Effects of Varying α and ϵ in Rayleigh Wave Recovery

Levi Walls

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Fixed Parameters

- Observation time [s]:
  100
- GPS time:
  1107416000-1107416100
- Recovery frequencies [Hz]:
  0.1, 1, and 3, and all frequencies
- Channels analyzed:
  HHE, HHN, and HHZ
- Stations:
  300, 800, A4100, C4100, D4100, B4850, C4850, D4850, and YATES

Independent Variables

- α [m]:

  100, 250, and 400

- ϵ:

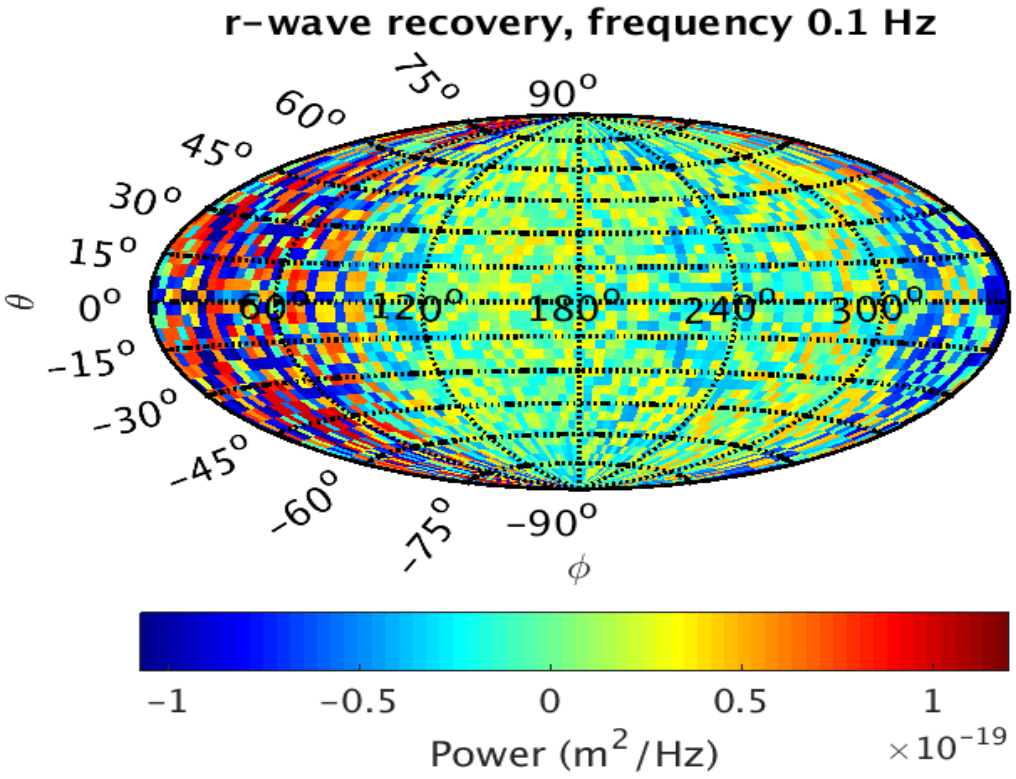
  0.7, 1, and 1.3

Goal of Recoveries

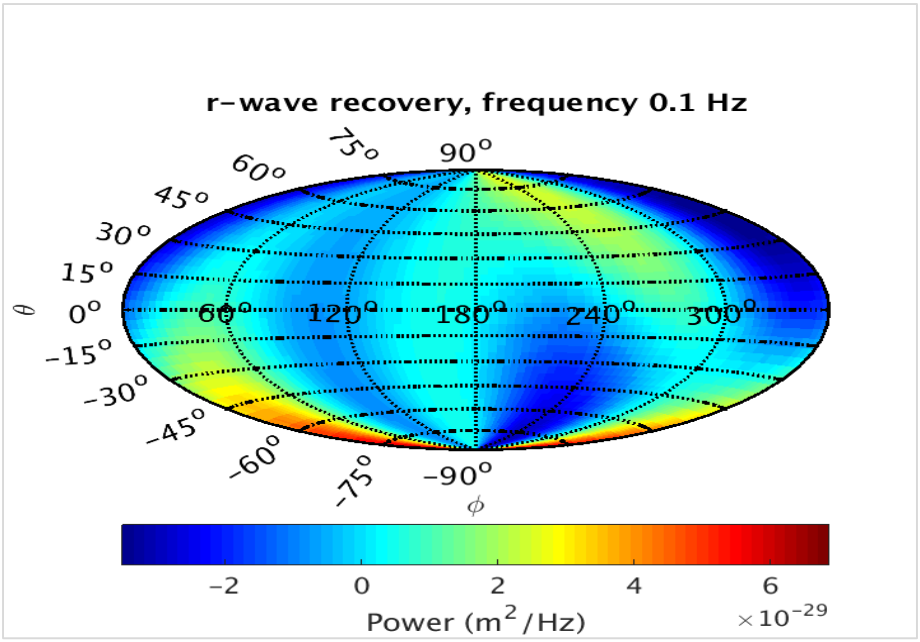
- To see how the recovered power was affected by the changing of α and ϵ in a Rayleigh wave recovery
- To modify the independent variables to obtain physically meaningful power spectra

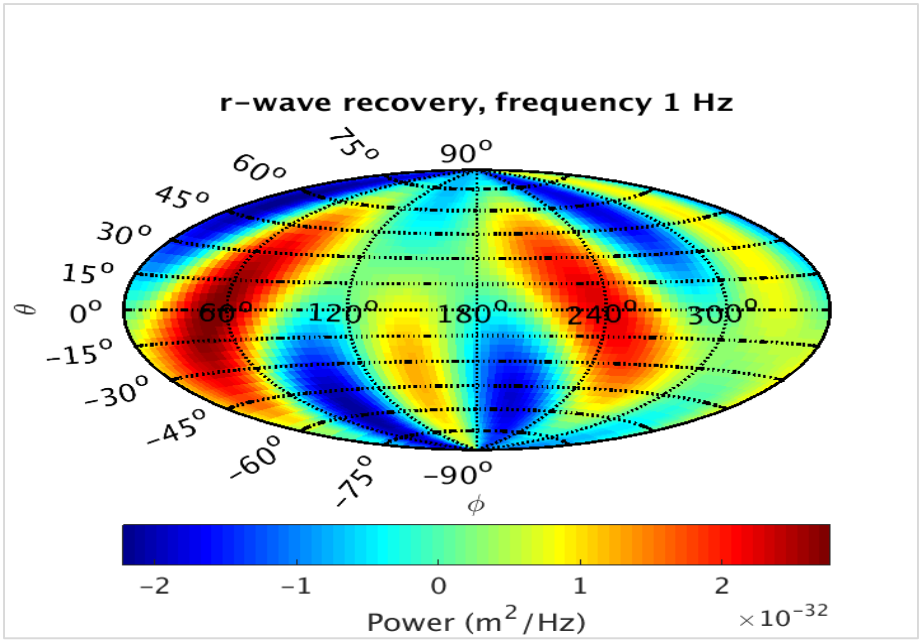
Potentially Misleading Skymaps

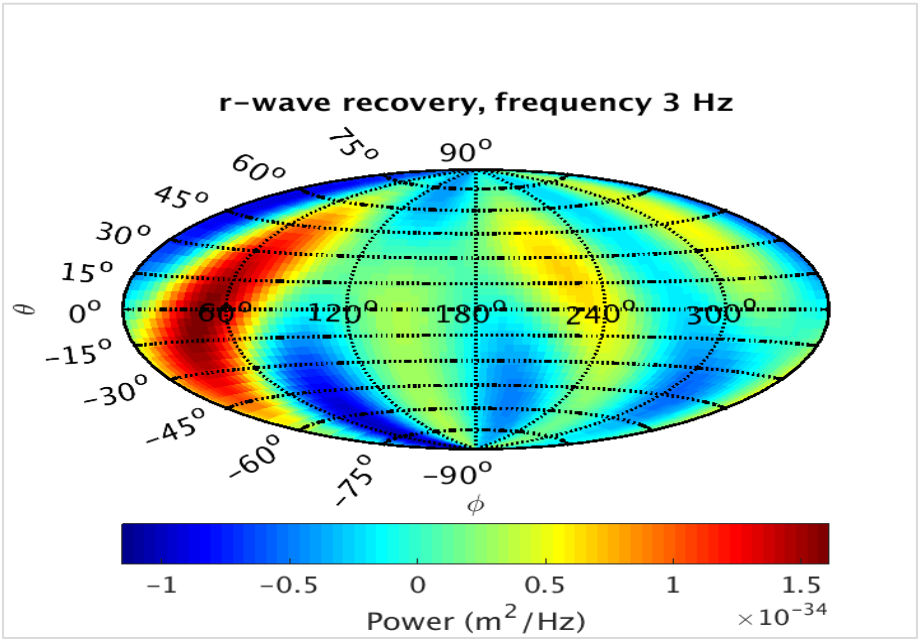
- The only skymaps <u>not</u> to display meaningful results were with: α = 250 and 400, at 0.1 Hz (and all frequencies)
- e.g. α = 250 at 0.1 Hz

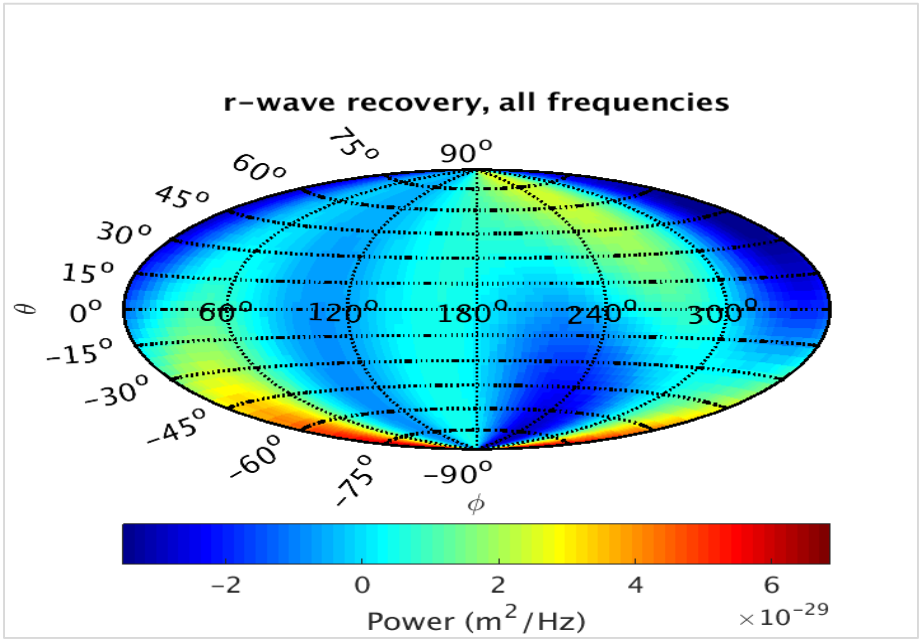


α = 100 m ; ϵ = 0.7

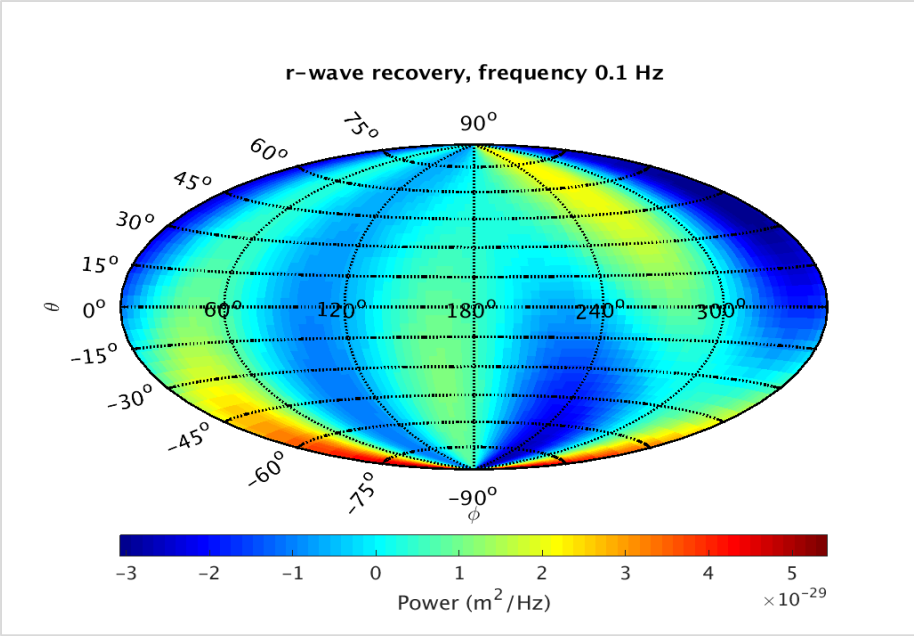

r-wave recovery, frequency 0.1 Hz
θ
ϕ
Power (m²/Hz)
×10⁻²⁹

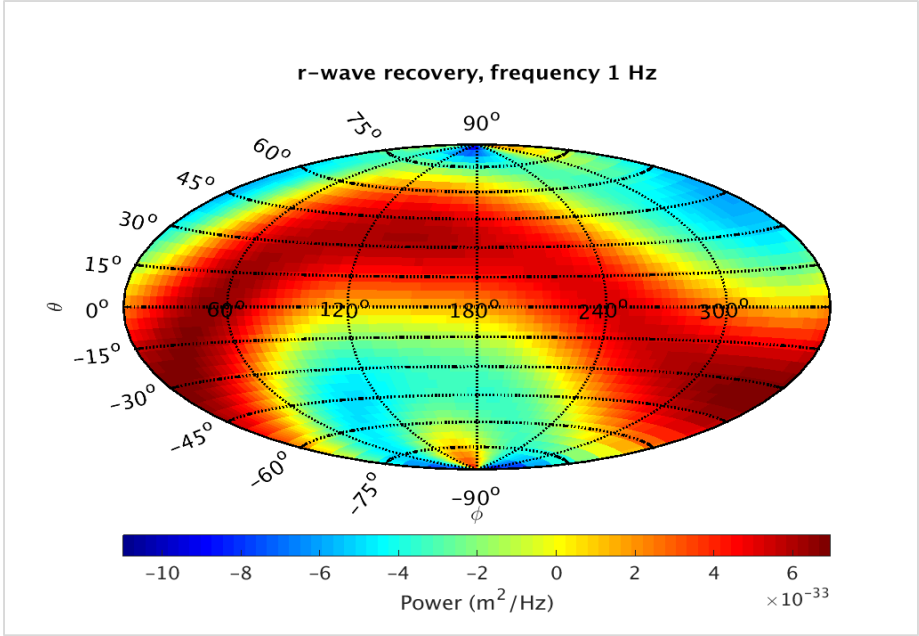

r-wave recovery, frequency 1 Hz
θ
ϕ
Power (m²/Hz)
×10⁻³²

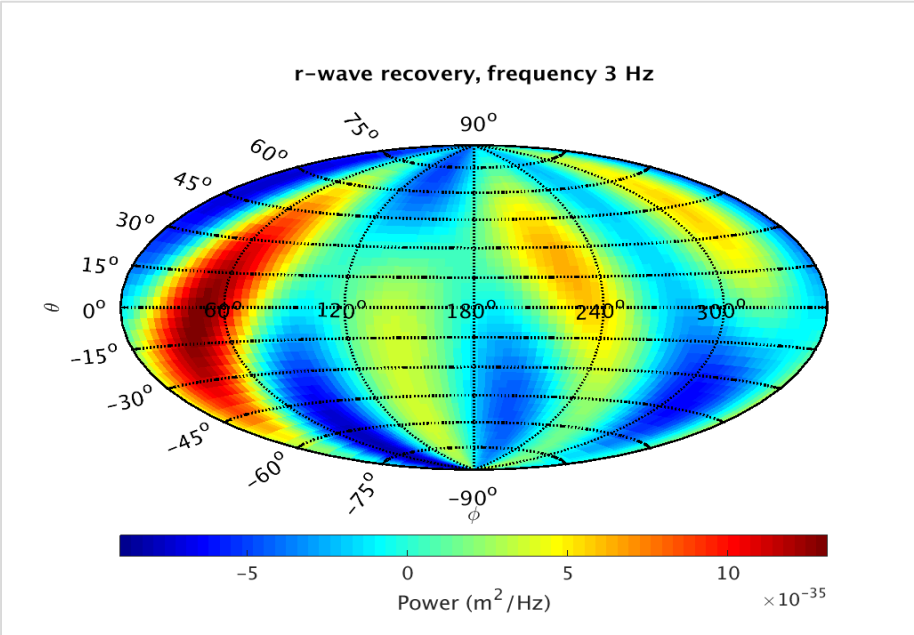

r-wave recovery, frequency 3 Hz
θ
ϕ
Power (m²/Hz)
×10⁻³⁴

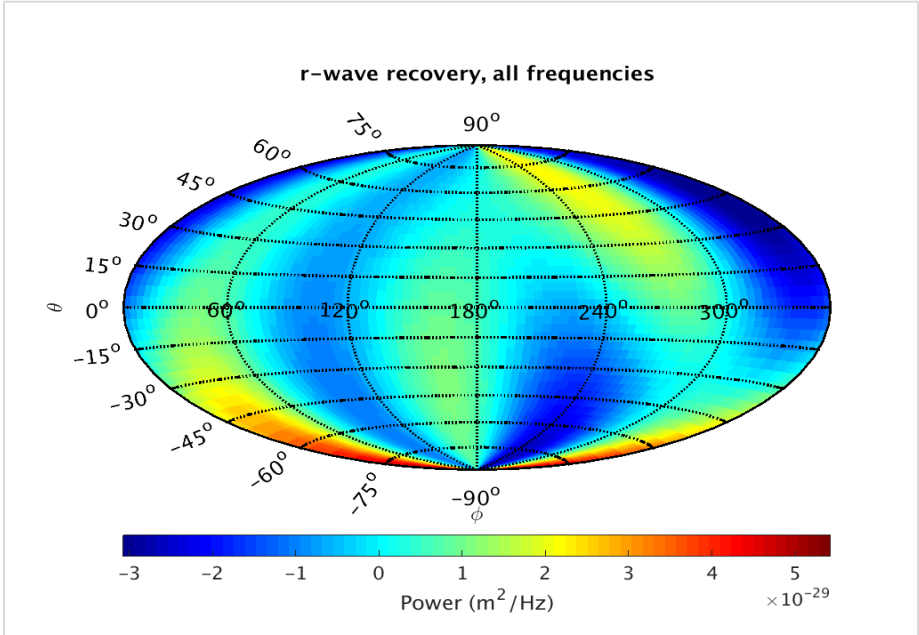

r-wave recovery, all frequencies
θ
ϕ
Power (m²/Hz)
×10⁻²⁹

α = 100 m ; ϵ = 1

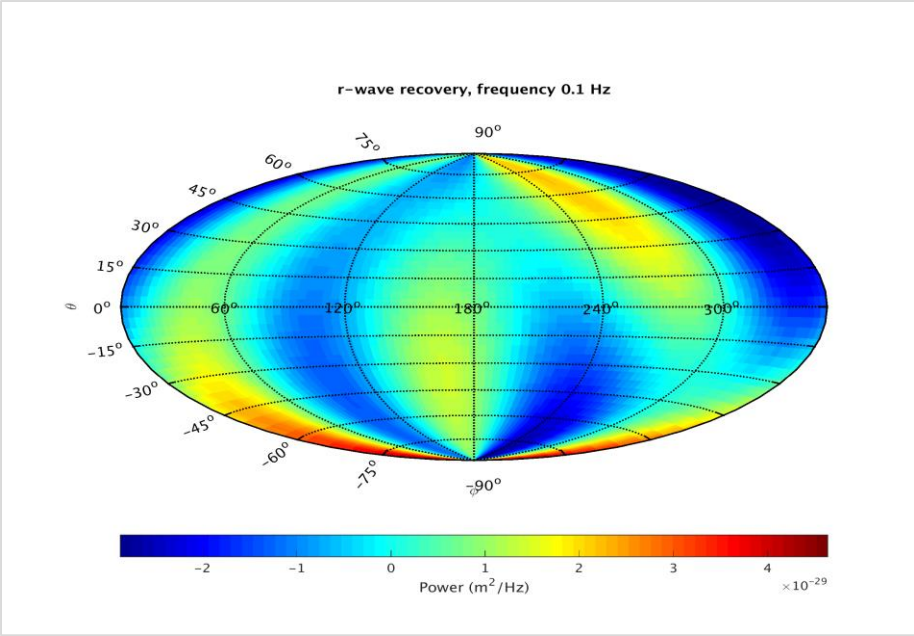

r-wave recovery, frequency 0.1 Hz
90°
75°
60°
45°
30°
15°
0°
-15°
-30°
-45°
-60°
-75°
-90°
θ
ϕ
60°
120°
180°
240°
300°
-3 -2 -1 0 1 2 3 4 5
Power (m²/Hz)
×10⁻²⁹

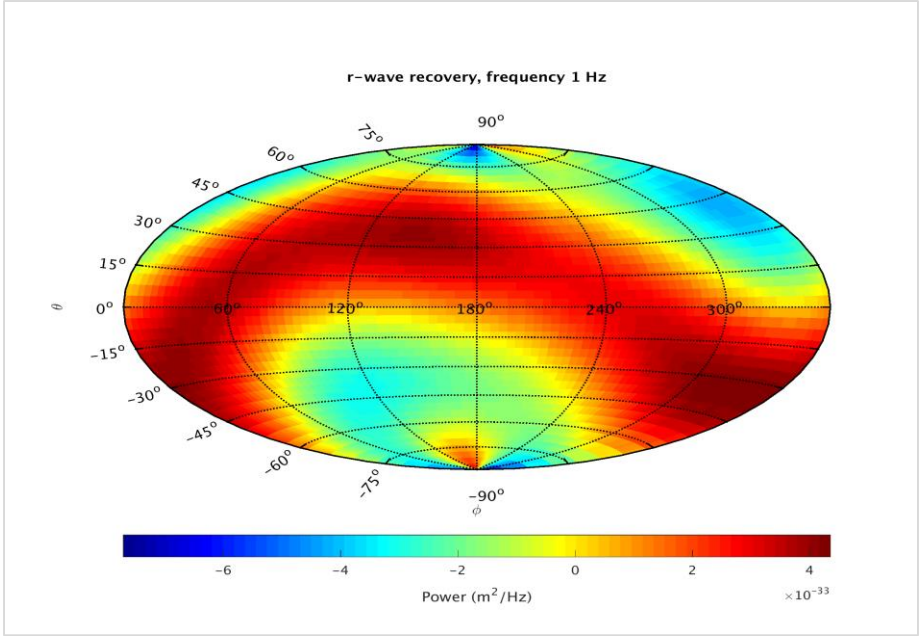

r-wave recovery, frequency 1 Hz
90°
75°
60°
45°
30°
15°
0°
-15°
-30°
-45°
-60°
-75°
-90°
θ
ϕ
60°
120°
180°
240°
300°
-10 -8 -6 -4 -2 0 2 4 6
Power (m²/Hz)
×10⁻³³

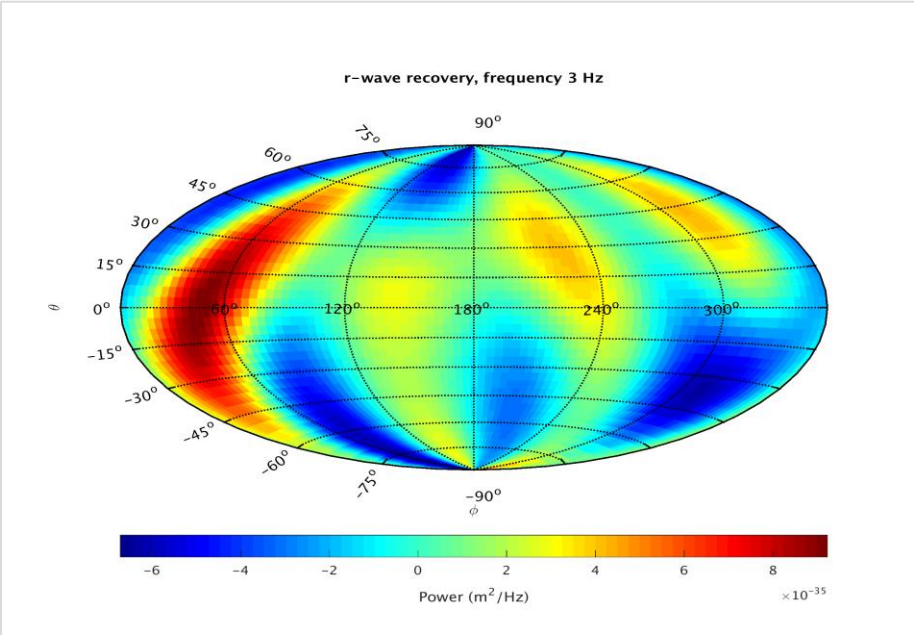

r-wave recovery, frequency 3 Hz
90°
75°
60°
45°
30°
15°
0°
-15°
-30°
-45°
-60°
-75°
-90°
θ
ϕ
60°
120°
180°
240°
300°
-5 0 5 10
Power (m²/Hz)
×10⁻³⁵

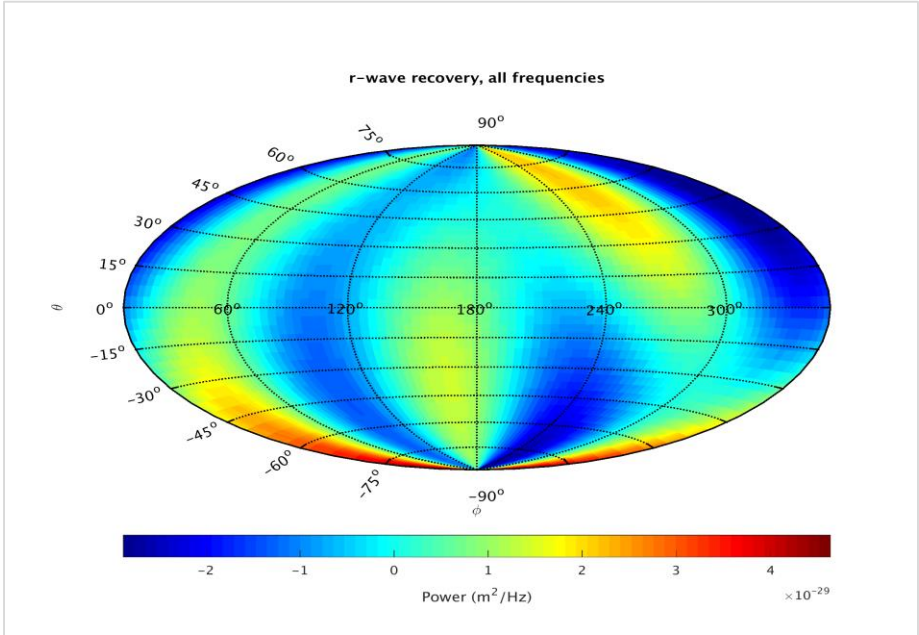

r-wave recovery, all frequencies
90°
75°
60°
45°
30°
15°
0°
-15°
-30°
-45°
-60°
-75°
-90°
θ
ϕ
60°
120°
180°
240°
300°
-3 -2 -1 0 1 2 3 4 5
Power (m²/Hz)
×10⁻²⁹

α = 100 m ; ϵ = 1.3

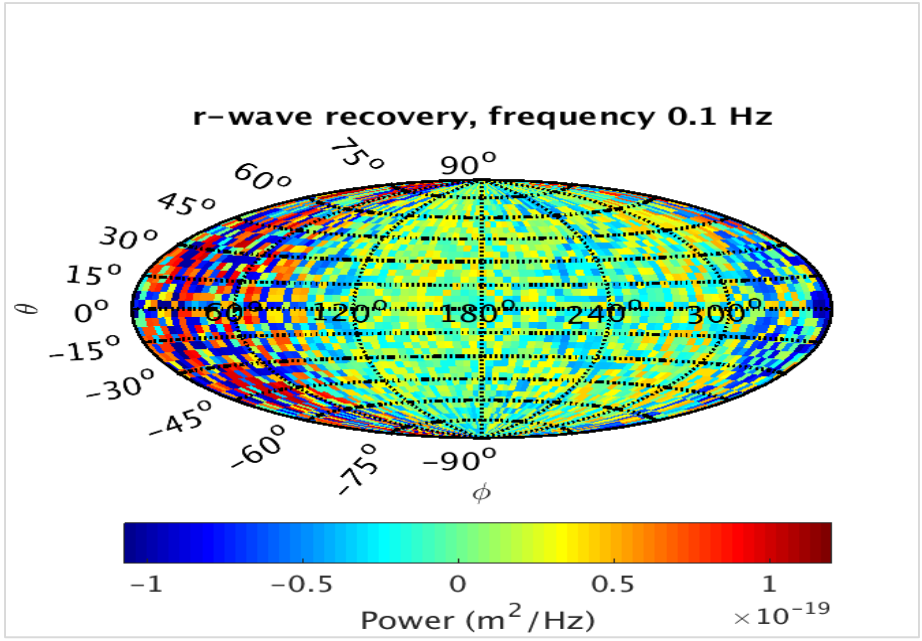

r-wave recovery, frequency 0.1 Hz
90°
75°
60°
45°
30°
15°
0°
-15°
-30°
-45°
-60°
-75°
-90°
θ
ϕ
60°
120°
180°
240°
300°
-2
-1
0
1
2
3
4
Power (m²/Hz)
×10⁻²⁹

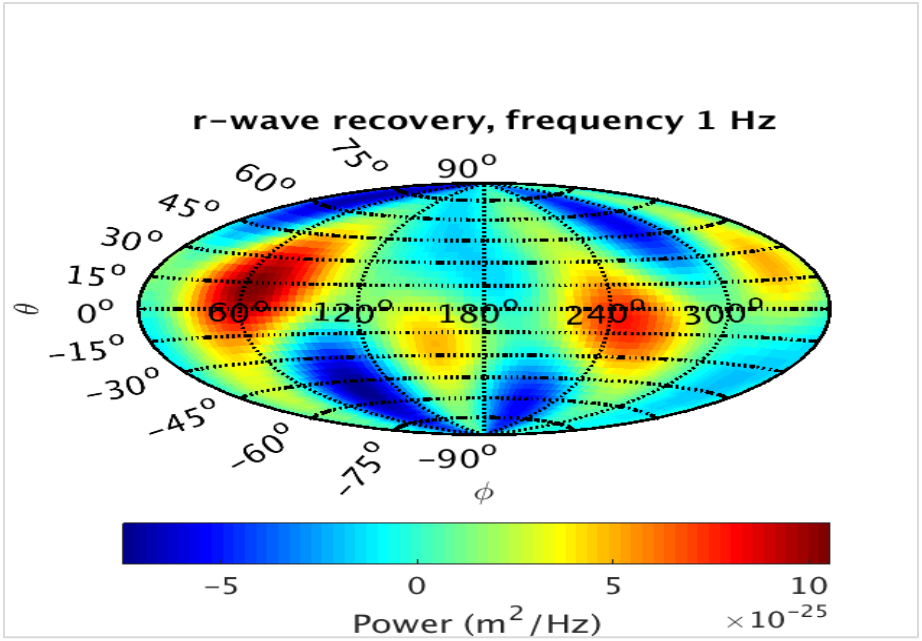

r-wave recovery, frequency 1 Hz
90°
75°
60°
45°
30°
15°
0°
-15°
-30°
-45°
-60°
-75°
-90°
θ
ϕ
60°
120°
180°
240°
300°
-6
-4
-2
0
2
4
Power (m²/Hz)
×10⁻³³

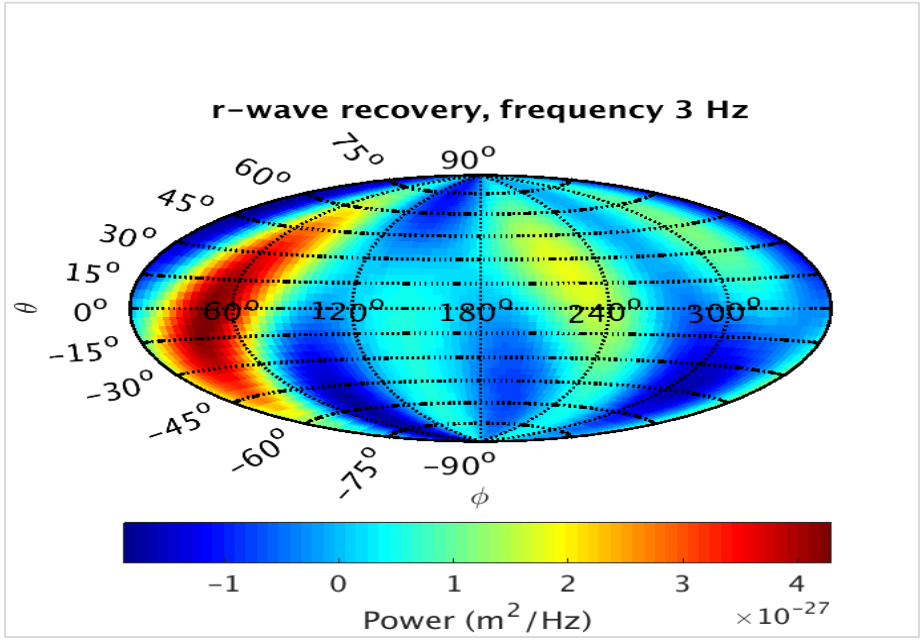

r-wave recovery, frequency 3 Hz
90°
75°
60°
45°
30°
15°
0°
-15°
-30°
-45°
-60°
-75°
-90°
θ
ϕ
60°
120°
180°
240°
300°
-6
-4
-2
0
2
4
6
8
Power (m²/Hz)
×10⁻³⁵

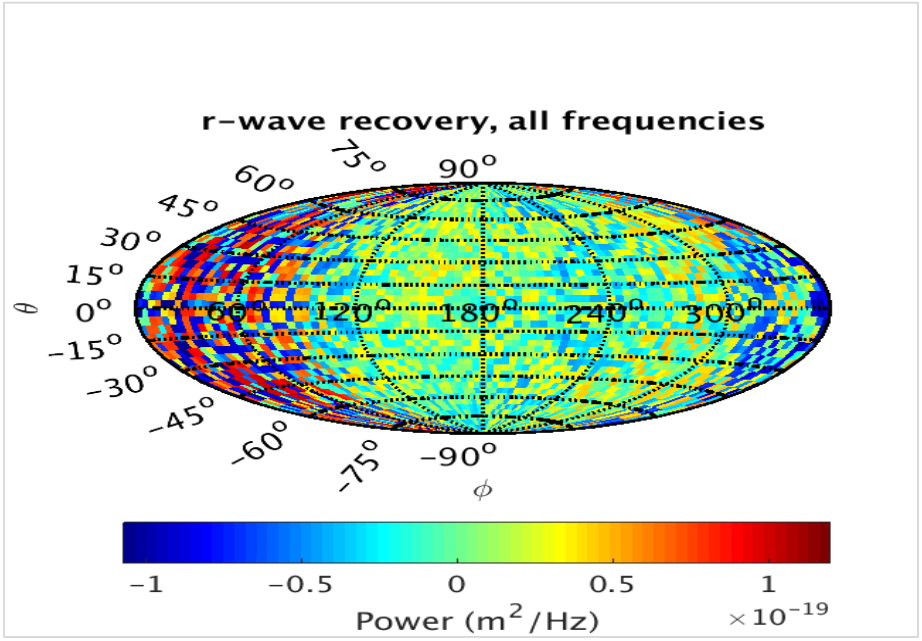

r-wave recovery, all frequencies
90°
75°
60°
45°
30°
15°
0°
-15°
-30°
-45°
-60°
-75°
-90°
θ
ϕ
60°
120°
180°
240°
300°
-2
-1
0
1
2
3
4
Power (m²/Hz)
×10⁻²⁹

α = 250 m ; ϵ = 0.7

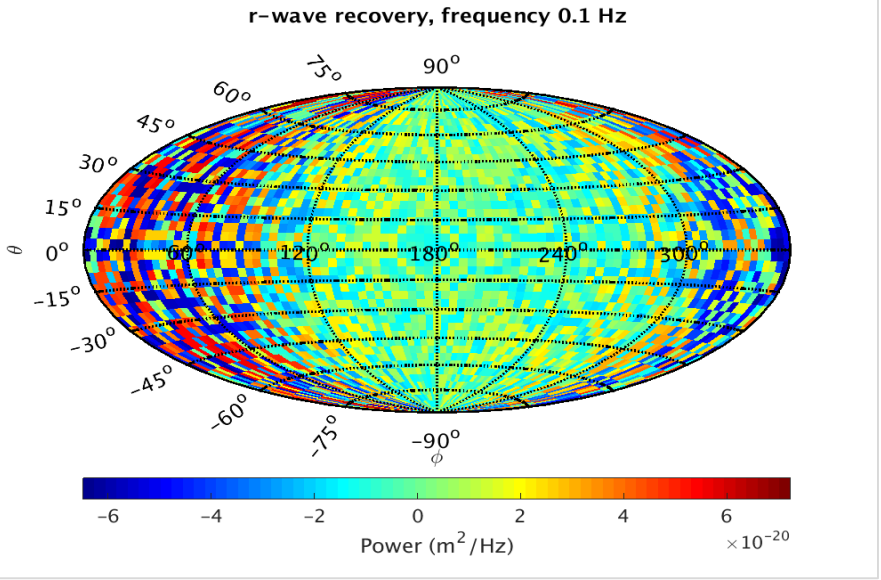

r-wave recovery, frequency 0.1 Hz
θ
ϕ
Power (m²/Hz)
×10⁻¹⁹

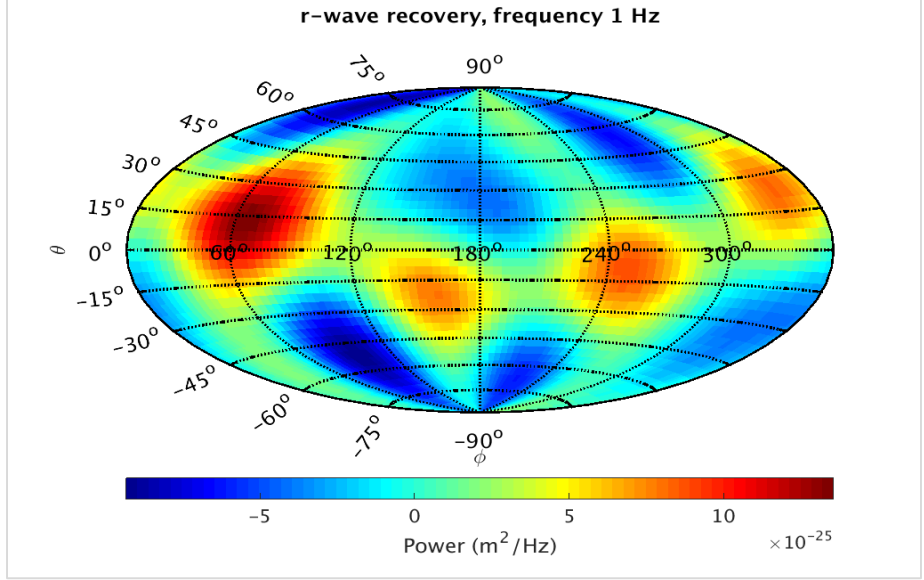

r-wave recovery, frequency 1 Hz
θ
ϕ
Power (m²/Hz)
×10⁻²⁵

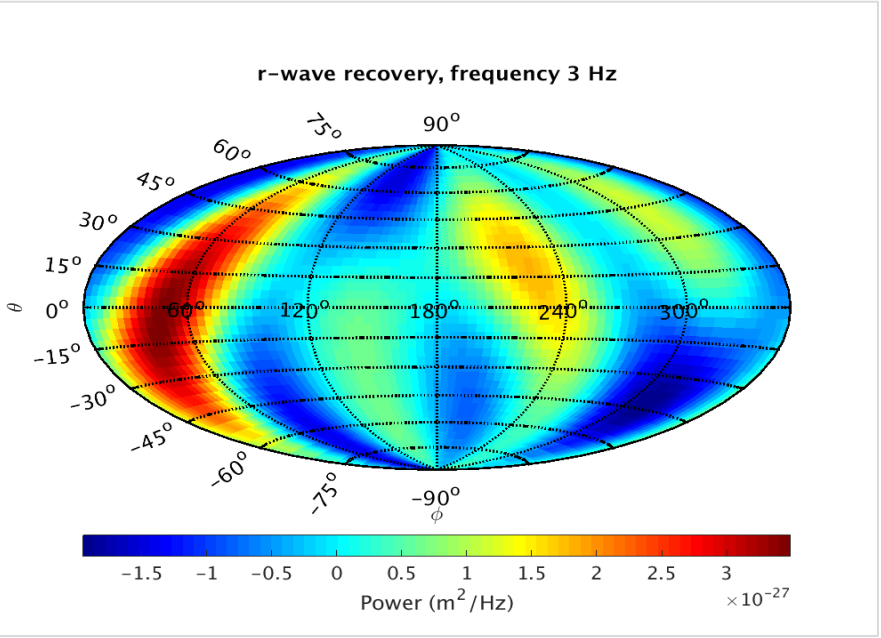

r-wave recovery, frequency 3 Hz
θ
ϕ
Power (m²/Hz)
×10⁻²⁷

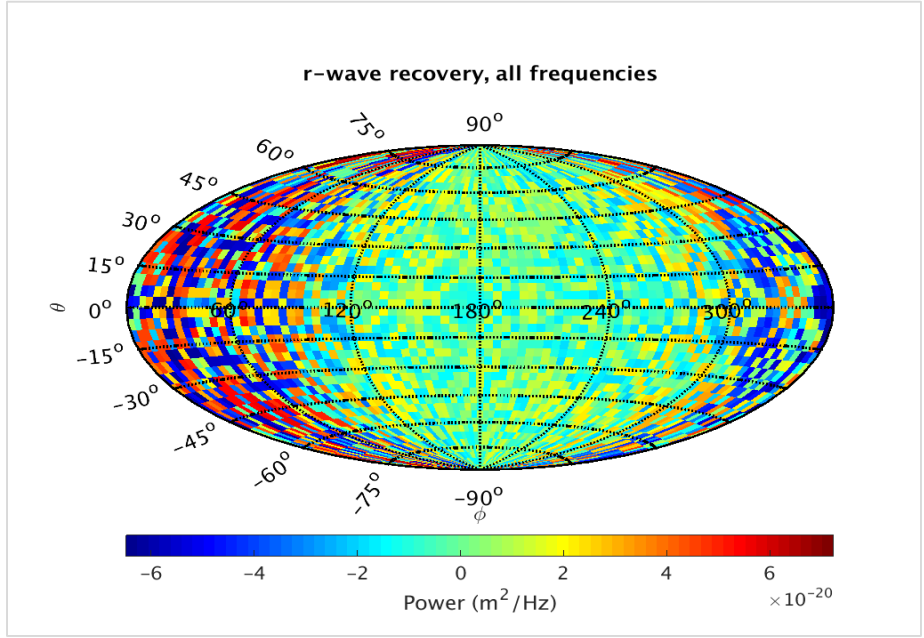

r-wave recovery, all frequencies
θ
ϕ
Power (m²/Hz)
×10⁻¹⁹

α = 250 m ; ϵ = 1

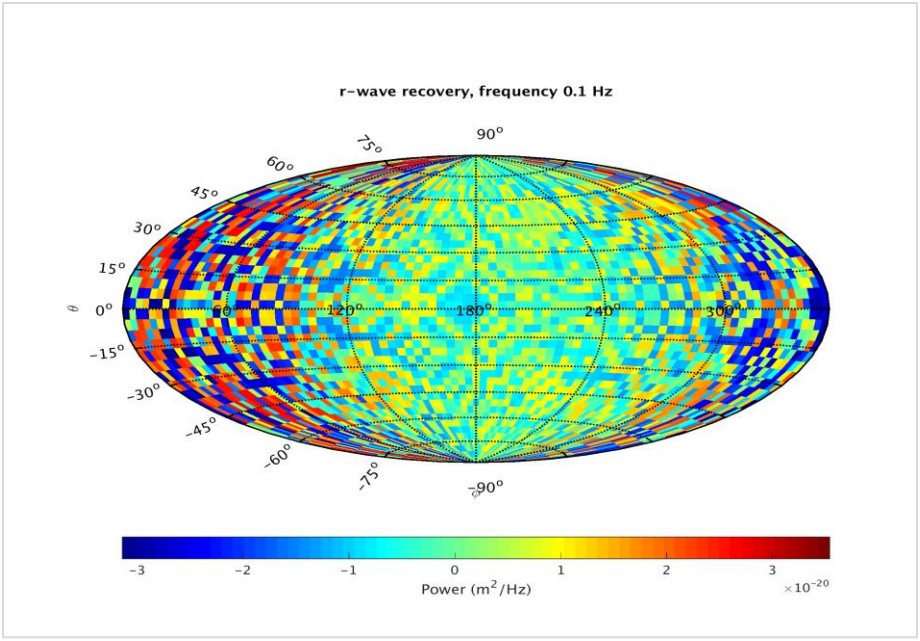

r-wave recovery, frequency 0.1 Hz
θ
ϕ
Power (m²/Hz)
×10⁻²⁰

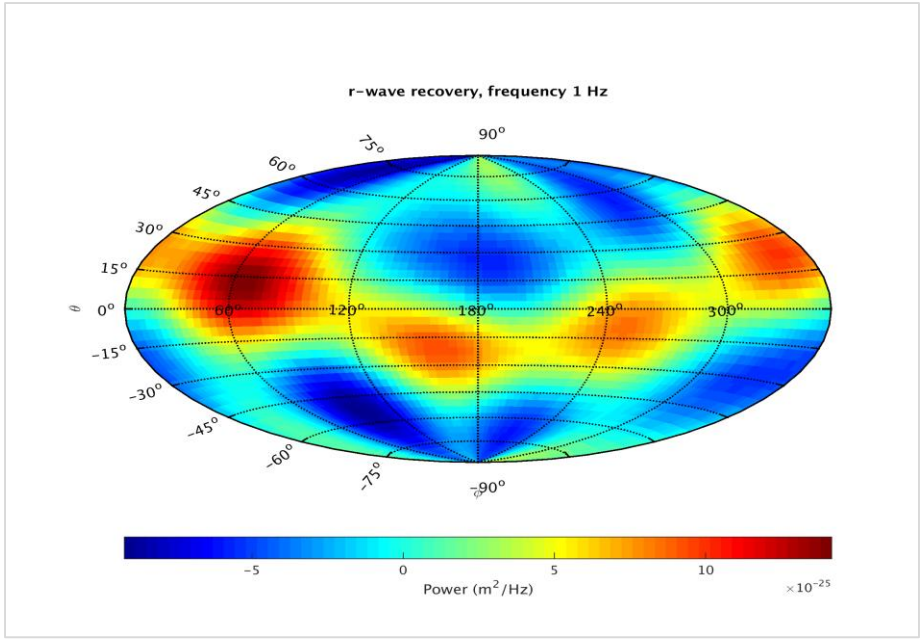

r-wave recovery, frequency 1 Hz
θ
ϕ
Power (m²/Hz)
×10⁻²⁵

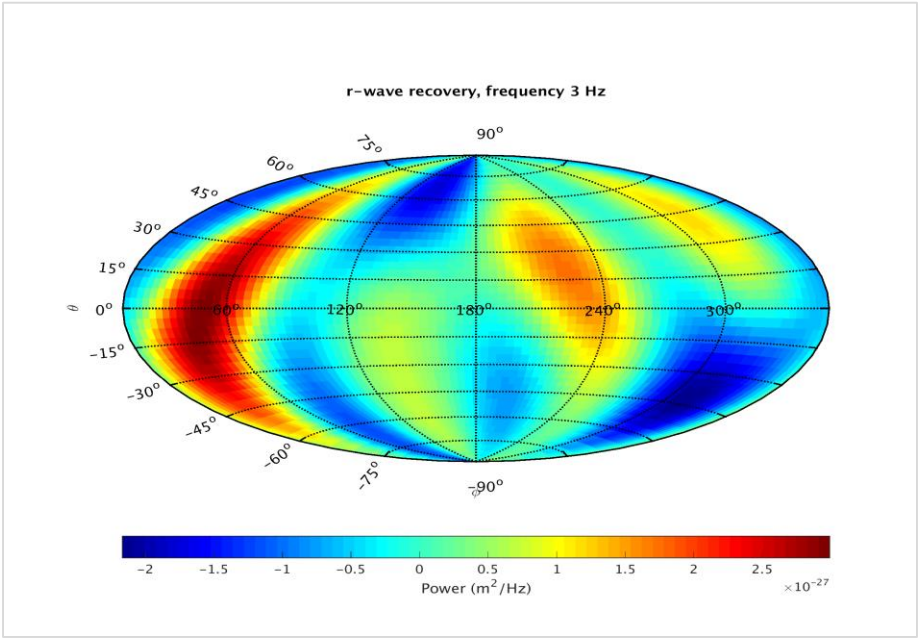

r-wave recovery, frequency 3 Hz
θ
ϕ
Power (m²/Hz)
×10⁻²⁷

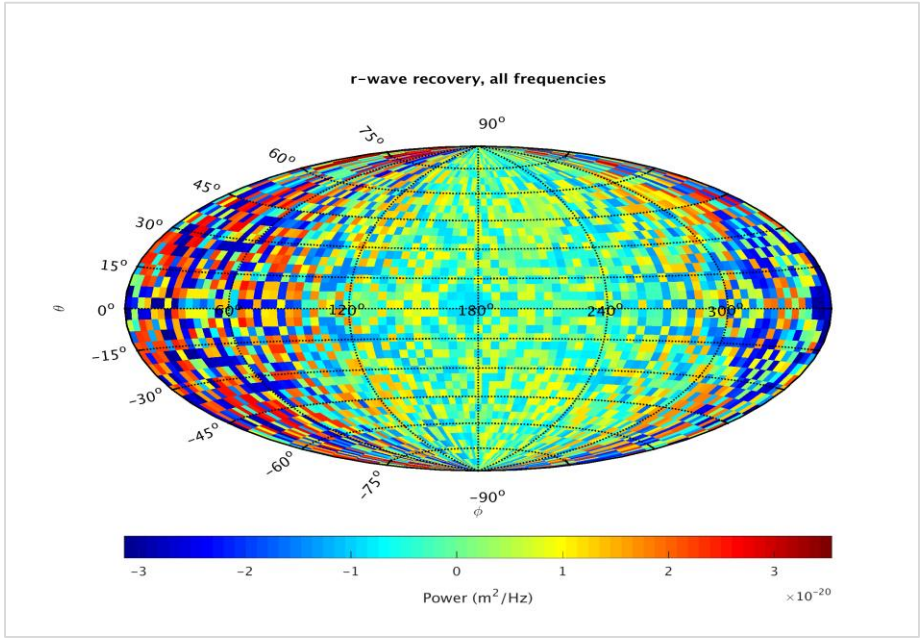

r-wave recovery, all frequencies
θ
ϕ
Power (m²/Hz)
×10⁻²⁰

α = 250 m ; ϵ = 1.3

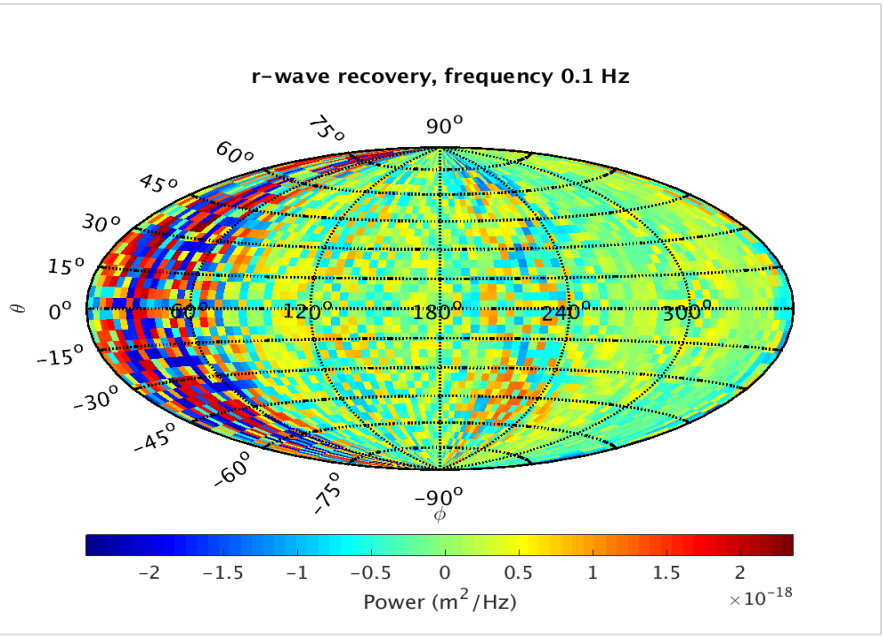

r-wave recovery, frequency 0.1 Hz
Power (m²/Hz)
×10⁻²⁰

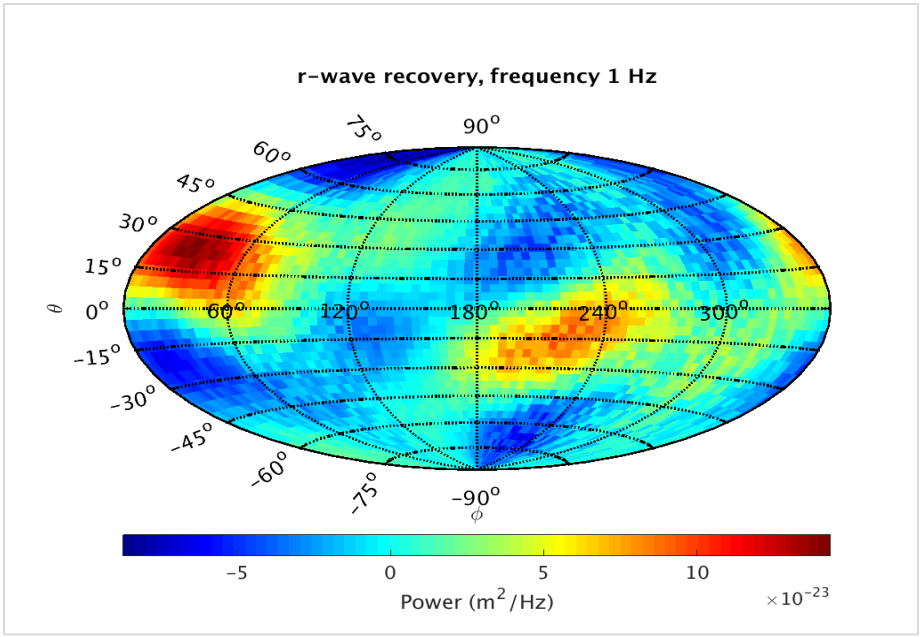

r-wave recovery, frequency 1 Hz
Power (m²/Hz)
×10⁻²⁵

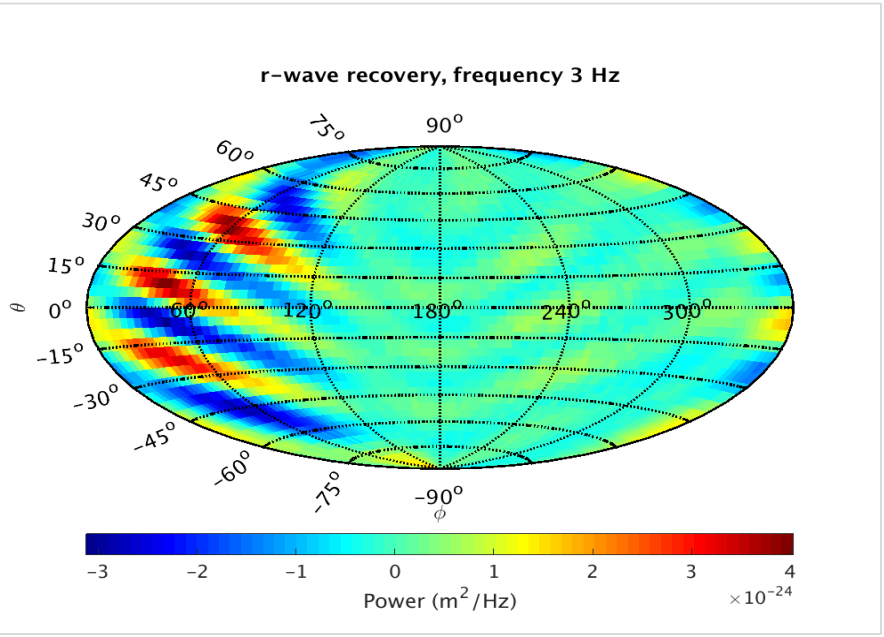

r-wave recovery, frequency 3 Hz
Power (m²/Hz)
×10⁻²⁷

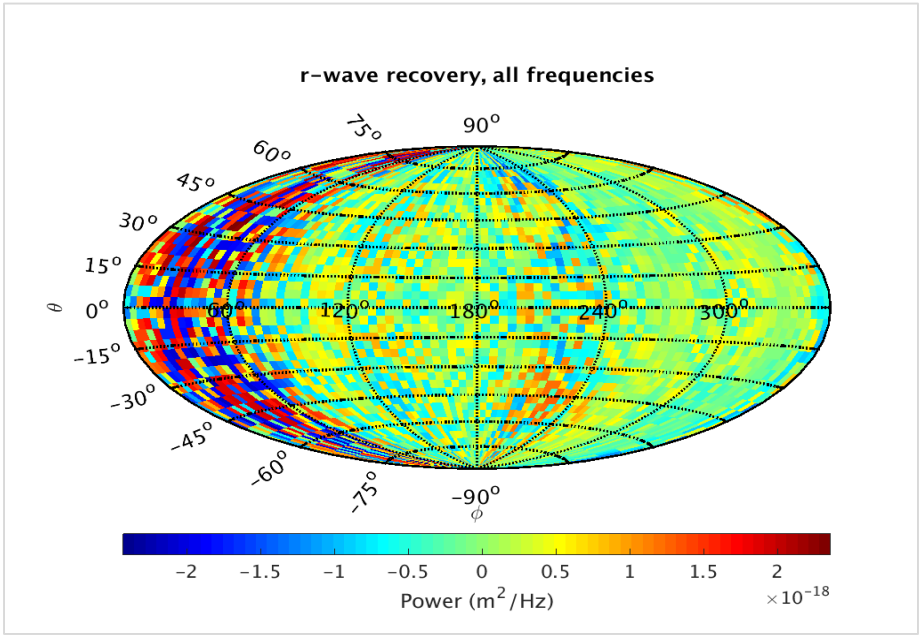

r-wave recovery, all frequencies
Power (m²/Hz)
×10⁻²⁰

α = 400 m ; ϵ = 0.7

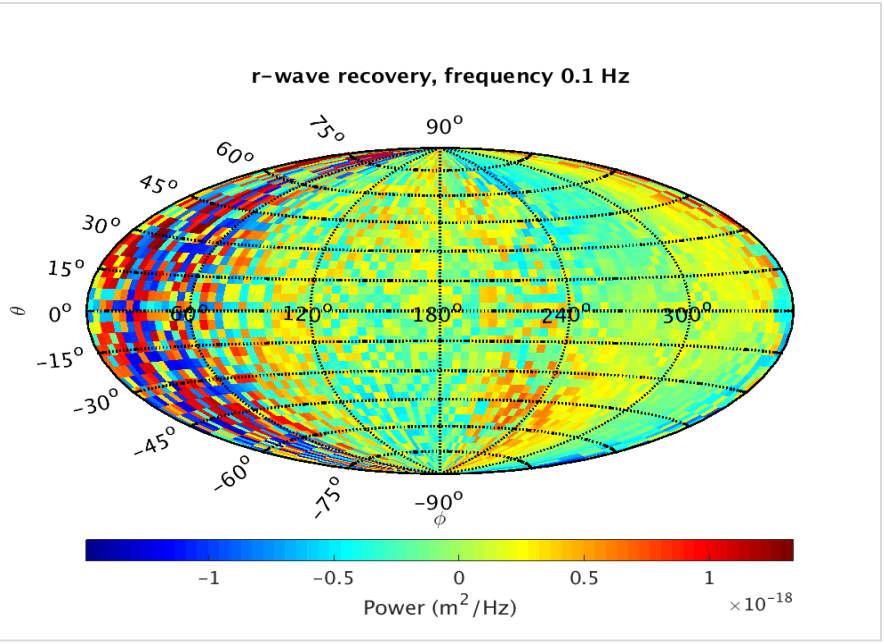

r-wave recovery, frequency 0.1 Hz
θ
ϕ
Power (m²/Hz)
×10⁻¹⁸

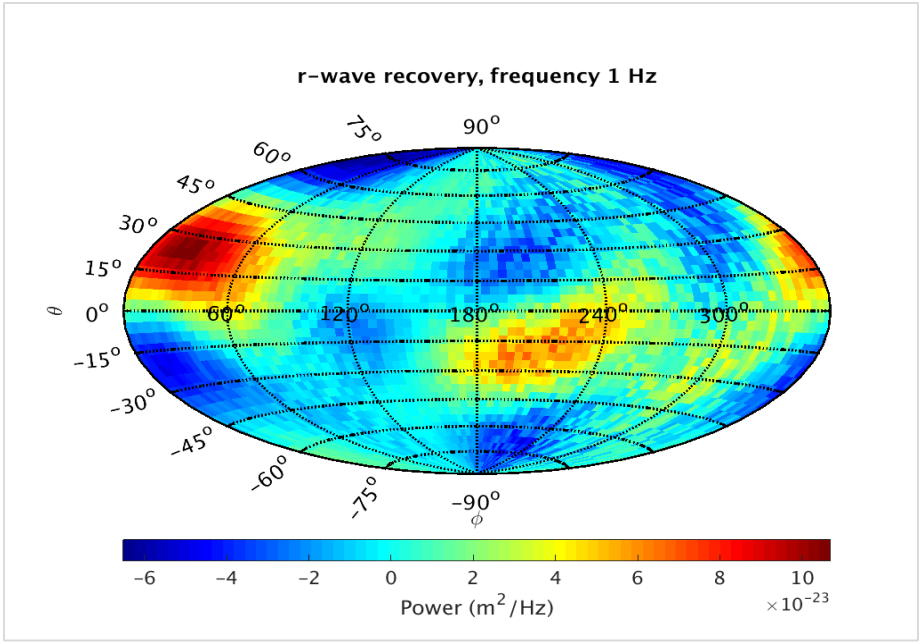

r-wave recovery, frequency 1 Hz
θ
ϕ
Power (m²/Hz)
×10⁻²³

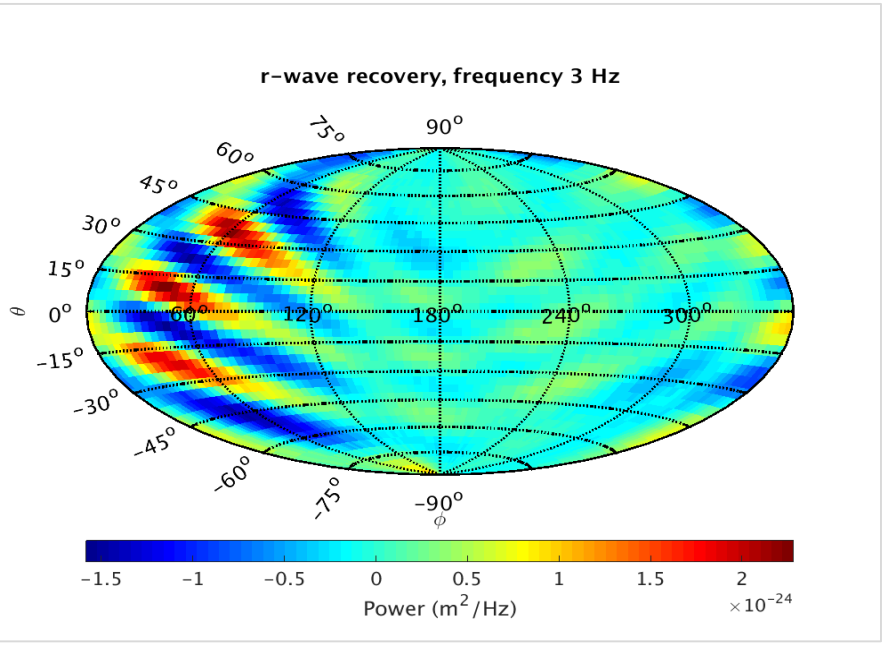

r-wave recovery, frequency 3 Hz
θ
ϕ
Power (m²/Hz)
×10⁻²⁴

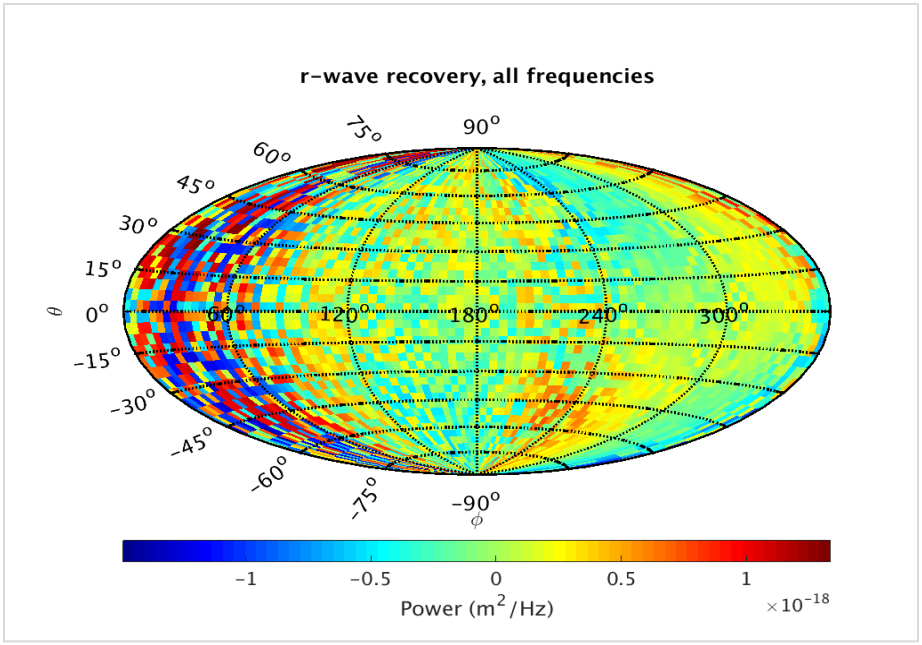

r-wave recovery, all frequencies
θ
ϕ
Power (m²/Hz)
×10⁻¹⁸

α = 400 m ; ϵ = 1

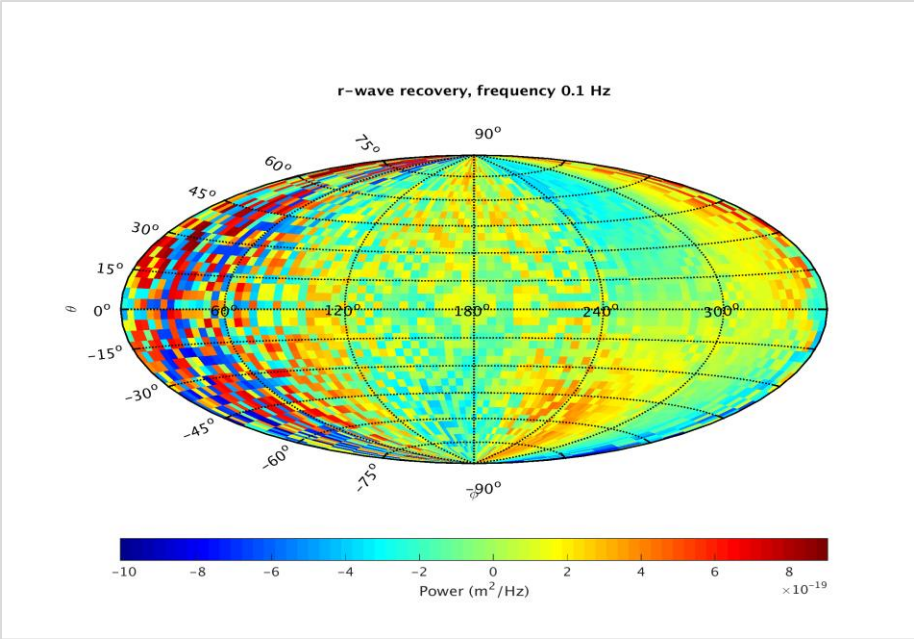

r-wave recovery, frequency 0.1 Hz
90°
75°
60°
45°
30°
15°
0°
-15°
-30°
-45°
-60°
-75°
-90°
θ
φ
60°
120°
180°
240°
300°
-1
-0.5
0
0.5
1
Power (m²/Hz)
×10⁻¹⁸

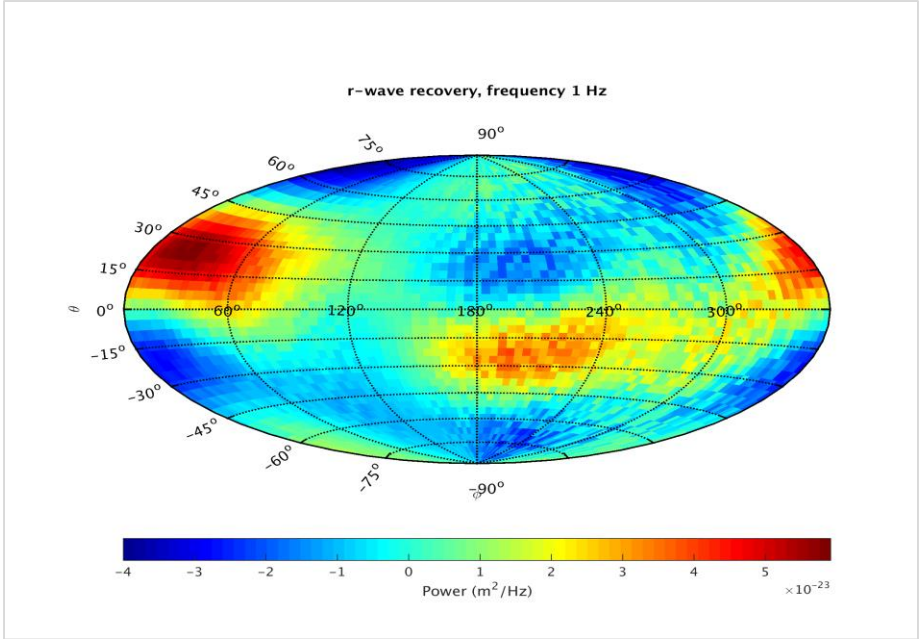

r-wave recovery, frequency 1 Hz
90°
75°
60°
45°
30°
15°
0°
-15°
-30°
-45°
-60°
-75°
-90°
θ
φ
60°
120°
180°
240°
300°
-6
-4
-2
0
2
4
6
8
10
Power (m²/Hz)
×10⁻²³

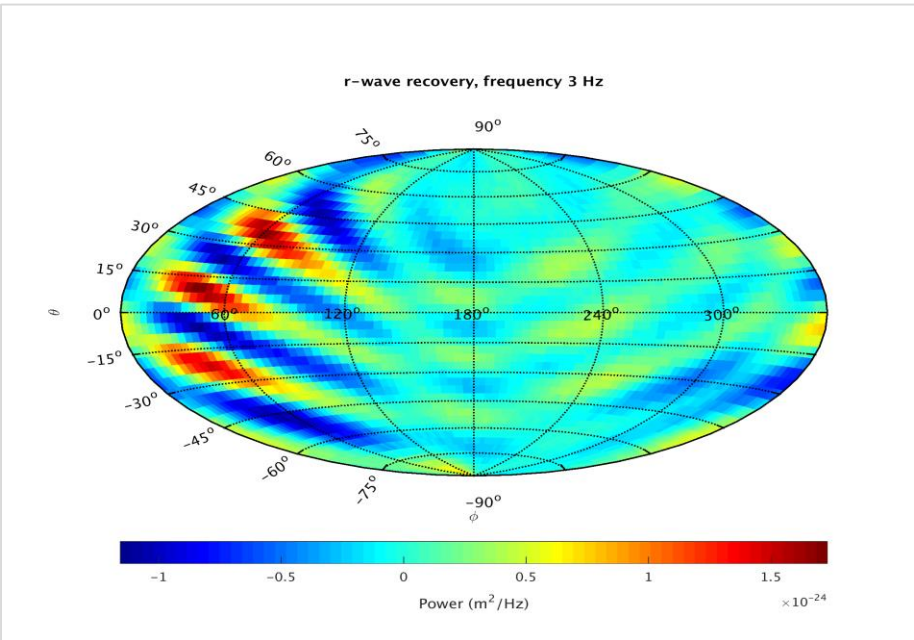

r-wave recovery, frequency 3 Hz
90°
75°
60°
45°
30°
15°
0°
-15°
-30°
-45°
-60°
-75°
-90°
θ
φ
60°
120°
180°
240°
300°
-1.5
-1
-0.5
0
0.5
1
1.5
2
Power (m²/Hz)
×10⁻²⁴

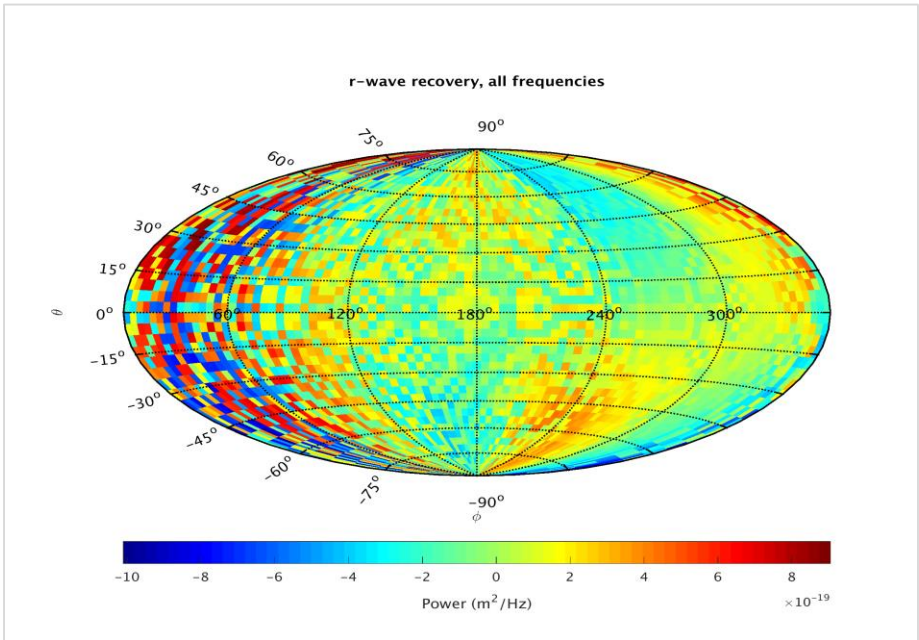

r-wave recovery, all frequencies
90°
75°
60°
45°
30°
15°
0°
-15°
-30°
-45°
-60°
-75°
-90°
θ
φ
60°
120°
180°
240°
300°
-1
-0.5
0
0.5
1
Power (m²/Hz)
×10⁻¹⁸

α = 400 m ; ϵ = 1.3


r-wave recovery, frequency 0.1 Hz
90°
75°
60°
45°
30°
15°
0°
-15°
-30°
-45°
-60°
-75°
-90°
θ
ϕ
60°
120°
180°
240°
300°
−10 −8 −6 −4 −2 0 2 4 6 8
Power (m²/Hz)
×10⁻¹⁹


r-wave recovery, frequency 1 Hz
90°
75°
60°
45°
30°
15°
0°
-15°
-30°
-45°
-60°
-75°
-90°
θ
ϕ
60°
120°
180°
240°
300°
−4 −3 −2 −1 0 1 2 3 4 5
Power (m²/Hz)
×10⁻²³


r-wave recovery, frequency 3 Hz
90°
75°
60°
45°
30°
15°
0°
-15°
-30°
-45°
-60°
-75°
-90°
θ
ϕ
60°
120°
180°
240°
300°
−1 −0.5 0 0.5 1 1.5
Power (m²/Hz)
×10⁻²⁴


r-wave recovery, all frequencies
90°
75°
60°
45°
30°
15°
0°
-15°
-30°
-45°
-60°
-75°
-90°
θ
ϕ
60°
120°
180°
240°
300°
−10 −8 −6 −4 −2 0 2 4 6 8
Power (m²/Hz)
×10⁻¹⁹

Comments

- As α is varied, there is more variation in the recovered power signals than when ϵ is varied.
  - There is even more variation in recovered signal (than in the above cases) as recovery frequency is varied.
- Frequently, there will be a strong signal recovered; then, a weaker signal (of the same shape) will be recovered 180° from the original.
  - My thoughts are that, maybe, the seismometer is detecting vibrations from a Rayleigh wave being reflected off the cavity walls