Comparison of Rayleigh Wave Recoveries at Homestake

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Independent Parameters

- Detectors used:
  - 300, 800, A4100, C4100, D4100, B4850, C4850, D4850, ROSS, YATES
- Channels used:
  - HHE, HHN, HHZ
- Observation time: 100 sec.
  - GPS times: 1107416000 – 1107416100 sec.
- Recovery bin size: 5°

Structure of Slides

Left-hand Side

- Used plausible recovery parameters
- Used following relation to obtain α, where v_R is the wave speed, and f is the recovery frequency :

$$\alpha = \frac{v_R}{2f}$$

Right-hand side

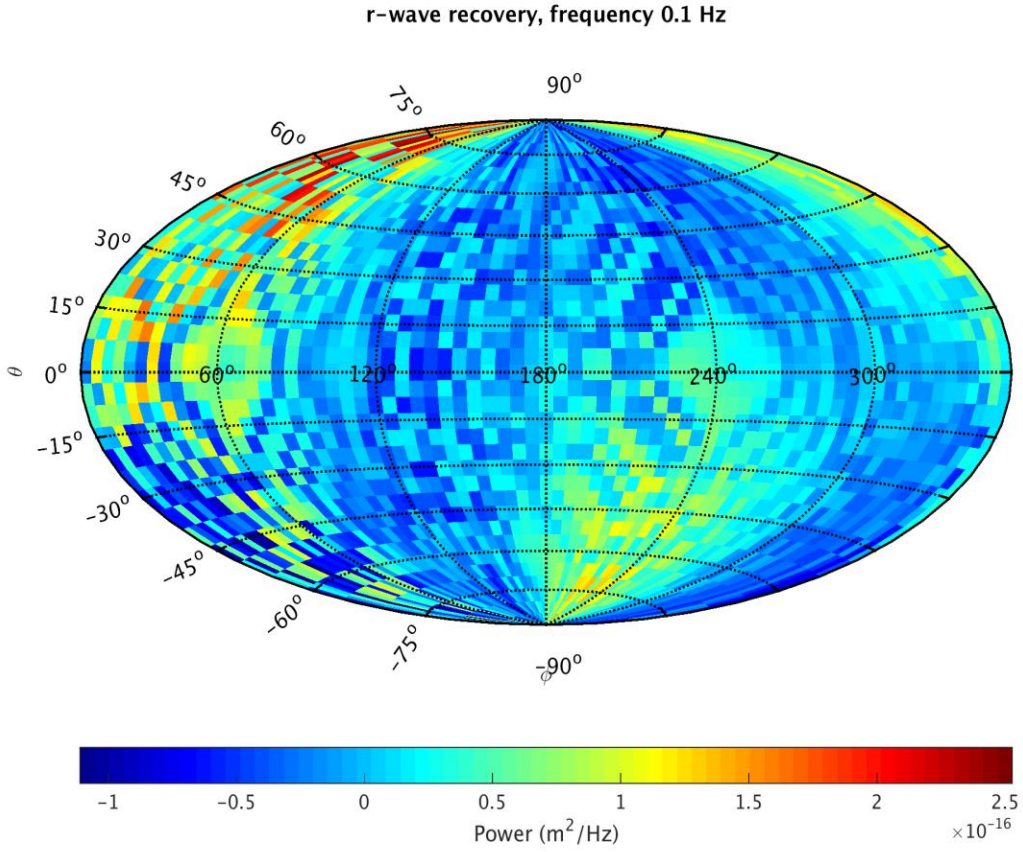
- Parameters were estimated based on geologic composition [1] of terrain surrounding Homestake Mine, i.e. shale

$$v_R = 0.6 \left(\frac{4{,}900\frac{m}{s} + 1{,}800\frac{m}{s}}{2} \right) = 3{,}350\ m/s$$

Recovery Frequency: 0.1 Hz

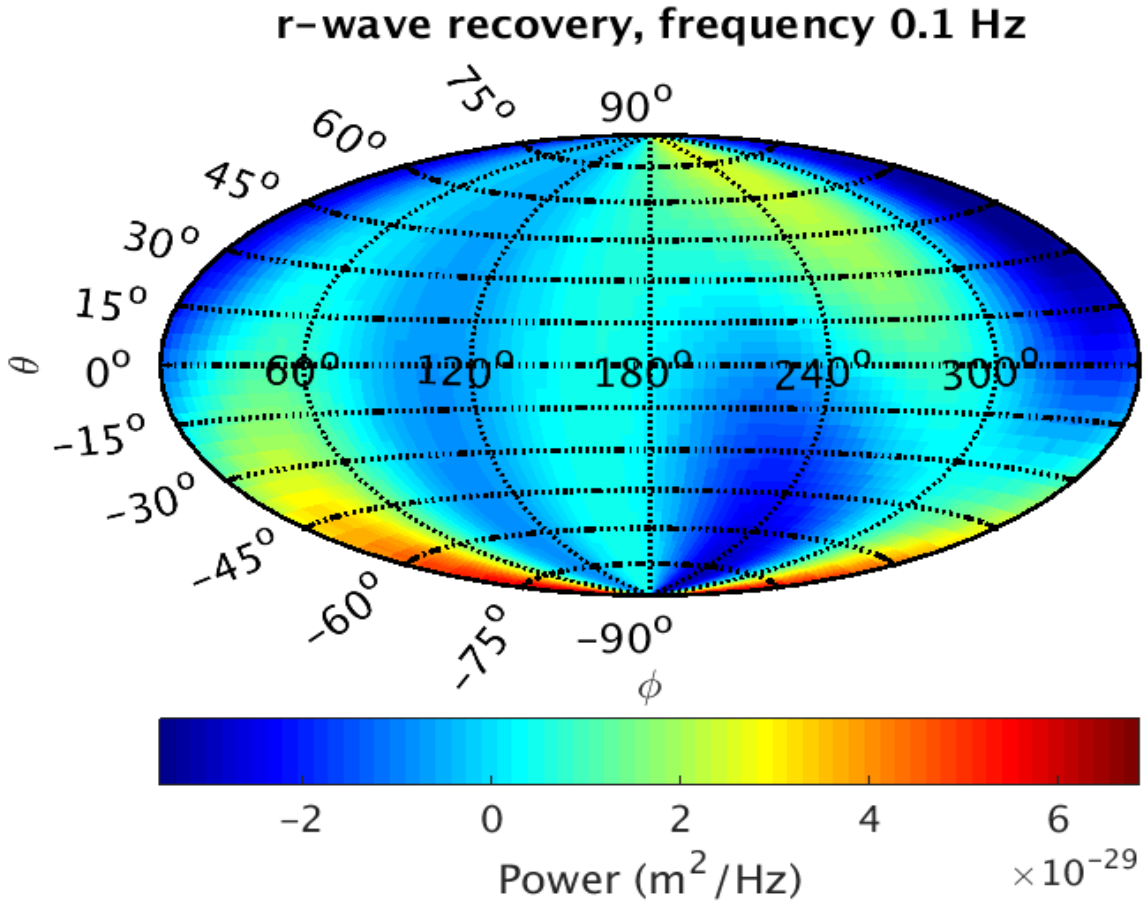
α = 15,500 m, ϵ = 0.7

v_R = 3,100 m/s



α = 100 m, ϵ = 0.7

v_R = 3,350 m/s



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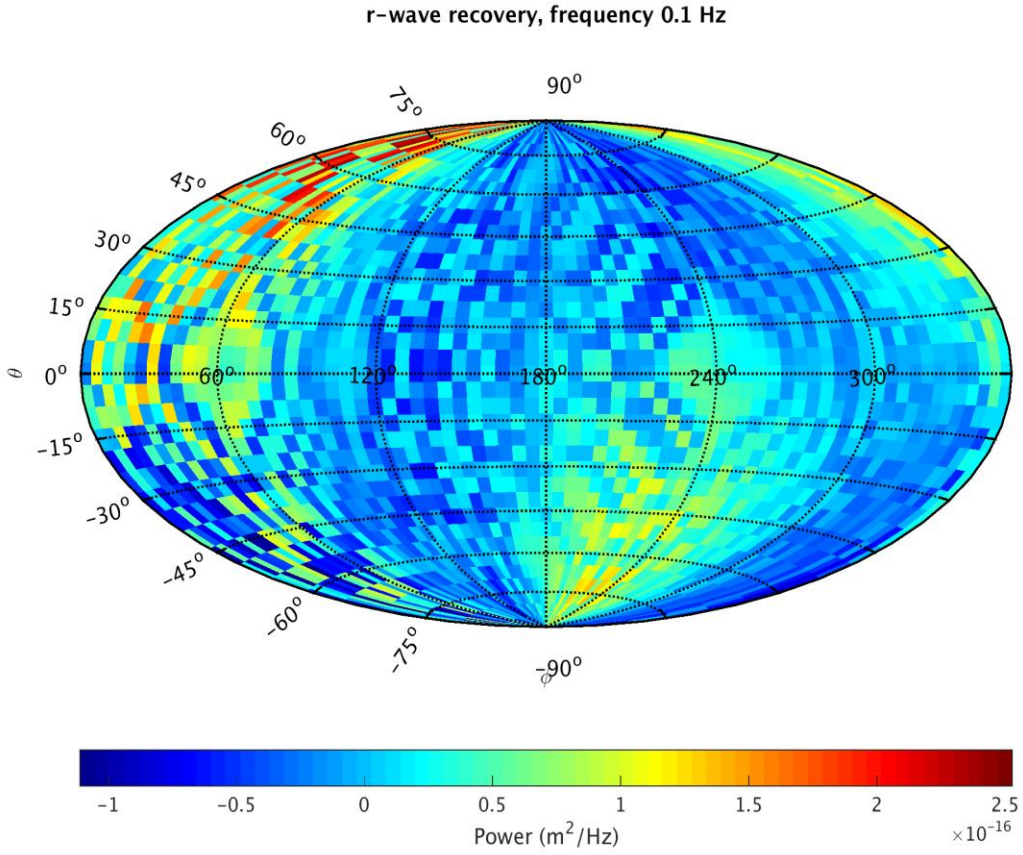
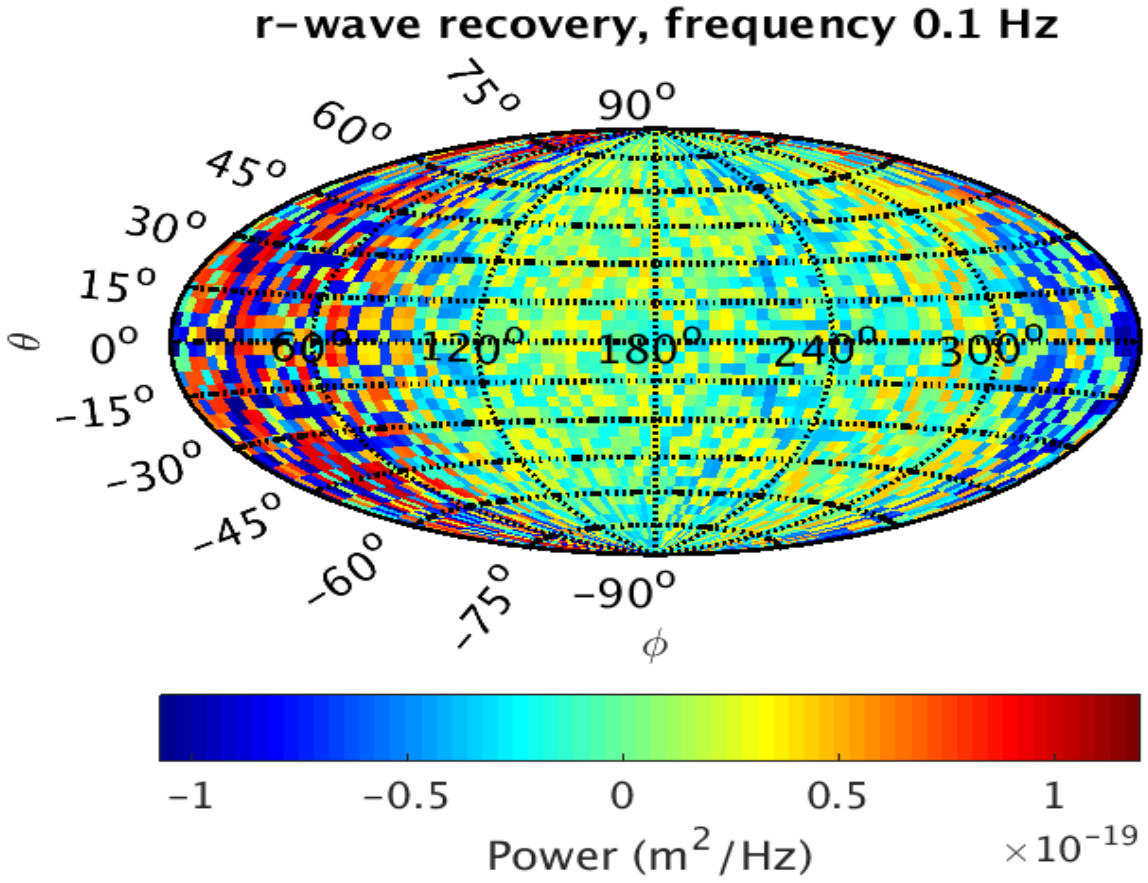


α = 250 m, ϵ = 0.7

v_R = 3,350 m/s



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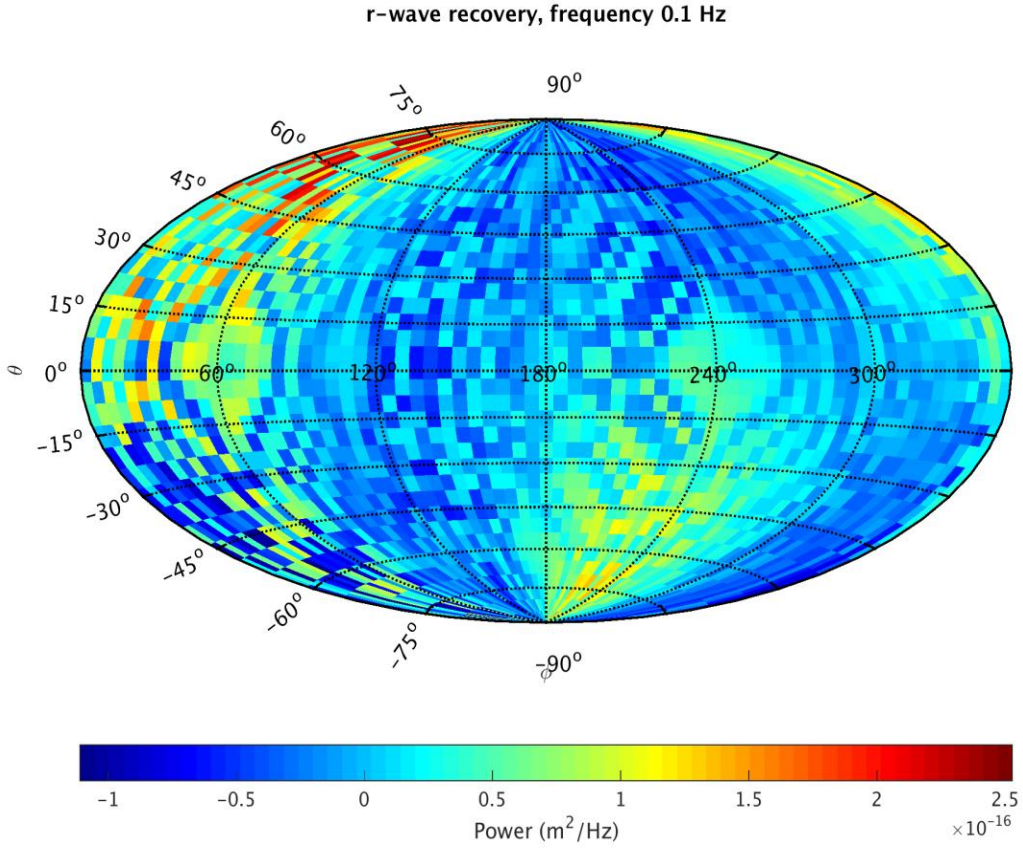
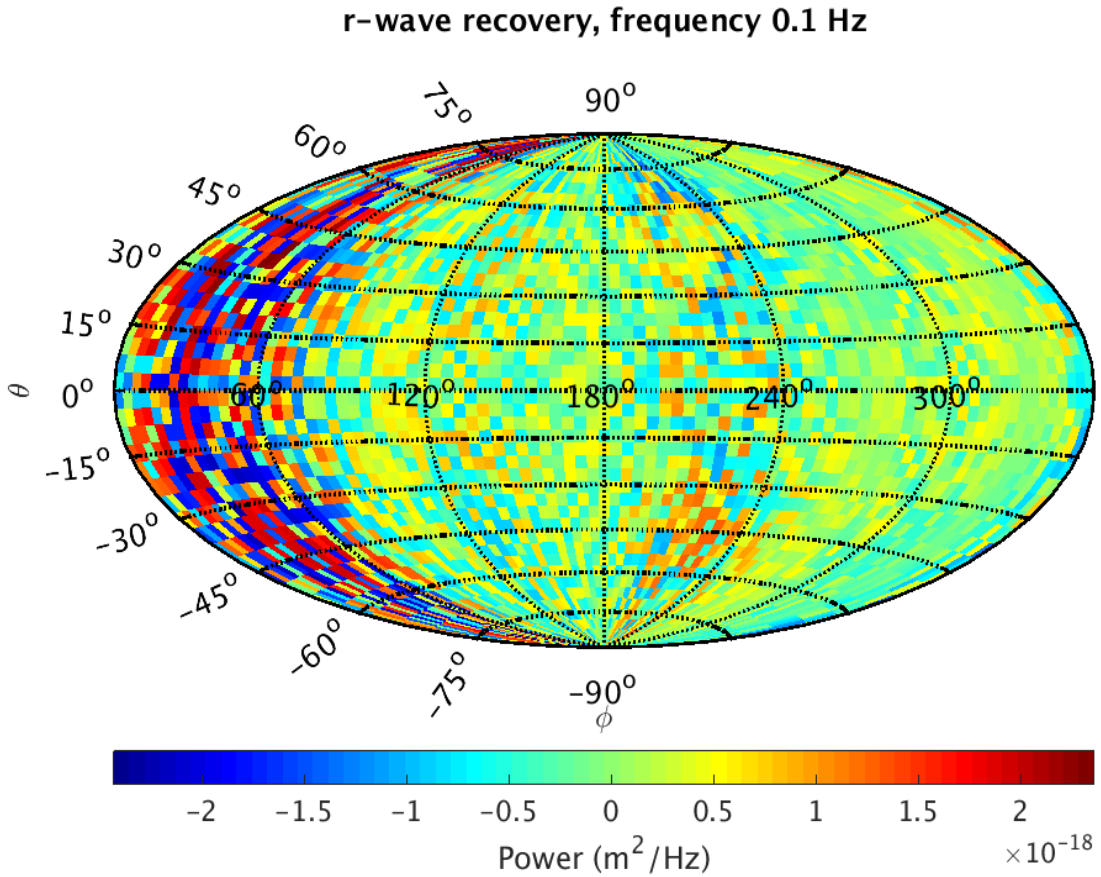


α = 400 m, ϵ = 0.7

v_R = 3,350 m/s



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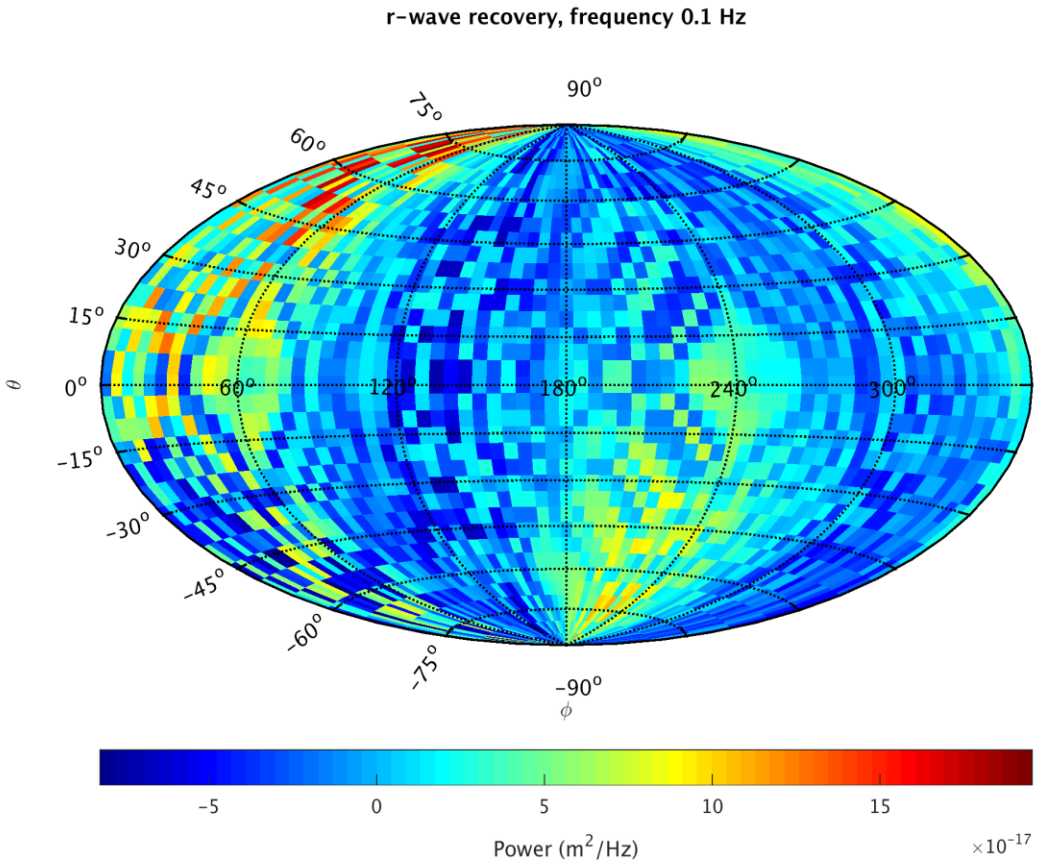
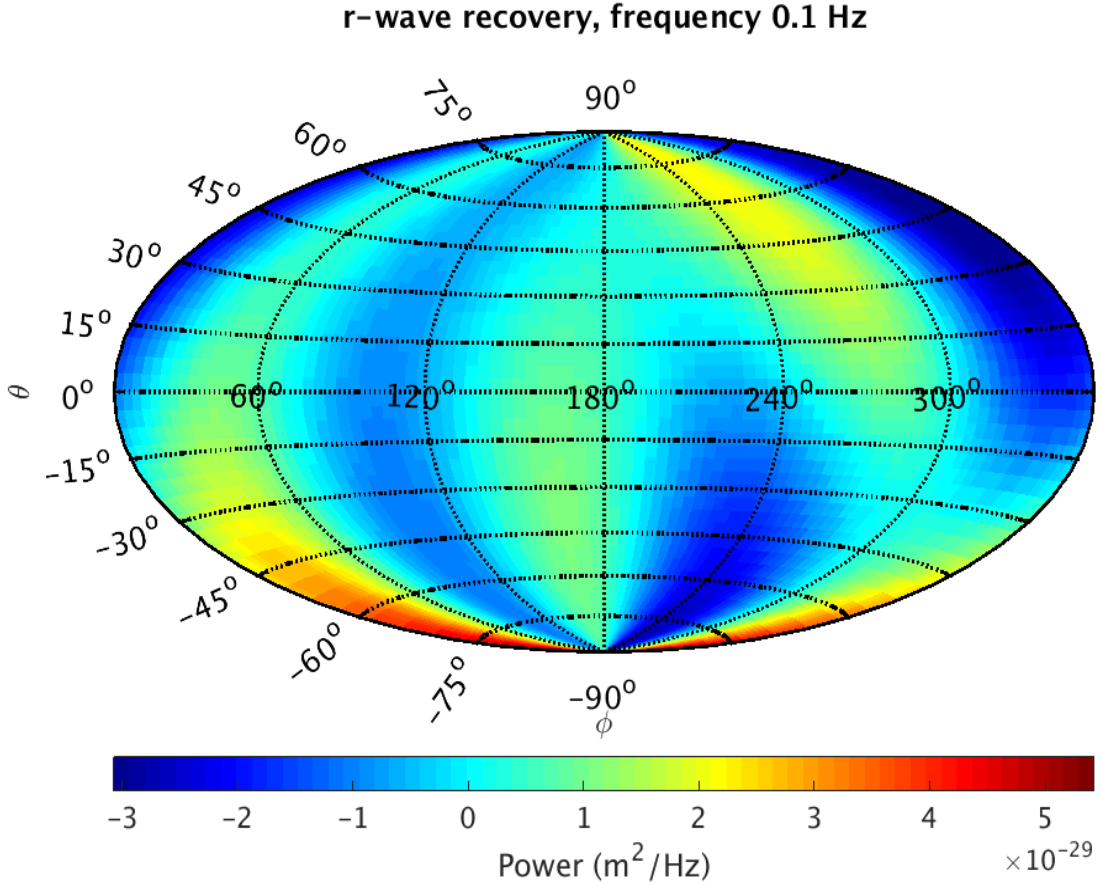


α = 100 m, ϵ = 1.0

v_R = 3,350 m/s



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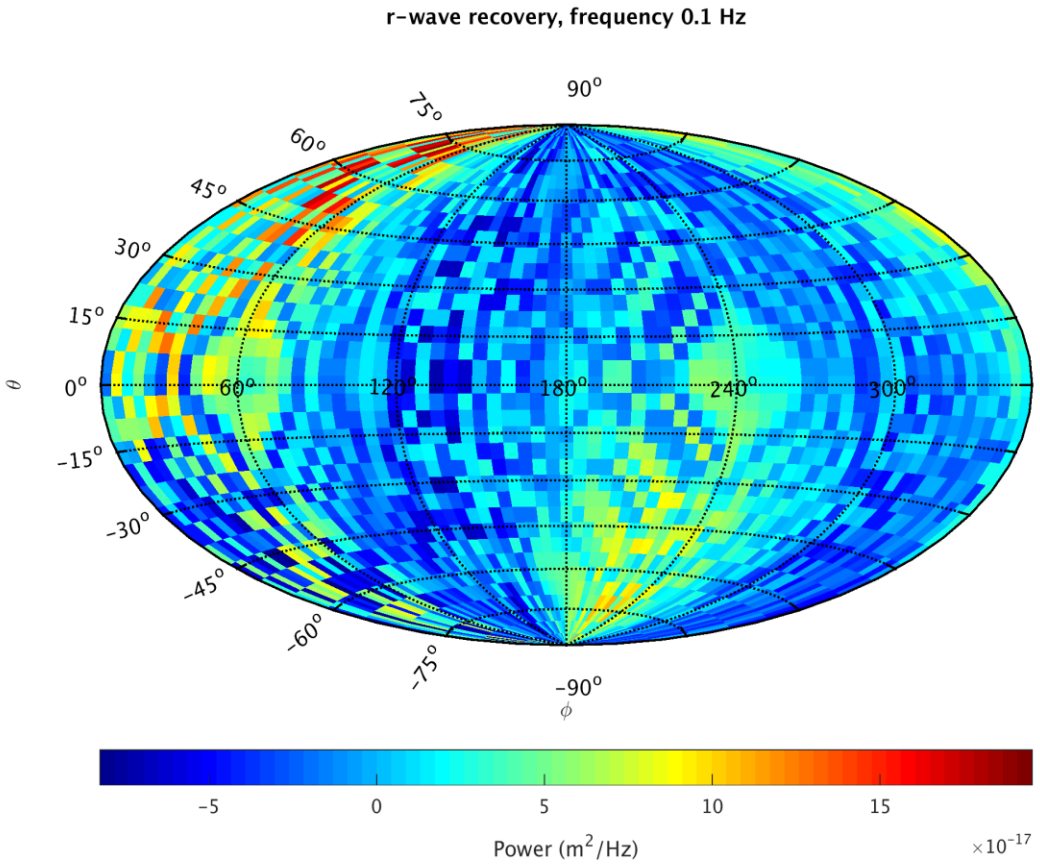
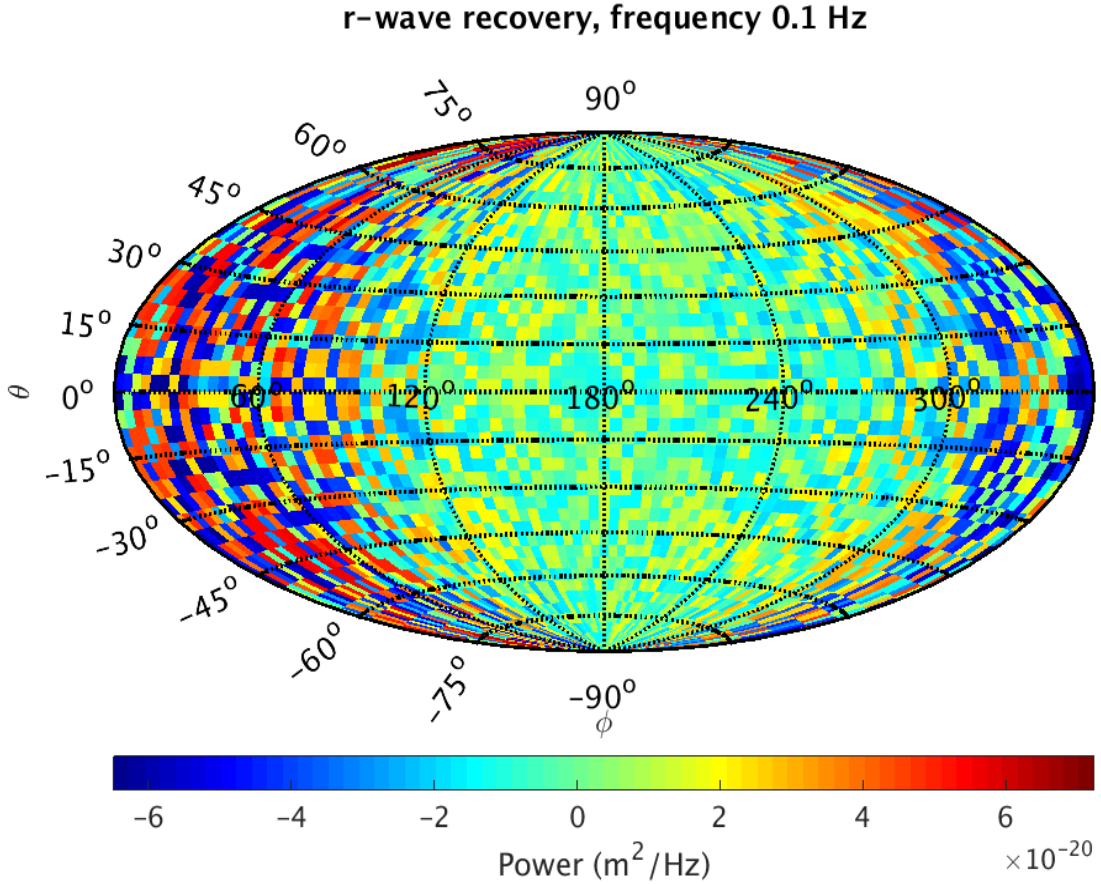


α = 250 m, ϵ = 1.0

v_R = 3,350 m/s



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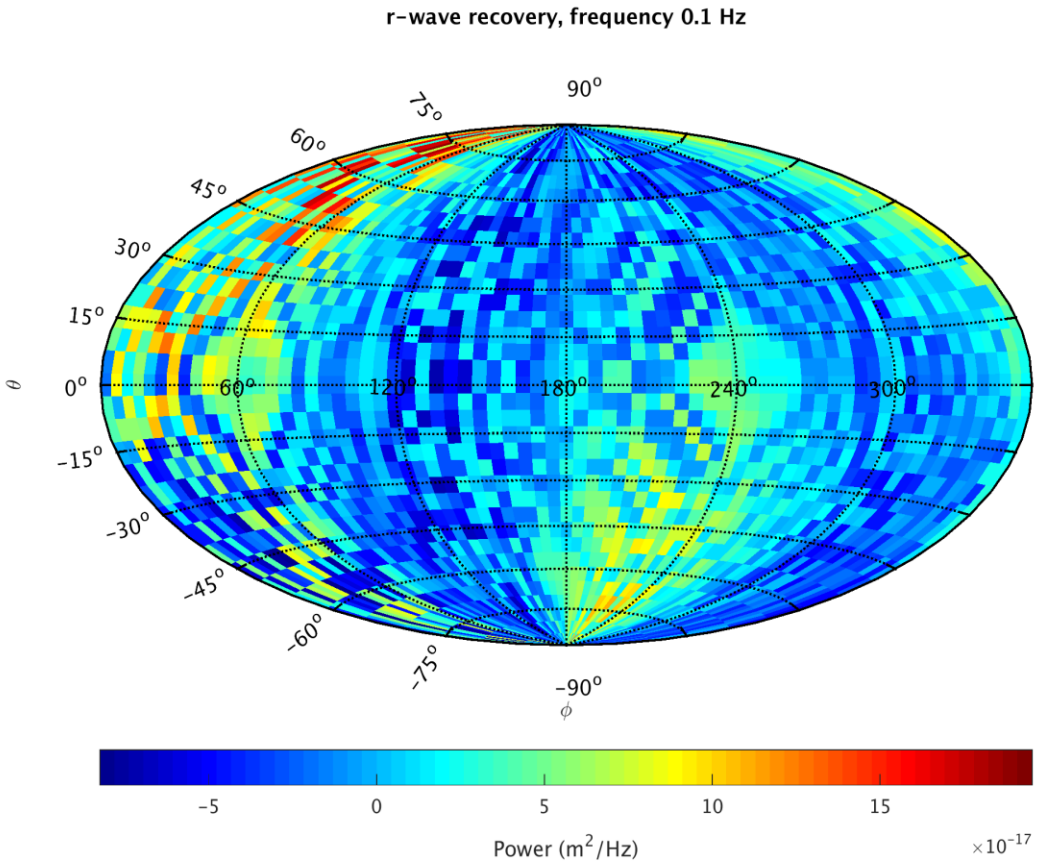
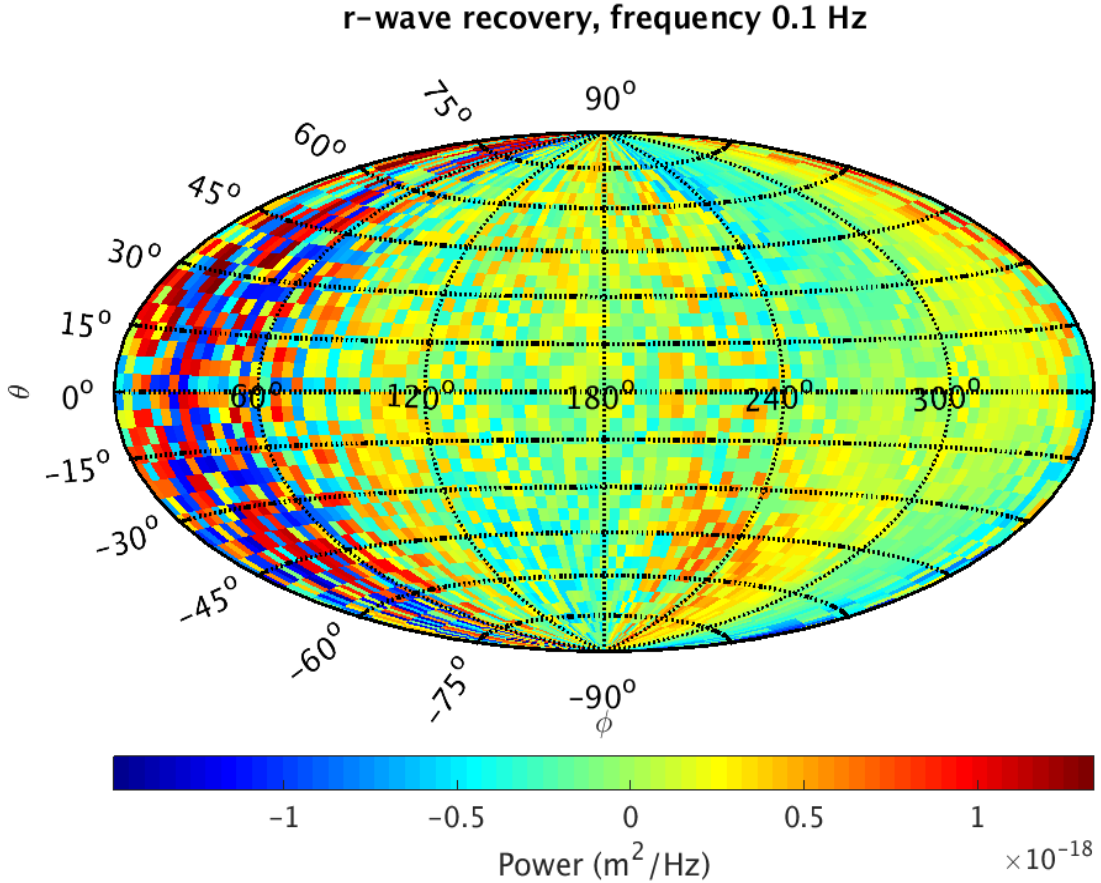
v_R = 3,100 m/s



α = 400 m, ϵ = 1.0

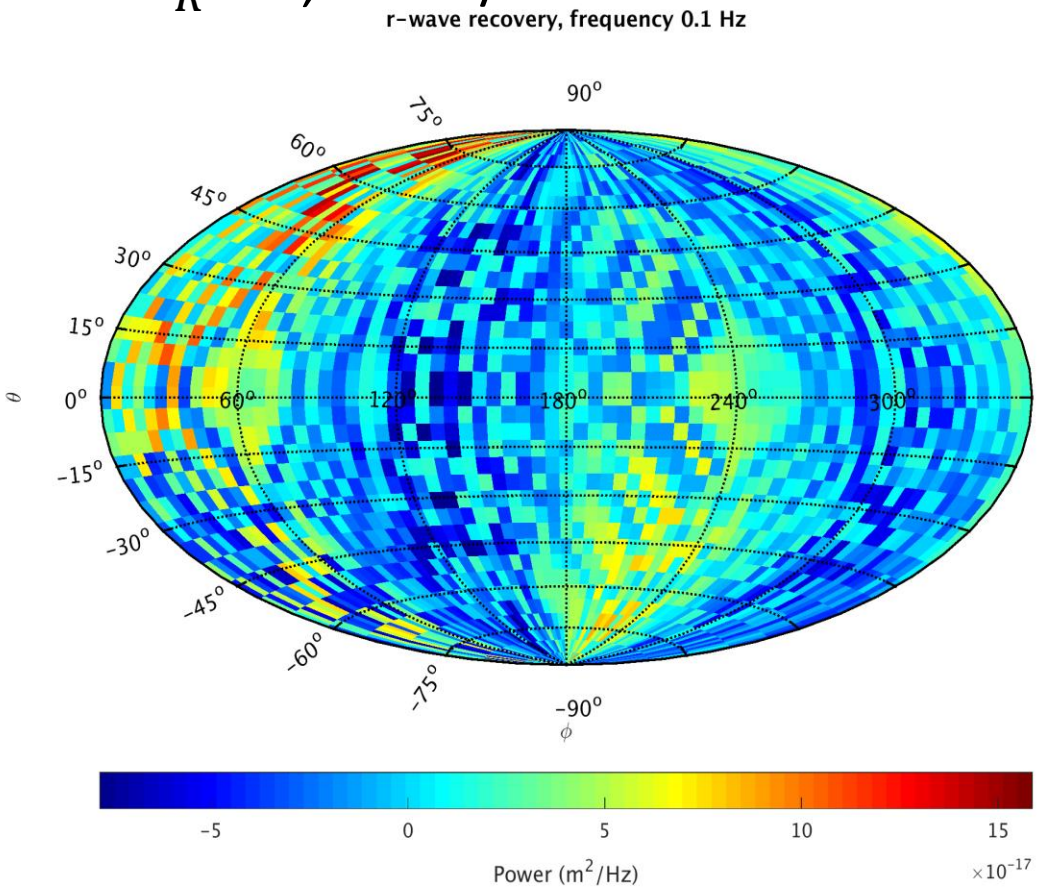
v_R = 3,350 m/s



Recovery Frequency: 0.1 Hz

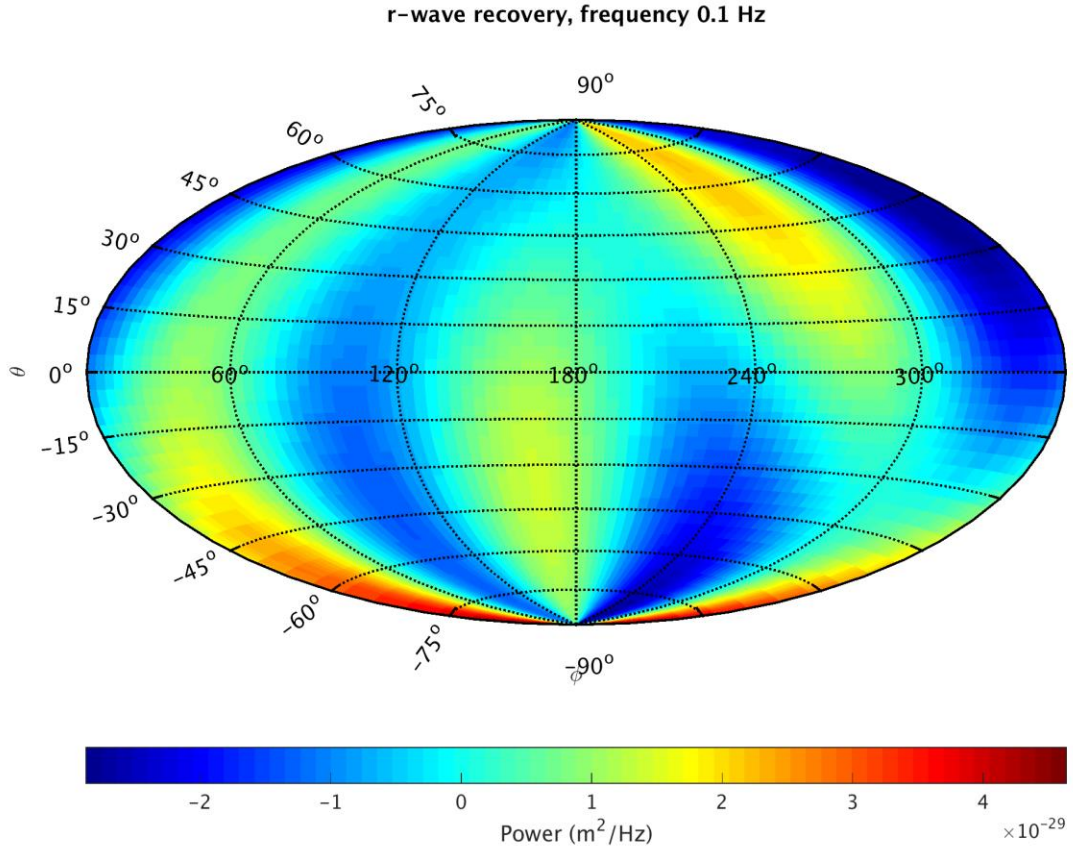
α = 15,500 m, ϵ = 1.3

v_R = 3,100 m/s



α = 100 m, ϵ = 1.3

v_R = 3,350 m/s



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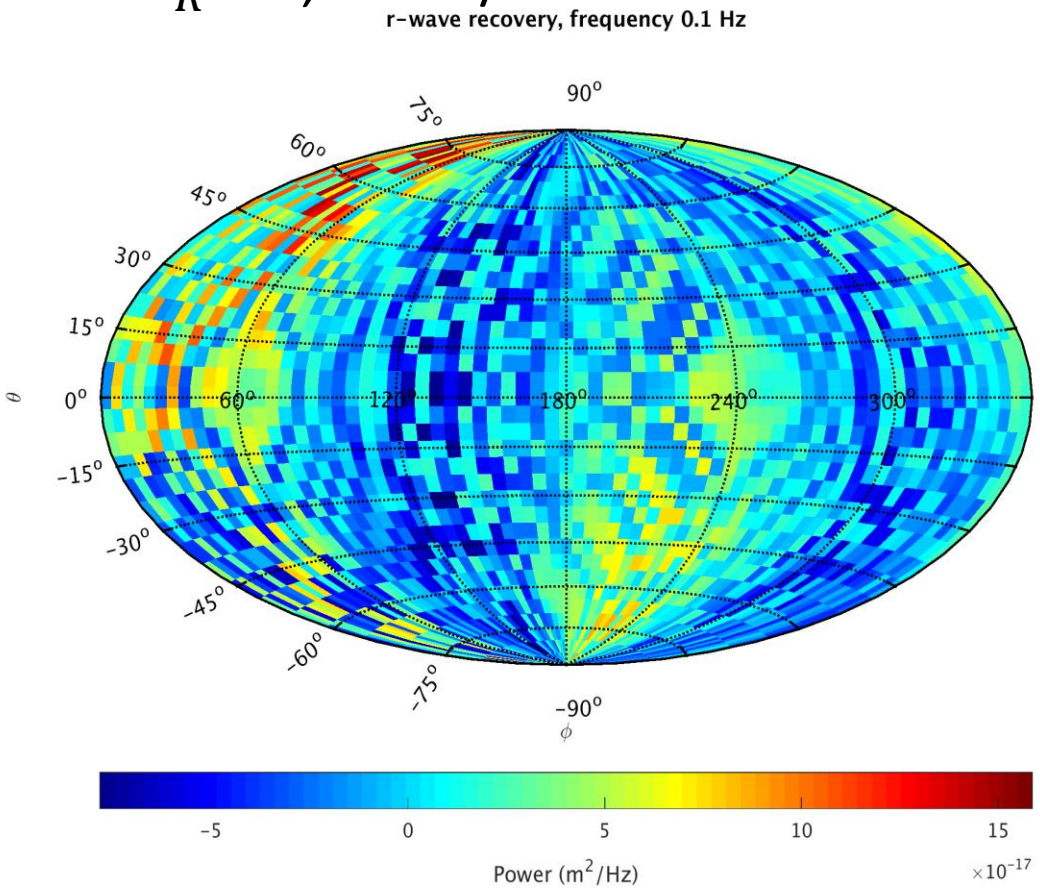
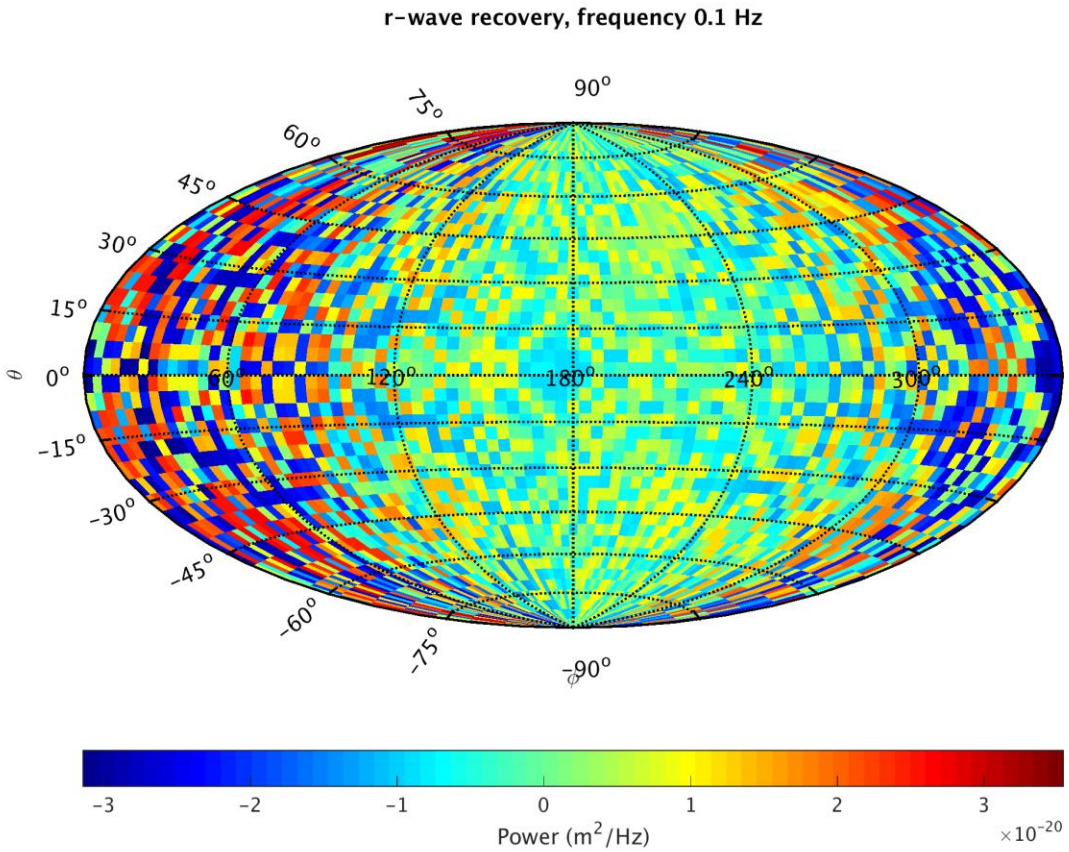


α = 250 m ϵ = 1.3



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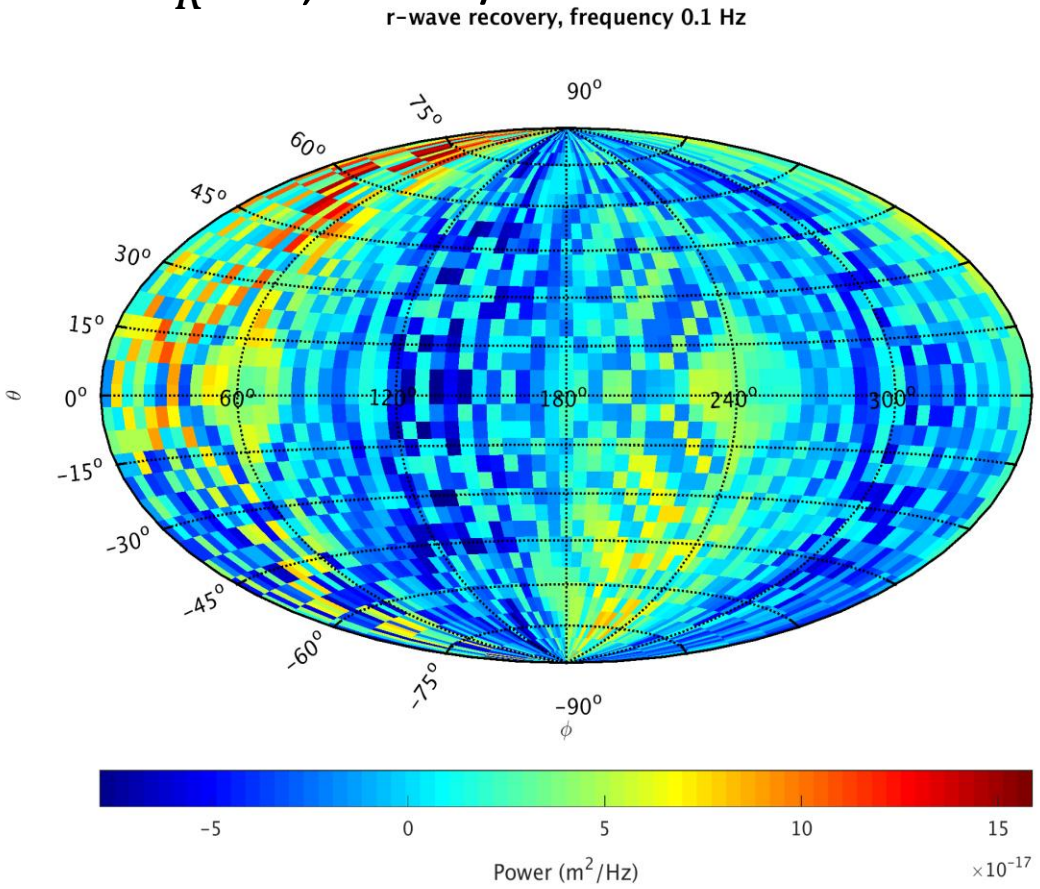
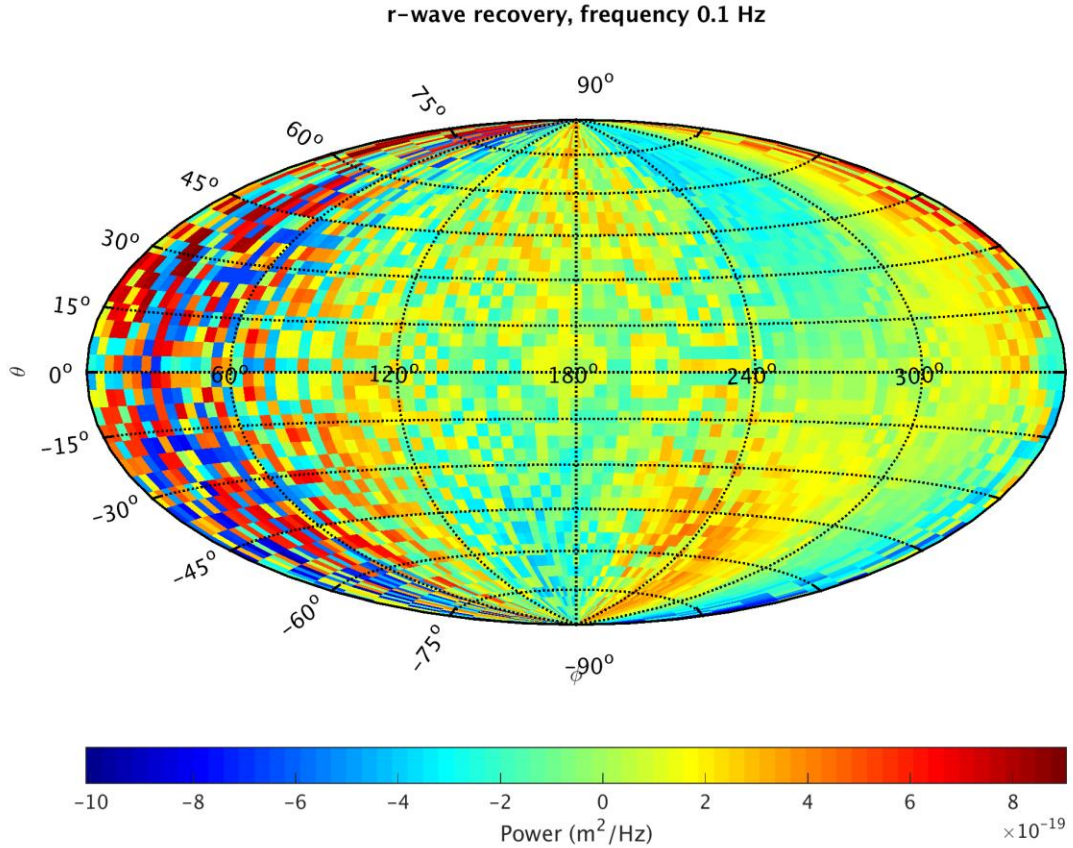


α = 400 m, ϵ = 1.3

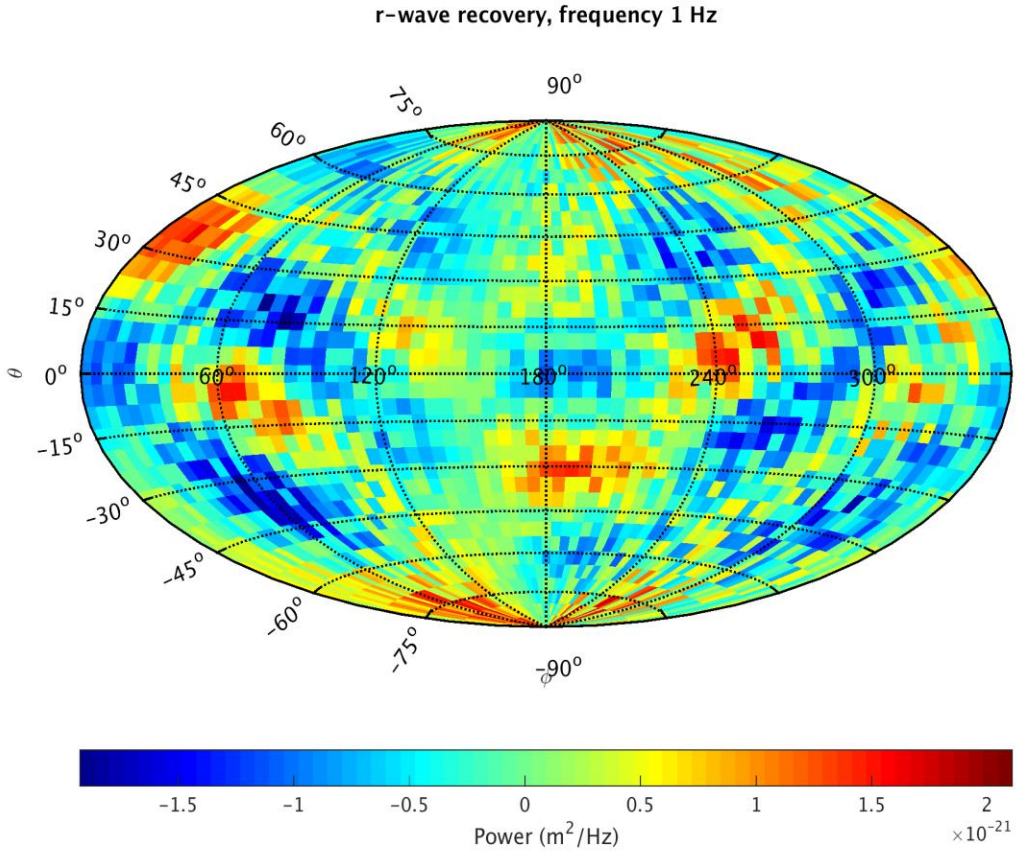
v_R = 3,350 m/s



Recovery Frequency: 1 Hz

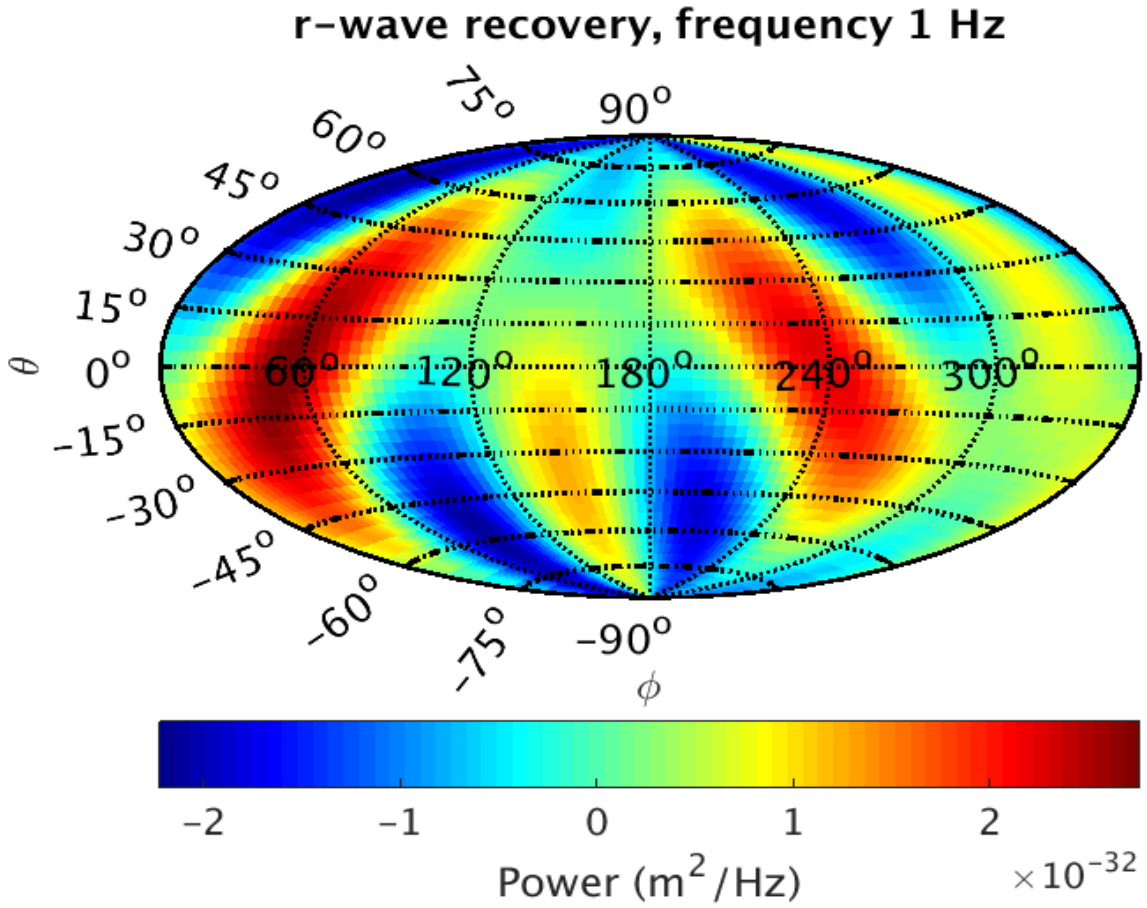
α = 650 m, ϵ = 0.7

v_R = 1,300 m/s



α = 100 m, ϵ = 0.7

v_R = 3,350 m/s



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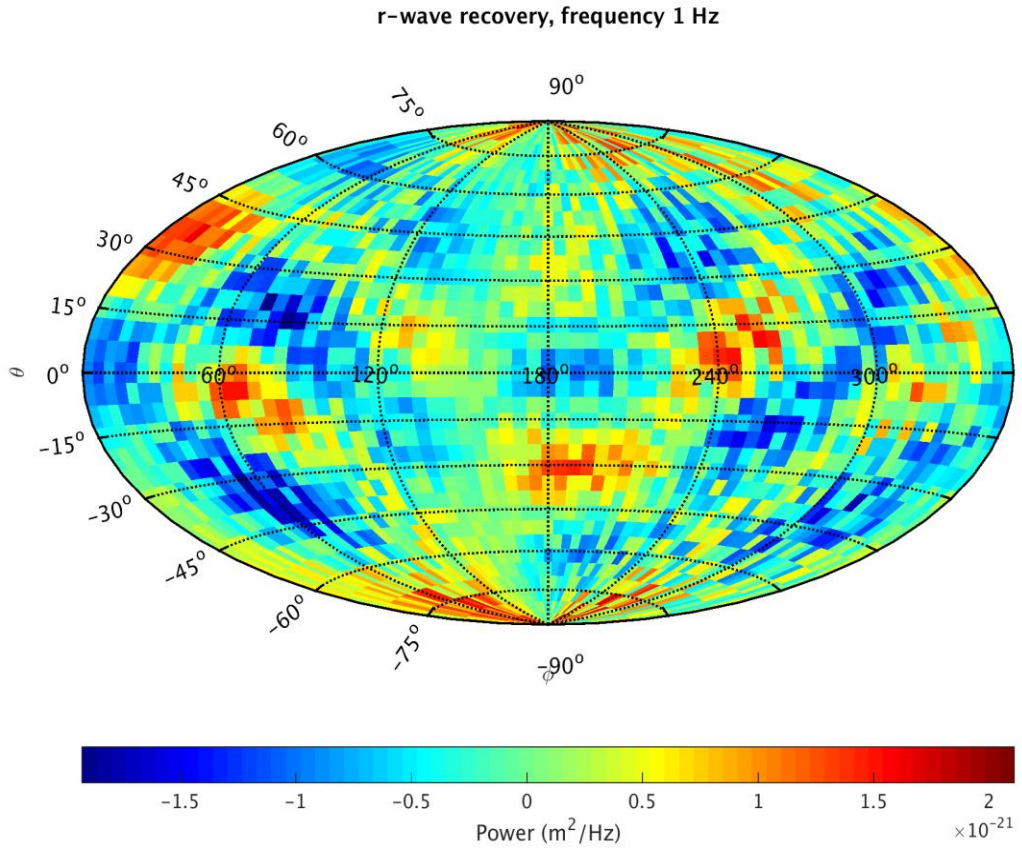

α = 250 m, ϵ = 0.7

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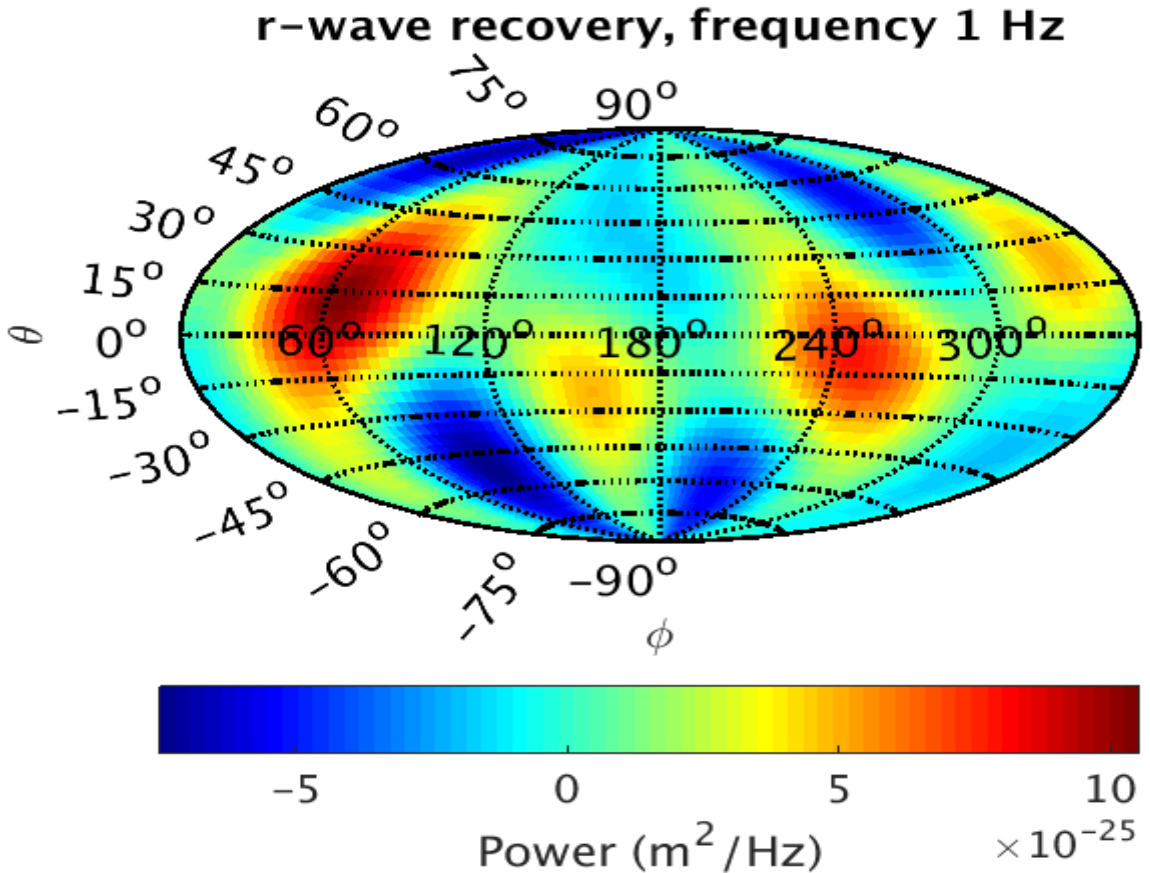

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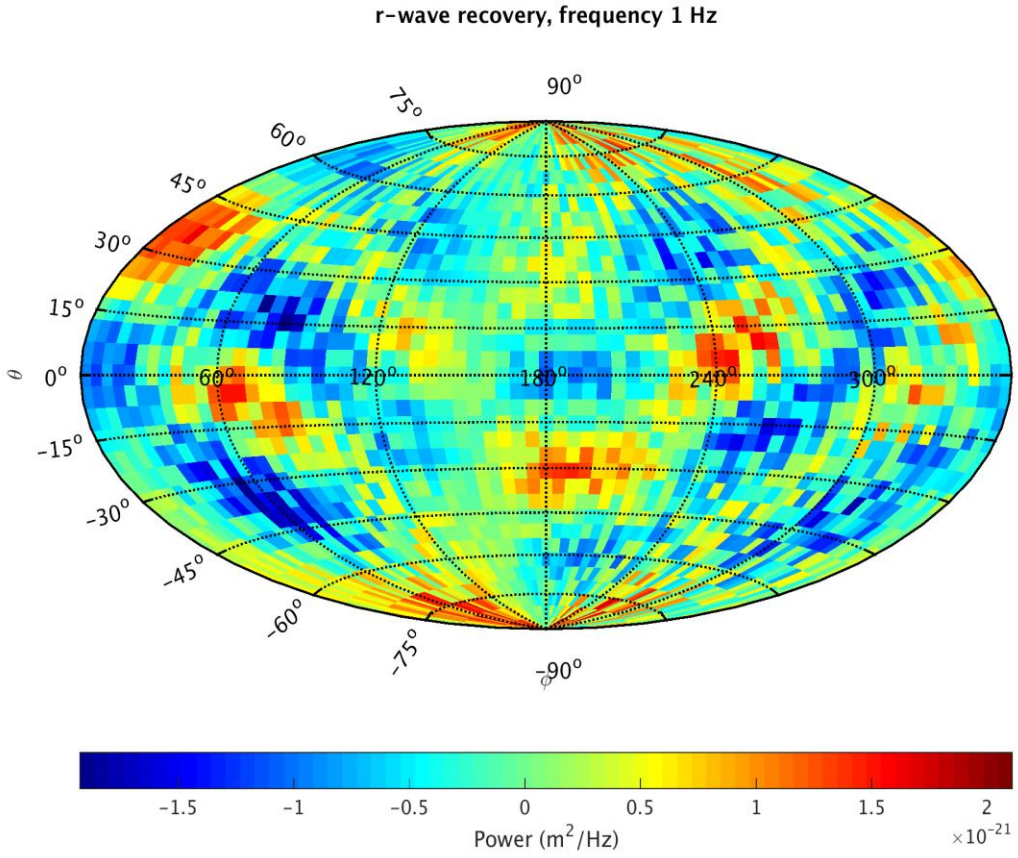

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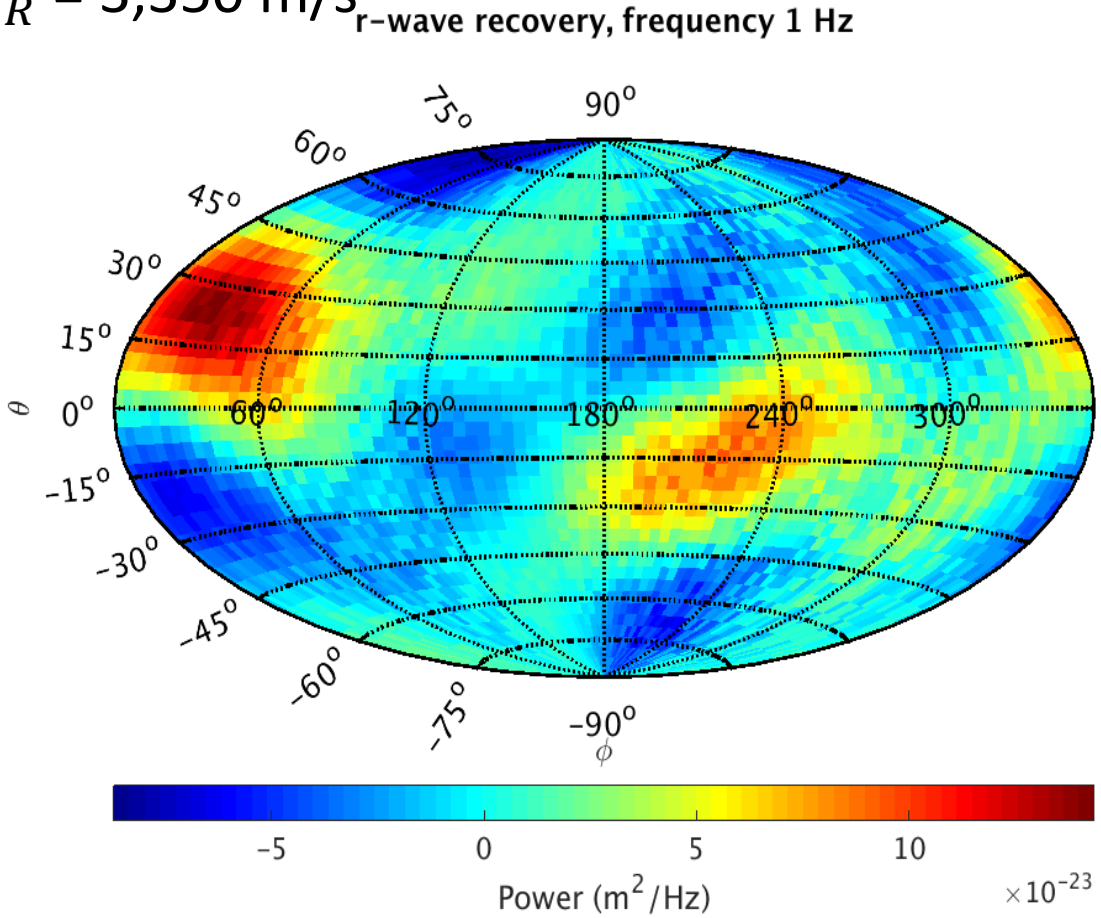
v_R = 3,350 m/s



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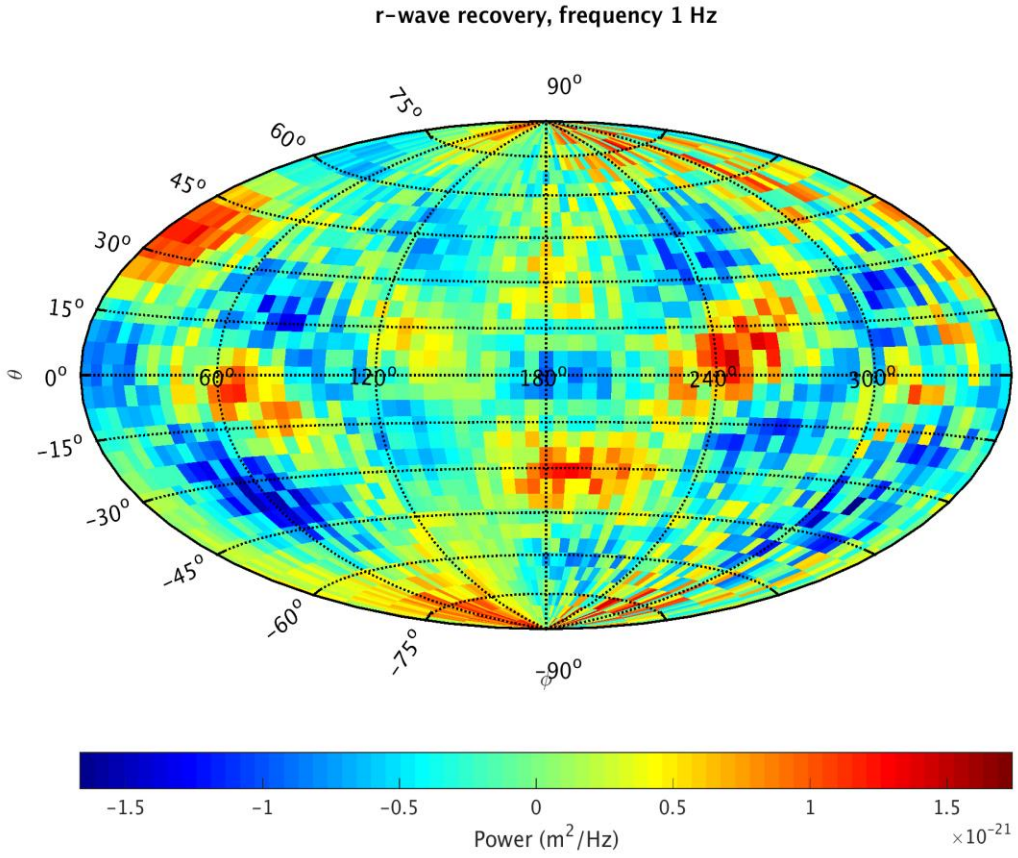

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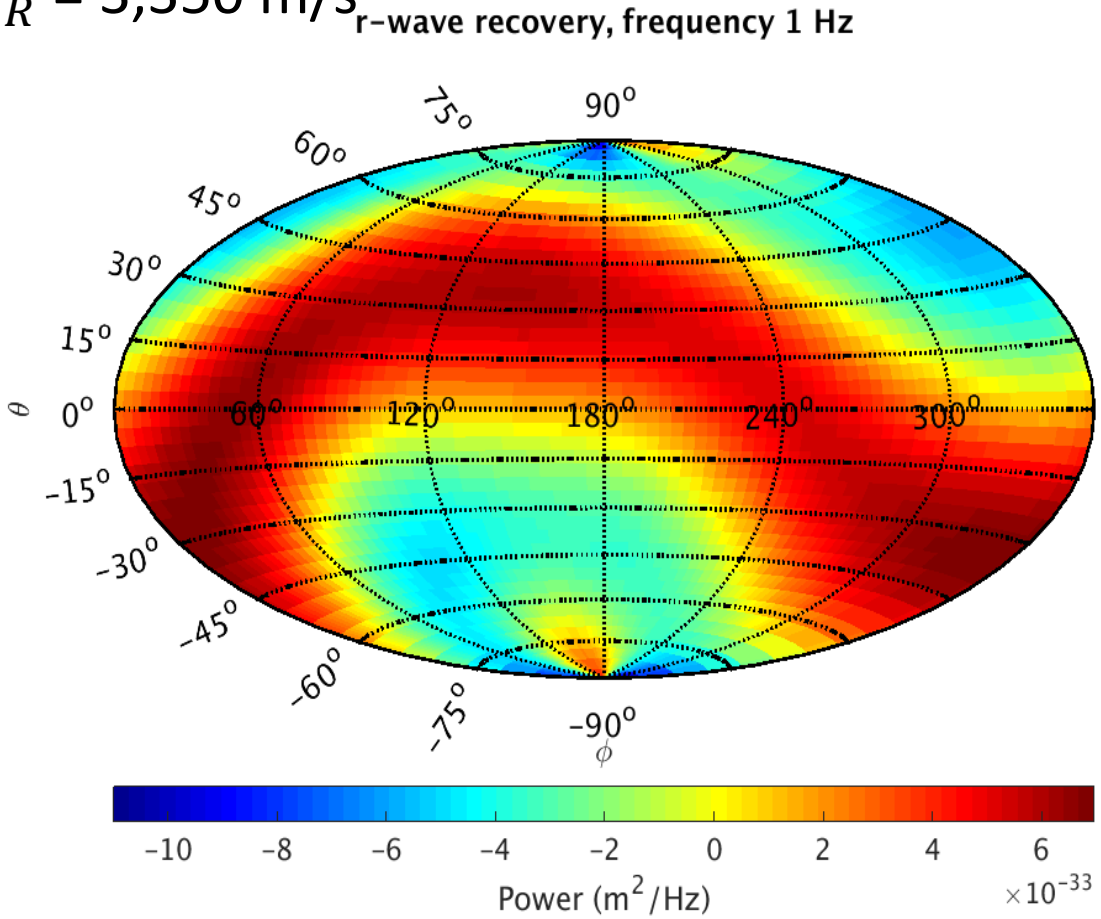

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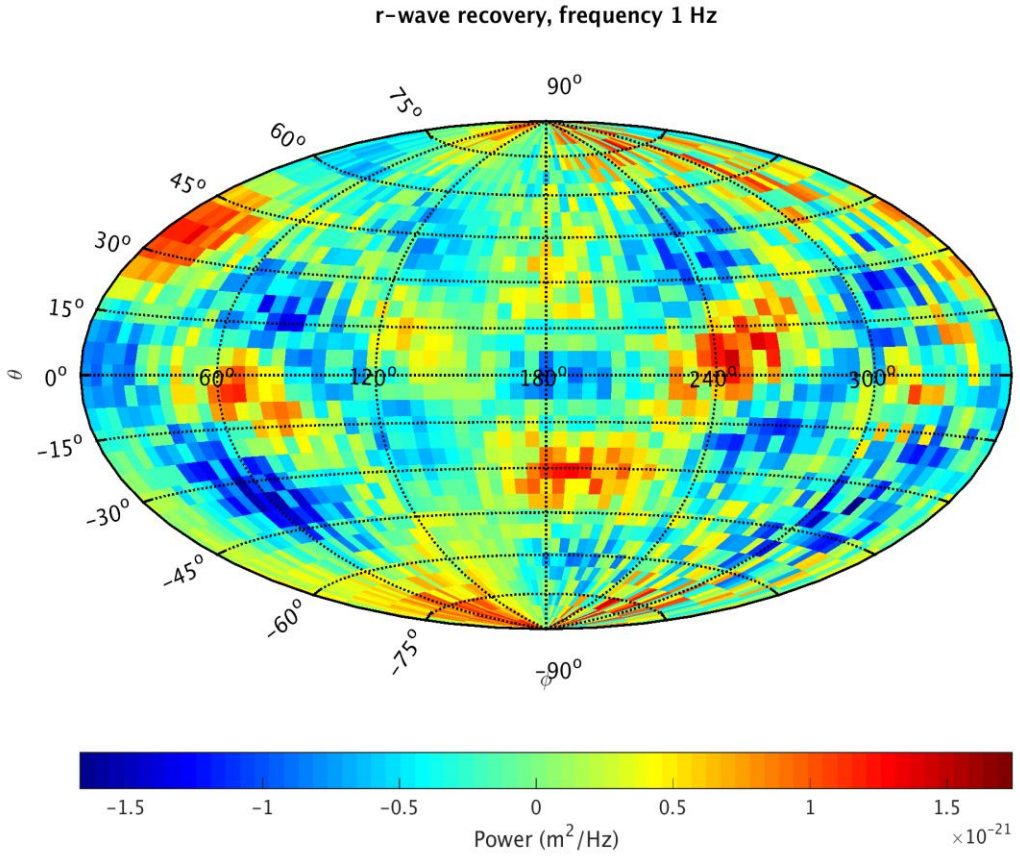

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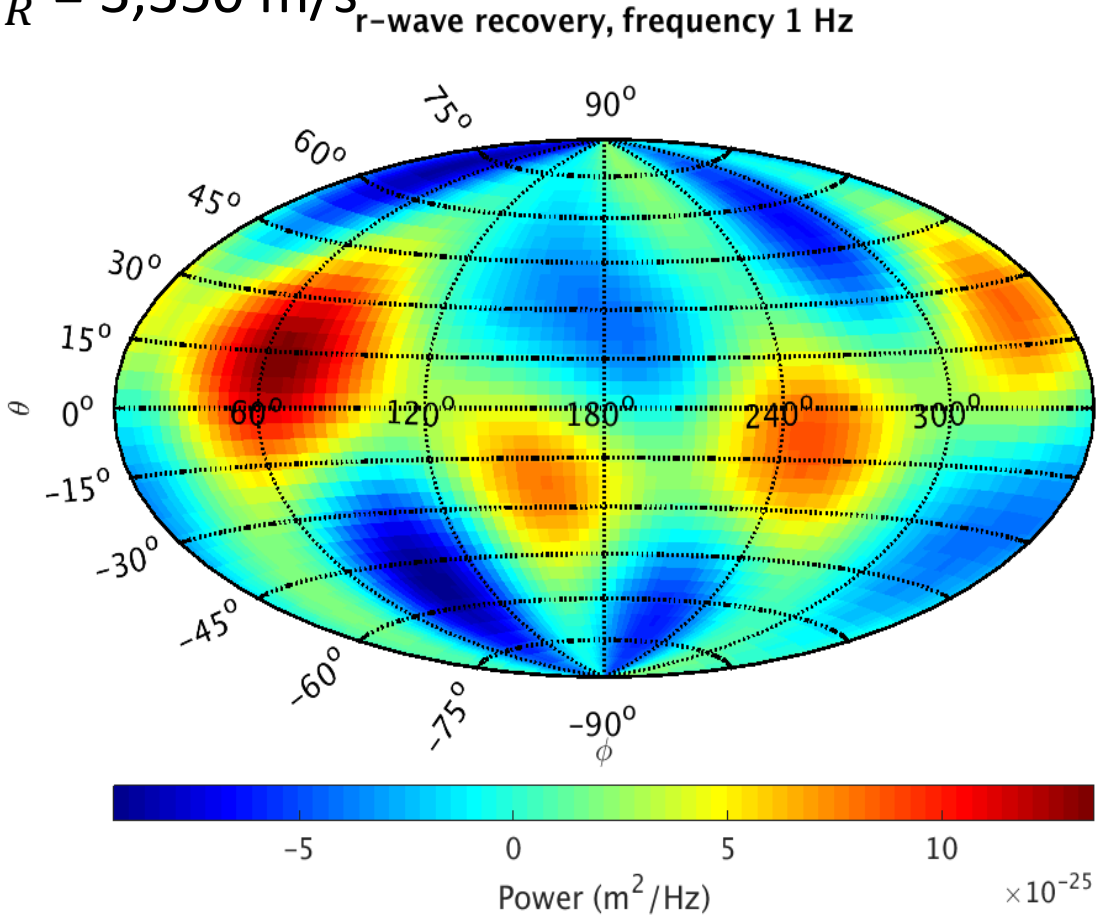

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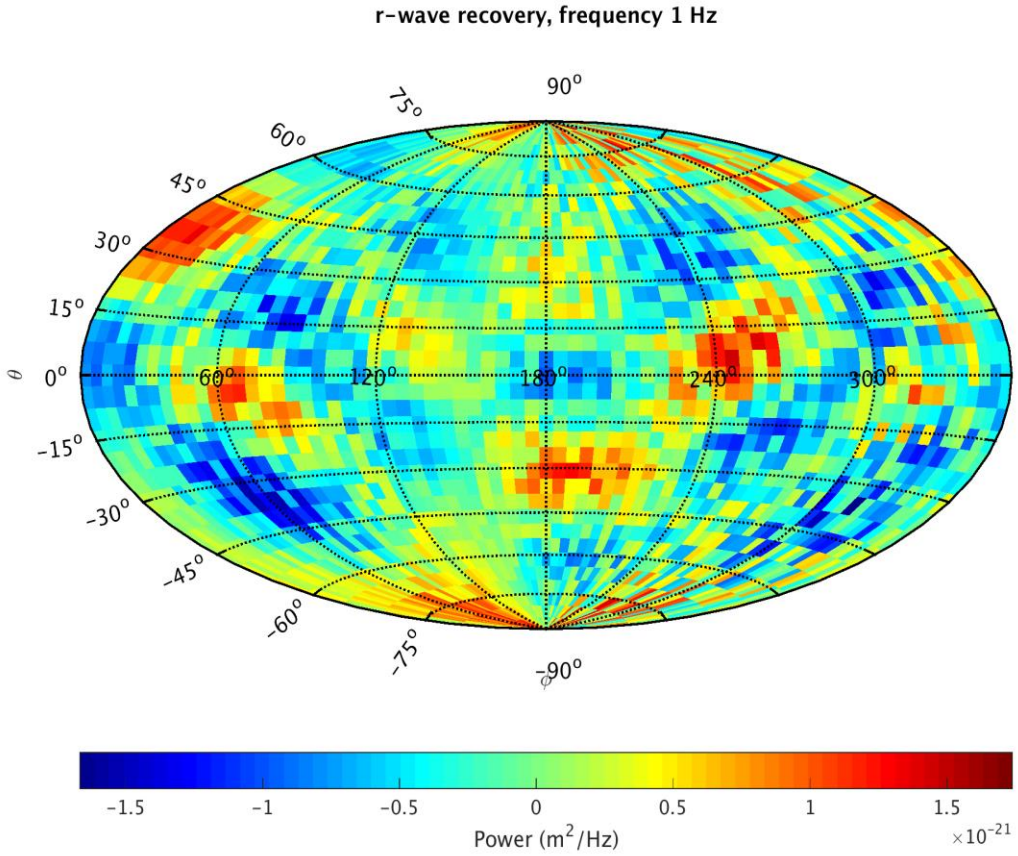

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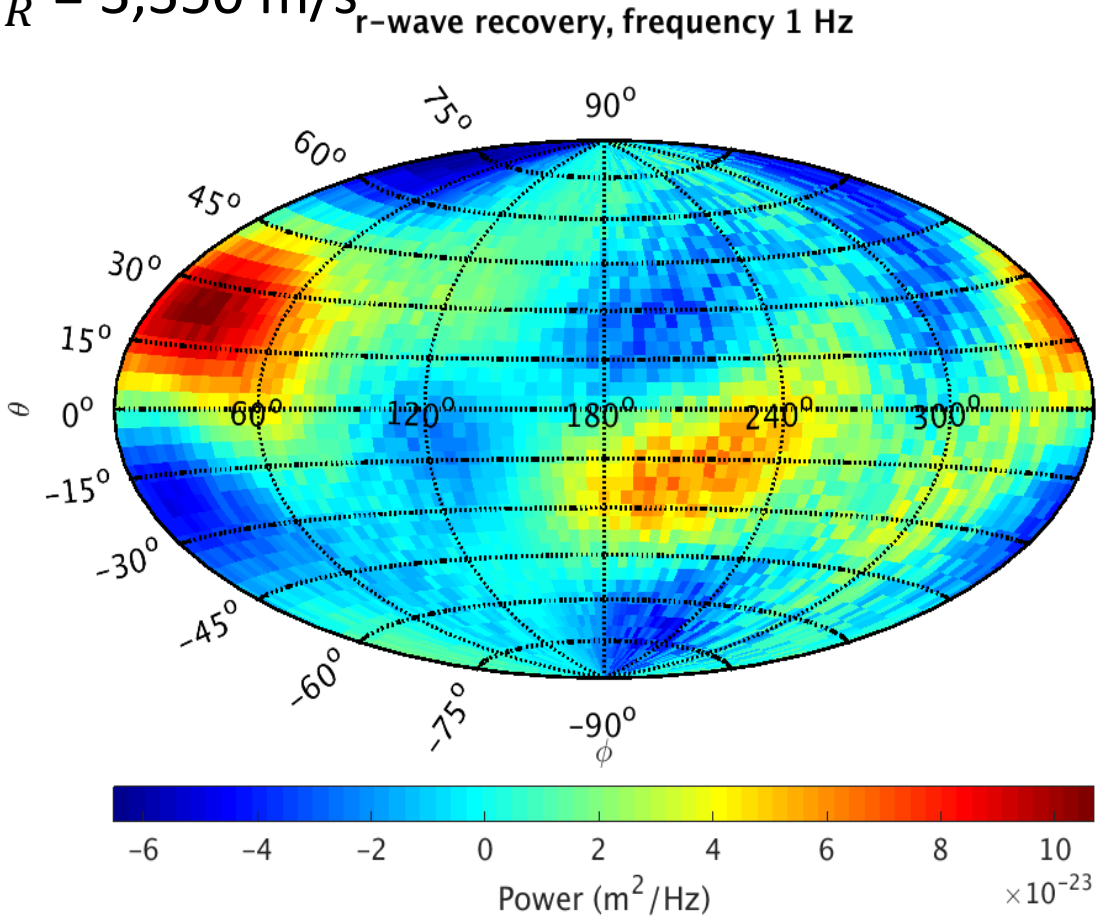

Recovery Frequency: 1 Hz

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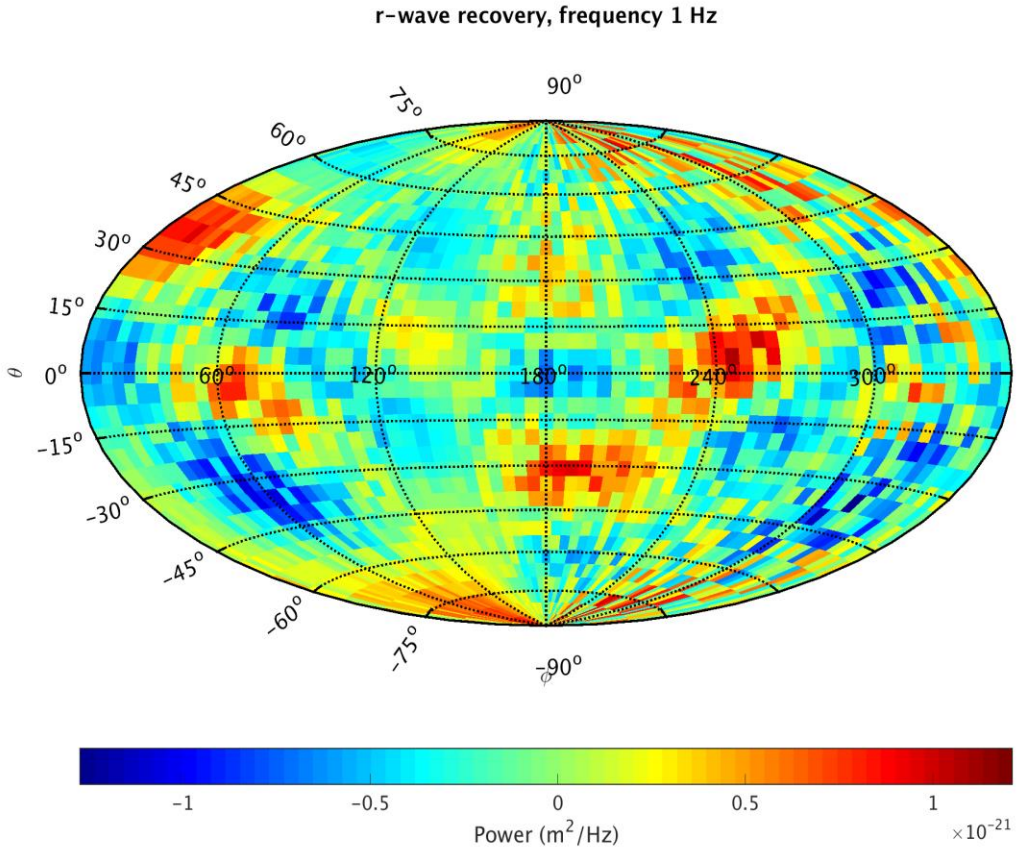
v_R = 1,300 m/s



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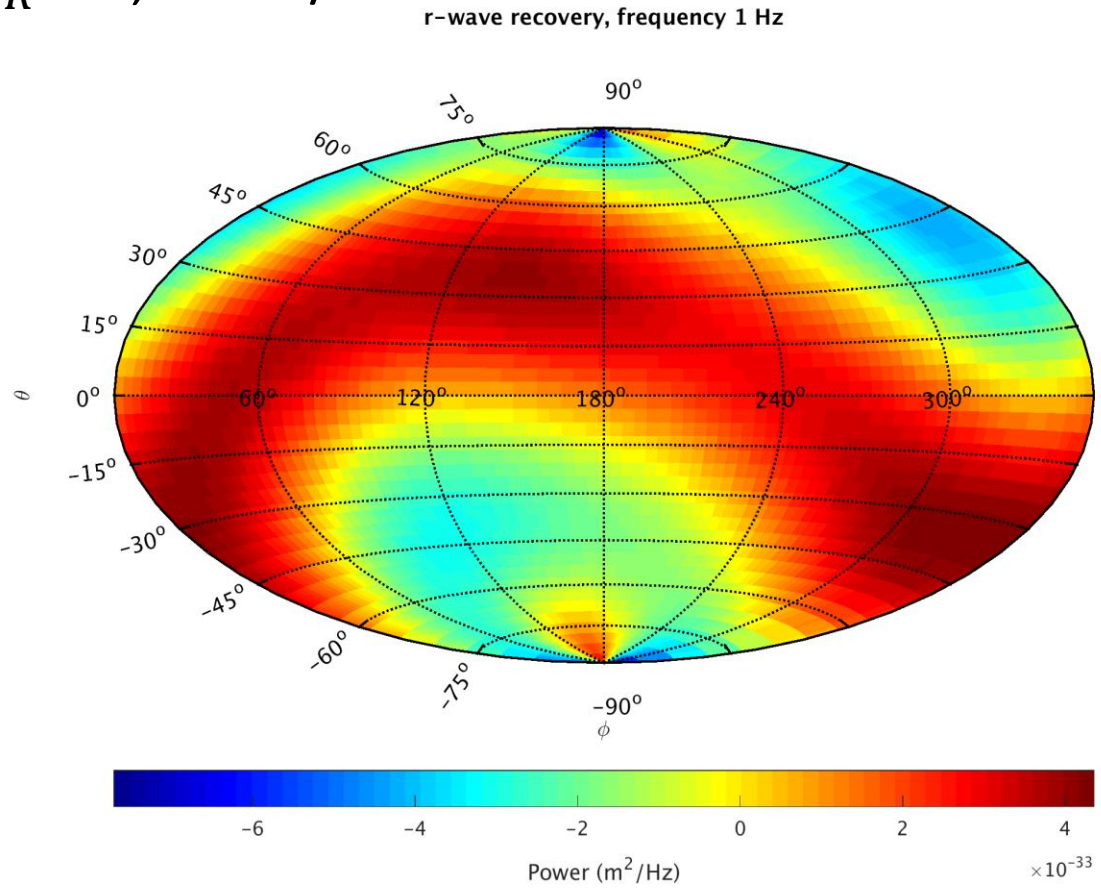
v_R = 3,350 m/s



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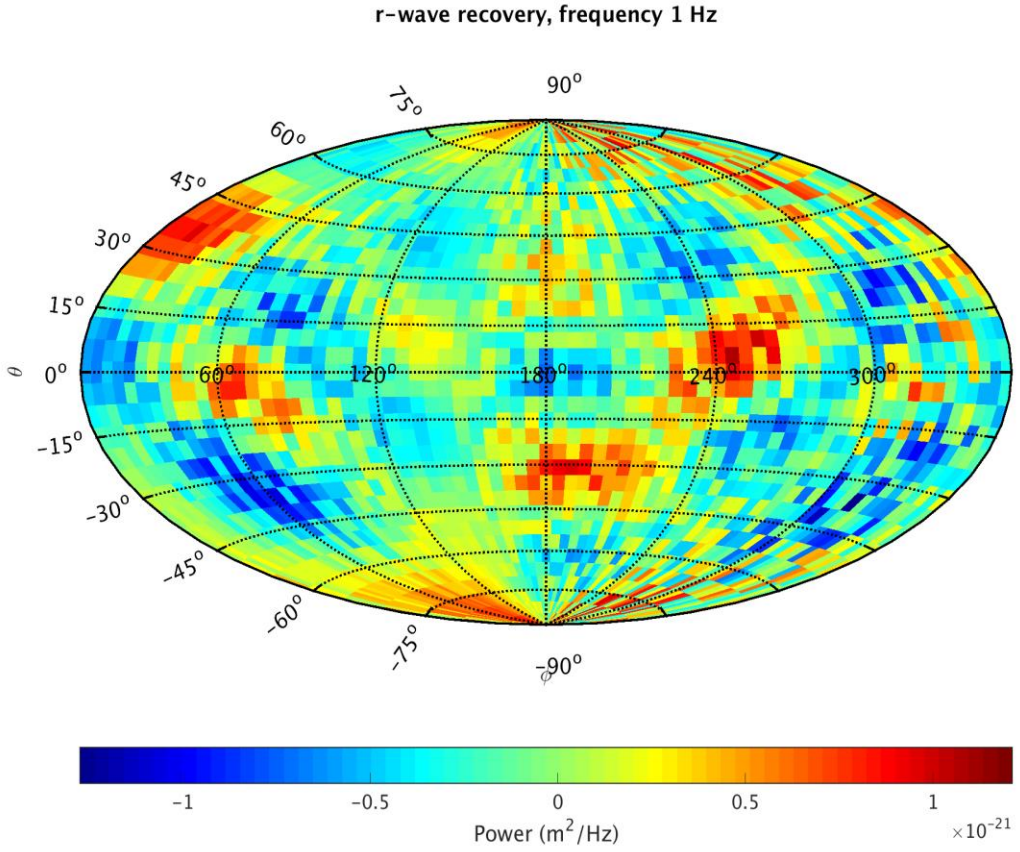
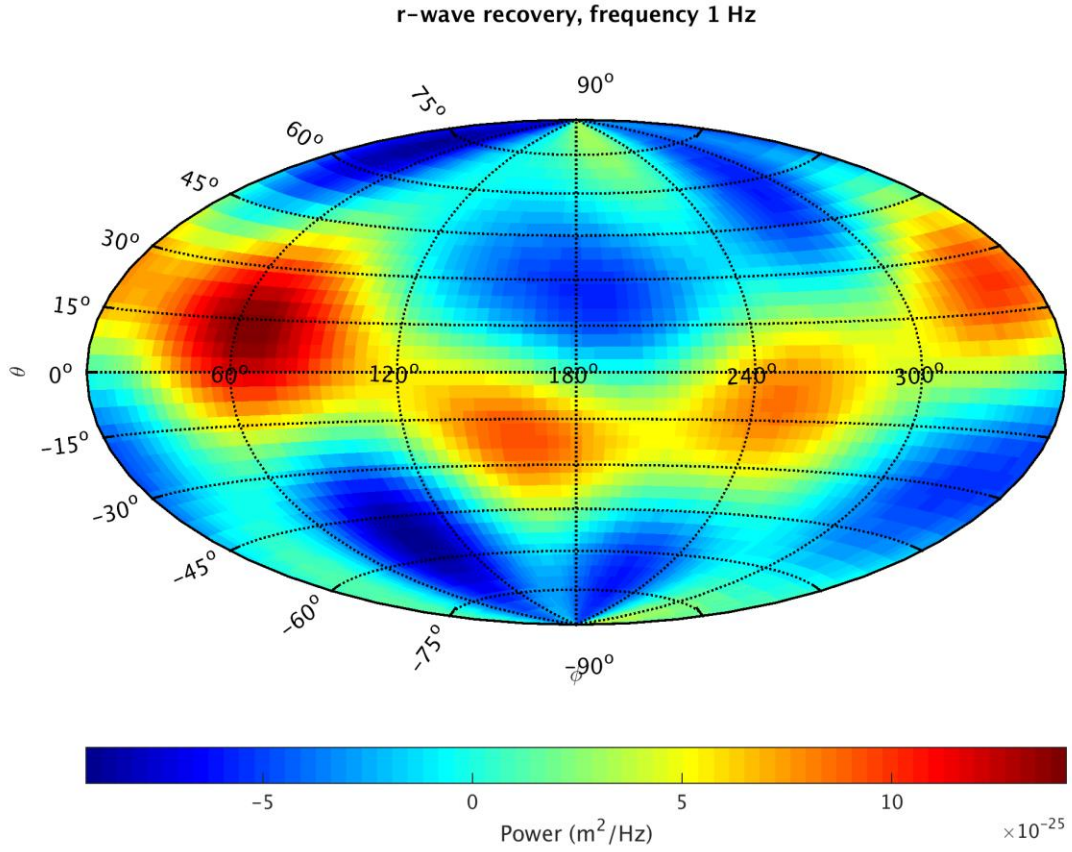


α = 250 m, ϵ = 1.3

v_R = 3,350 m/s



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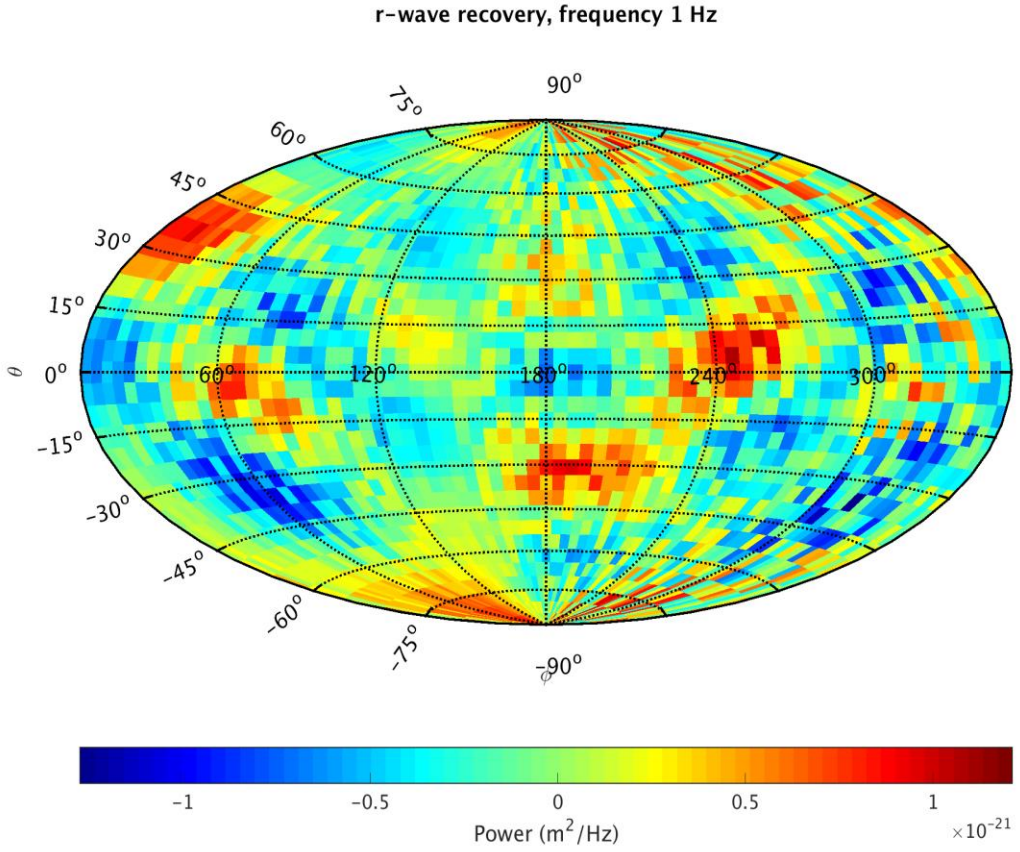
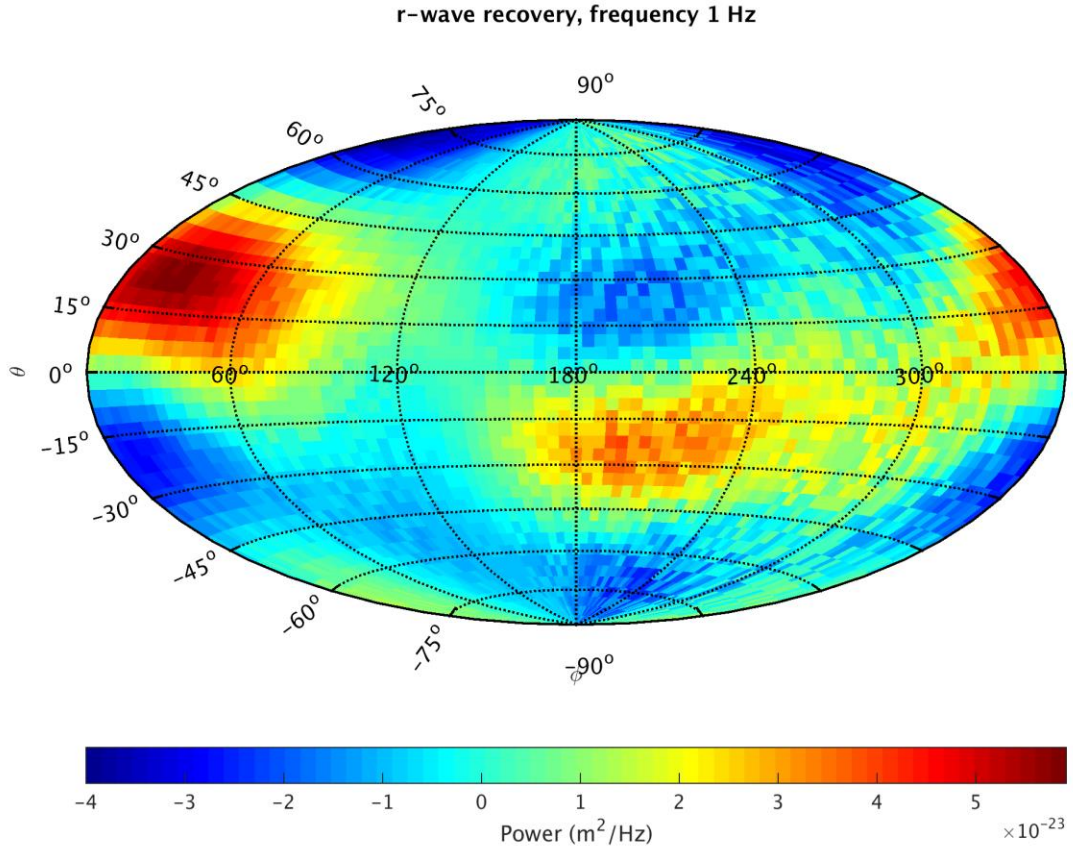
v_R = 1,300 m/s



α = 400 m, ϵ = 1.3

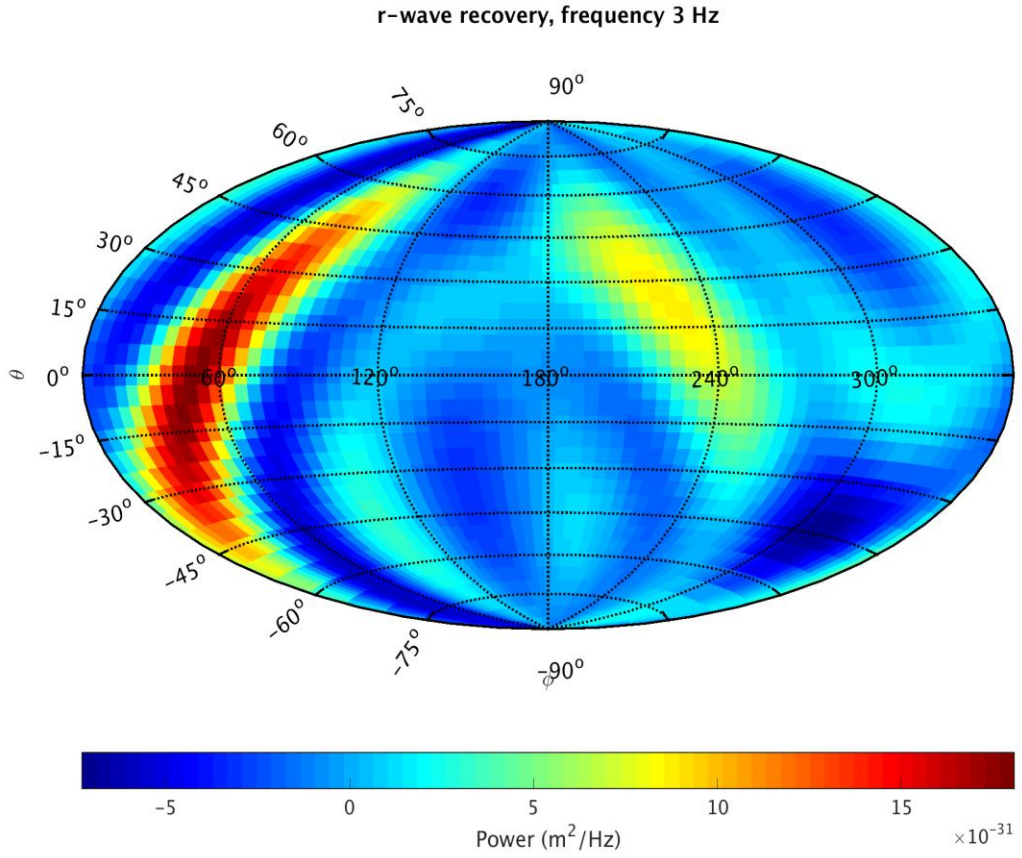
v_R = 3,350 m/s



Recovery Frequency: 3 Hz

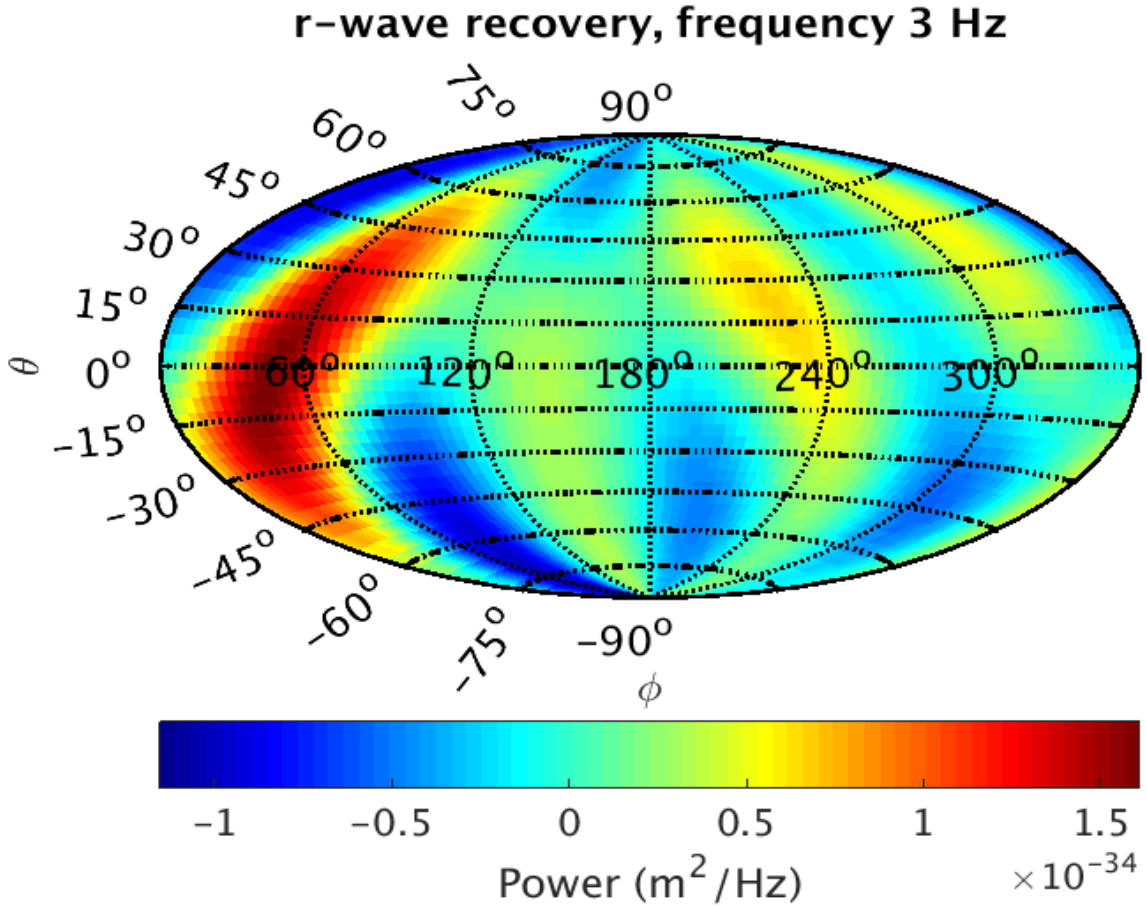
α = 144 m, ϵ = 0.7

v_R = 862 m/s



α = 100 m, ϵ = 0.7

v_R = 3,350 m/s



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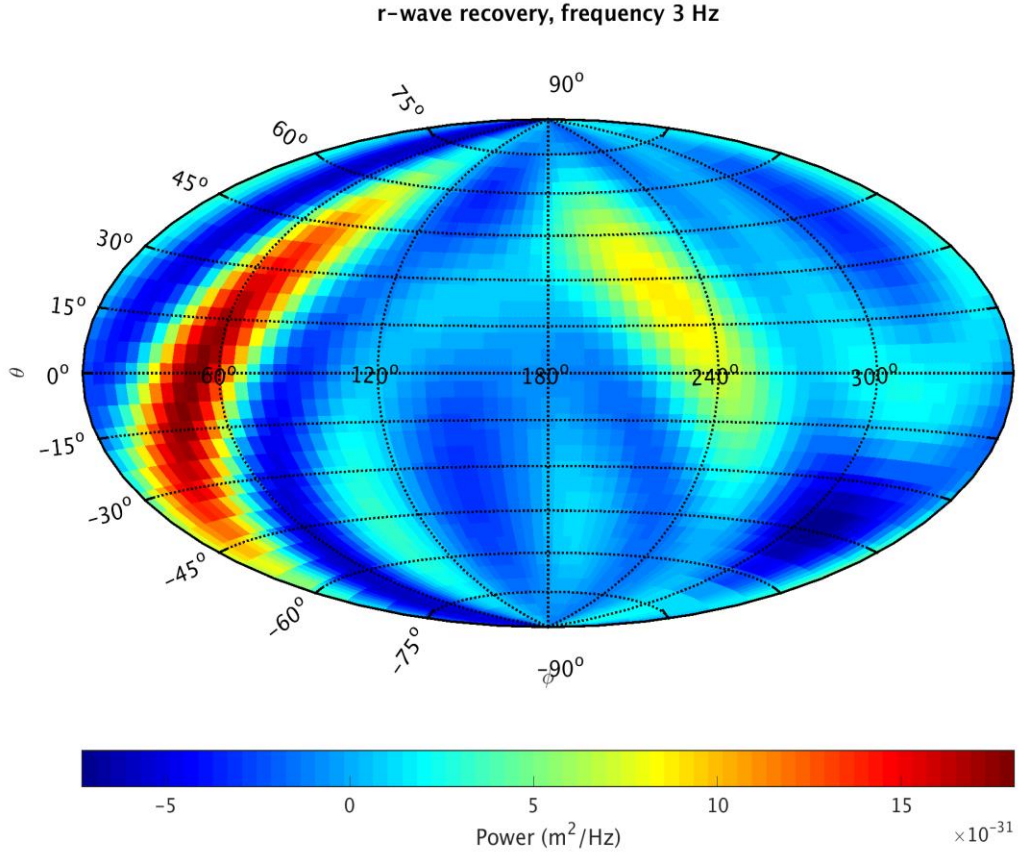
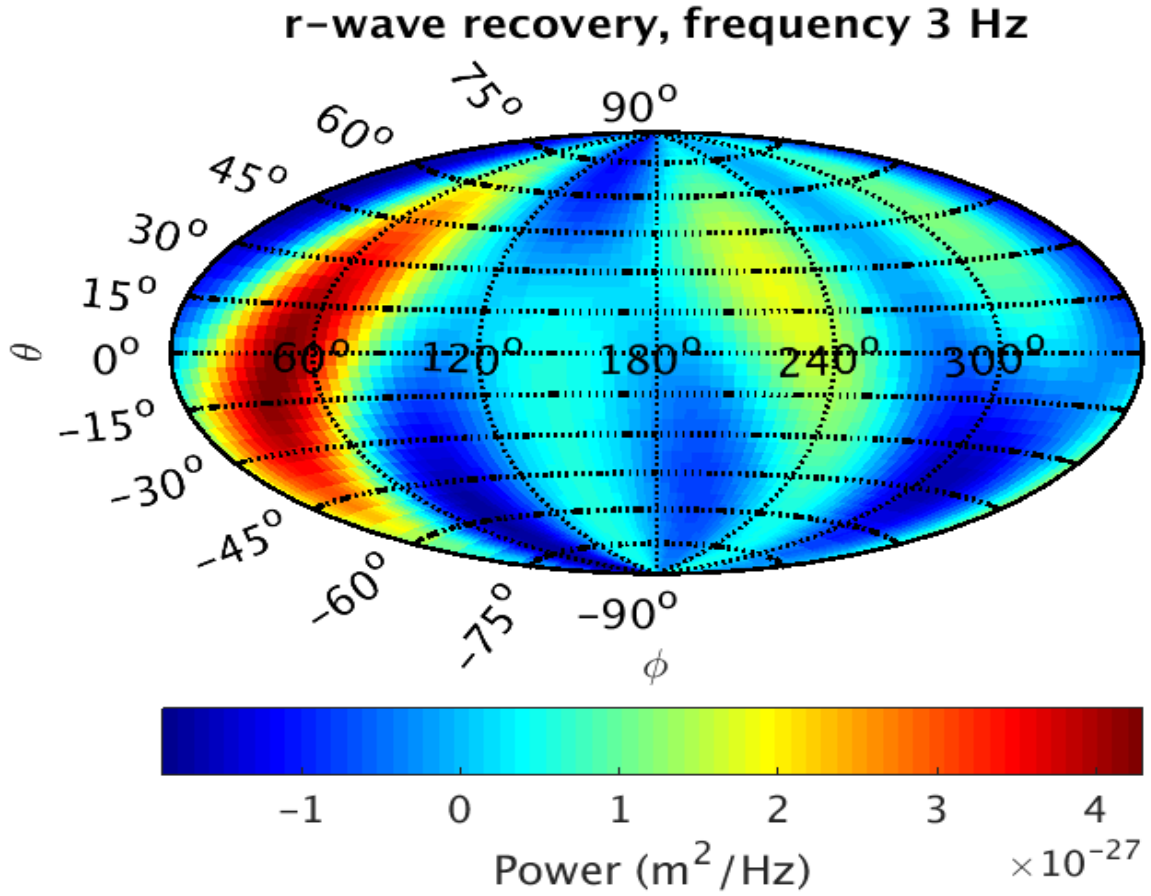


α = 250 m, ϵ = 0.7

v_R = 3,350 m/s



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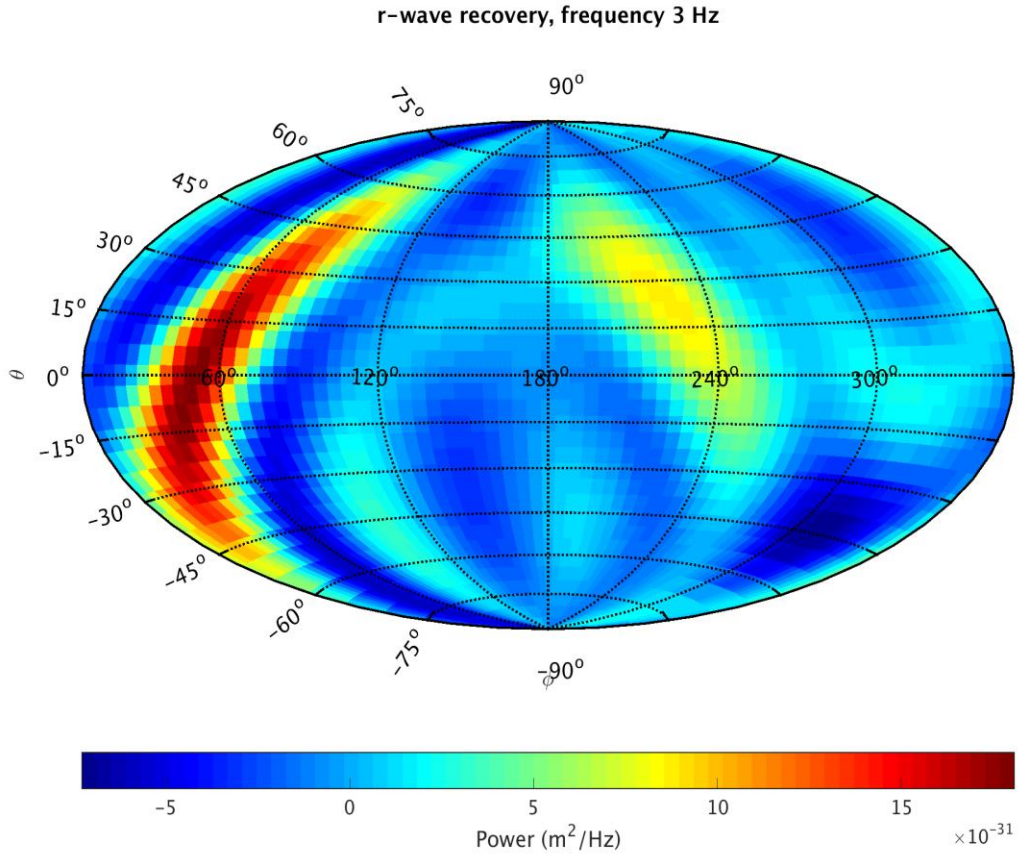

α = 400 m, ϵ = 0.7

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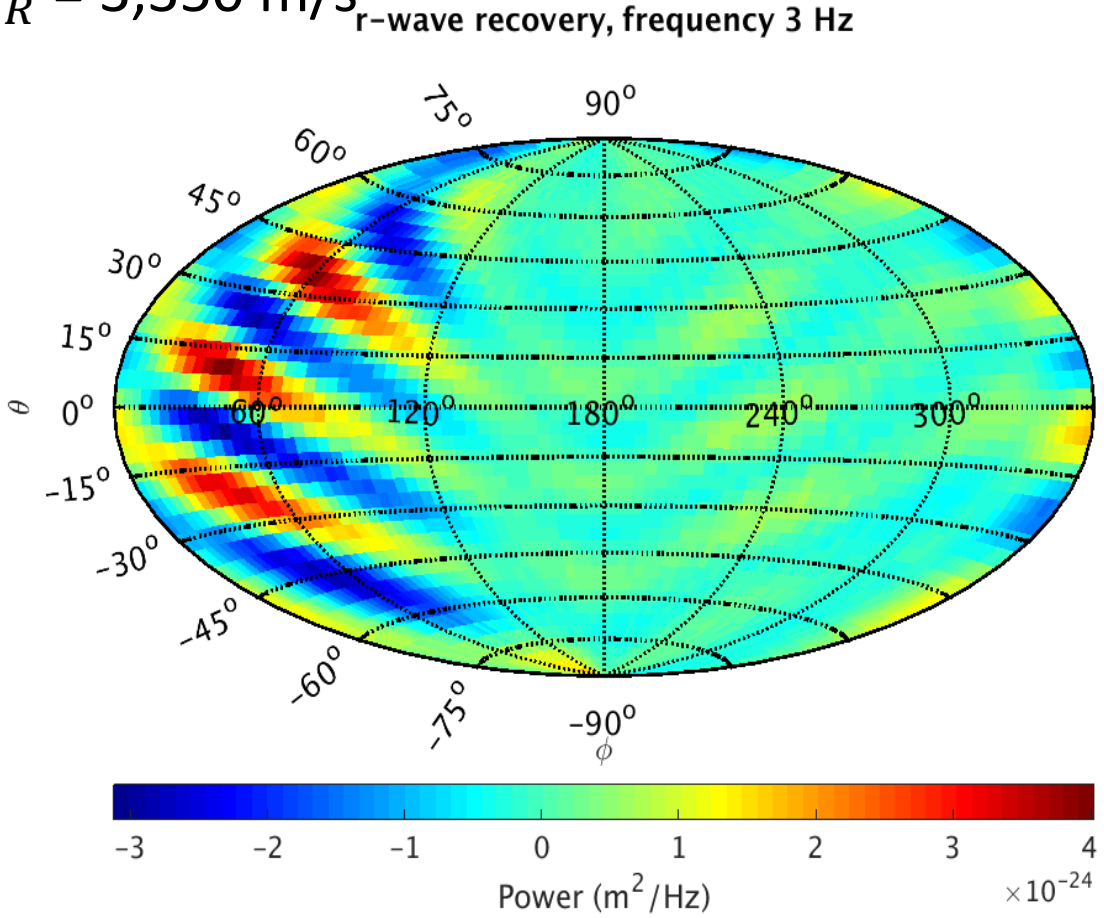

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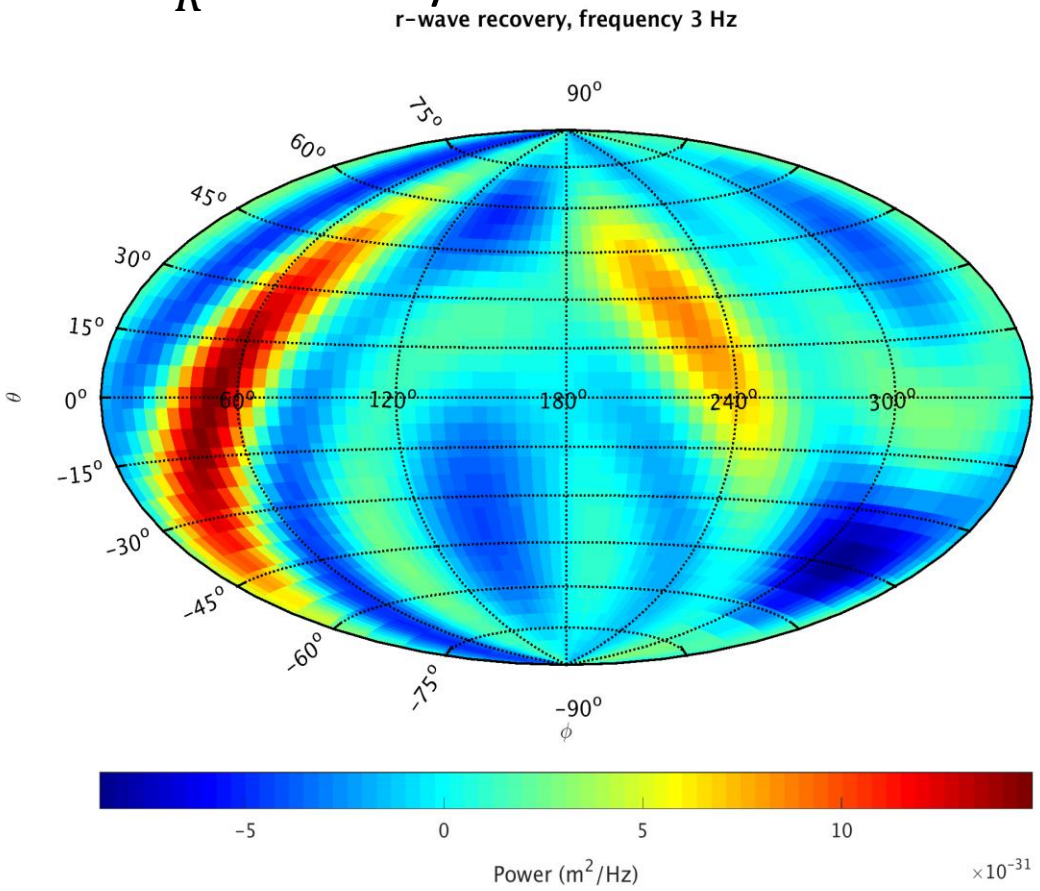
v_R = 862 m/s



α = 100 m, ϵ = 1.0

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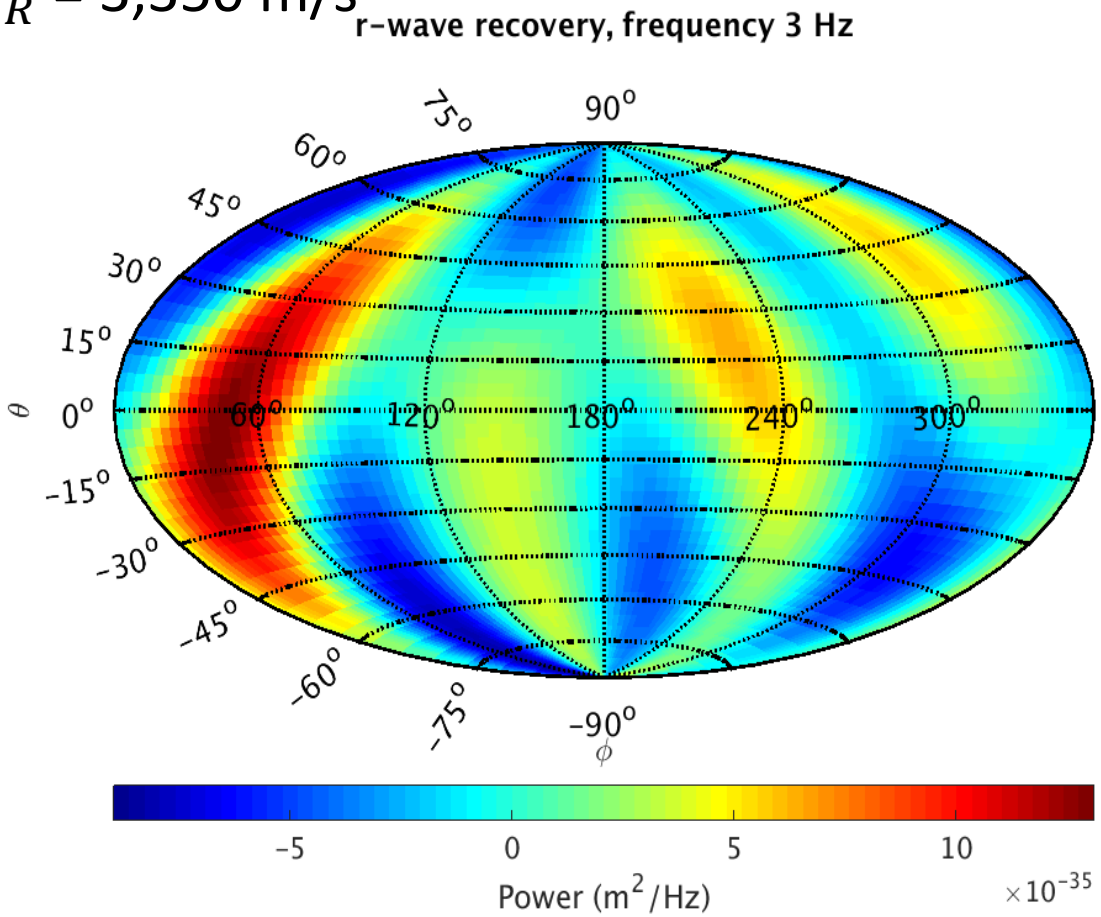

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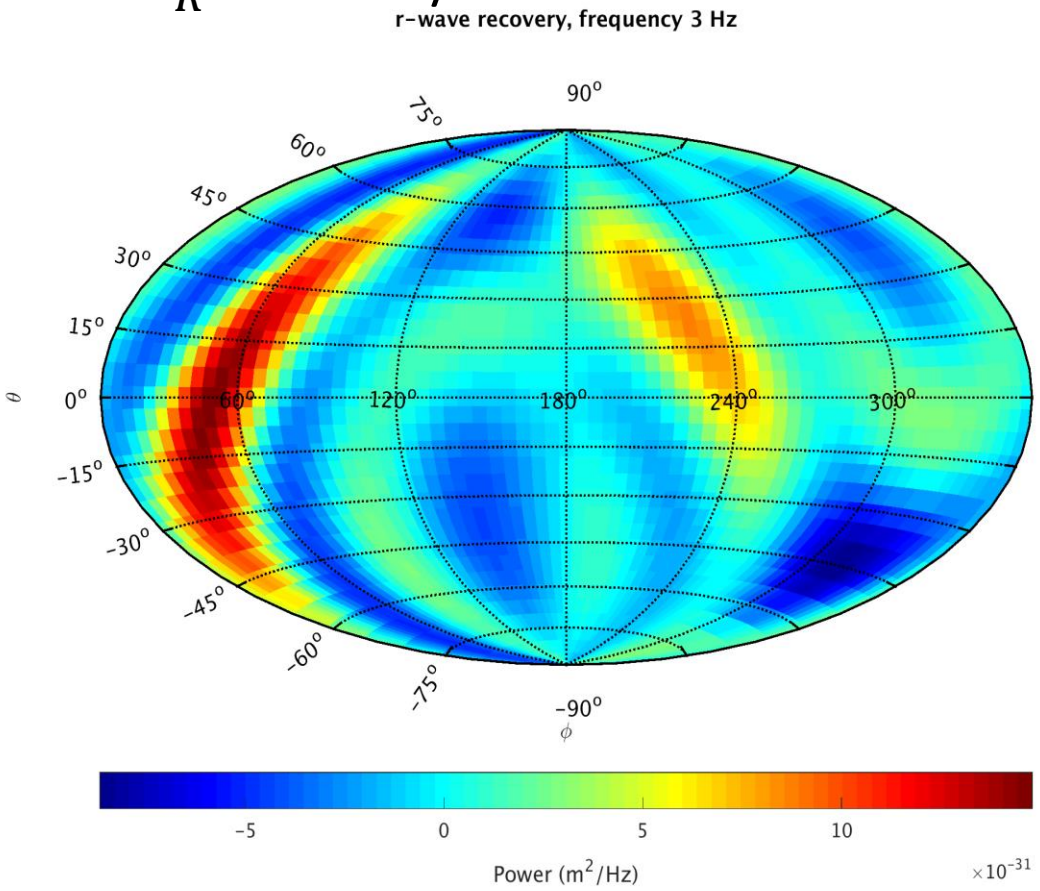

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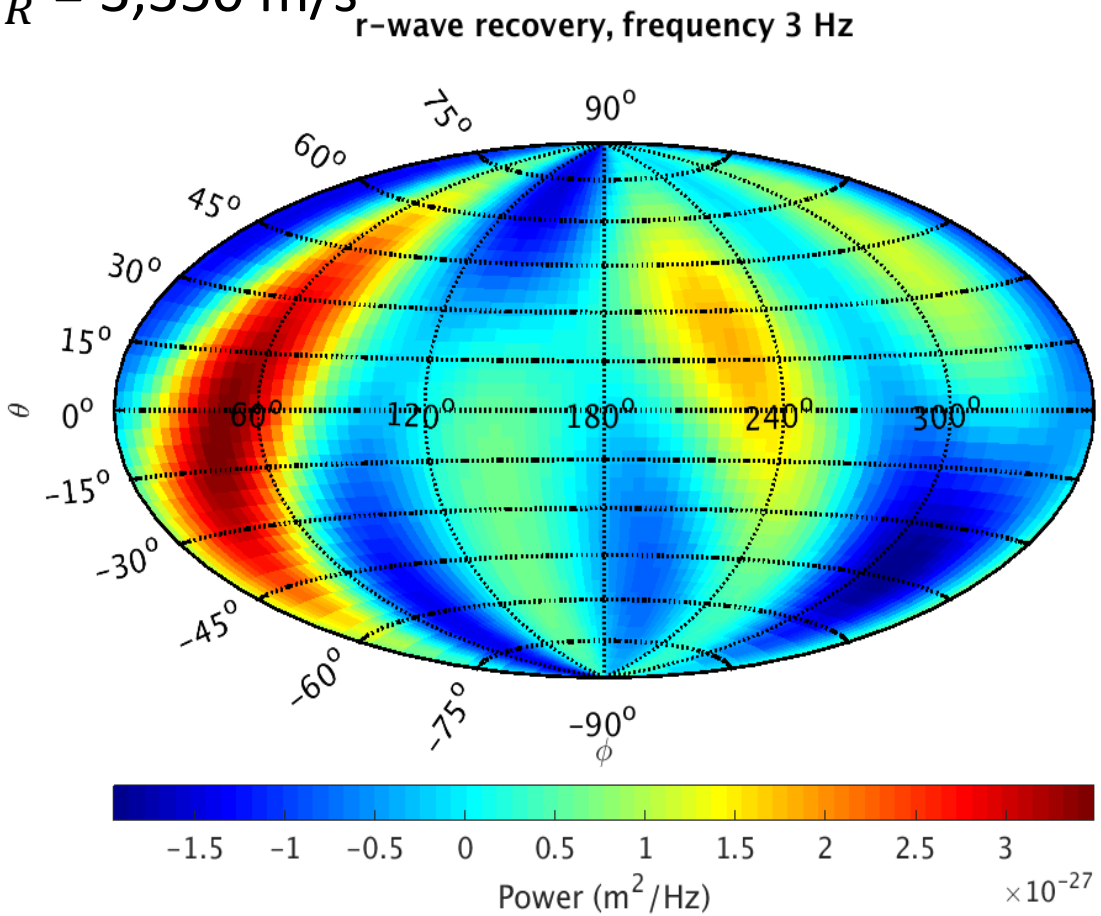

Recovery Frequency: 3 Hz

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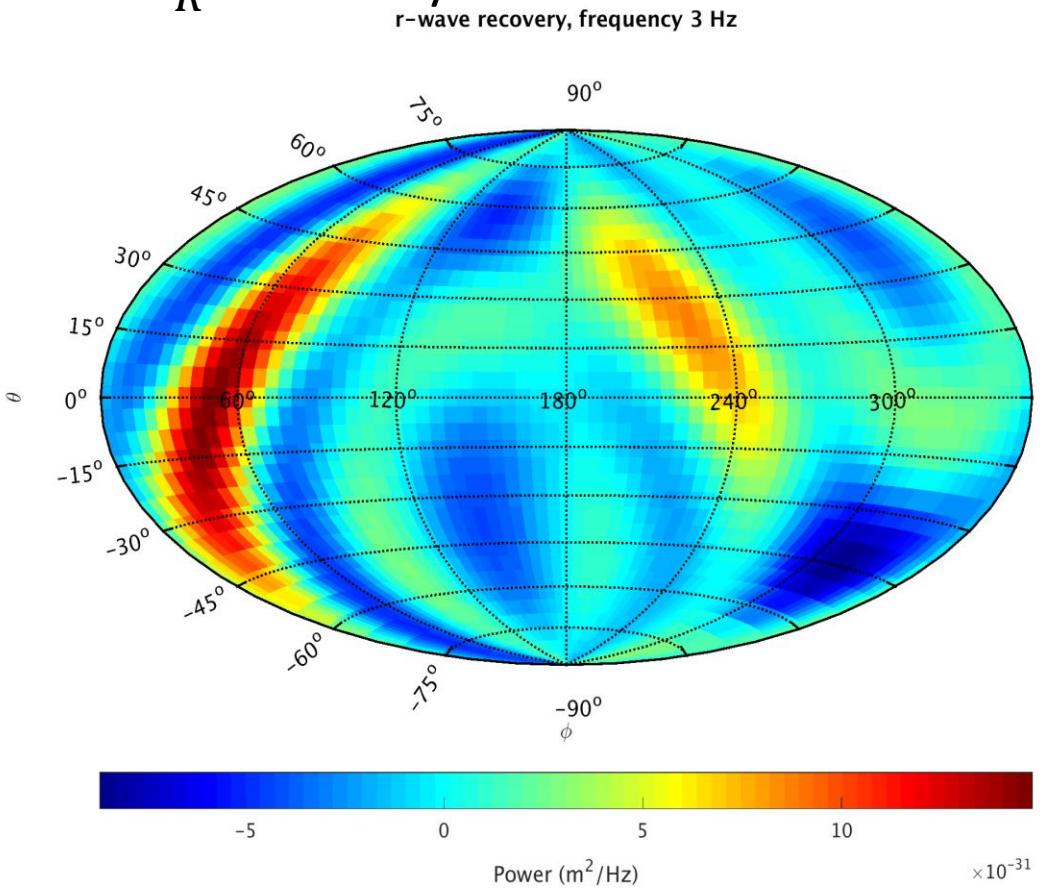
v_R = 862 m/s



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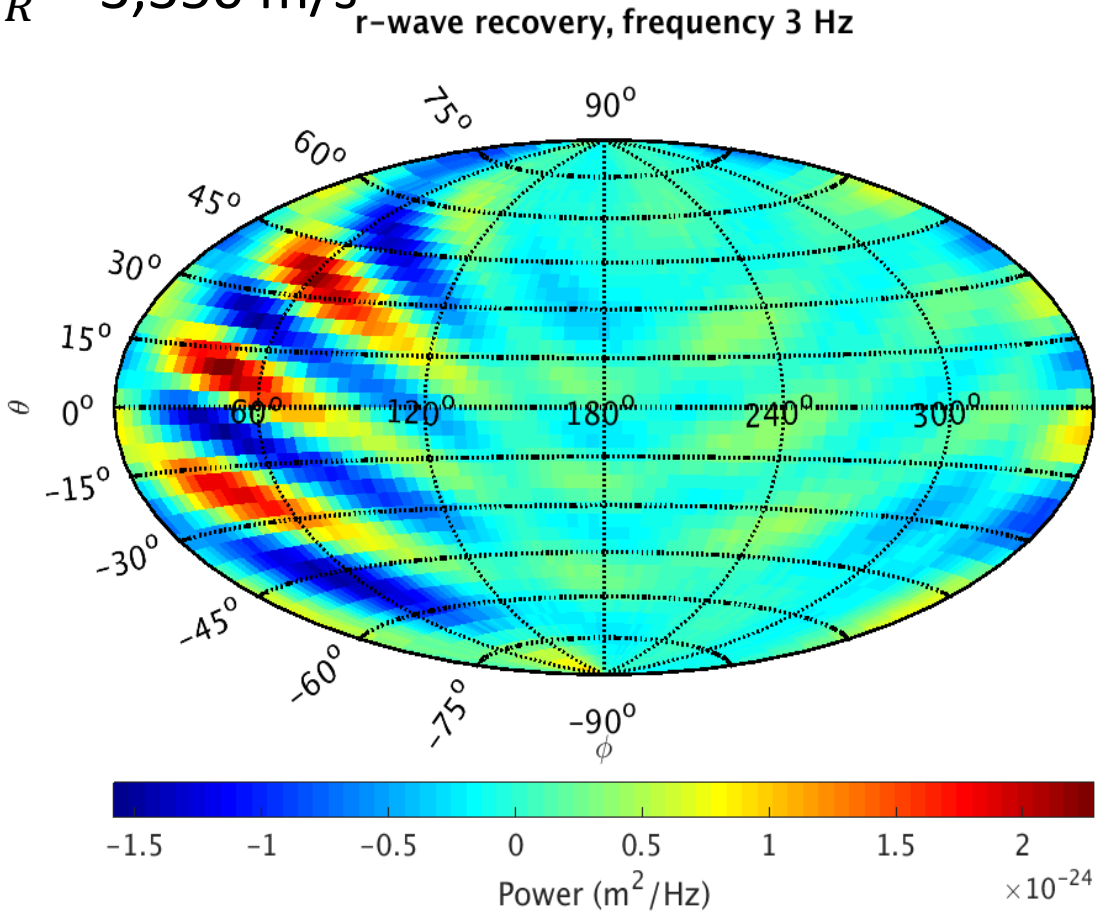
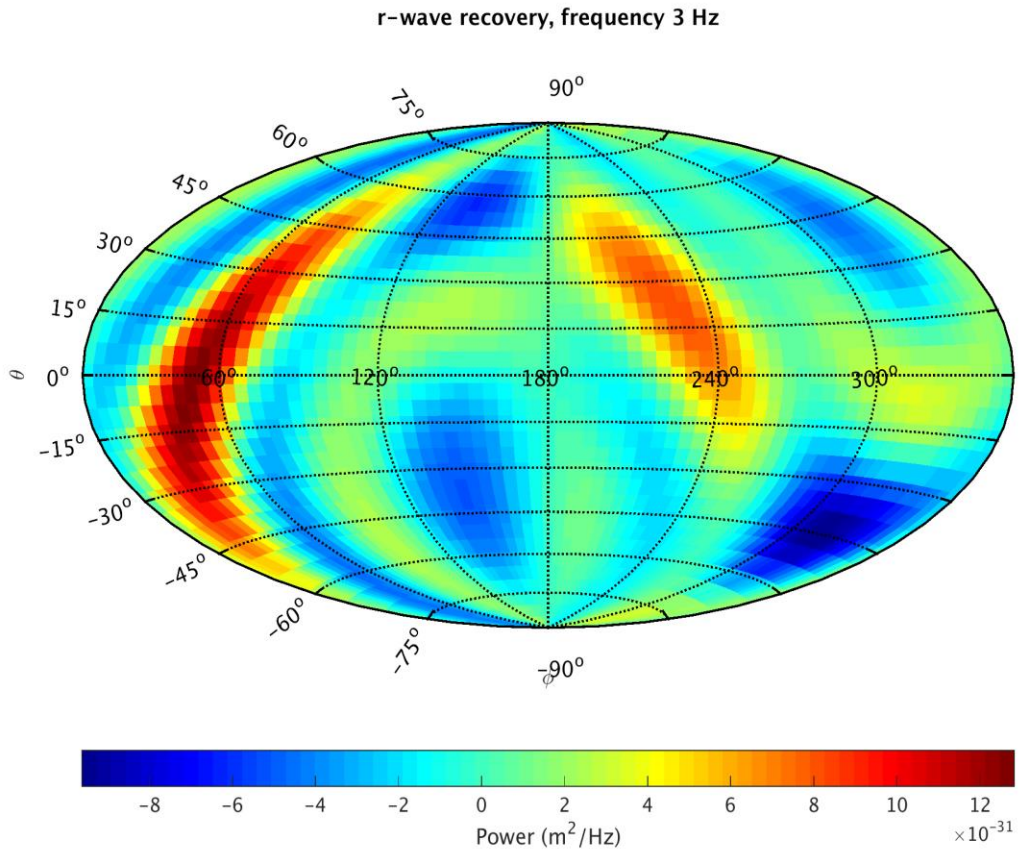


Recovery Frequency: 3 Hz

α = 144 m, ϵ = 1.3

v_R = 862 m/s



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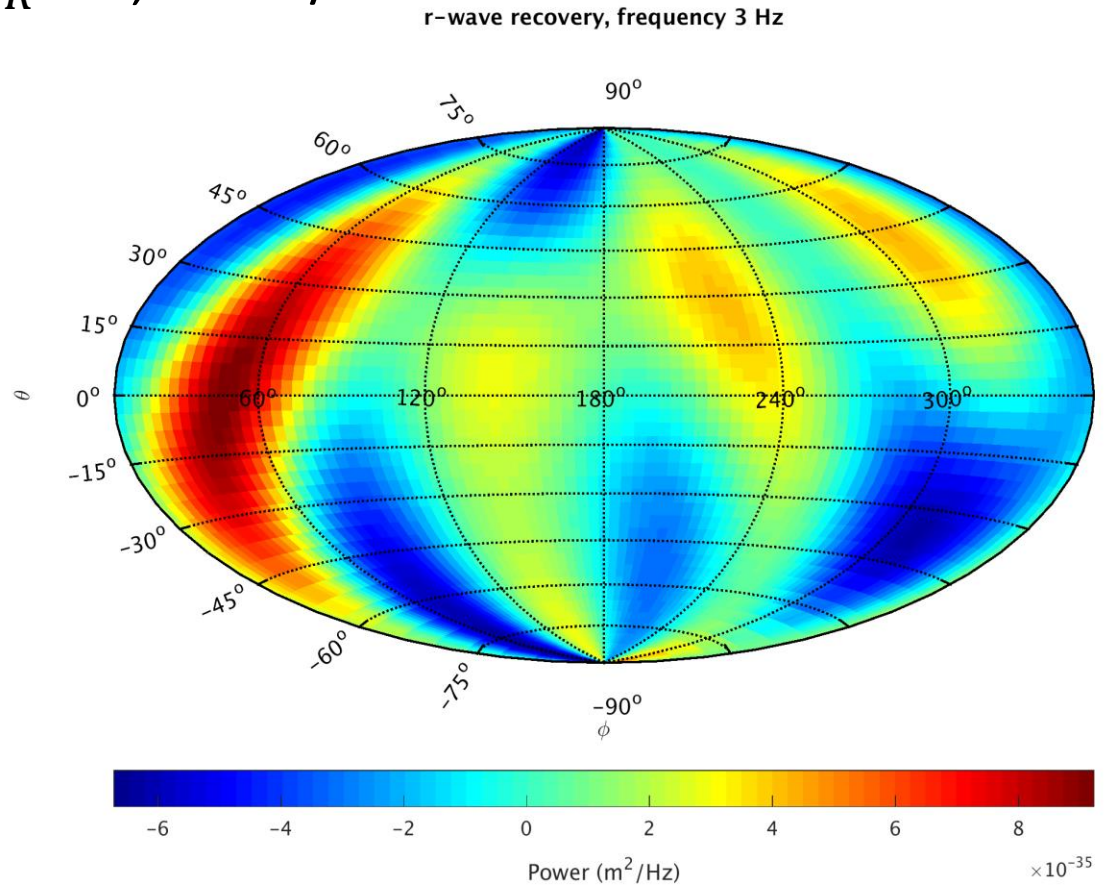

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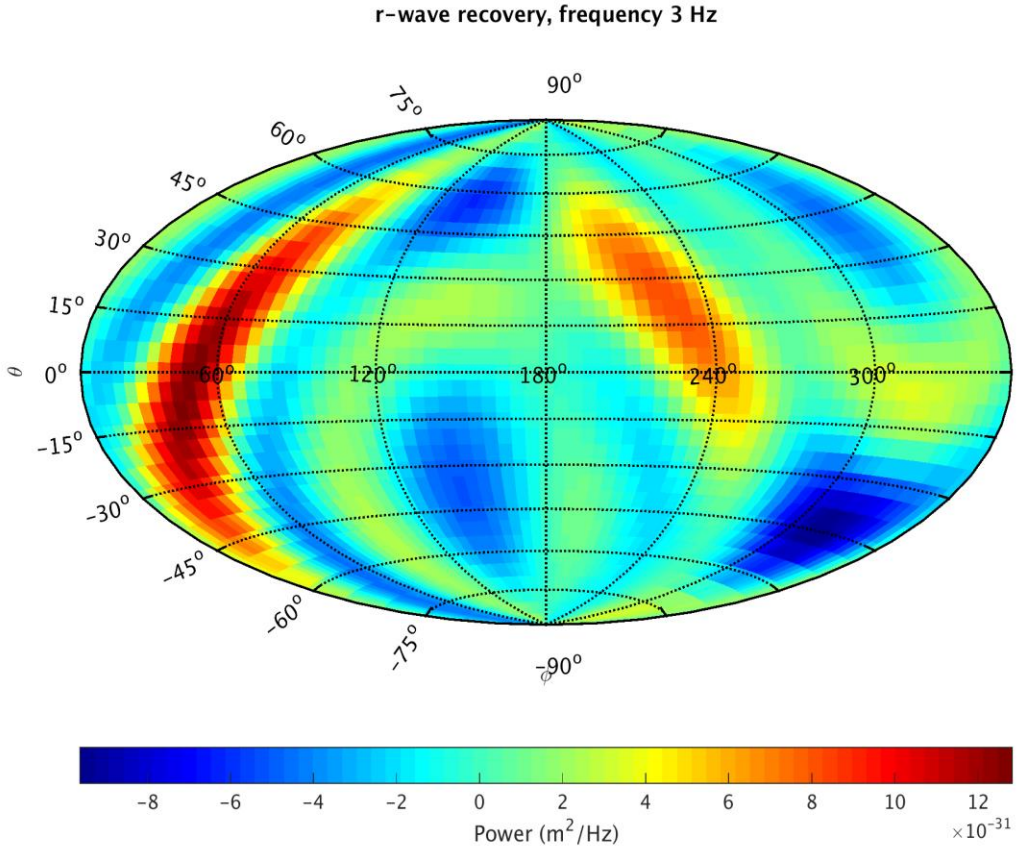
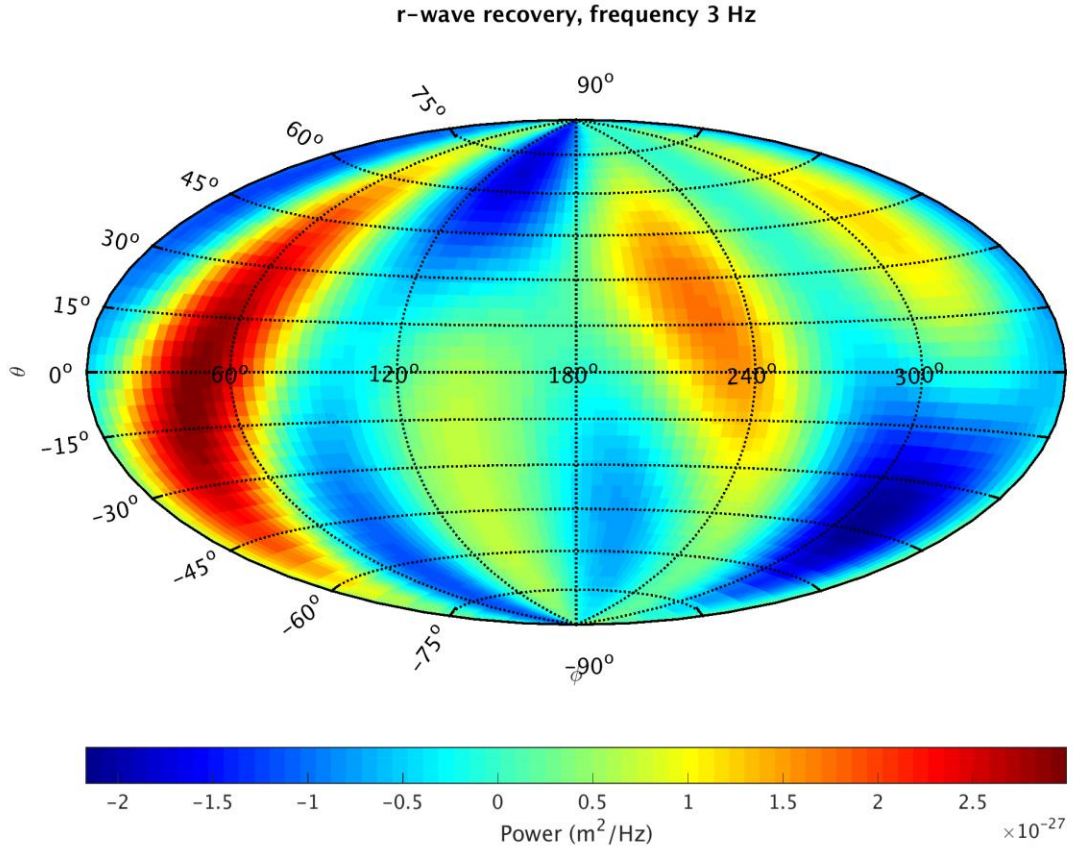
α = 144 m, ϵ = 1.3

v_R = 862 m/s



α = 250 m, ϵ = 1.3

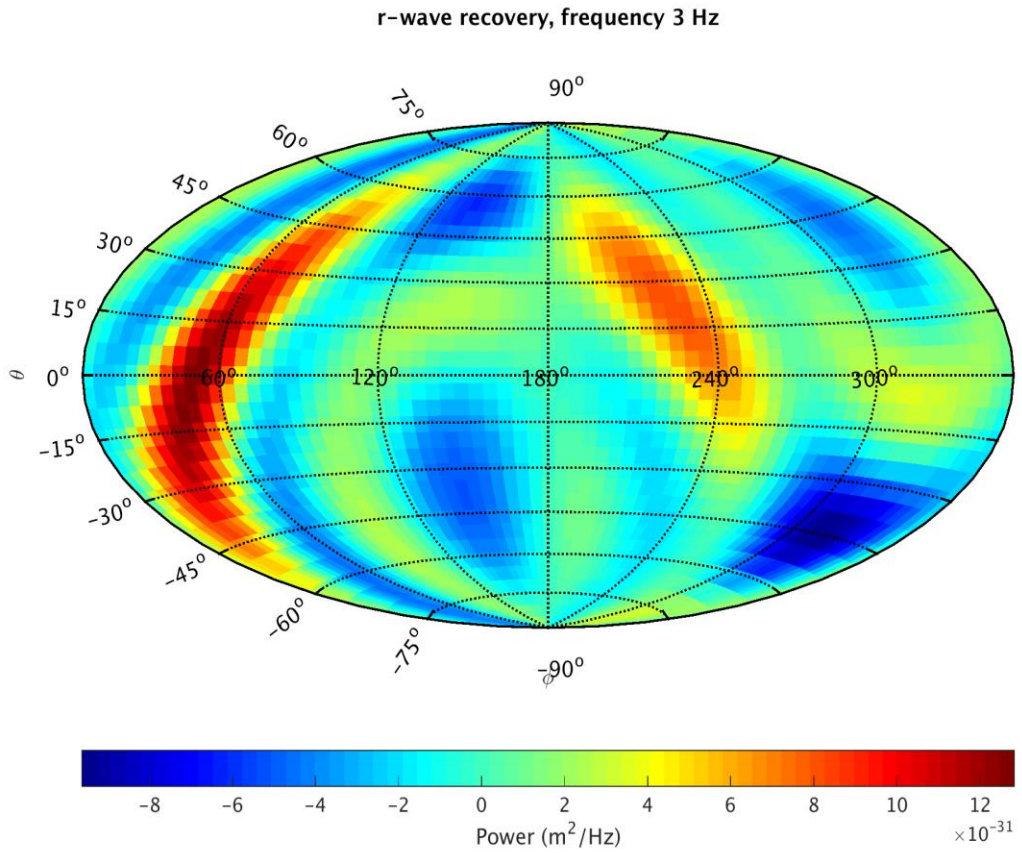
v_R = 3,350 m/s



Recovery Frequency: 3 Hz

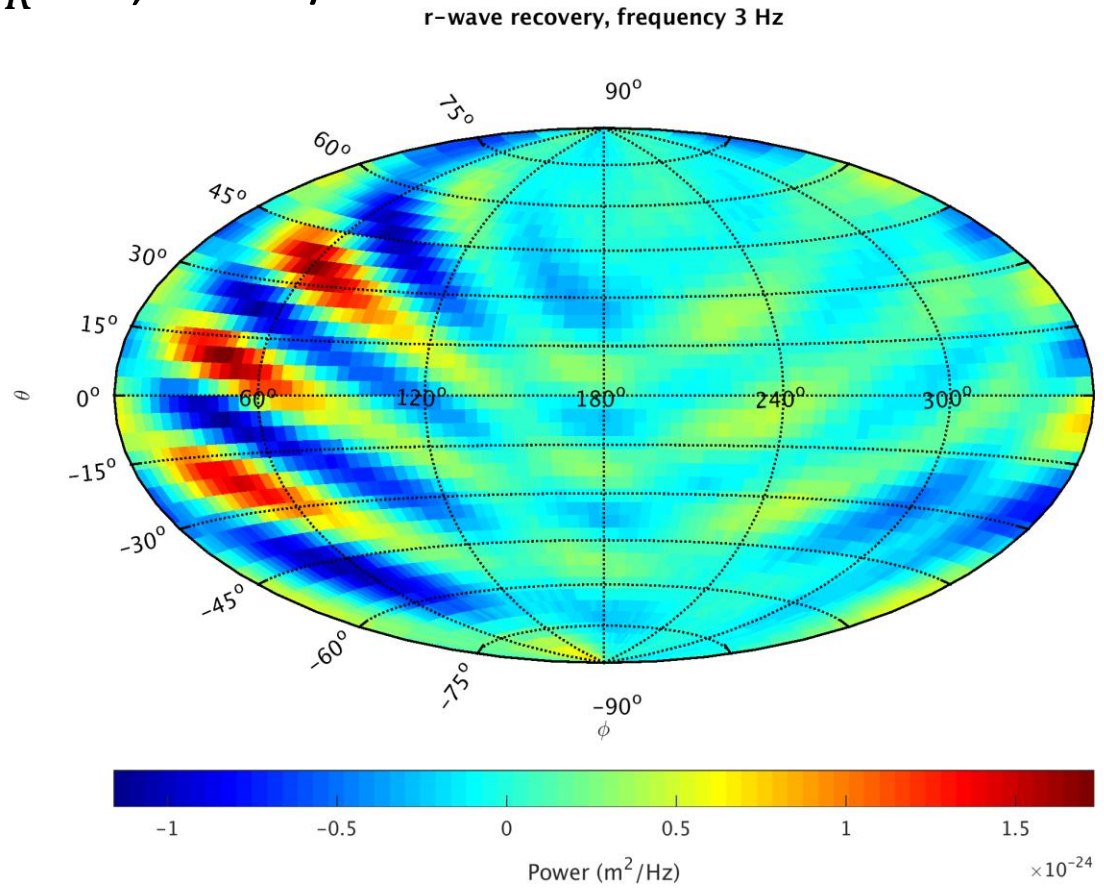
α = 144 m, ϵ = 1.3

v_R = 862 m/s



α = 400 m, ϵ = 1.3

v_R = 3,350 m/s



Future Directions and Questions

- Perform Rayleigh recoveries with $1.3 < \epsilon < 5$
  - Learn the boundary between relevant and irrelevant recoveries
- Construct time series of data and do a sanity check
  - Use wave speed and detector location to try and see if recoveries are consistent with our current understanding
- Why is the power recovered so small?
  - Why, if the power is so small, do we get well-defined structures on some but not all recoveries?

References

[1] "Acoustic Logging". epa.gov. 2011-12-12. Retrieved2015-02-03.