Measuring the ‘First Five’ with HF radar

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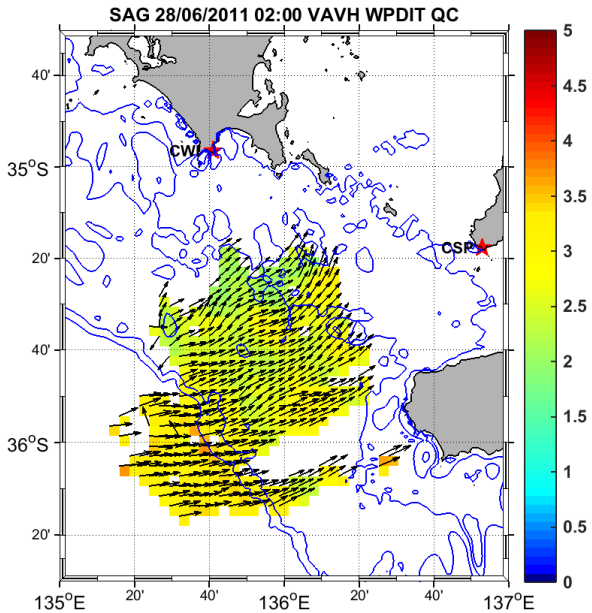
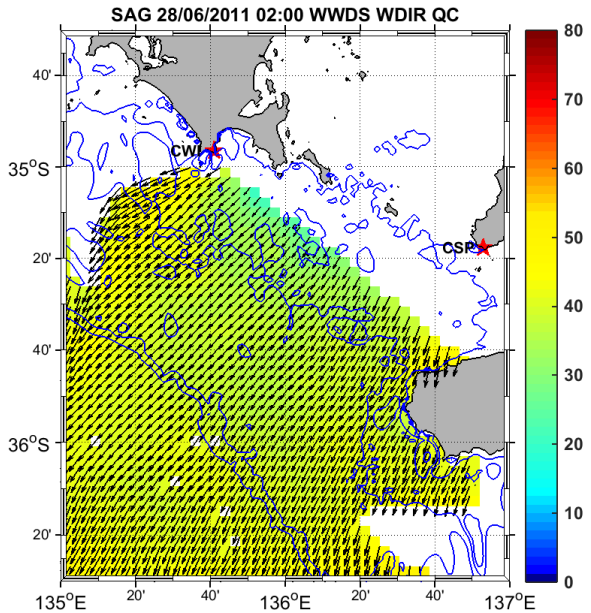
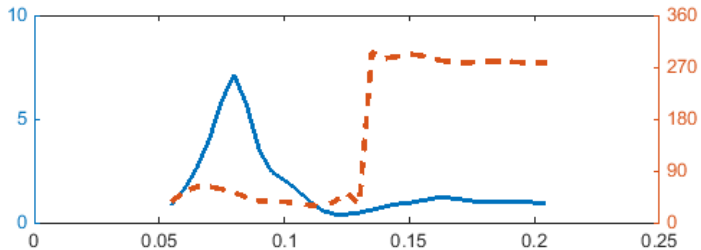
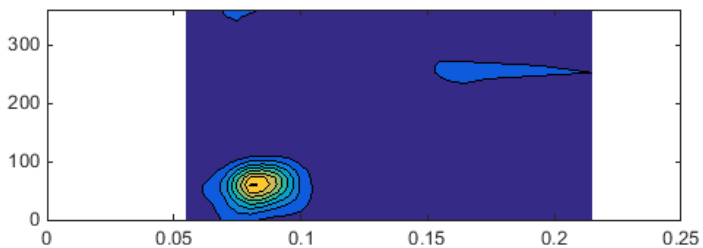
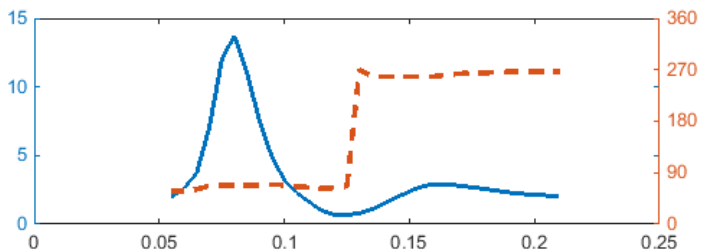
HF radar wave measurements in South Australia

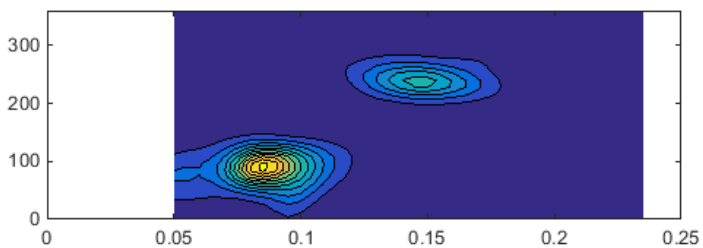






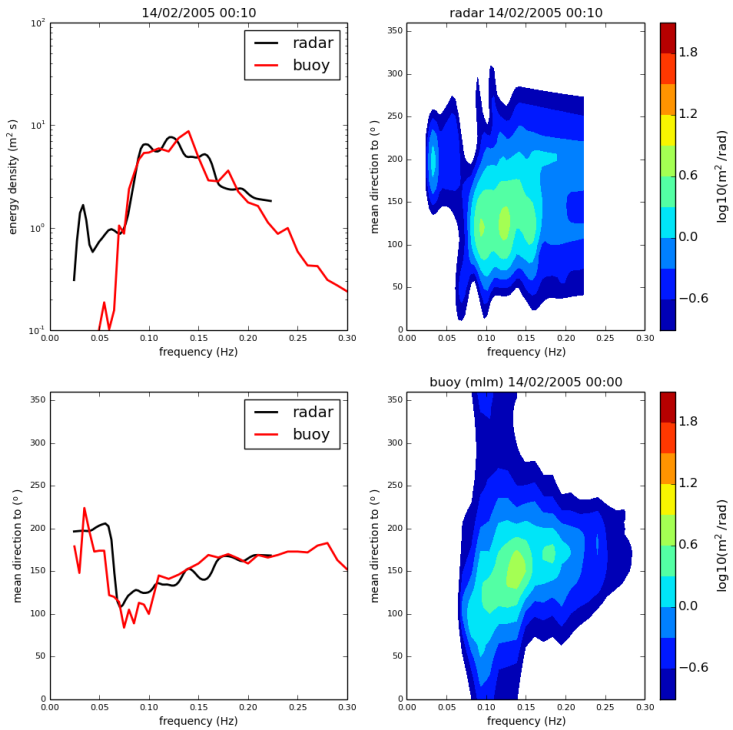




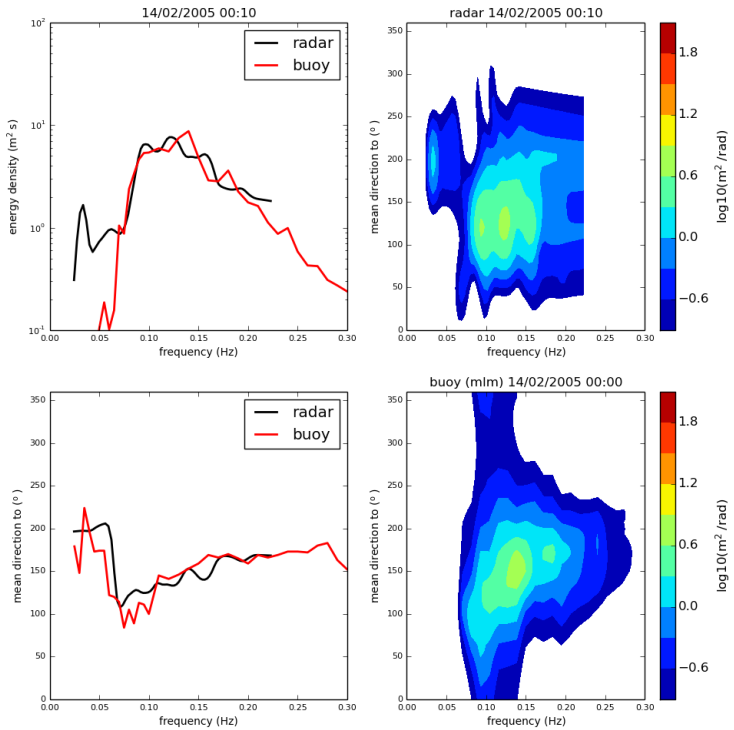


Data from IMOS/SA WERA radars

HF radar wave measurement

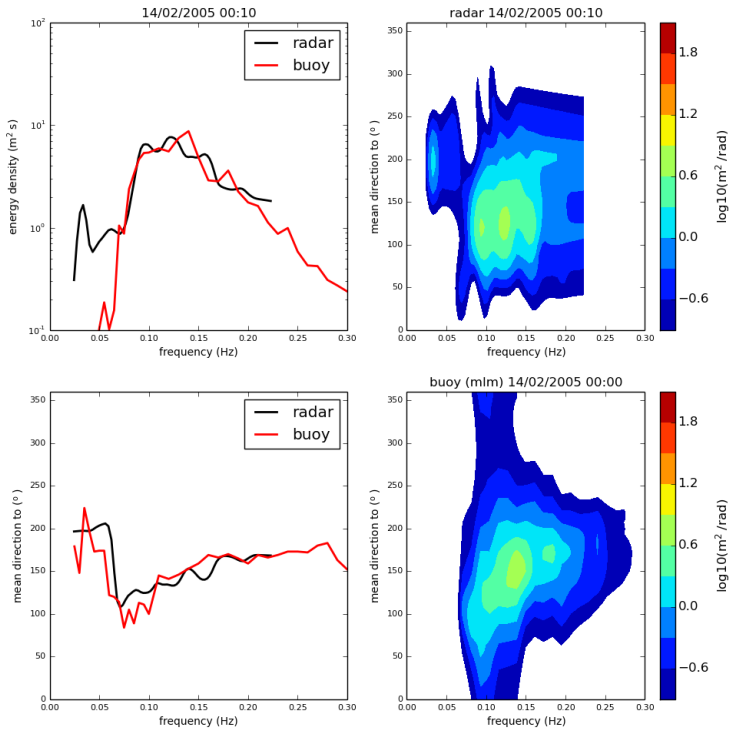


HF radar wave measurement



The HF radar directional spectrum is obtained by integral inversion of radar Doppler spectra from 2 radars.

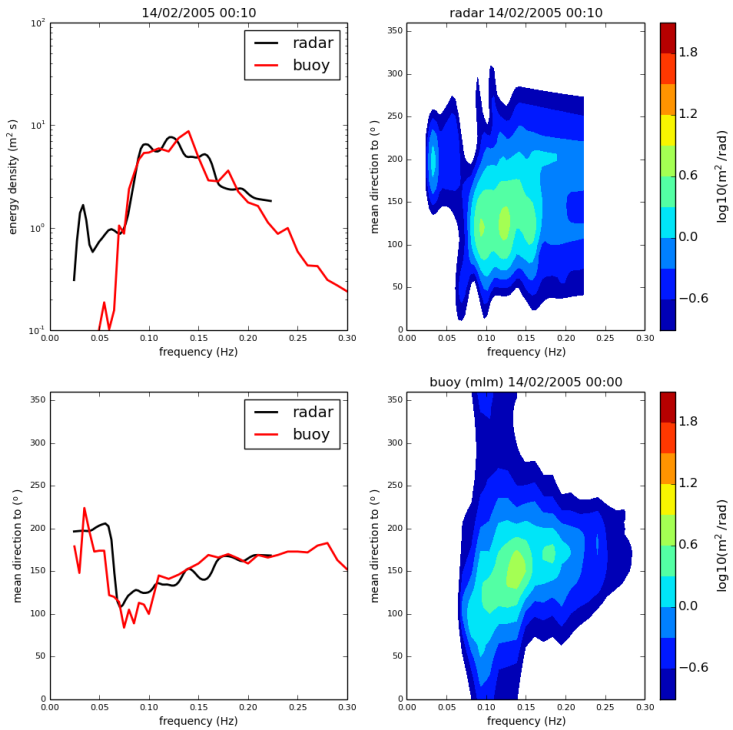
HF radar wave measurement



The HF radar directional spectrum is obtained by integral inversion of radar Doppler spectra from 2 radars.

The buoy directional spectrum is obtained using a maximum likelihood method applied to the measured Fourier coefficients at each frequency (**the first five**).

HF radar wave measurement



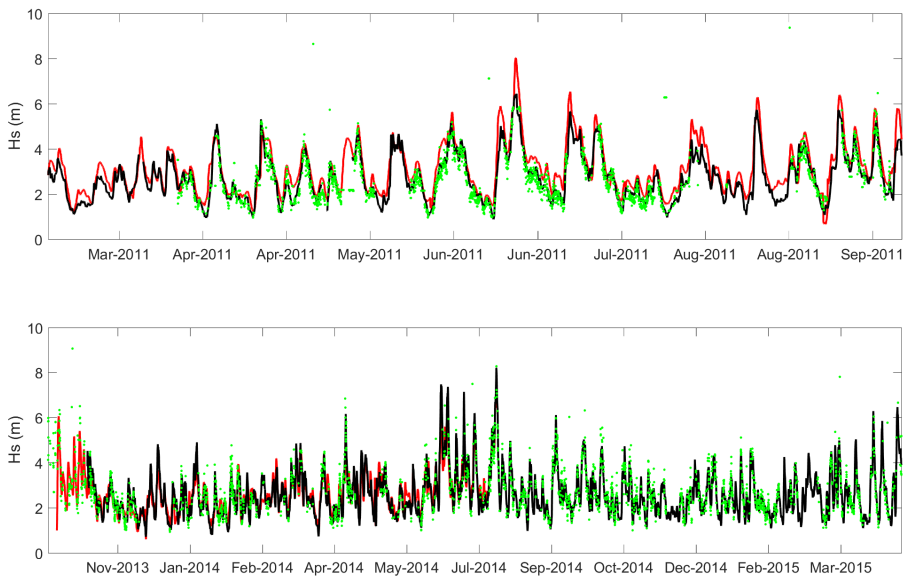
The HF radar directional spectrum is obtained by integral inversion of radar Doppler spectra from 2 radars.

The buoy directional spectrum is obtained using a maximum likelihood method applied to the measured Fourier coefficients at each frequency (**the first five**).

Energy spectra, significant waveheight, peak direction, power, Fourier coefficients etc are obtained from the radar directional spectrum using standard methods.

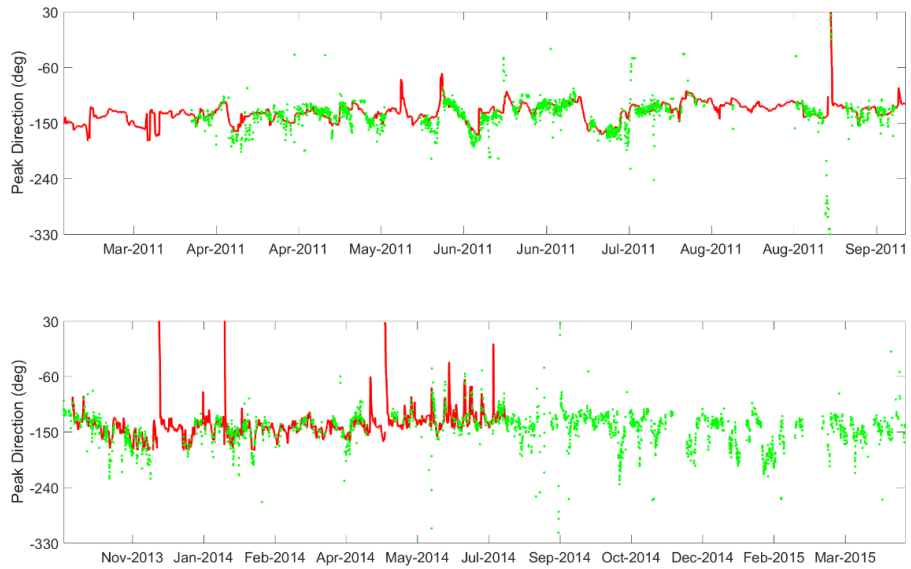
Buoy and model validations

Measurements from the IMOS South Australian Gulf WERA radars (green) compared with non-directional waverider buoy (black) and SWAN model (red).



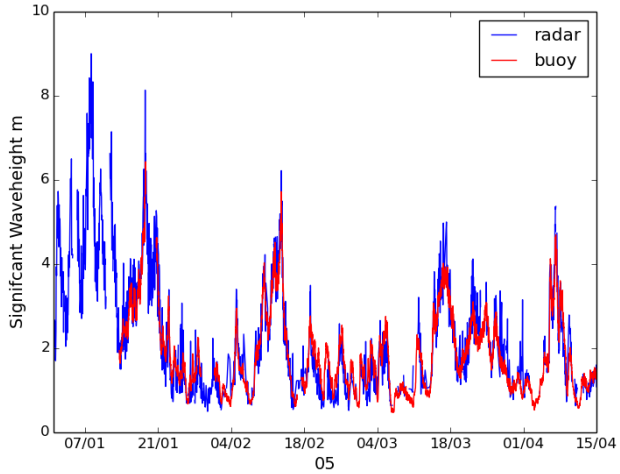
Significant Waveheight

provided by Charles James, SARDI

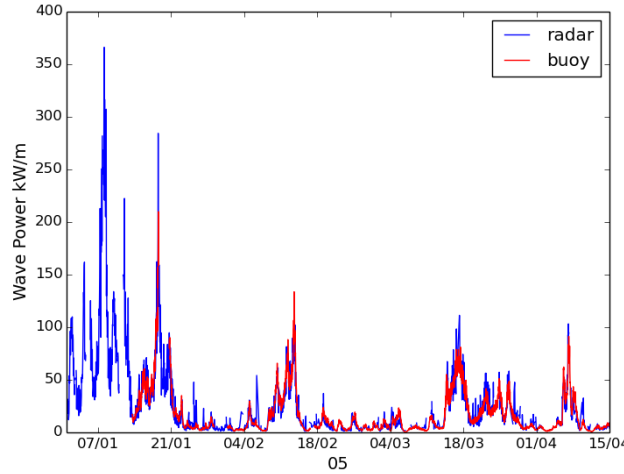


Peak Wave Direction

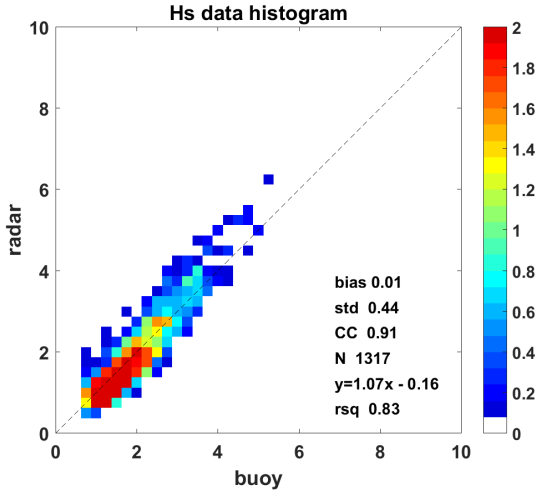
Pisces buoy comparisons



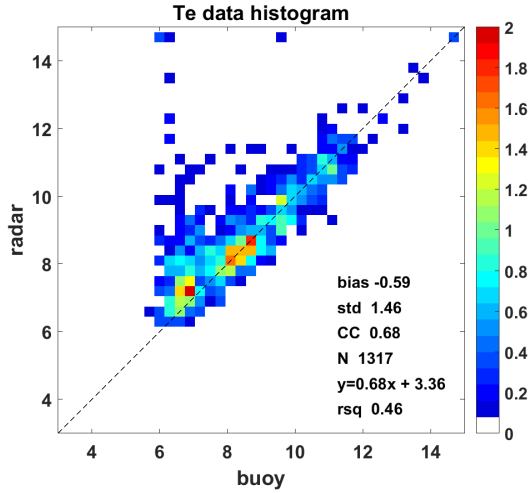
Significant Waveheight



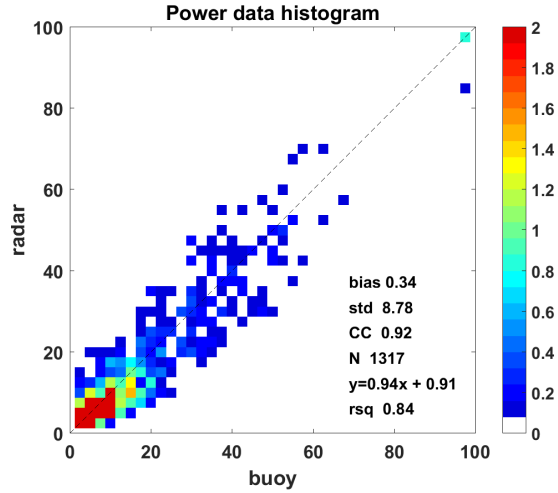
Wave power



Hs (m)



T_E (s)

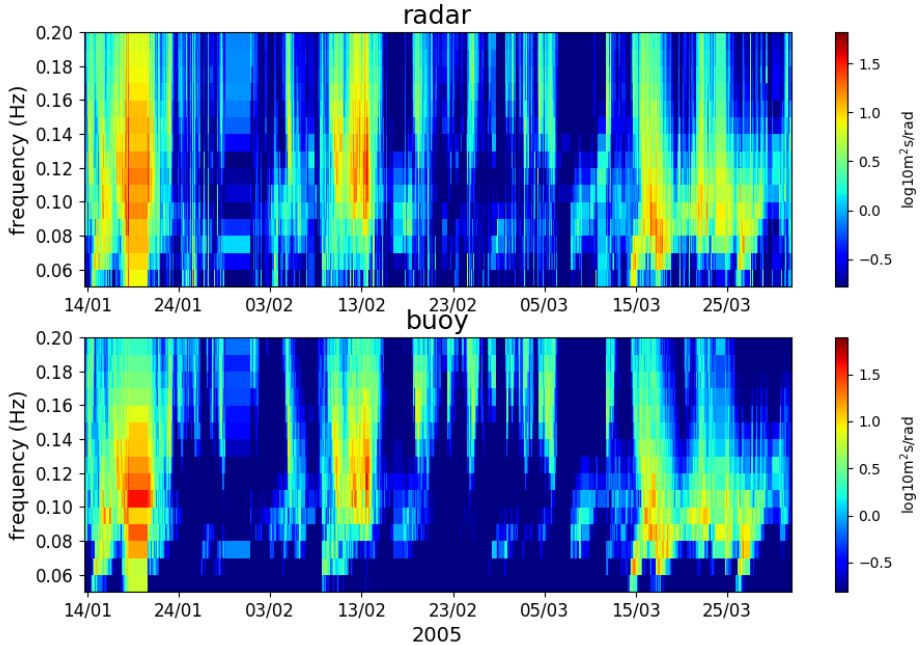


power (kW/m)

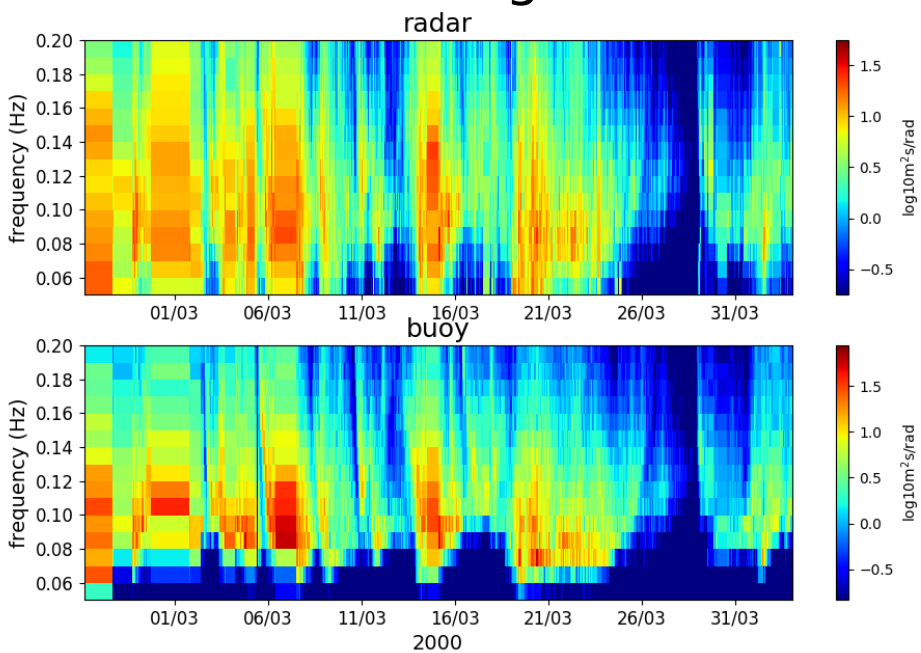
Buoy comparisons

Energy spectra time series

Pisces in Celtic Sea



WERA in Norwegian Sea

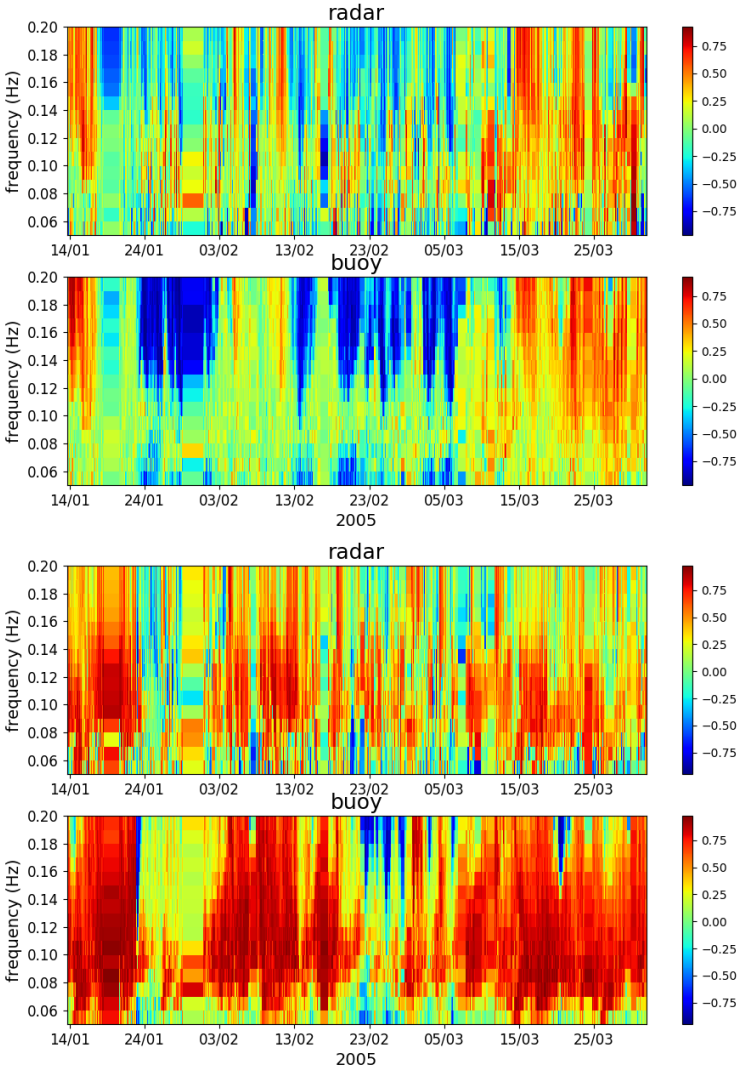


upper panel –radar
lower panel –buoy.

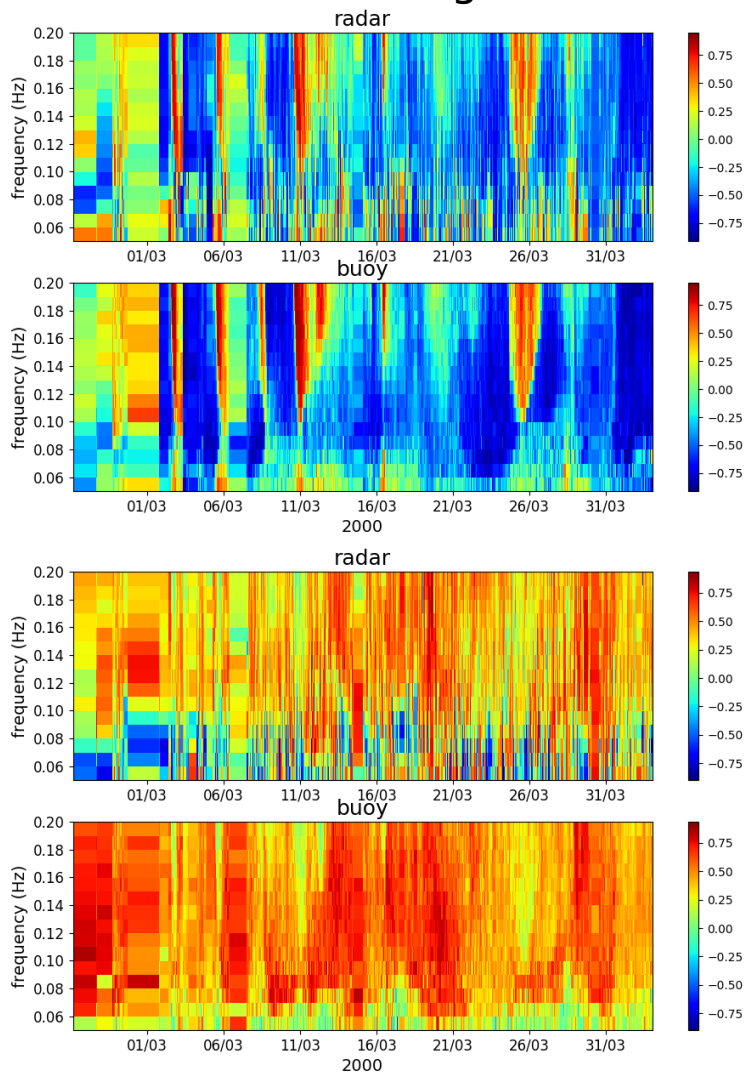
Buoy comparisons

Fourier coefficient timeseries

Pisces in Celtic Sea

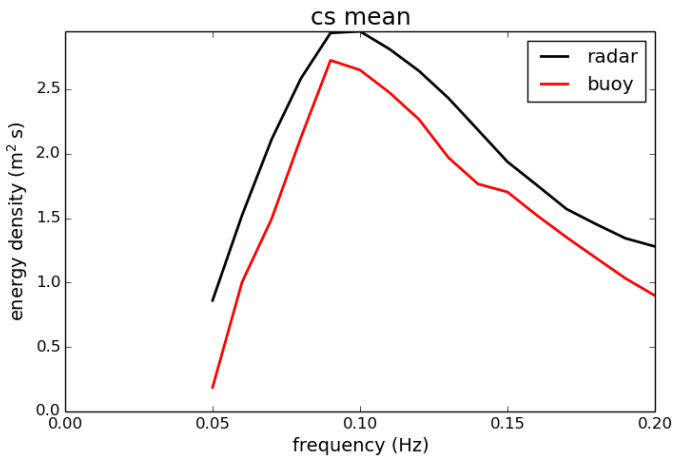


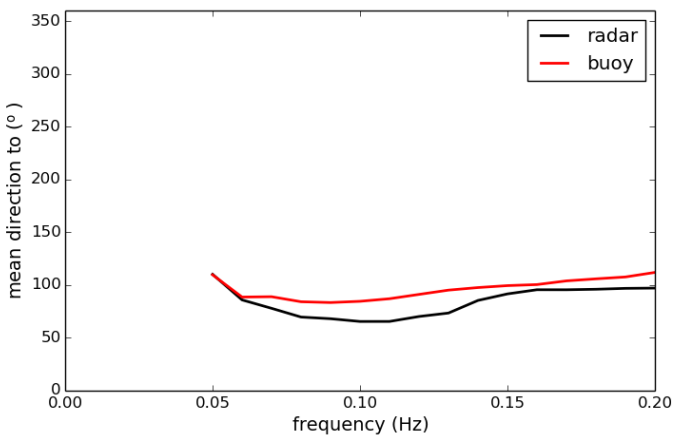
WERA in Norwegian Sea

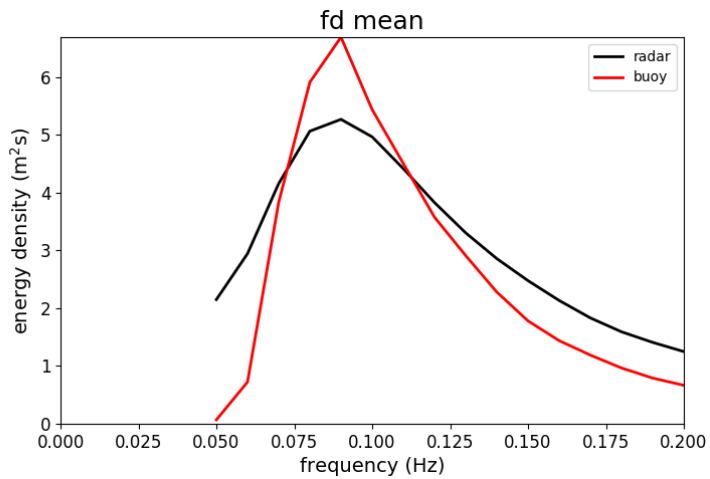


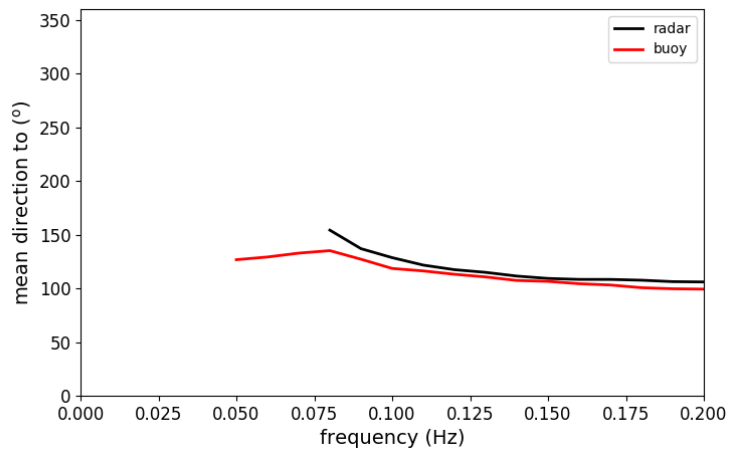
upper panel –radar, lower panel –buoy. upper pair $a_1(f)$, lower pair $b_1(f)$.

Buoy mean comparisons





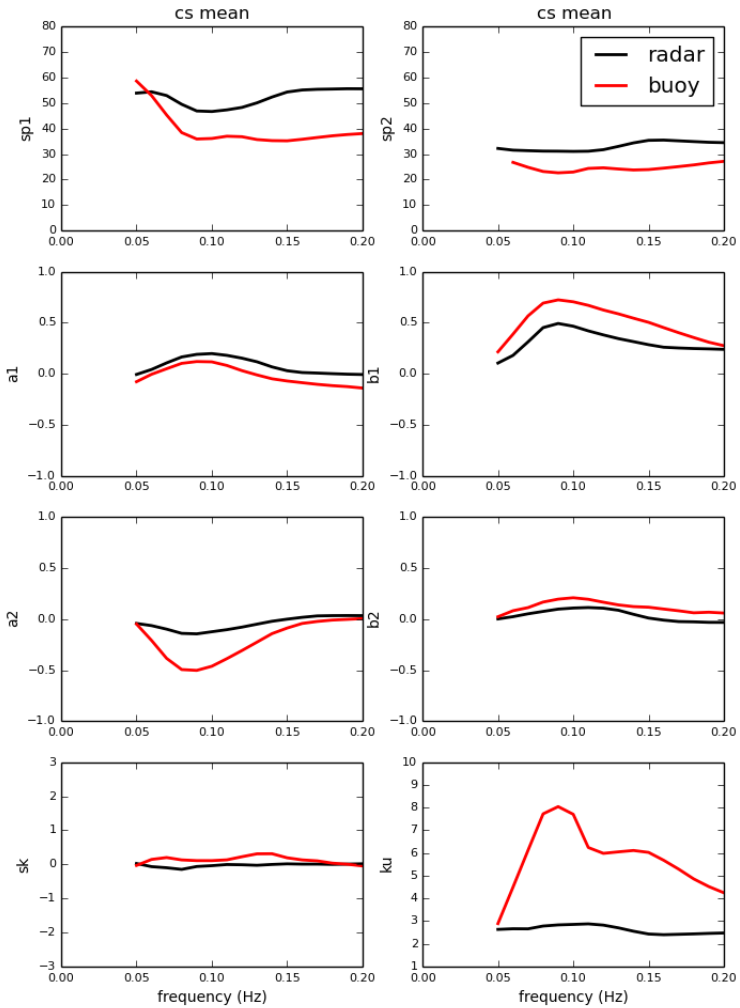




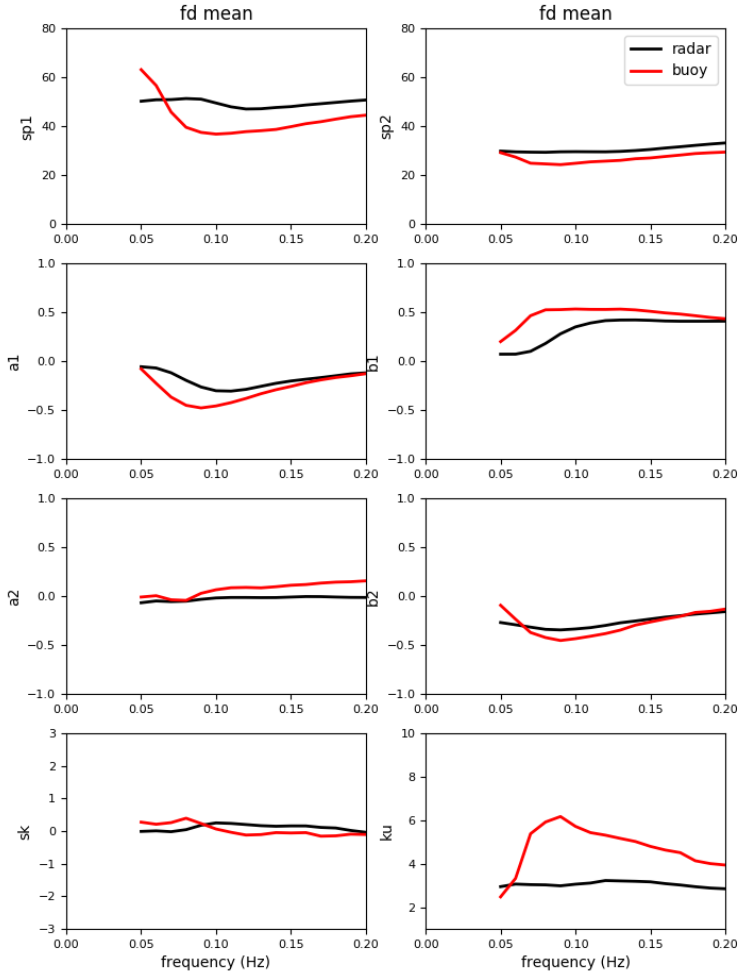
Pisces in Celtic Sea

Wera in Norway

Buoy mean comparisons



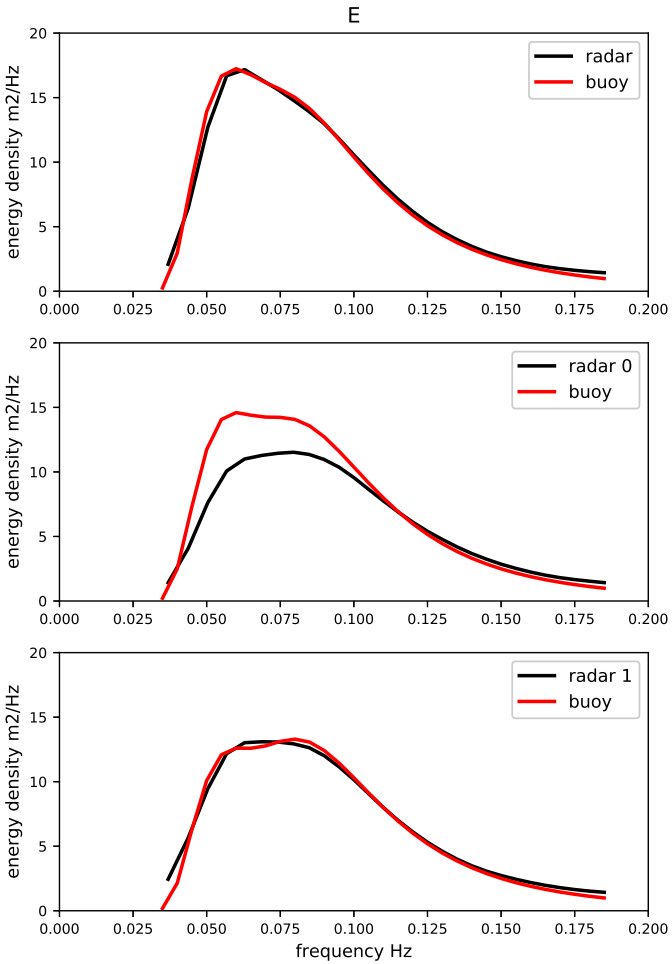
Pisces in Celtic Sea



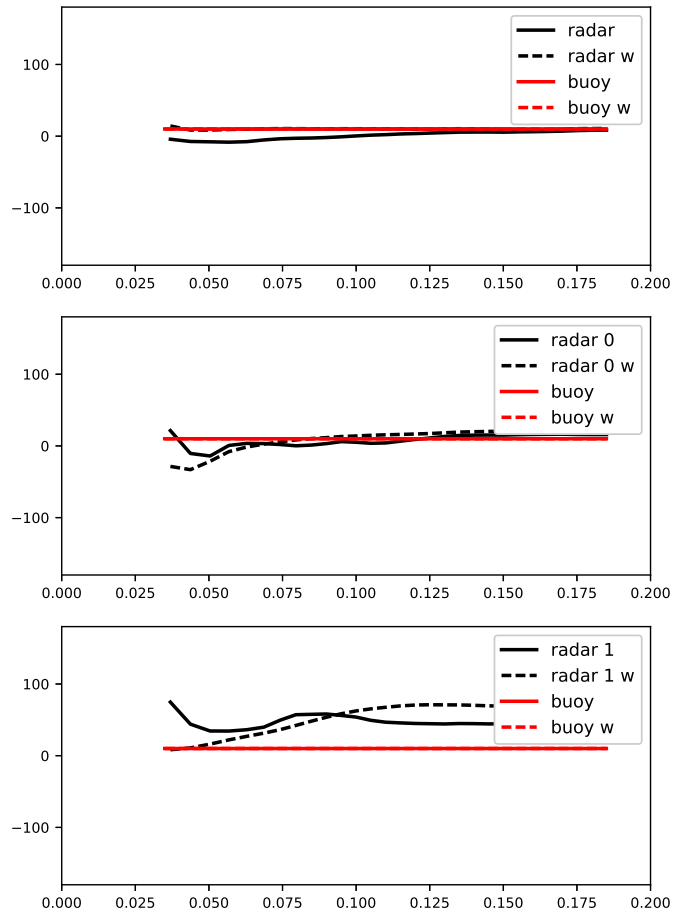
Wera in Norway

Simulation results

Using different radio frequencies, wind speed and directions.



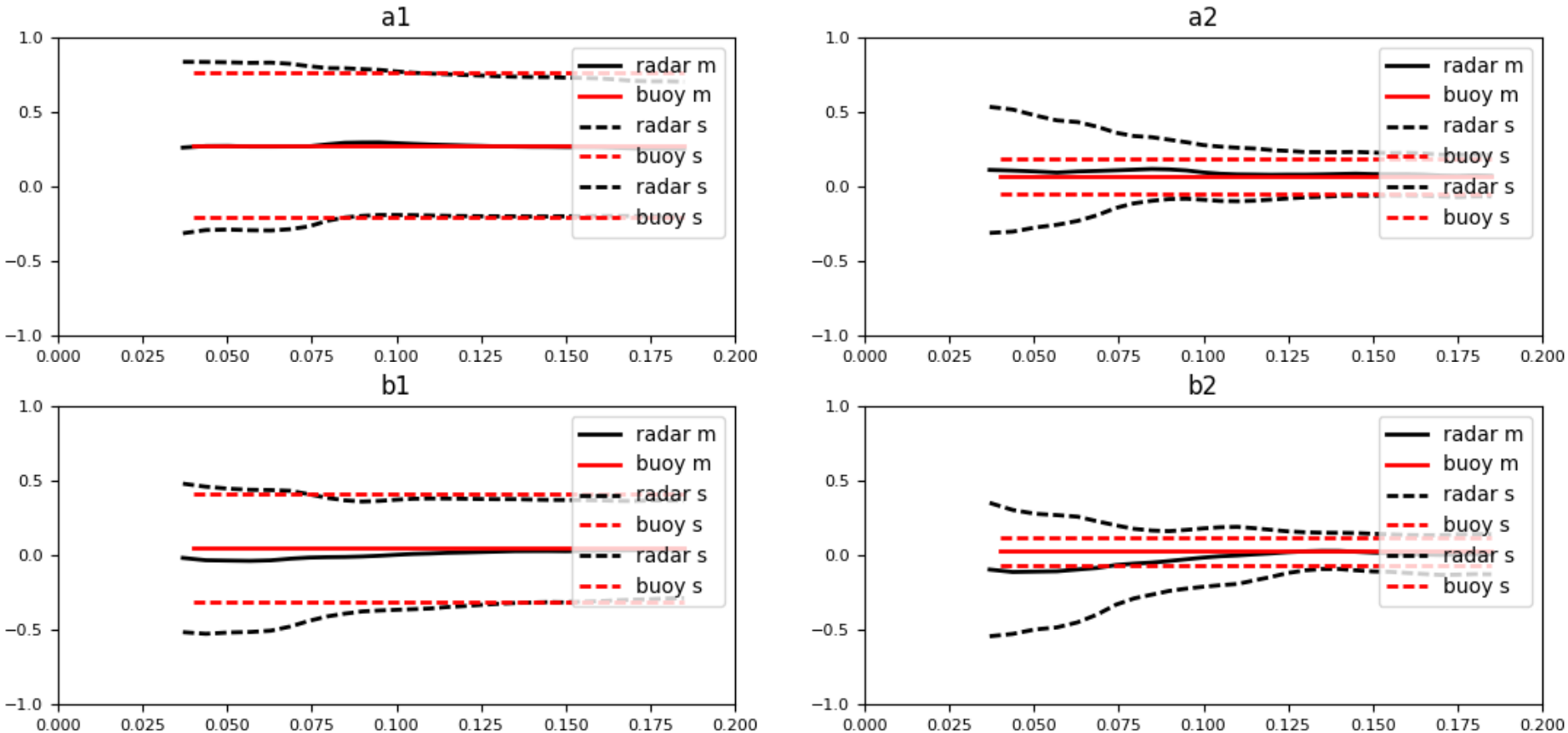
$\overline{E}(f)$



$\overline{\theta}(f)$

Simulation results

Mean Fourier Coefficients with std.



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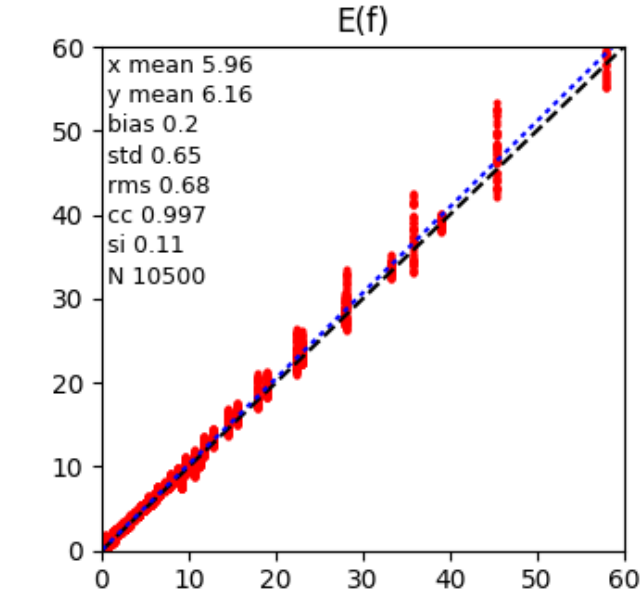
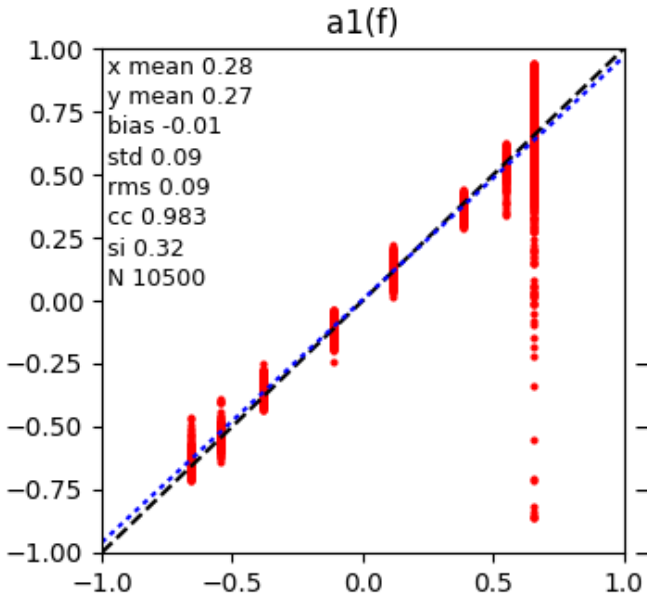
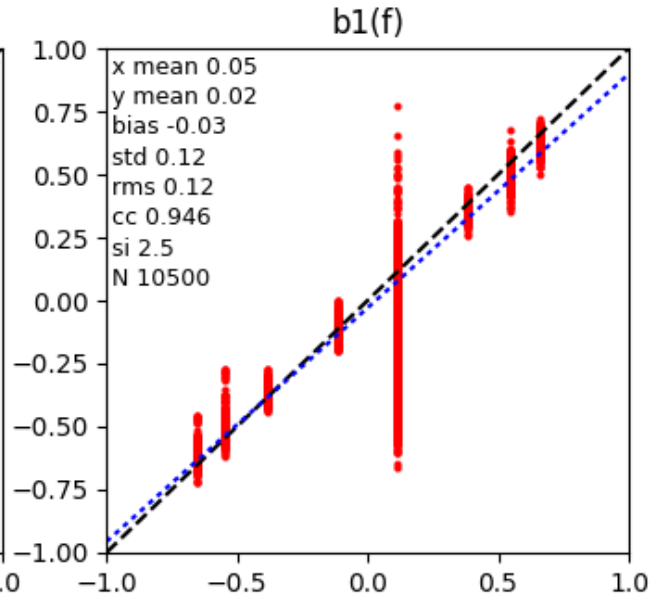




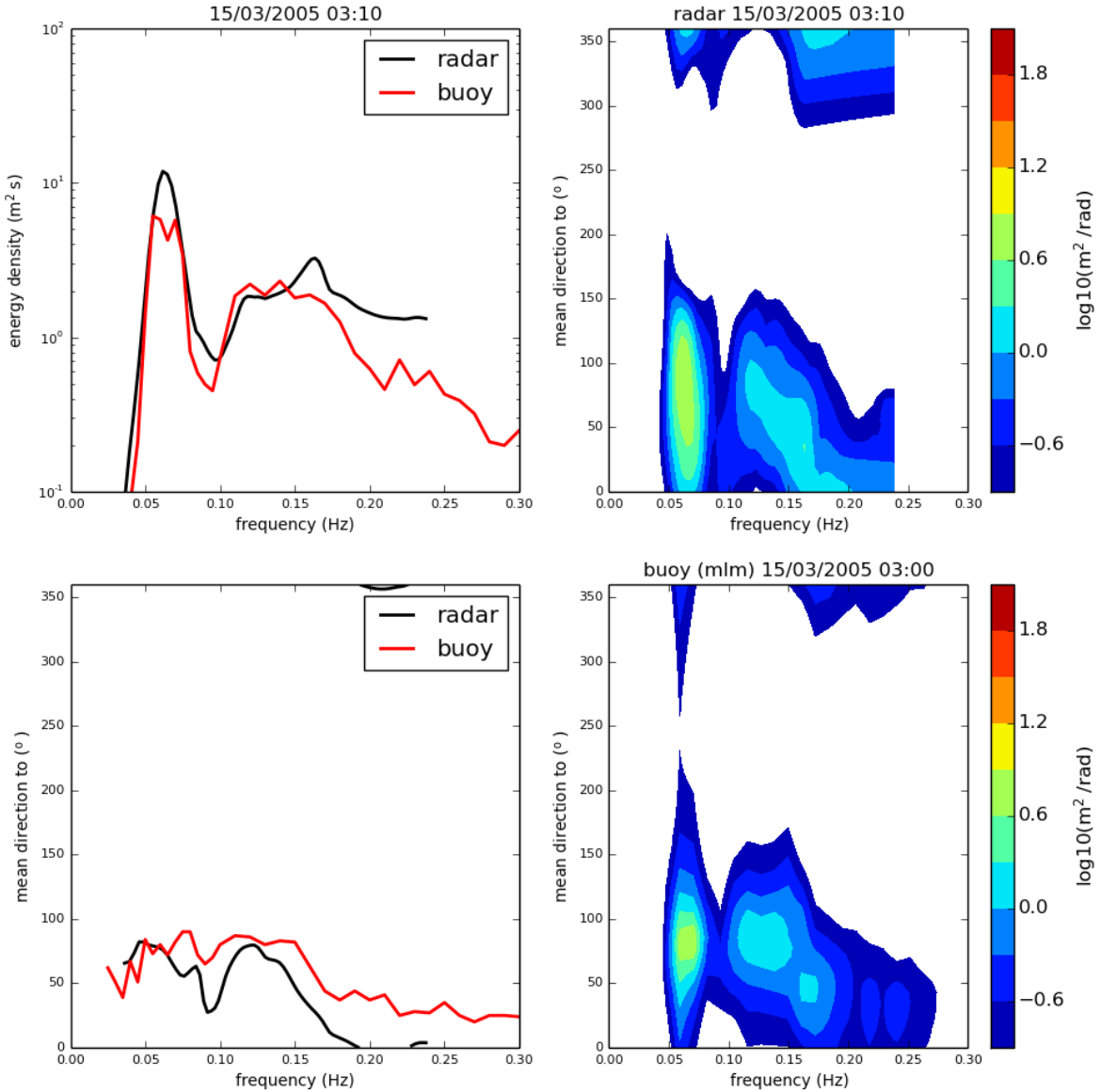


Summary

- Simulations indicate that Fourier coefficients can be measured with reasonable accuracy within previously identified limitations of the inversion method:
  - low radio frequencies at low waveheights
  - high radio frequencies at high waveheights

- Comparisons with buoys include additional sources of difference/error:
  - noise levels, radio interference, ship signals
  - uncertainities in buoy measurements
  - spatial and temporal measurement differences

Thank you for your attention



HF radar and wavebuoy ocean wave spectra