follows the **disturbed flow**.	The wake is moved with the **mean wind speed**.
Shear profile	Contains a **shear profile**.	There is **no shear** included.
Wind files	Uses **one** wind file. No added-wake.	Needs **three** input files: meandering, deficit and added turbulence.
Wind turbine	Coupled with OpenFAST. Can include elasticity, yaw and tilt angles, and platform motions.	Stand-alone program. Uses stiff blades, no yaw angle and no tilt of the rotor.
Output	Structural response. Wind speeds.	Power and thrust. Wind files.
Comp. time	**3.5** hours	**0.5** hours

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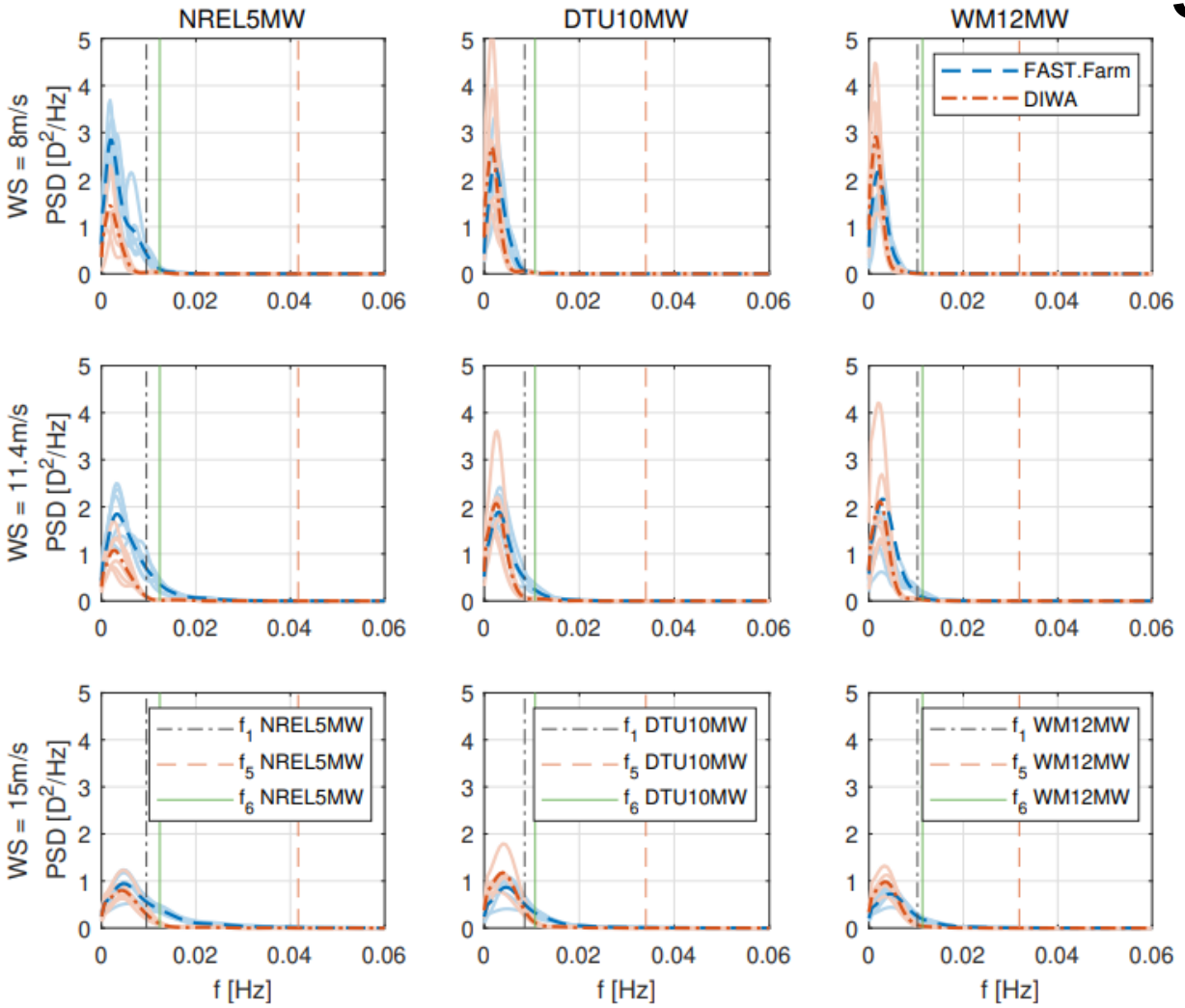
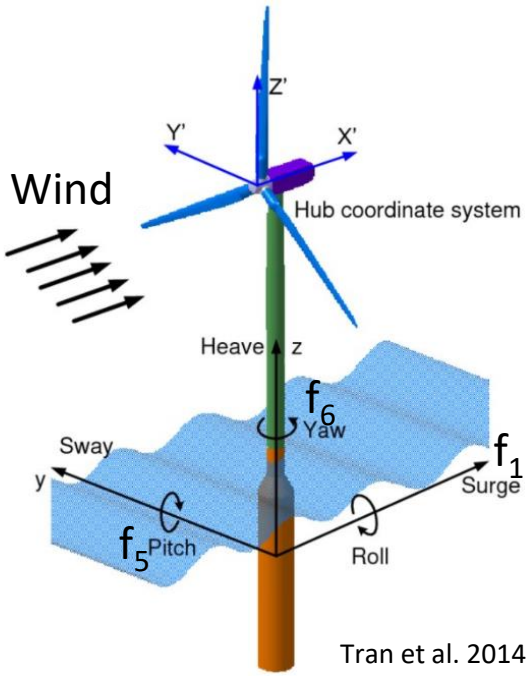
- 3 turbine models: NREL5MW, DTU10MW, WM12MW
- 3 wind speeds: 8 m/s; 11.4 m/s; 15 m/s
- 6 seeds, 1-hour duration
- Turbulence intensity: 5.6%
- Turbulence scaling: none
- Wind profile: constant

Horizontal meandering

Horizontal meandering





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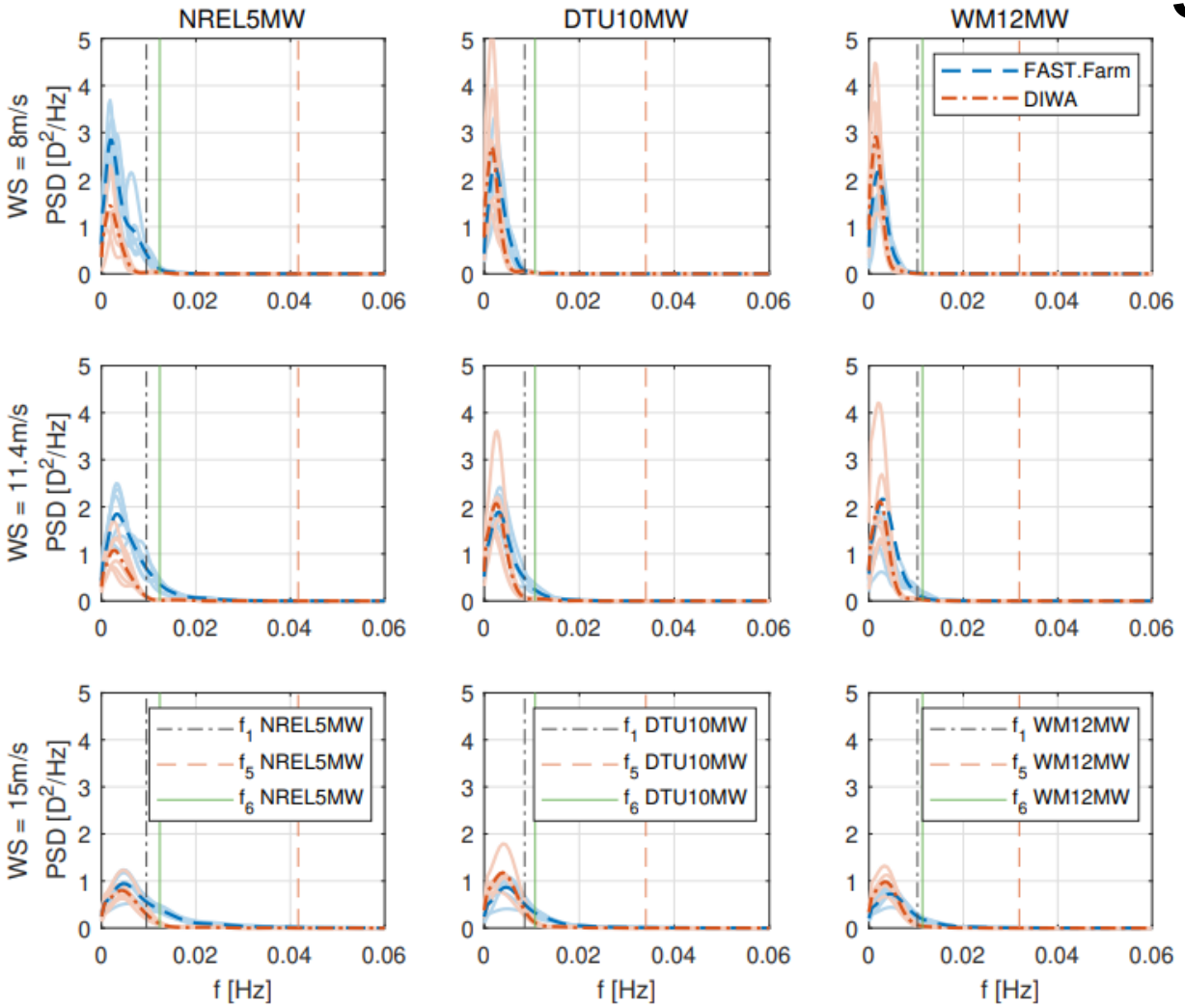
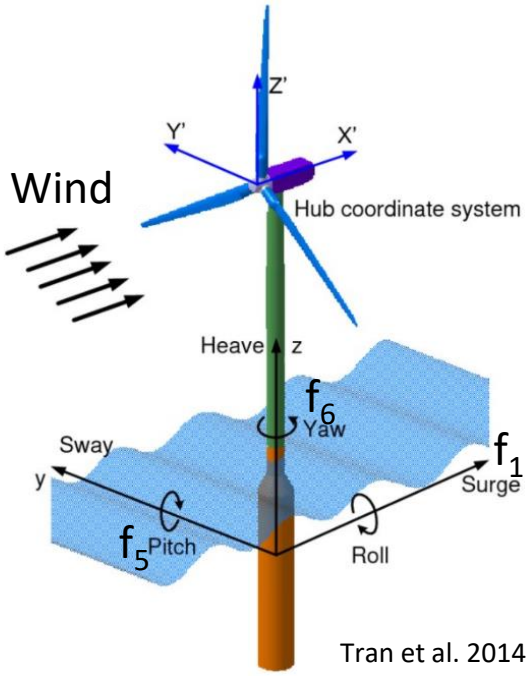
Horizontal meandering





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Same trend for vertical meandering

Conclusions and further work

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This study aimed to:

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- compare the **vertical and horizontal meandering**, due to the characteristic low rigid mode eigenfrequencies of FWTs.

The conclusions are:

- the **steady-state deficit model** used impacts the wake recovery to a non-negligible extent;

- the **horizontal and vertical meandering** yield substantial differences at low frequencies;

Next step includes a comparison with CFD simulations.

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