

High-Resolution Radar Wave and Current Measurements in Highly Inhomogeneous Coastal Areas

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AND 4th COASTAL HAZARDS SYMPOSIUM
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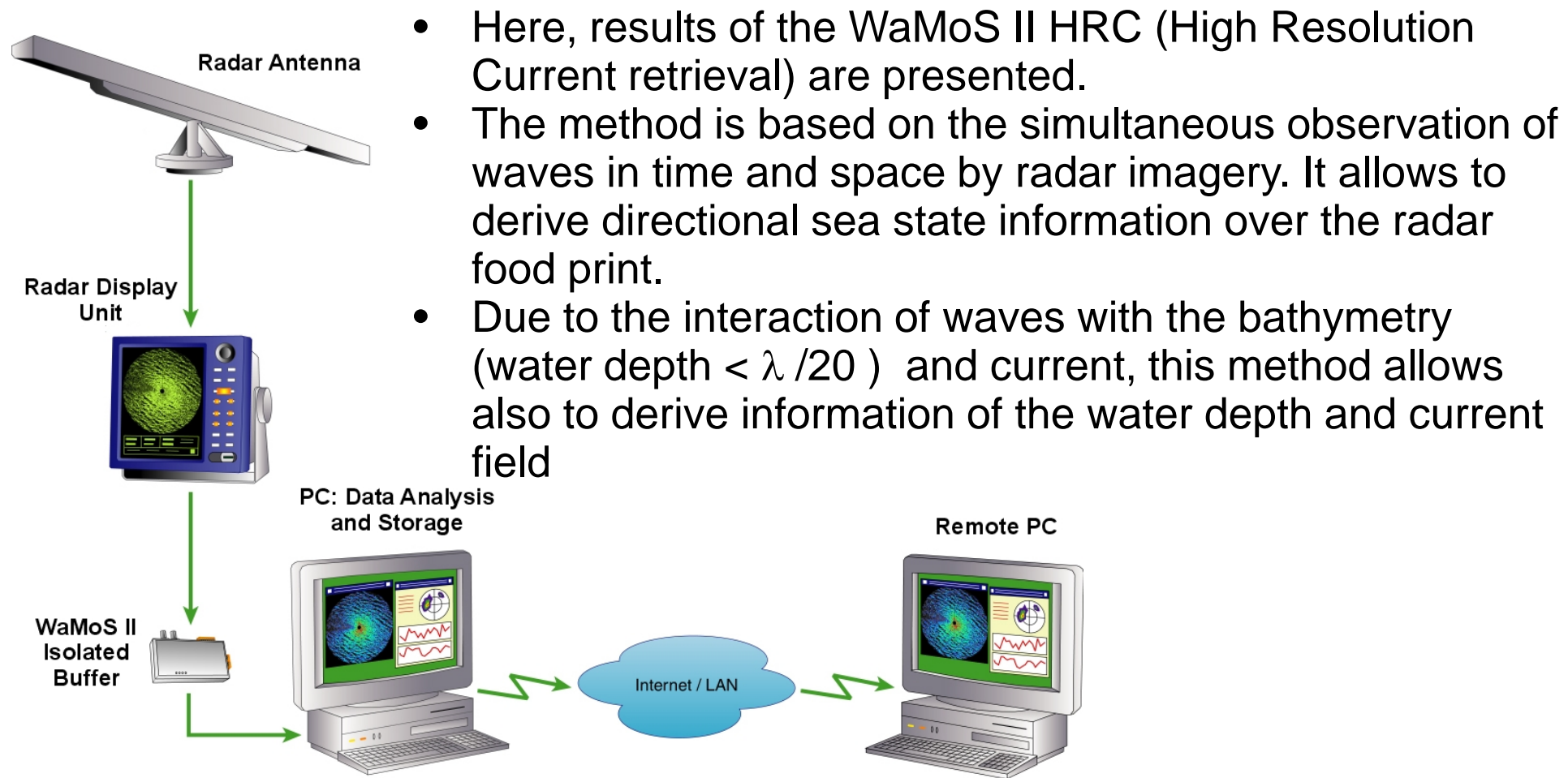
High-Resolution Radar Wave and Current Measurements in Highly Inhomogeneous Coastal Areas

Brief description of motivation for study/application

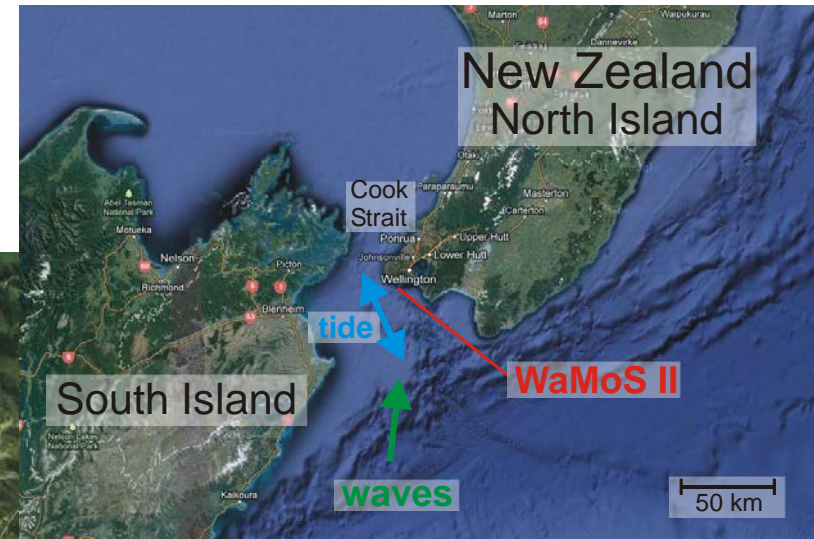
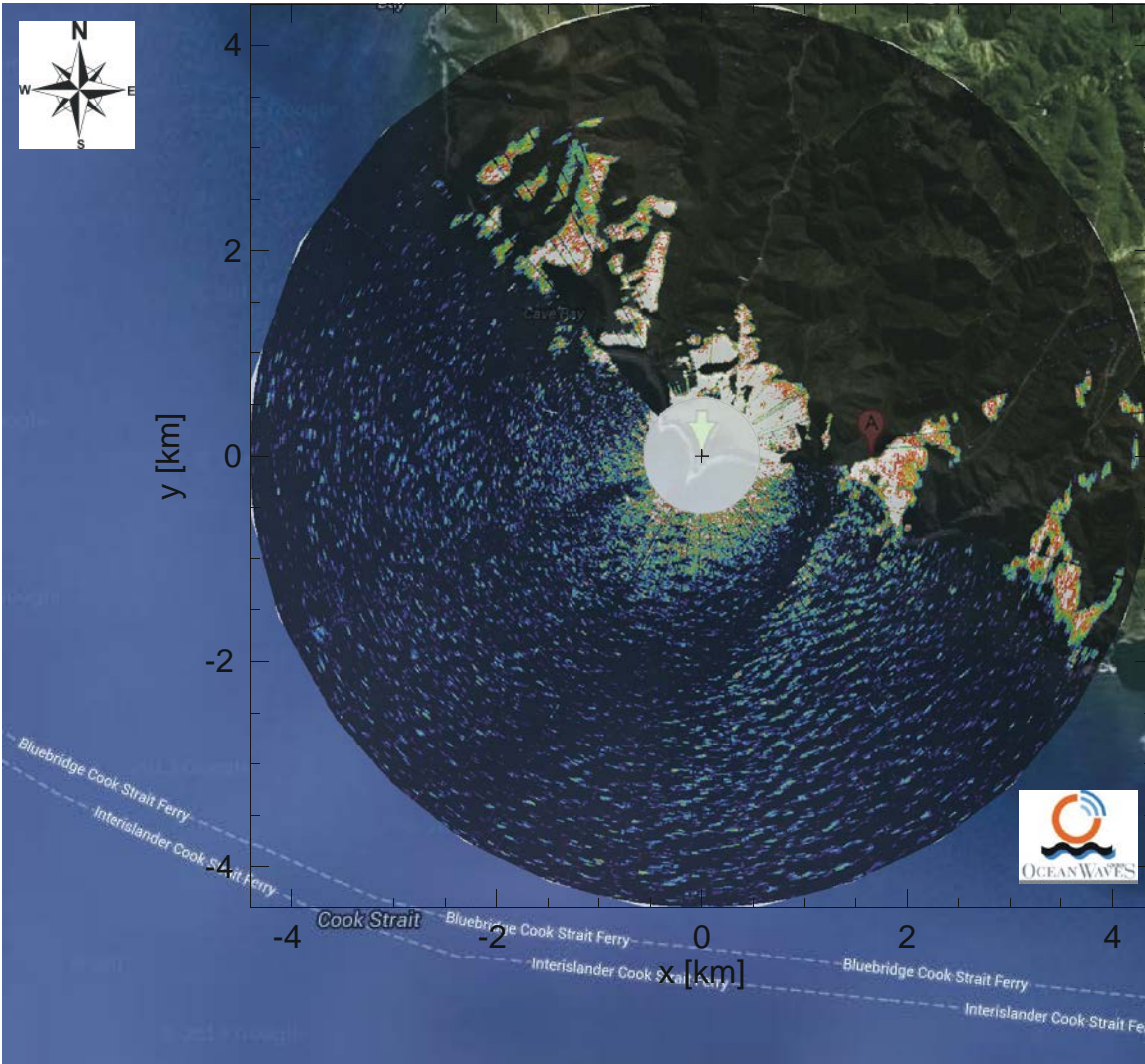
- Hydro dynamics in coastal waters are complex in time and space
- Standard in-situ point measurements are insufficient to reflect this complexity
- Nautical X-Band radars deliver sea surface information over a large area with high spatial and temporal resolution
- Sea state and current information is available over an area
- Increase off-shore operation safety
- Allows the investigation of local small phenomena
 - Erosion, morpho- dynamics
 - Engineering issues (break waters, ...)
 - Environmental topic: small scale distribution of water quality
- Evaluate optimal location of offshore energy resources.

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Brief description of the methodology used in the study/application

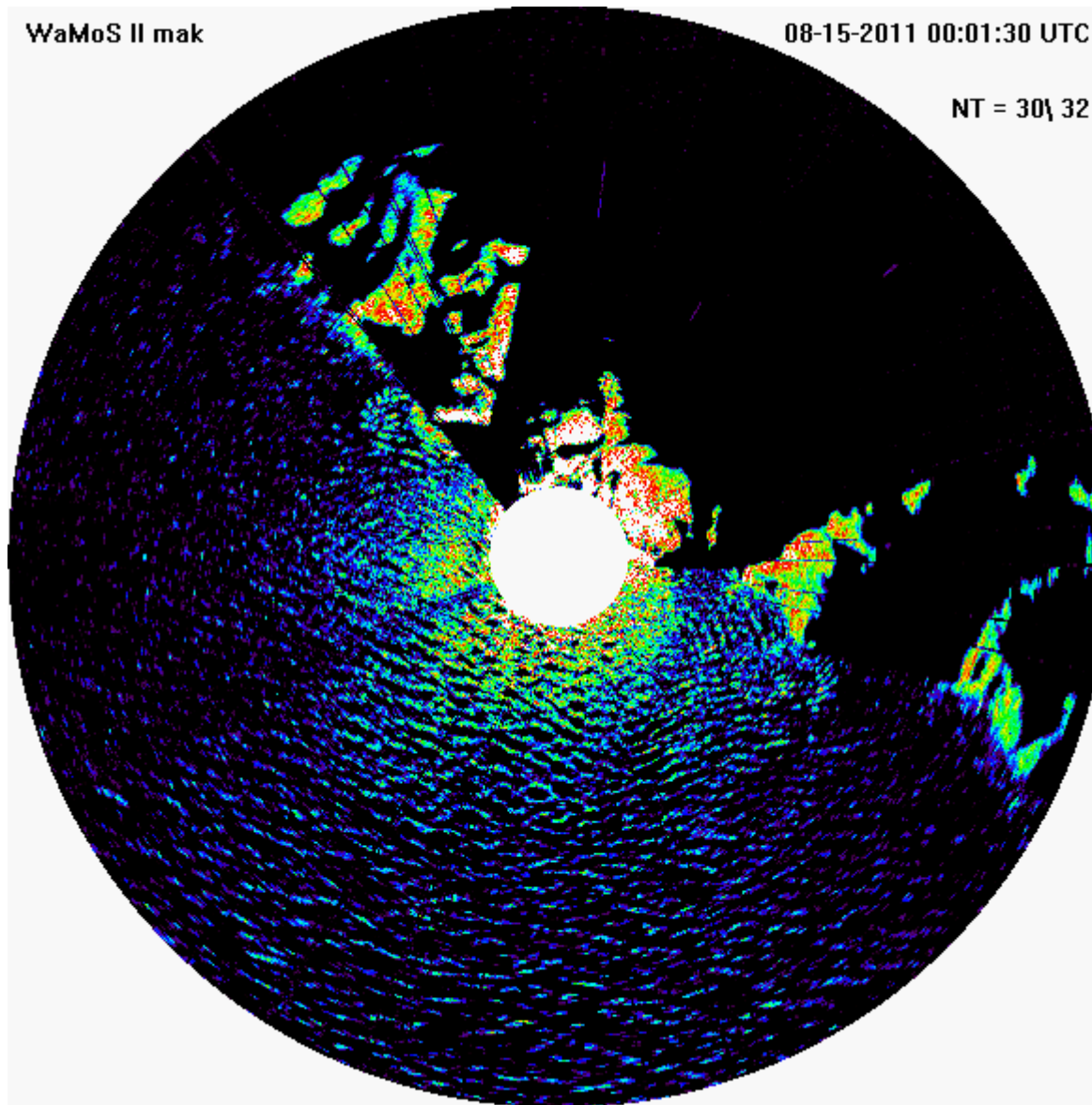


WaMoS II Station at Makaram New Zealand



Source: HiRes Project

WaMoS II Station at Makara



Tides
Waves
Coastal processes

- Refraction
- Reflection
- Shoaling

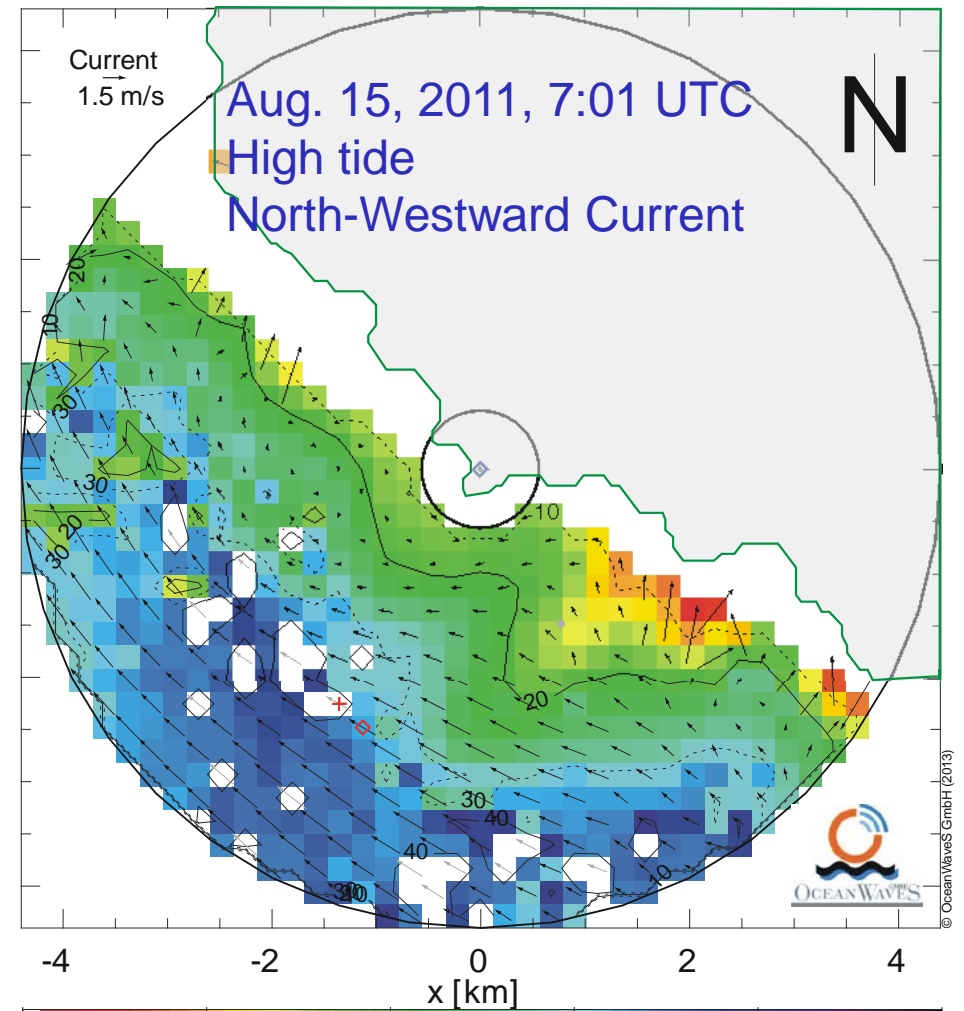
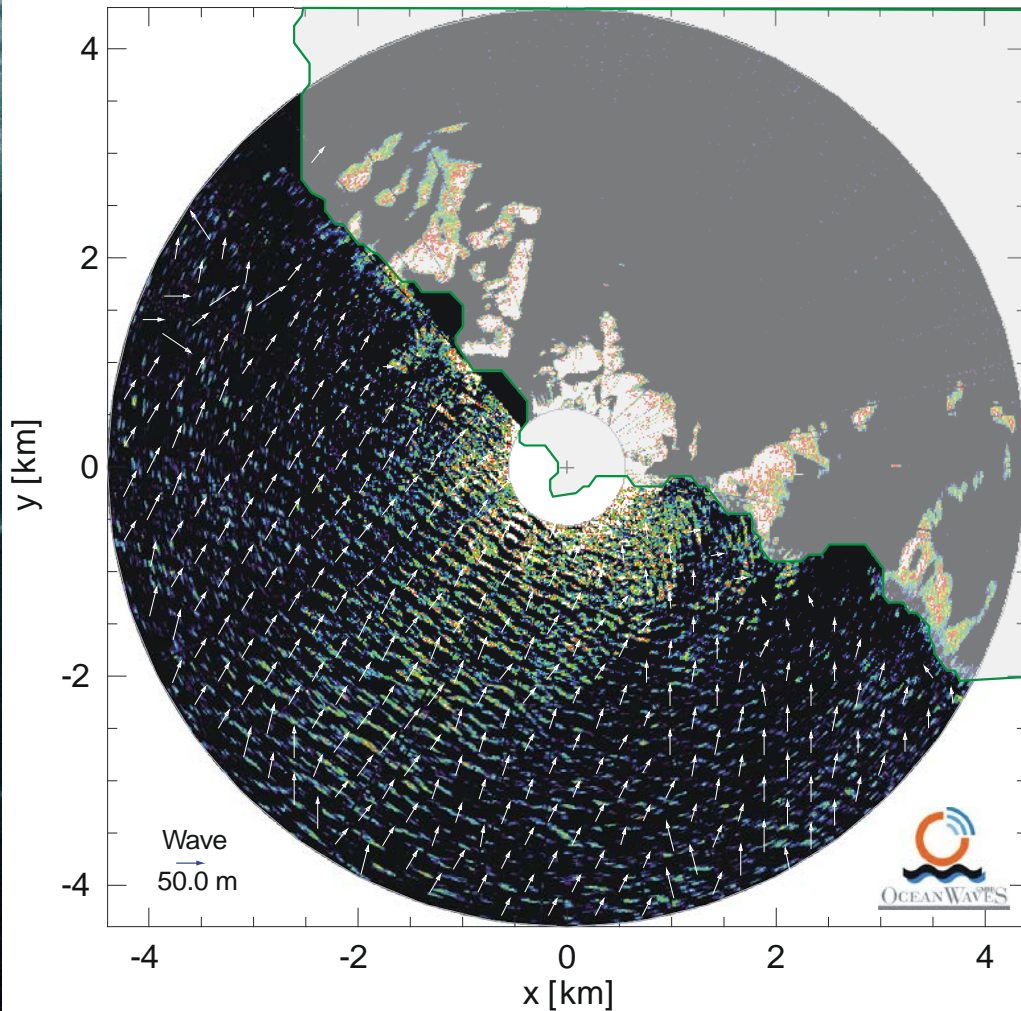
3 Tidal scenarios:

- High Tide
- Slack tide
- Low Tide

Wave and Current measurements in Space WaMoS II HRC measurement

Radar-Waves

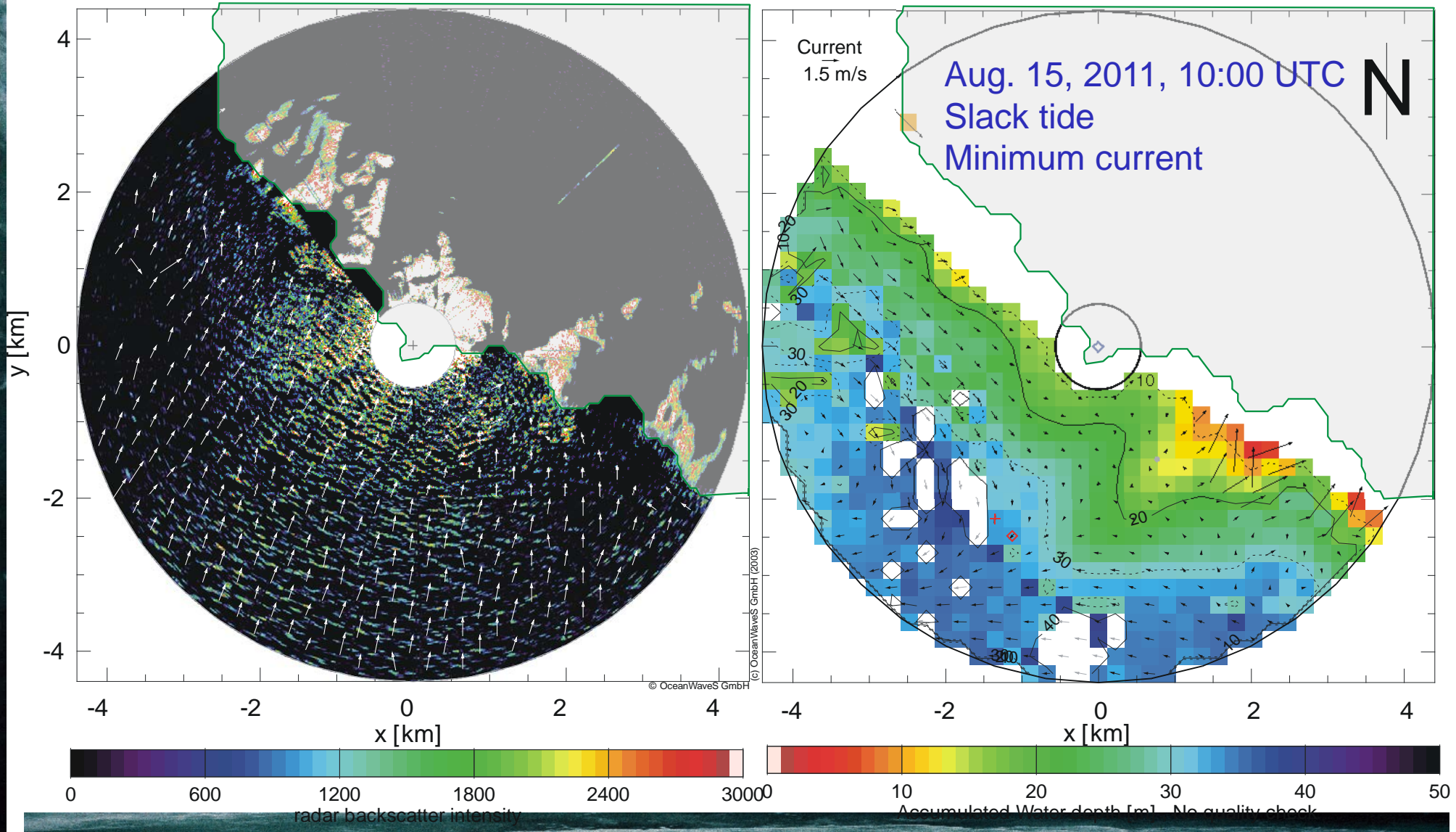
Bathymetry - Current



Wave and Current Measurements in Space WaMoS II HRC Measurement

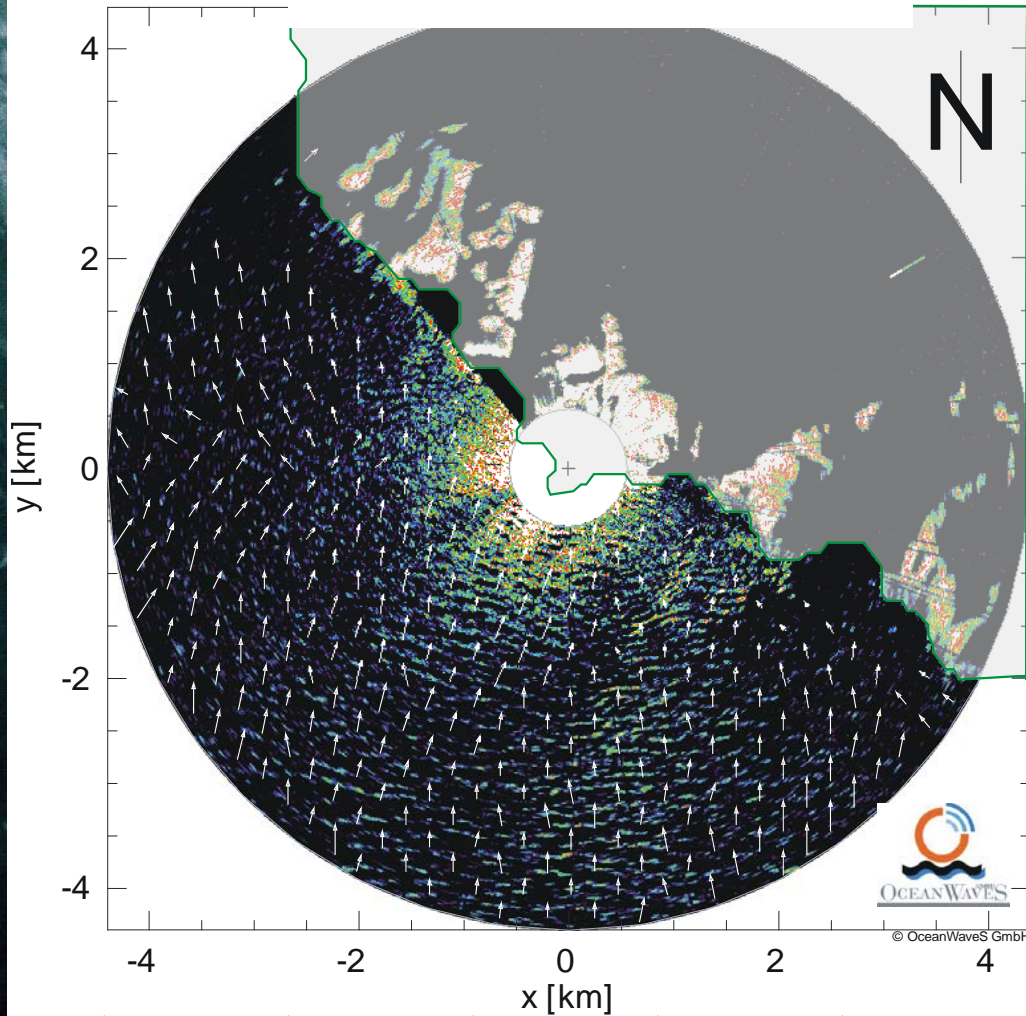
Radar-Waves

Bathymetry - Current

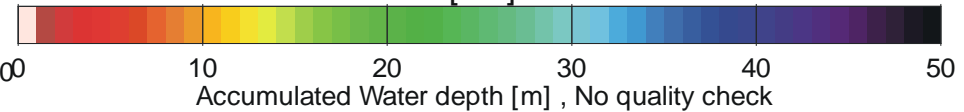
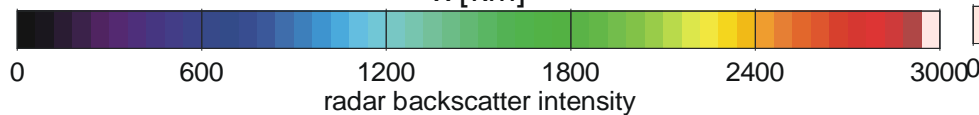
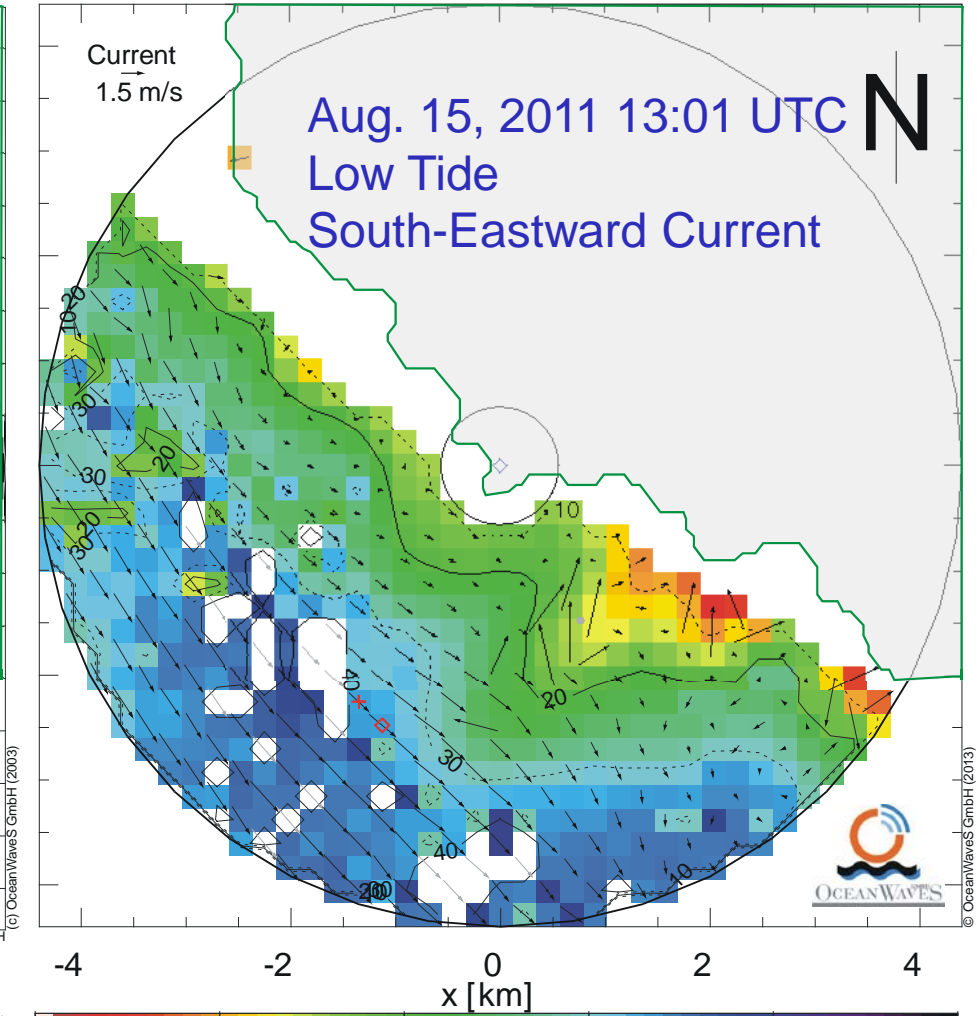


Wave and Current Measurements in Space WaMoS II HRC Measurement

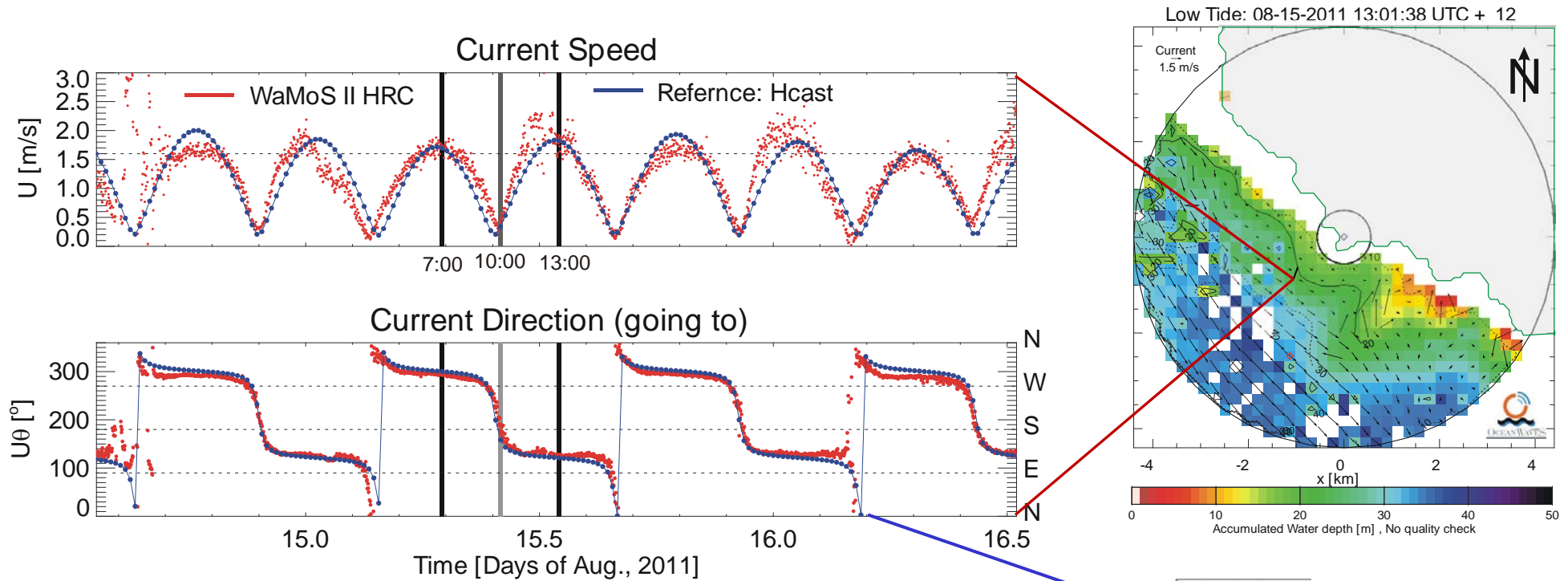
Radar-Waves



Bathymetry - Current

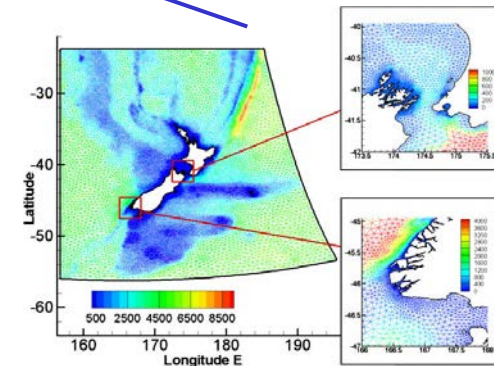


Current Measurements in Time WaMoS II HRC Measurement

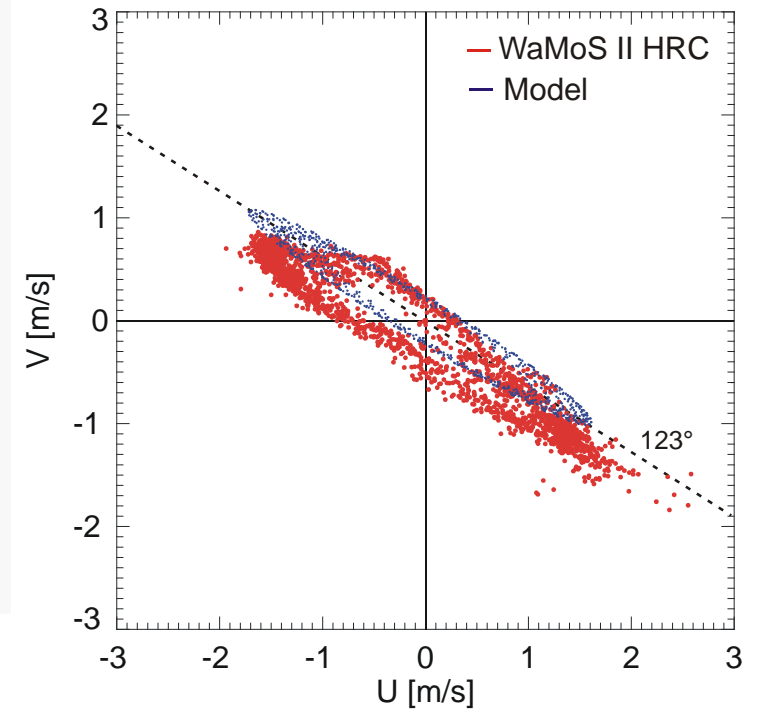
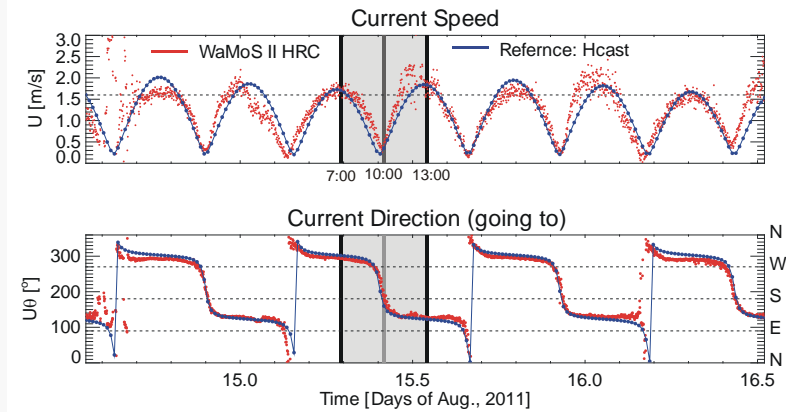
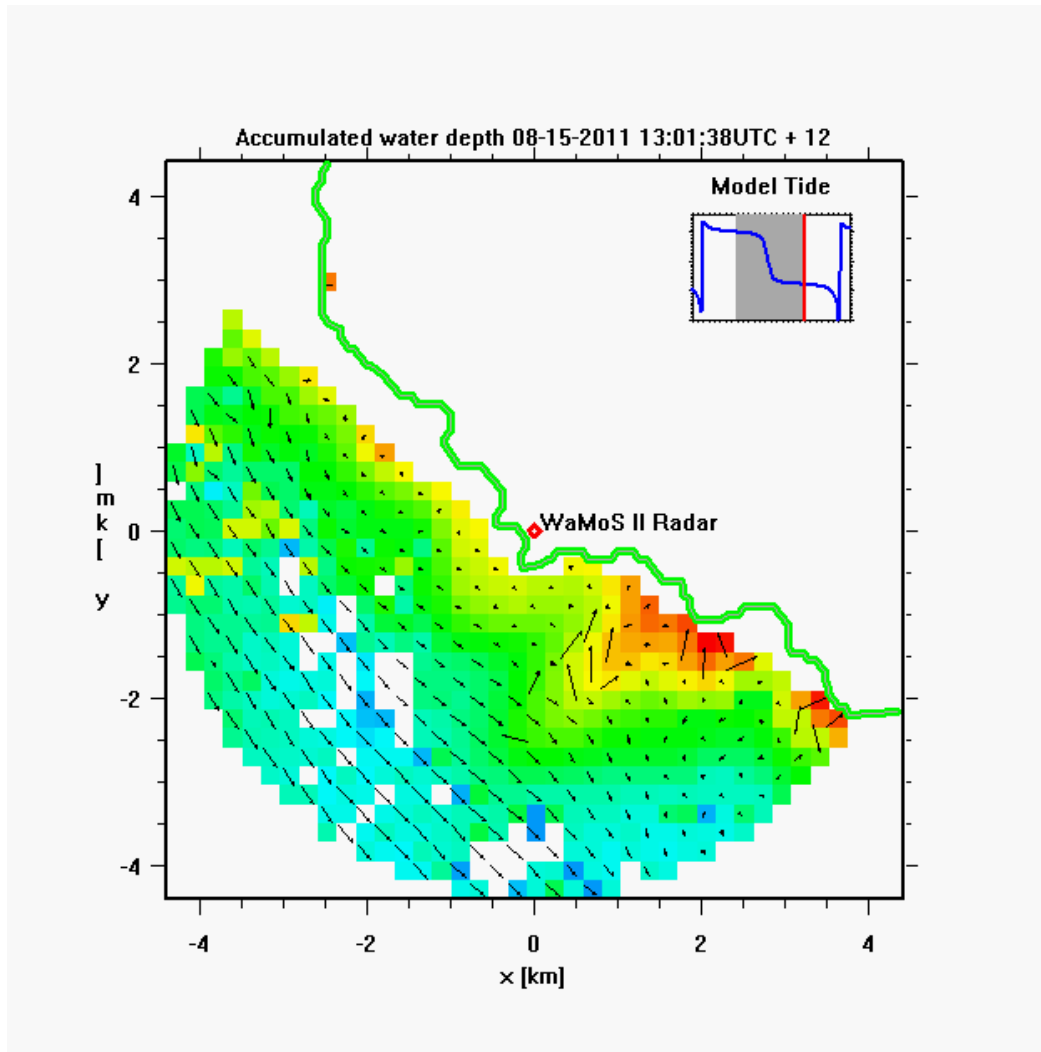


RiCOM storm surge model for modeling the dynamics of Cook Strait including Marlborough Sounds (upper right) and Fiordland (lower right). The colour scales indicate water depth (m).

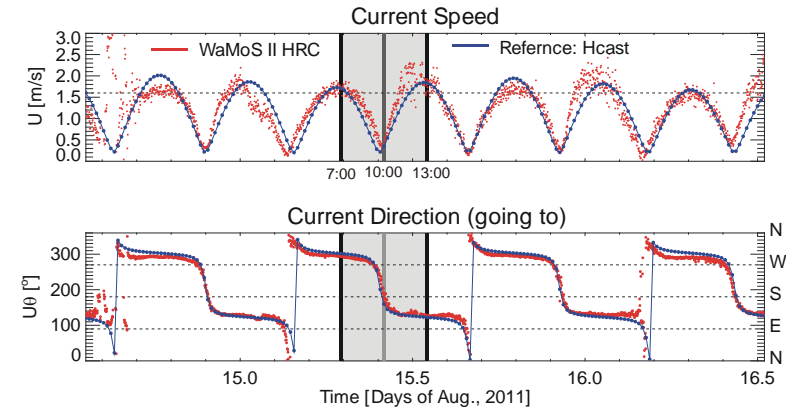
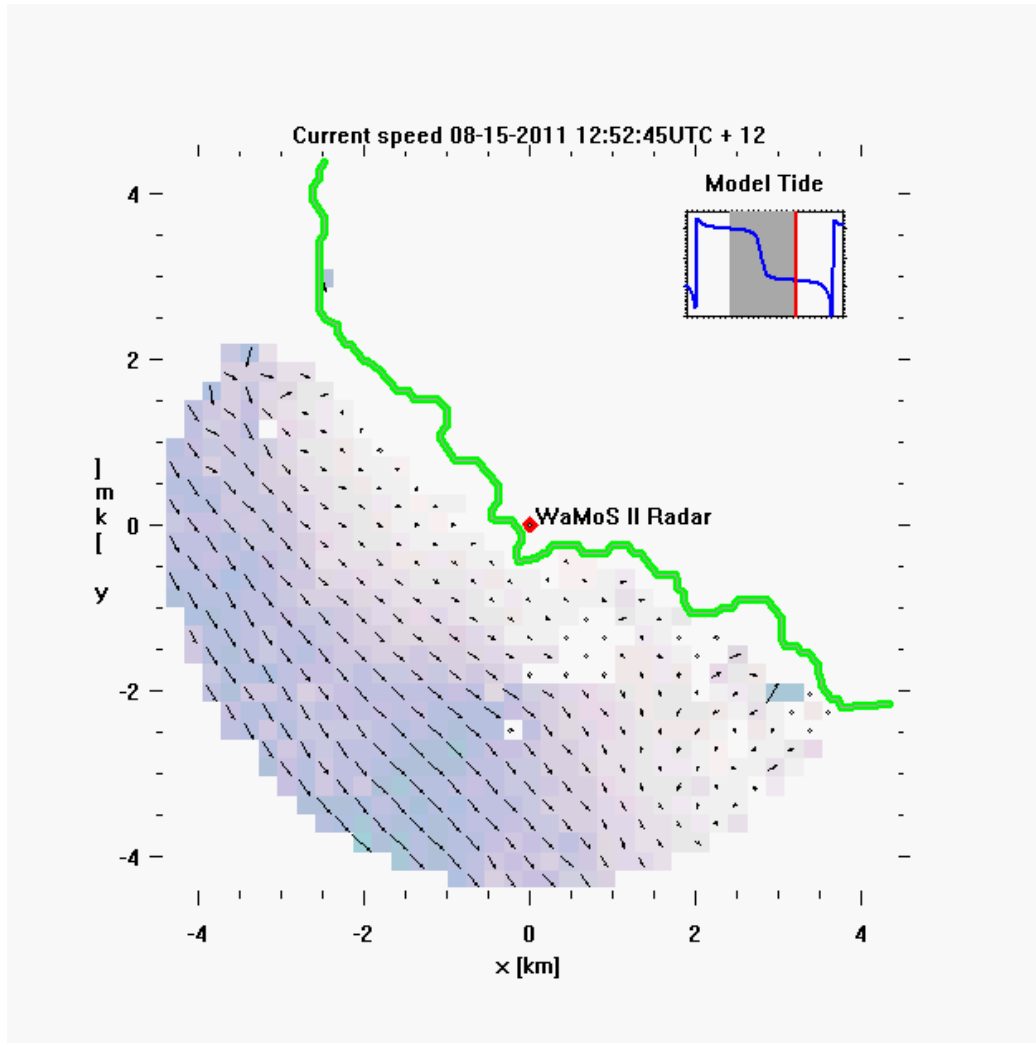
Source: Operational forecasting of sea level height using an unstructured grid ocean model , Lane et al. 2009



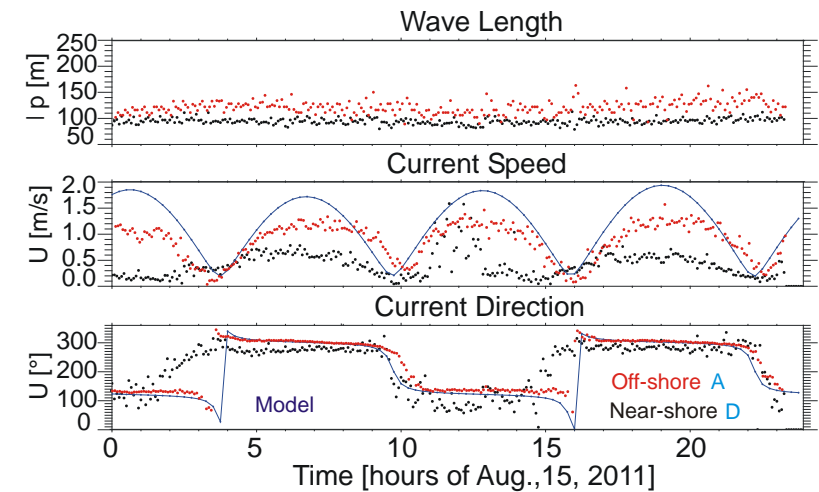
WaMoS II station: Makara HRC Current Animation



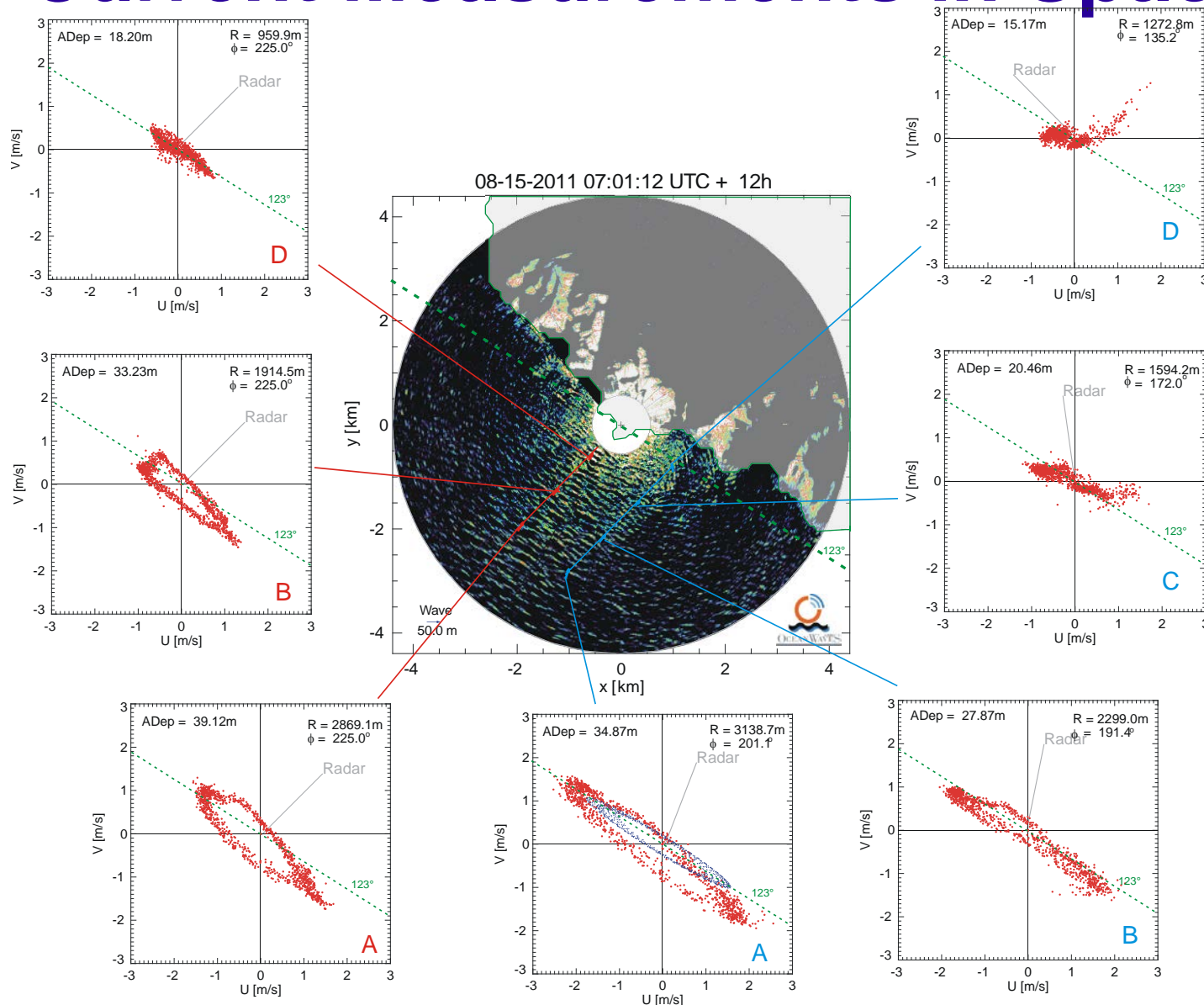
WaMoS II station: Makara HRC Current Animation



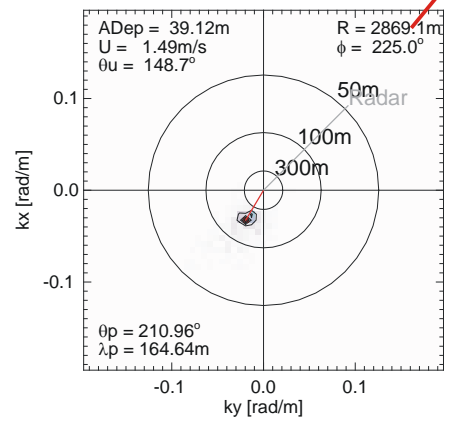
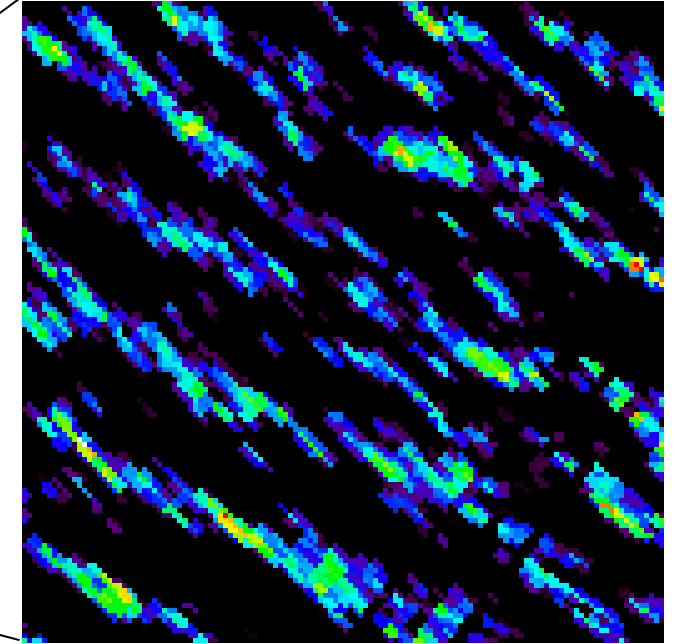
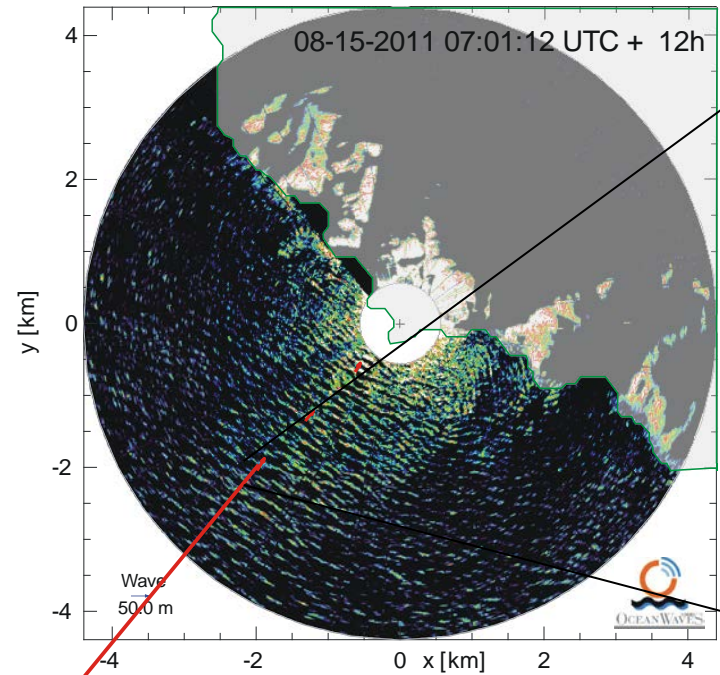
0.4 km near-shore, 3.4 km off-shore



WaMoS II HRC Current Measurements in Space

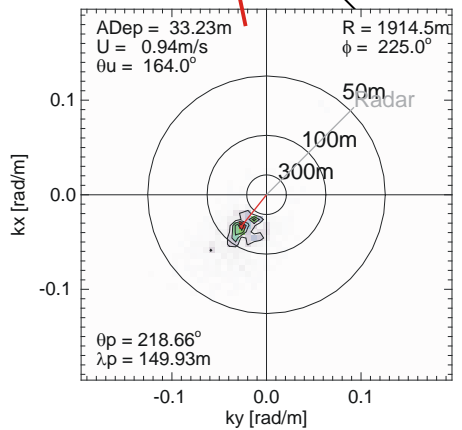
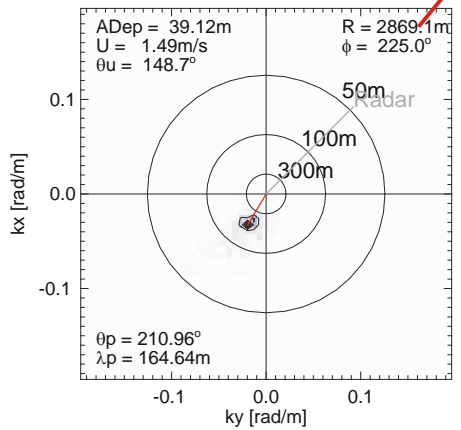
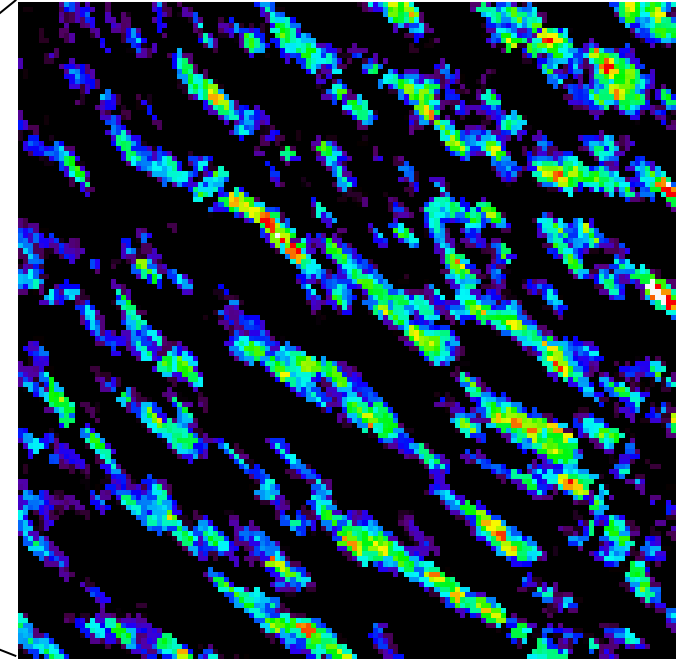
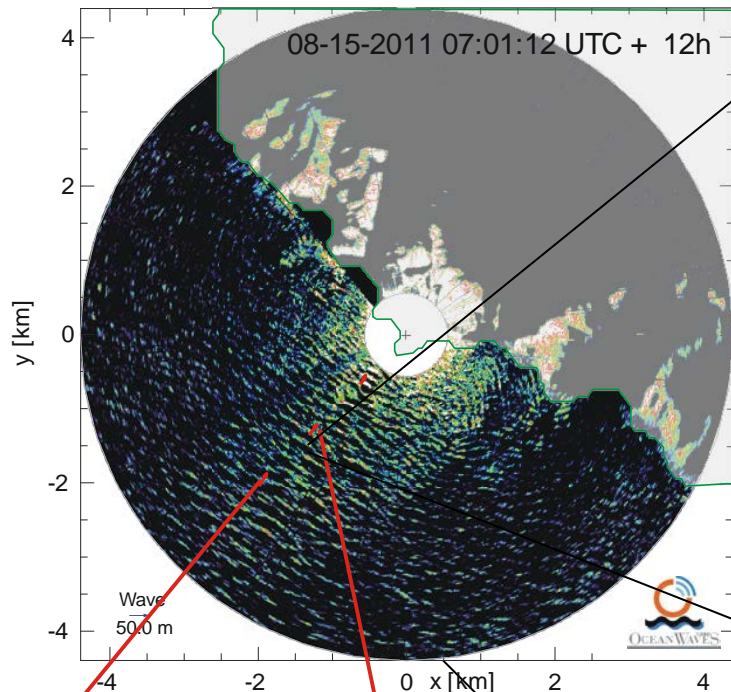


WaMoS II HRC Wave Measurements in Space



Wave Shoaling
 Depth λ_p
 39.12m 164.64m

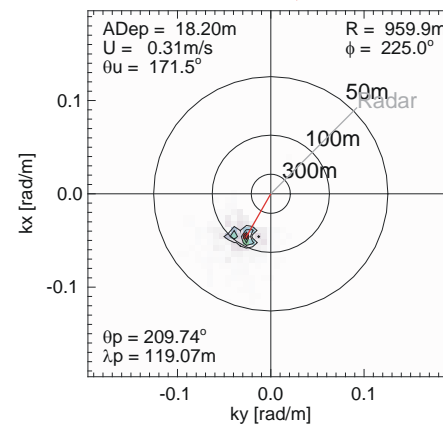
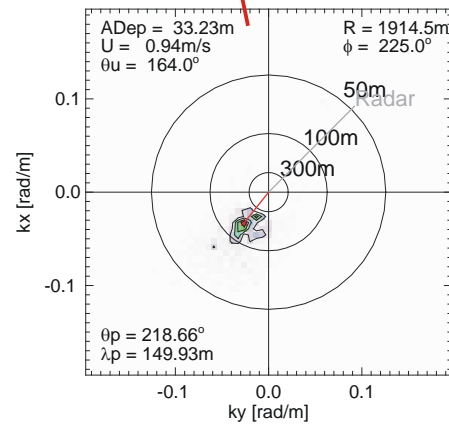
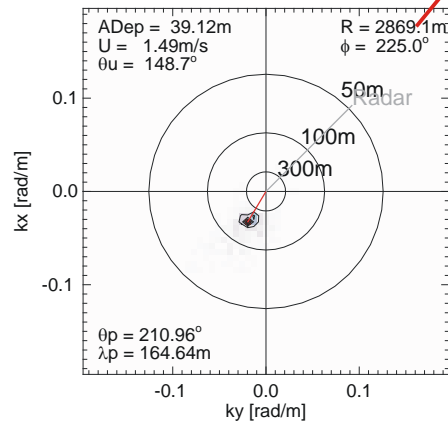
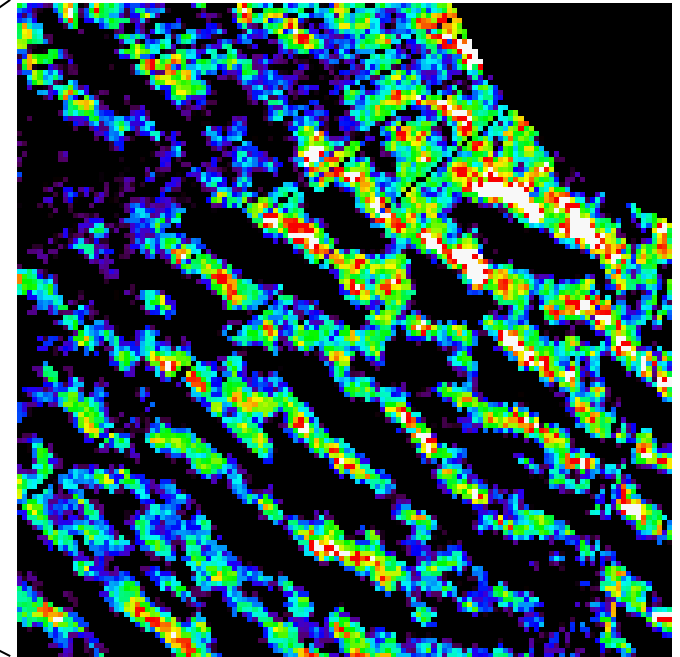
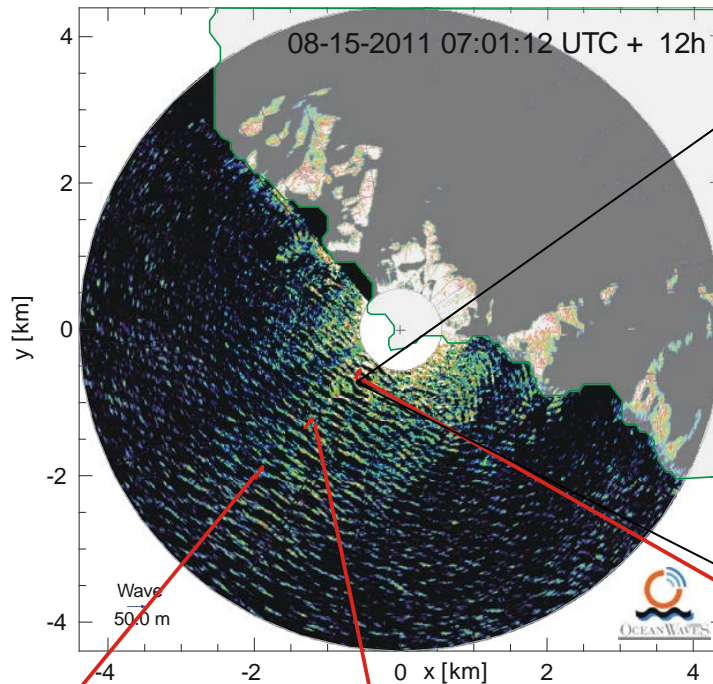
WaMoS II HRC Wave Measurements in Space



Wave Shoaling
 Depth λ_p
 39.12m 164.64m
 33.23m 149.93m



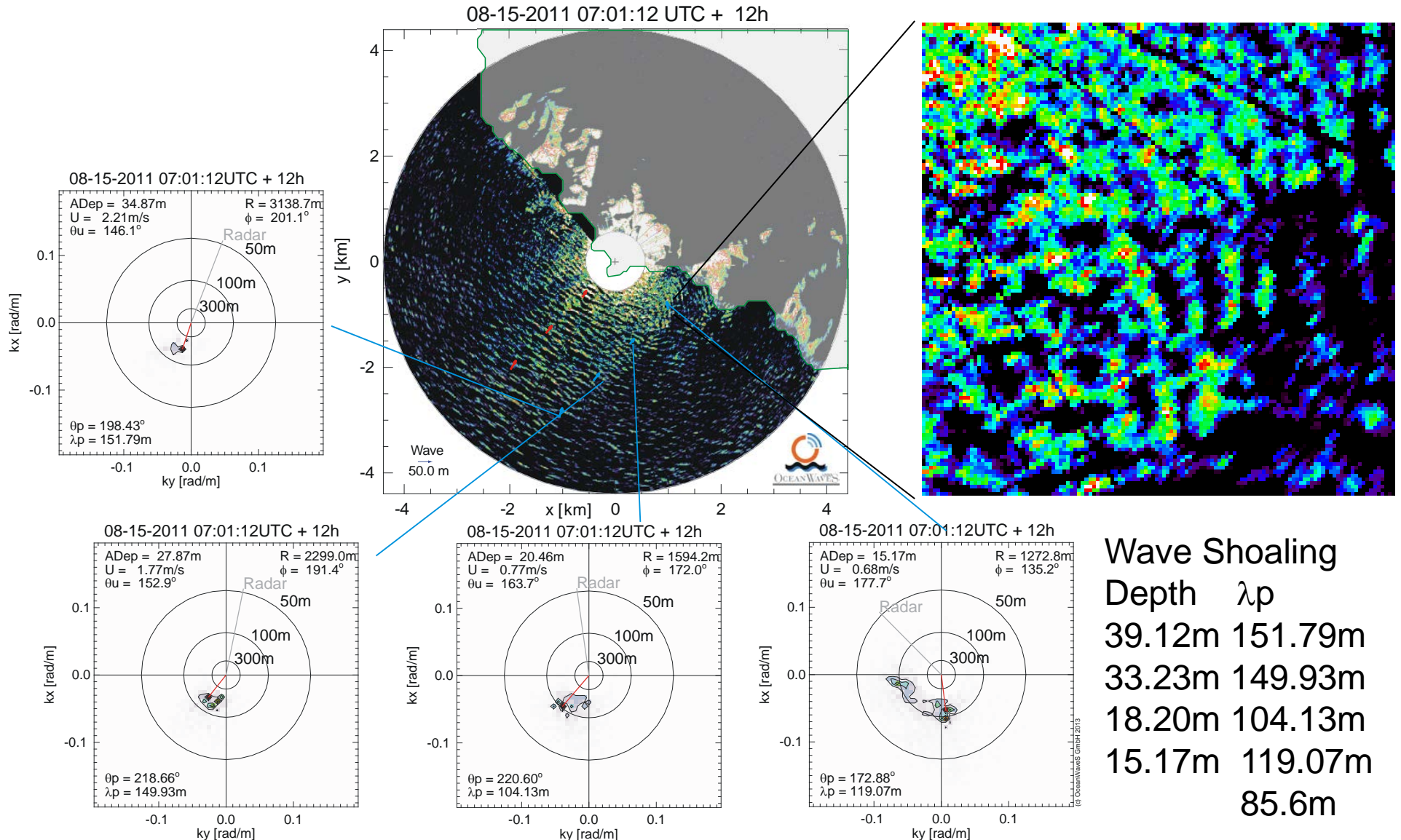
WaMoS II HRC Wave Measurements in Space



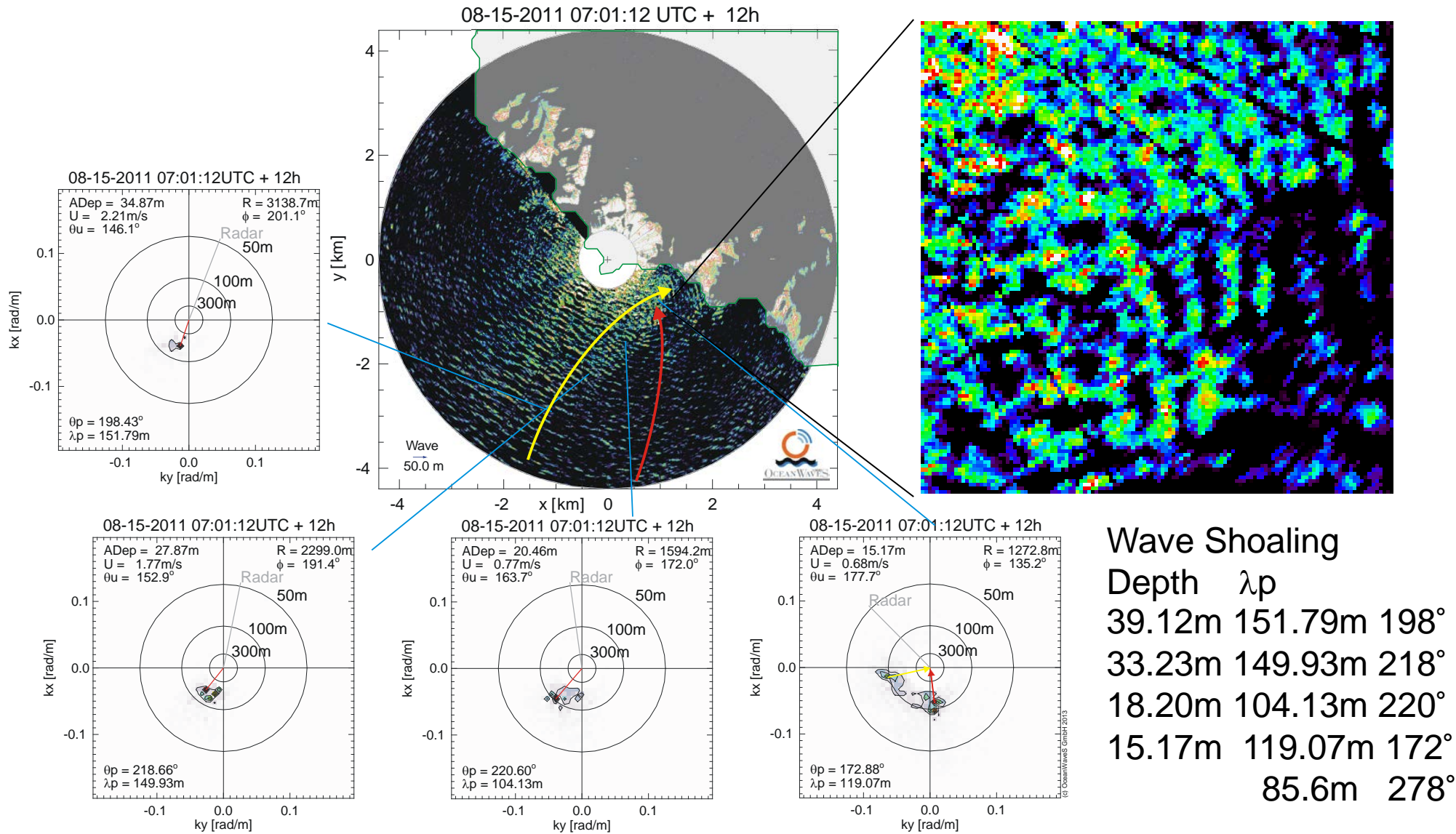
Wave Shoaling

Depth	λ_p
39.12m	164.64m
33.23m	149.93m
18.20m	119.07m

WaMoS II HRC Wave Measurements in Space

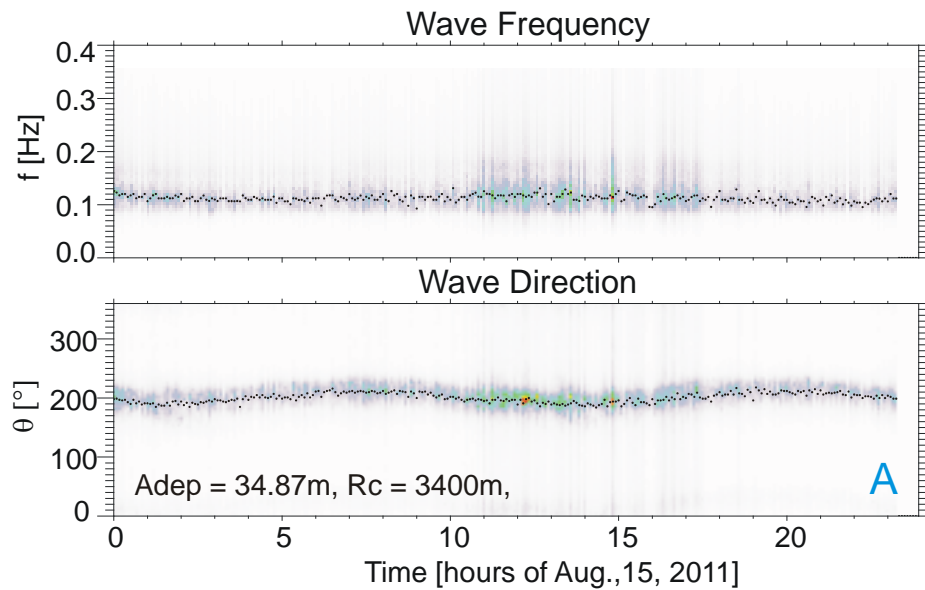


WaMoS II HRC Wave Measurements in Space

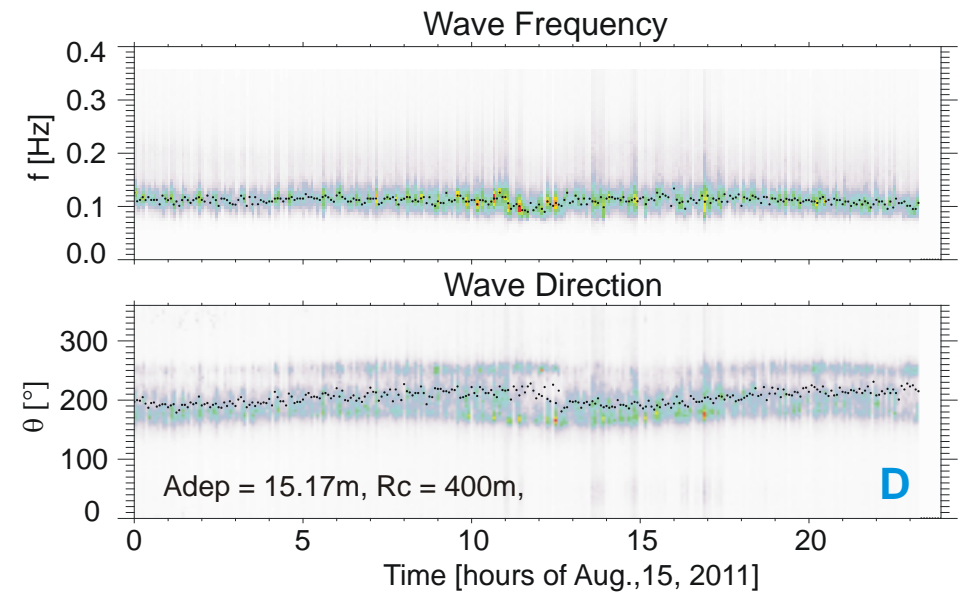


WaMoS II HRC Wave Measurements in Time/Space

3.4 km off-shore,
water depth 34.87m



0.4 km near-shore,
water depth 15.17m



WaMoS II Station at Island

WaMoS II HRC application

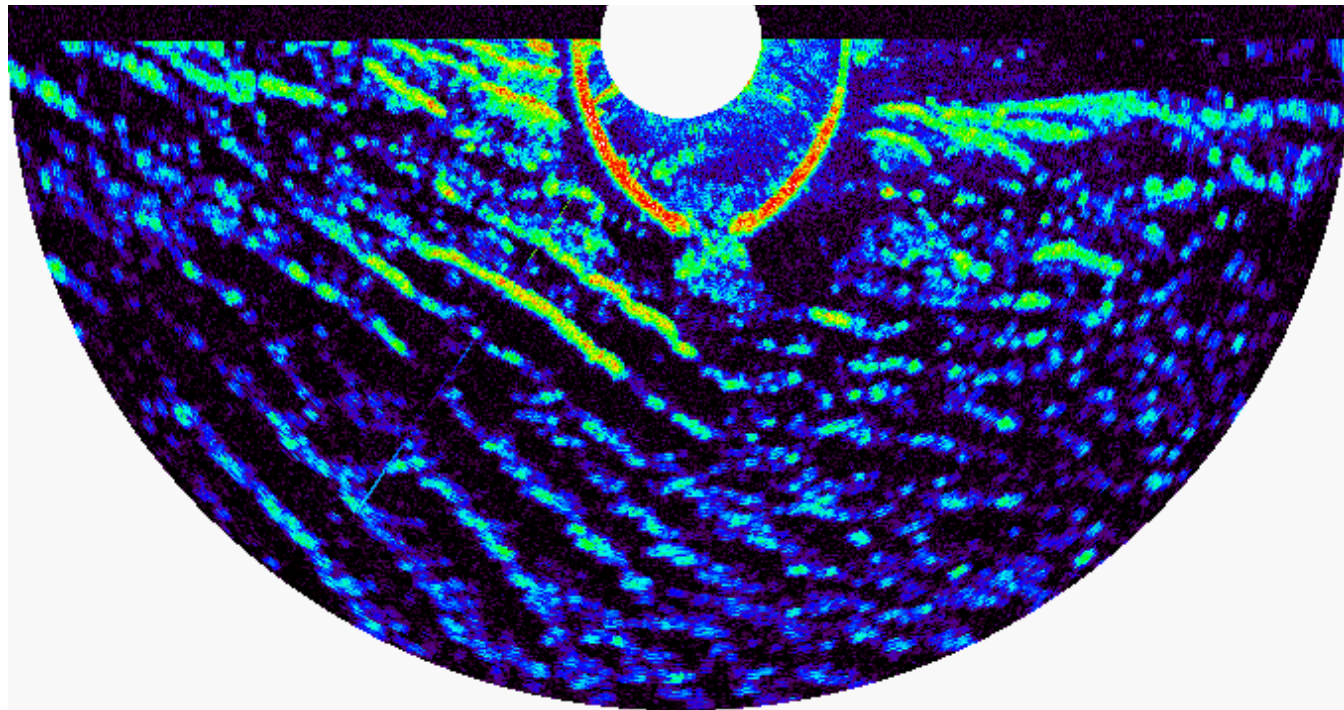
Decision support for

Safe harbor entrance



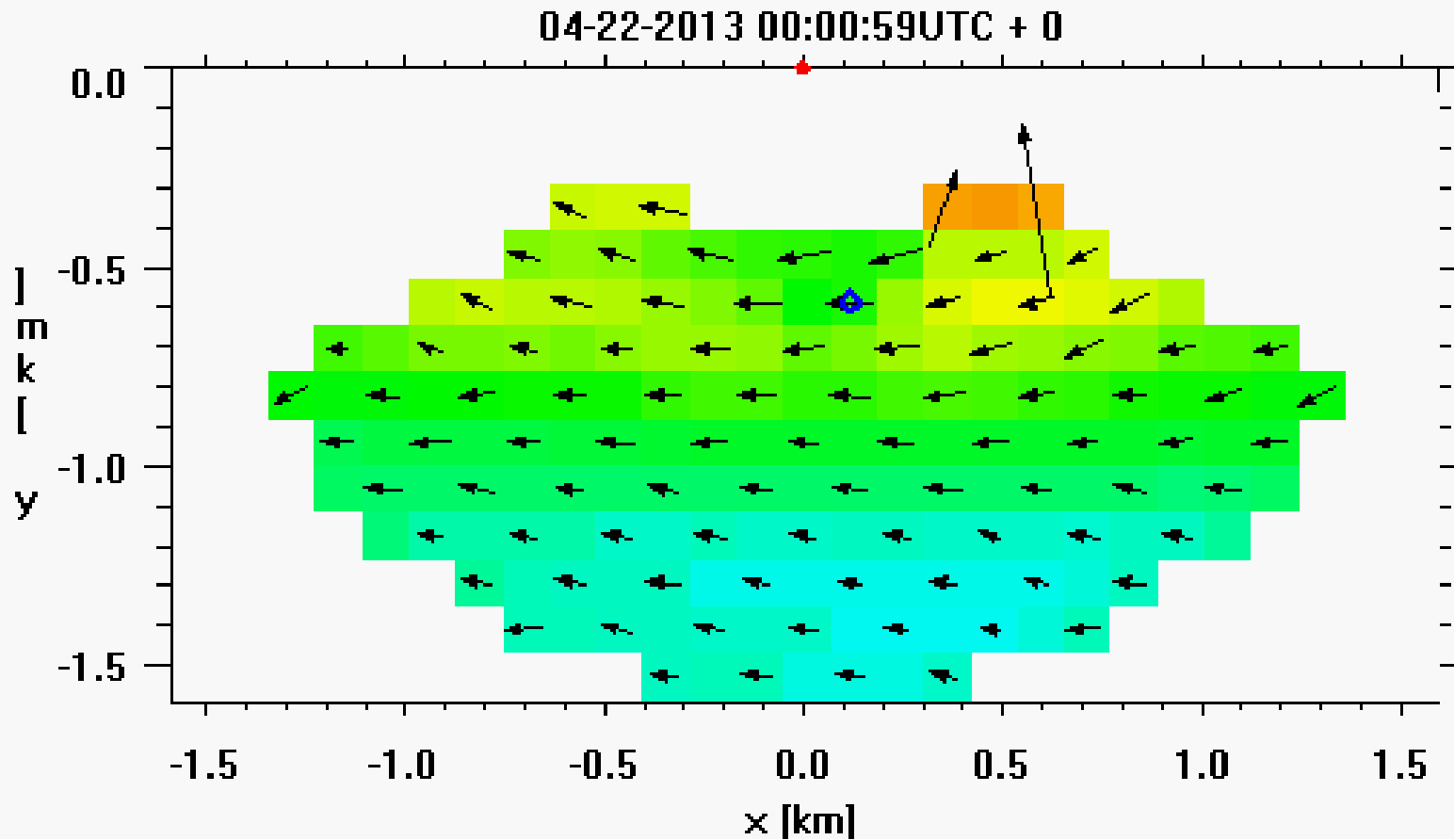
WaMoS II Island

Waves in Radar Imagery Sea State Hs ~ 2m



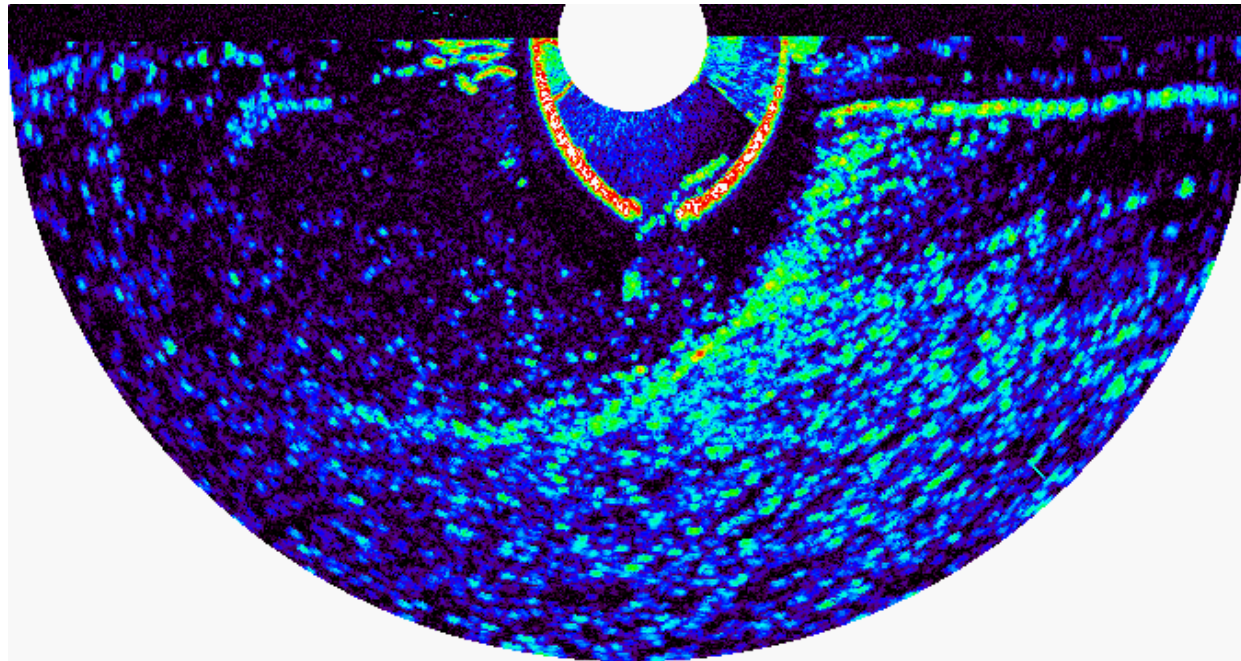
WaMoS II HRC Island

High Resolution Current and Bathymetry



WaMoS II Island

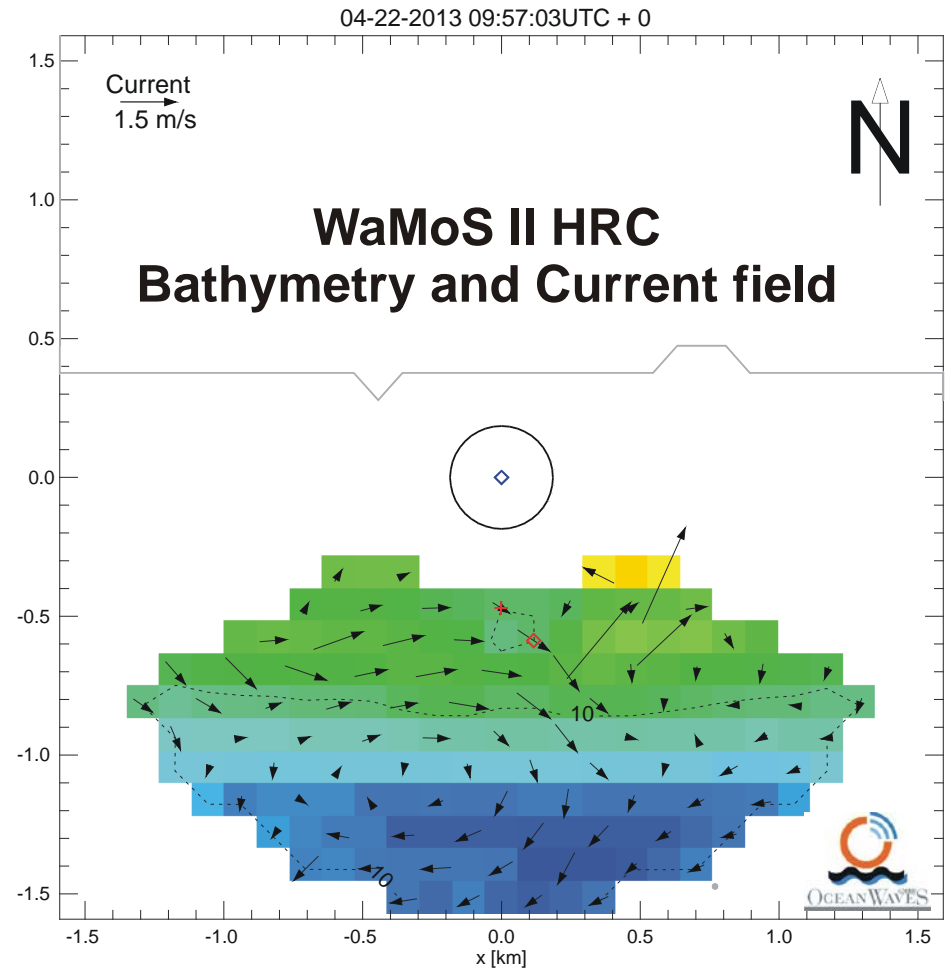
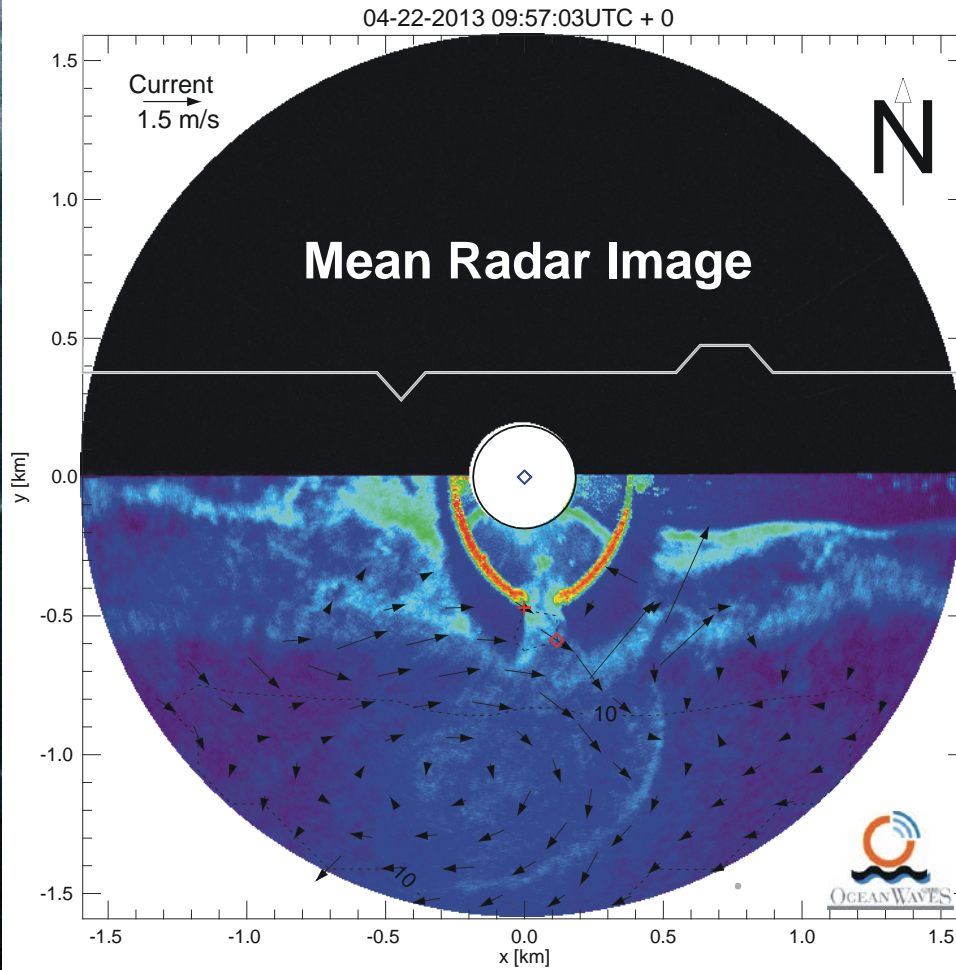
Waves in Radar Imagery Sea State Hs ~ 1m



WaMoS II Island

Mean X-Band Radar Image

– WaMoS II HRC



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Summary of Conclusions

- WaMoS II HRC is capable to monitor sea state and current in time and space, so that complex hydrography in coastal areas can be reflected.
- Spatial wave fields allow to investigate processes like wave shoaling, wave deflection, separation
- Spatial current fields allow to identify also small scale current features like, shear zones, eddies, convergent/divergent zones.
- Interaction between current and wave can be studied.

Thank you for your attention