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Assessing Resource Assessment for Marine Renewable Energy

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(Invited Talk)

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Assessing Resource Assessment for Marine Renewable Energy

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Geophysical sciences as a foundation for assessing and developing marine renewable energy will <u>improve our understanding of the resource</u>, enhance environmental stewardship, and solidify the overall economics of implementation.

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The Oceans' Roles

Recent emphasis on renewable energy has energized interest on oceanic resources in the form of kinetic energy and thermal potential energy.

Marine hydrokinetic *(MHK) resources include waves, tides, and ocean currents—our first focus at SNMREC.*

The temperature stratification across the main thermocline can be used for* ocean thermal energy conversion*, in which a Rankine cycle is driven by the temperature difference; Florida also has OTEC resources.

The Challenge

Two fundamental questions arise:

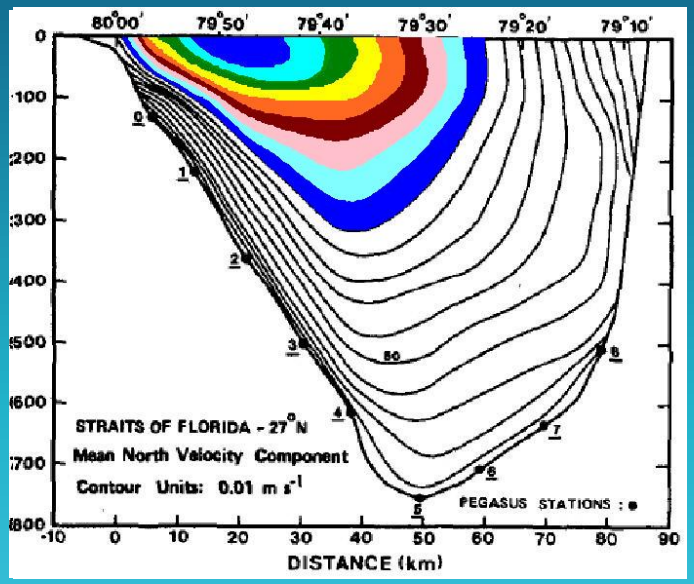
- **Is enough power available to make this economically feasible?**
- **If so, how can implementation embrace environmental stewardship?**

Oceanographers have been studying the Florida Straits for decades, but not from the power perspective.

Power engineers have only guesswork on which to estimate power availability.

MHK example follows

Observational Estimate



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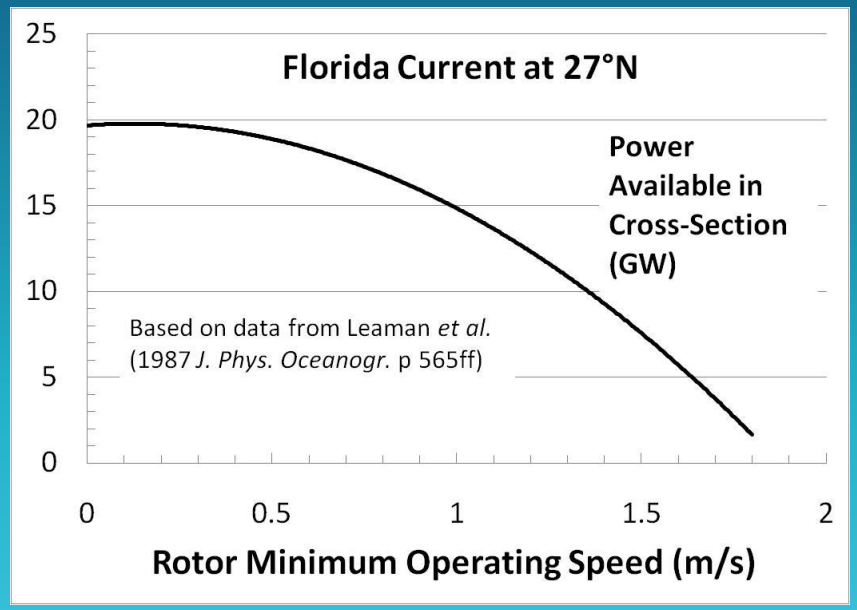
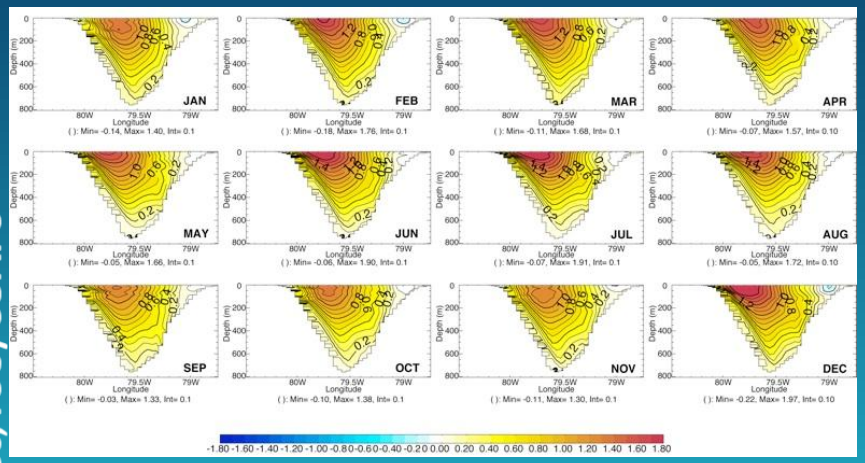
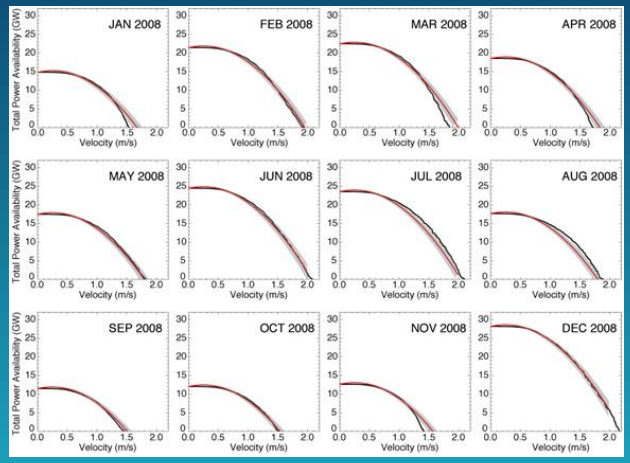


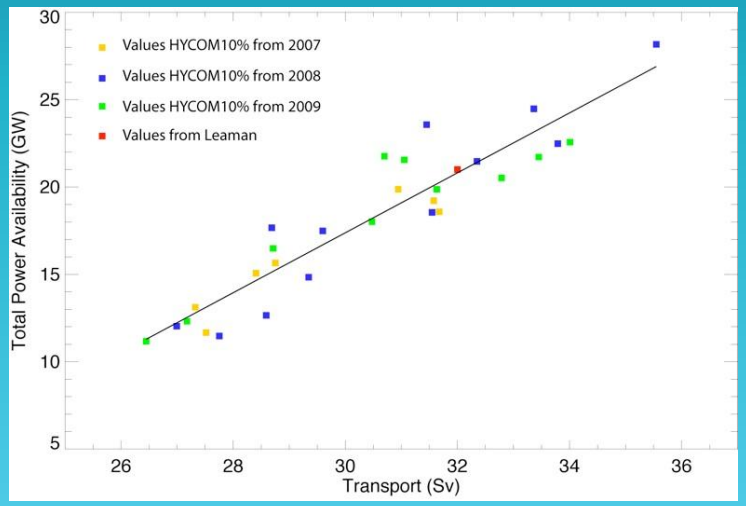
This estimate is for one E-W cross-section, and represents the power of the flow – how much can be recovered is another matter. How many such cross-sections can be tapped is yet another question. *And what about time variations?*

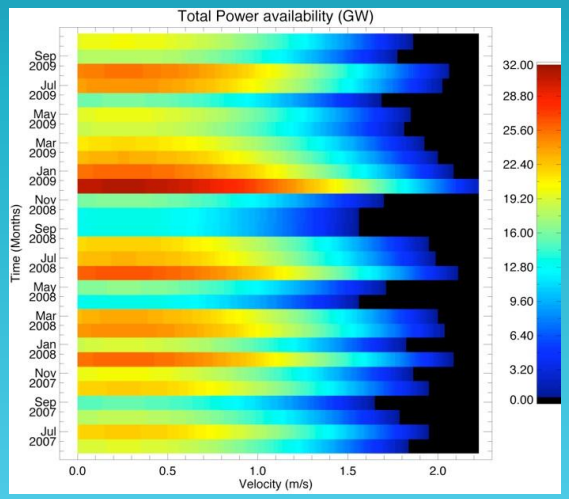
HYCOM Results

HYCOM results, courtesy A. Bozec, FSU/COAPS

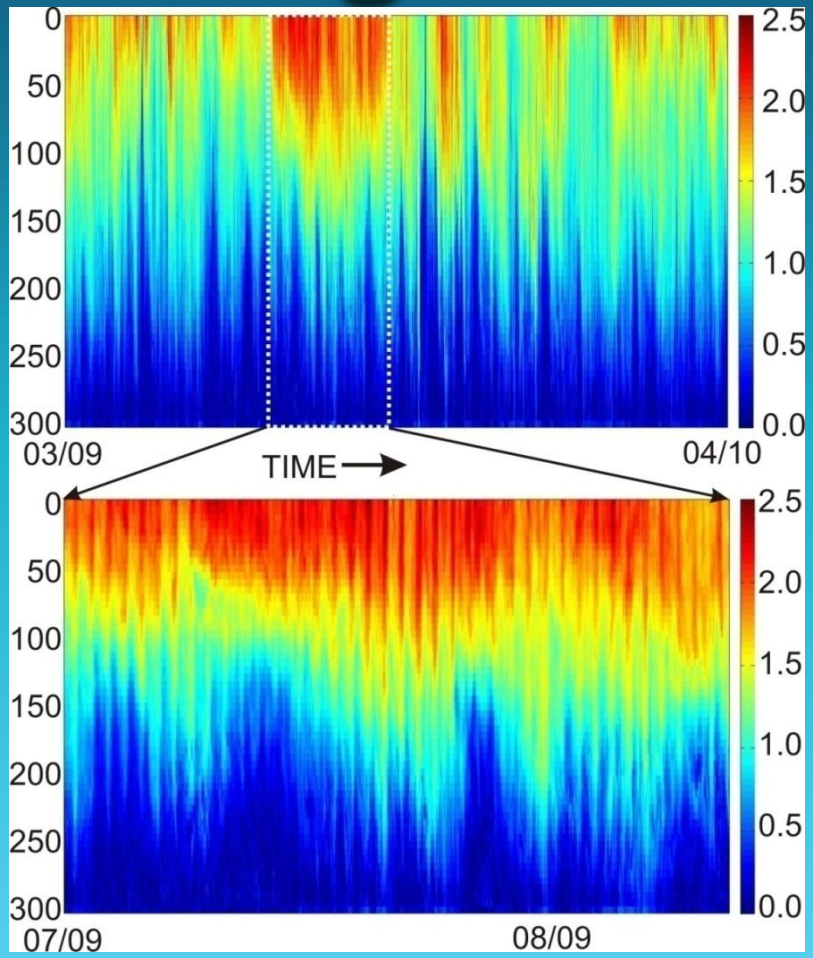








Higher Frequencies



Bottom-moored ADCP data, looking upward at the core of the Florida Current.

Note variations on wide range of time scales, including an apparent diurnal cycle.

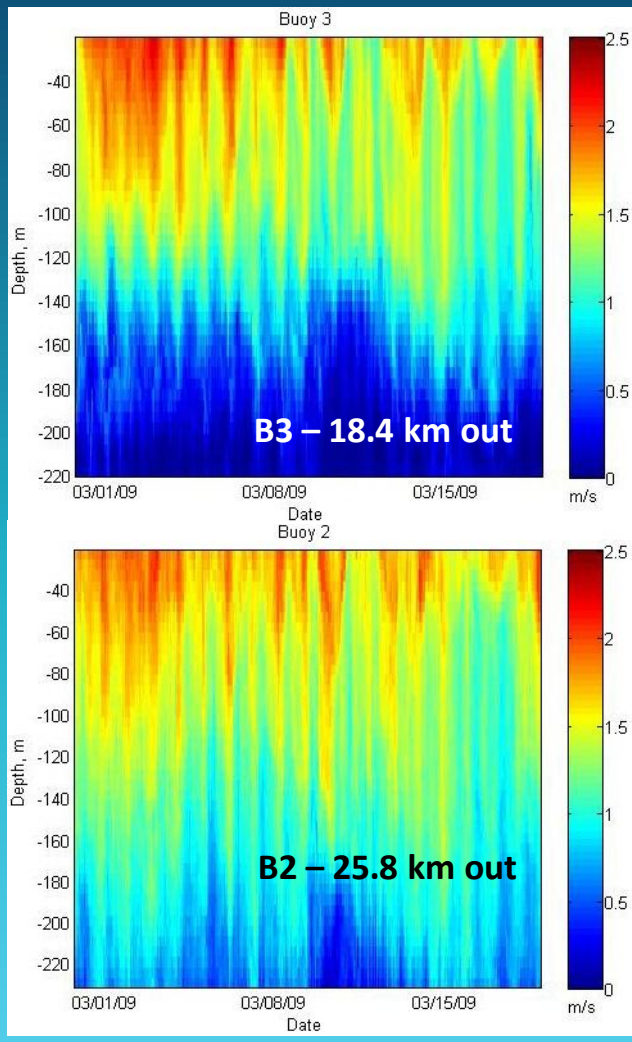
How will this affect in-water systems?

Spatial variations

Three weeks of data at two locations offshore of Ft. Lauderdale reveal current variations on a range of time scales.

- How will the daily surges affect generating devices?
- How will out-of-phase variations affect performance of arrays spanning these scales?

For that matter, *how will wakes affect the behavior of such arrays?*



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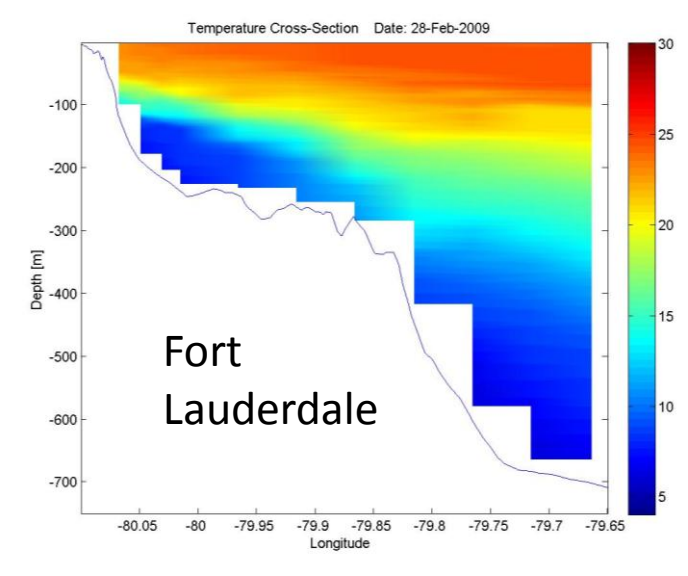
Note on OTEC

NODC data have been used to estimate the global OTEC potential, but results have missed some of the resource. (ΔT_{1000} is in the mud off SE Florida.)



Analyses at higher resolution, using, e.g., the HYCOM assimilation results, and more sophisticated techniques can remedy this and produce a better global estimate. ***Further, localized, detailed field studies will be required in the future.***

Summary

While new observations are needed, especially on smaller scales (turbulence), reinterpretation of existing datasets in the context of power production can provide useful insights for developers. *Geophysical scientists have an important role to play in this task.*

As will be seen in session U22A (MS104; Tuesday at 10:20 AM) the same comment applies to the world of wind power as well. *For AGU members, these are wonderful opportunities for the future.*