# Recent Progress in Downscaled Local Ocean Forecast Models for Irish Maritime Users

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- The Irish Marine Institute (IMI) implemented the Regional Ocean Modelling System (ROMS) to coastal waters on the west coast of Ireland.

- The IMI six models cover the North East Atlantic area, Southwest Ireland, Connemara, Bantry Bay, Galway Bay and Bertraghboy Bay.

- Details of the set-up of Connemara, Galway Bay and Bertraghboy model configuration, as regards the forcing functions, the choice of boundary conditions, atmospheric forcing, will be presented.

- Models validation against IMI observational platforms comprise of tide gauges and ADCPs.

- Report on the findings in terms of the computational efficiency and the changes to all models skill.
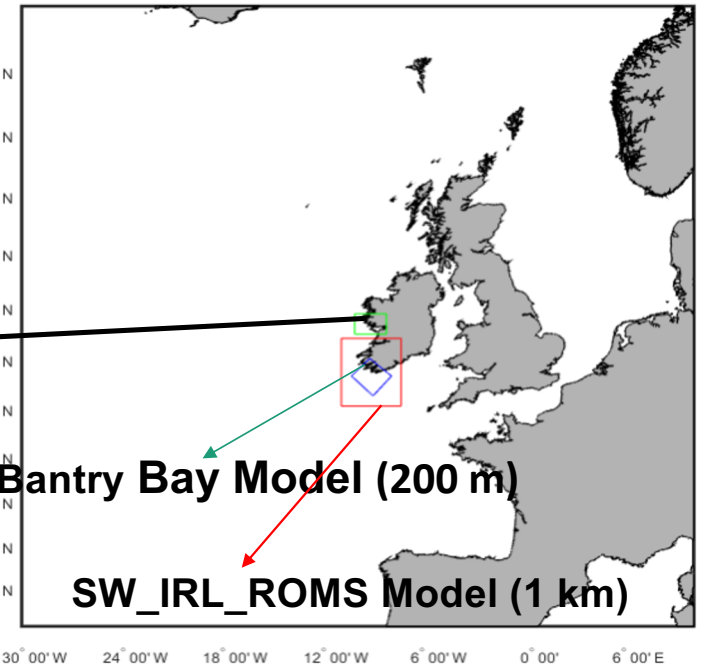
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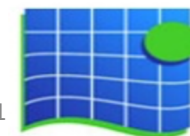
(200 m)
Wet/Dry Connemara Model Bathymetry
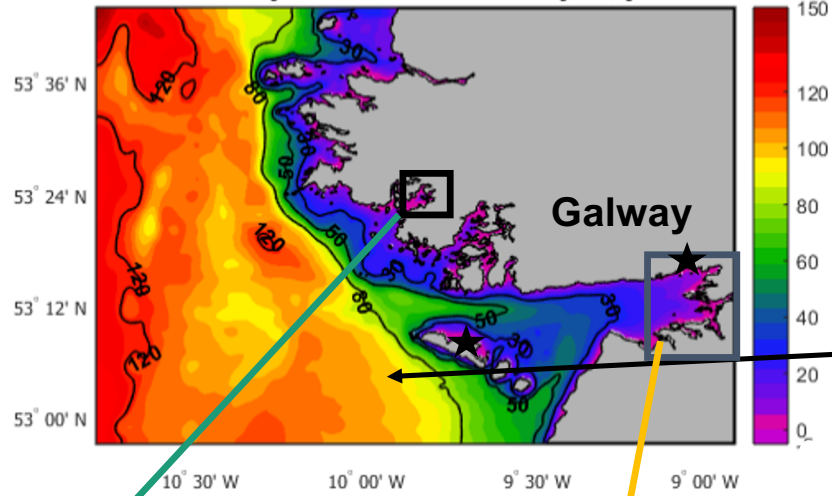
(1.1 km) NEA_ROMS Model (Nagy et al., 2020)

Galway

Bertraghboy Model (50) m)

Galway Bay Model (70 m)

Inner

Middle

Outer

A

B

C

Bantry Bay Model (200 m)

SW_IRL_ROMS Model (1 km)
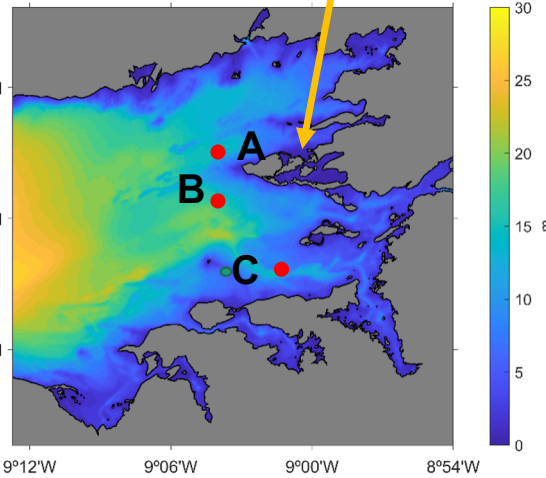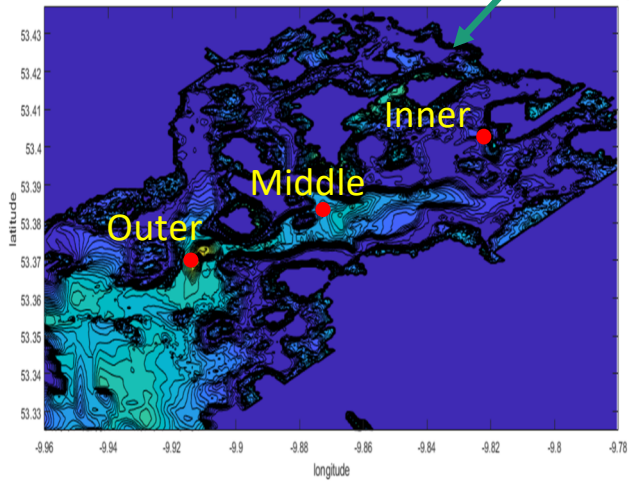
● **ADCPs**

★ **Tide Gauges**

Connemara Wet/Dry Model (200 m) Hourly Current/salinity (movie)

Connemara Wet/Dry surface salinity with currentApr.21,2019 15:00:00

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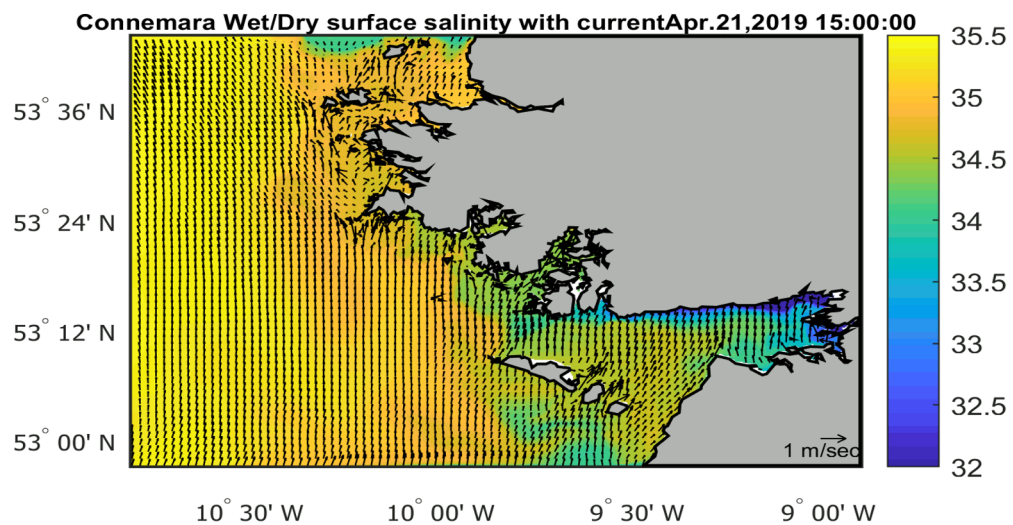
Connemara Wet/Dry Model

After

Before

Connemara Wet/Dry (1m) salinity with currentJan.09,2019 00:00:00

Connemara Wet/Dry (1m) salinity with currentJan.09,2019 00:00:00
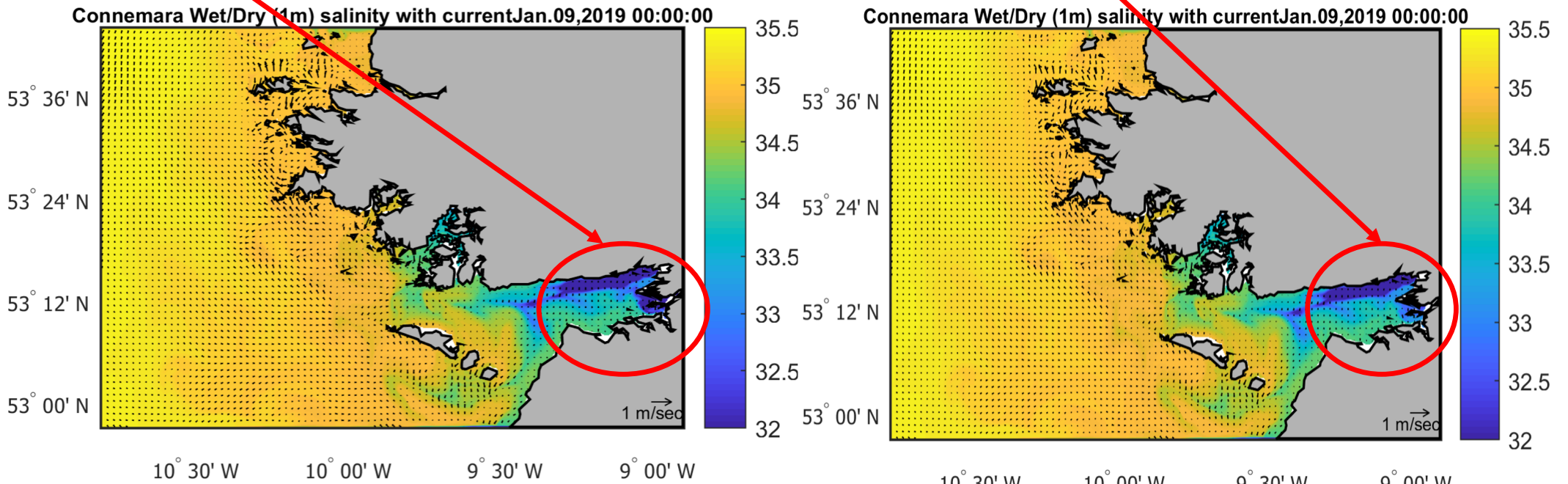
Corrib & Kilcolgan rivers

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Galway Bay Wet/Dry Model (~70 m)

Surface salinity and currents on the 1st of April 2020 00:00

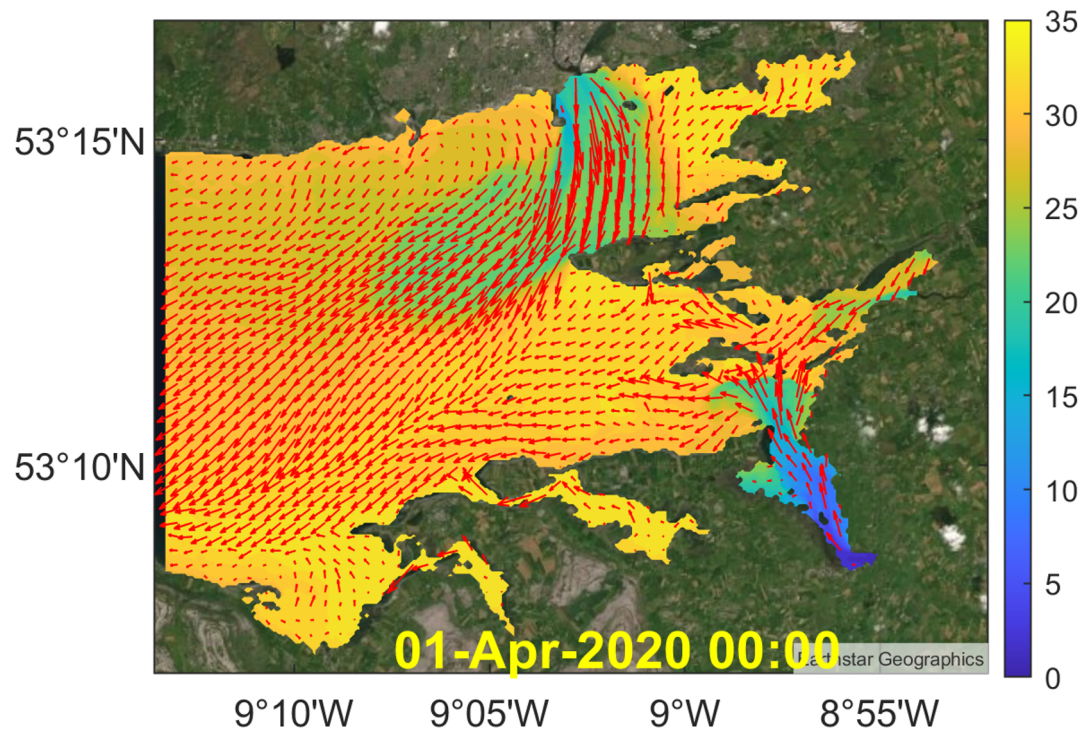**Challenges**: to get an accurate representation of salinity in a very dynamical area affected by several freshwater discharges, including submarine groundwater discharges.

Important for predicting oyster survival and mortality (H2020 FORCOAST)

Future improvements:
Add a wave + sediment module using COAWST
Continue validation of hydrodynamic model.

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Bertraghboy Bay Model (~50m)

Challenge: Circulation, biogeochemistry and accurate nutrient dispersion critical at Lehanagh pool (orange box, position of inner ADCP)
Magnitude of inner current at ADCP restored after refining bathymetry at the mouth of Bertraghboy Bay (grey box) and Lehanagh pool
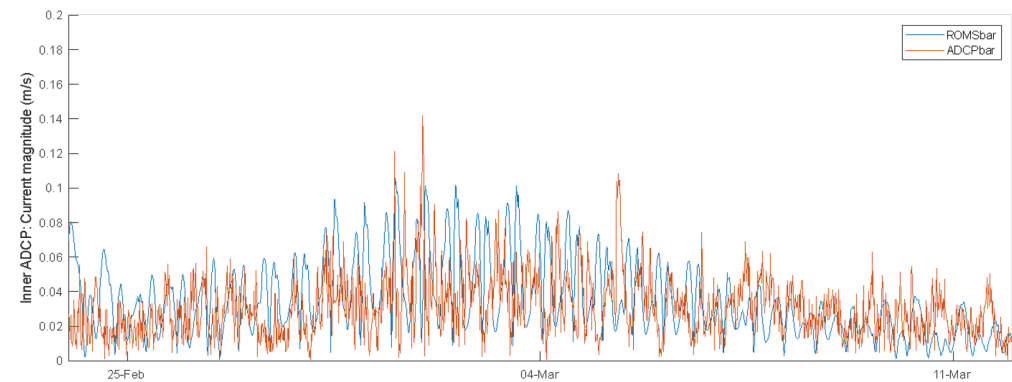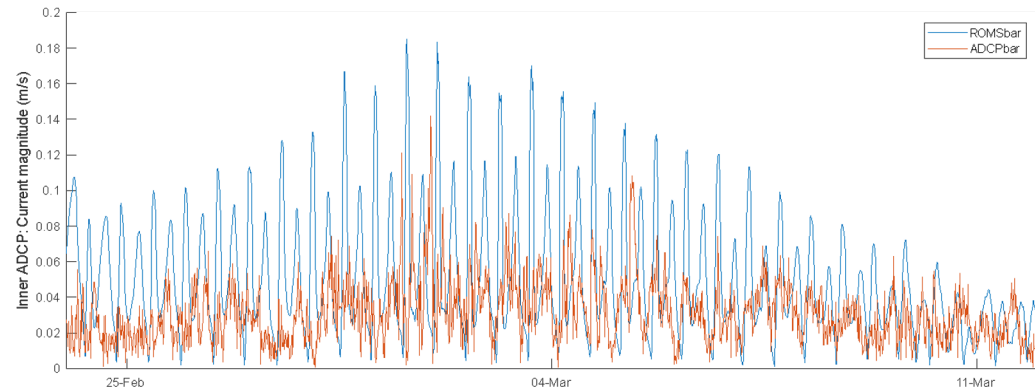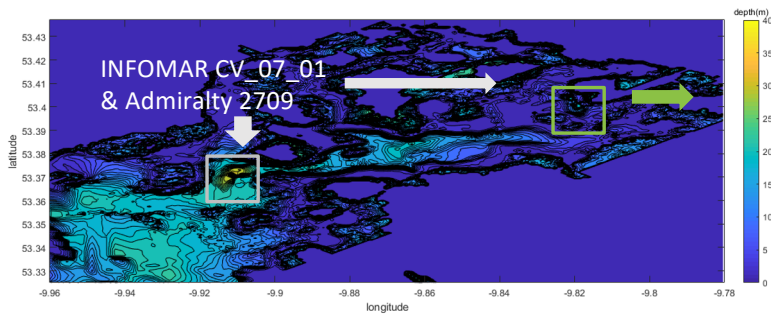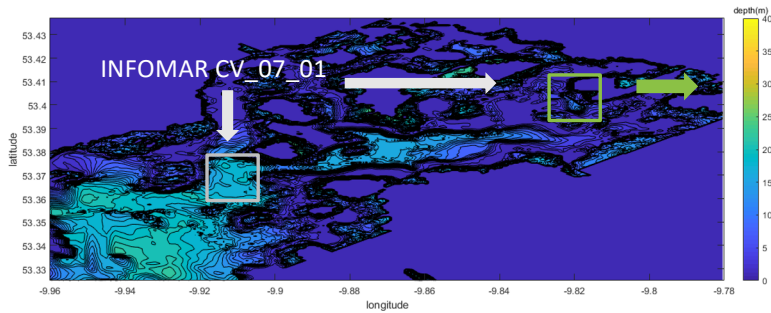
	CONNEMARA OPERATIONAL				CONNEMARA WET & DRY				GALWAY BAY			
	CORR	RMSE	STDN	ARMAE	CORR	RMSE	STDN	ARMAE	CORR	RMSE	STDN	ARMAE
ADCP A (u)	0.955	0.031	1.097	0.182	0.956	0.028	1.027	0.160	0.962	0.026	0.974	0.127
ADCP A (v)	0.757	0.031	2.194	0.973	0.714	0.035	2.328	1.155	0.771	0.027	1.966	0.732
ADCP B (u)	0.951	0.031	1.060	0.186	0.944	0.032	0.924	0.182	0.951	0.030	0.971	0.173
ADCP B (v)	0.066	0.029	0.329	0.583	0.292	0.027	0.218	0.522	0.289	0.027	0.369	0.519
ADCP C (u)	0.930	0.066	1.356	0.443	0.939	0.099	1.707	0.748	0.963	0.036	1.105	0.191
ADCP C (v)	-0.222	0.031	1.537	1.186	-0.036	0.035	1.950	1.340	-0.115	0.026	1.247	0.856

Legend:
- Excellent
- Good
- Reasonable
- Poor
- Bad

Connemara (left) and Galway Bay (right). CORR: correlation, RMSD: Root Mean Square Difference, STDN: Normalized Standard Deviation, ARMAE: Adjusted Relative Mean Absolute Error (Sutherland et al., 2004); u: u-component, v: v-component,) set out the ARMAE categorisation as follows: [ARMAE < 0.2] Excellent, [0.2 < ARMAE < 0.4] Good, [0.4 < ARMAE < 0.7] Reasonable, [0.7 < ARMAE < 1.0] Poor, [ARMAE > 1] Bad.

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ADCP vs. Bertraghboy Bay model, mean, RMSD: Root Mean Square Difference, std.Dev: Standard Deviation, ARMAE: Adjusted Relative Mean Absolute Error (Sutherland et al., 2004); u: u-component, v: v-component, and current magnitude

Bertraghboy Bay model	ADCP outer	ROMS outer	ADCP middle	ROMS middle	ADCP inner	ROMS inner
|U| Mean	0.12	0.169	0.12	0.15	0.016	0.025
|U| Std. Dev.	0.12	0.16	0.1	0.14	0.014	0.02
U RMSD	0.108		0.08		0.03	
U Correlation	0.92		0.93		0.2	
|V| Mean	0.15	0.23	0.11	0.15	0.02	0.04
|V| Std. Dev.	0.1	0.18	0.1	0.13	0.02	0.03
V RMSD	0.16		0.09		0.05	
V Correlation	0.9		0.89		-0.16	
Current magnitude ARMAE	0.092		0.044		0.018	

Excellent

Good

Reasonable

Poor

Bad

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Conclusions

❖ A good agreement has been found between tide gauges and Connemara models (operational and wet/dry) in terms of amplitudes and phase angles.

❖ The IMI downscaled models showed a good validation results against ADCPs.

❖ The validation results present an advantage in implementing a wetting and drying algorithm in shallow water models with large intertidal areas like Connemara and Galway Bay.

❖ Output data from the Irish system models provides services to numerous stakeholders, e.g. the aquaculture (HAB warning https://www.marine.ie/Home/site-area/data-services/interactive-maps/weekly-hab-bulletin , weather window tool https://www.digitalocean.ie/Home/WeatherWindow), search and rescue, oyster restoration efforts.

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