PACS power spectrum estimation

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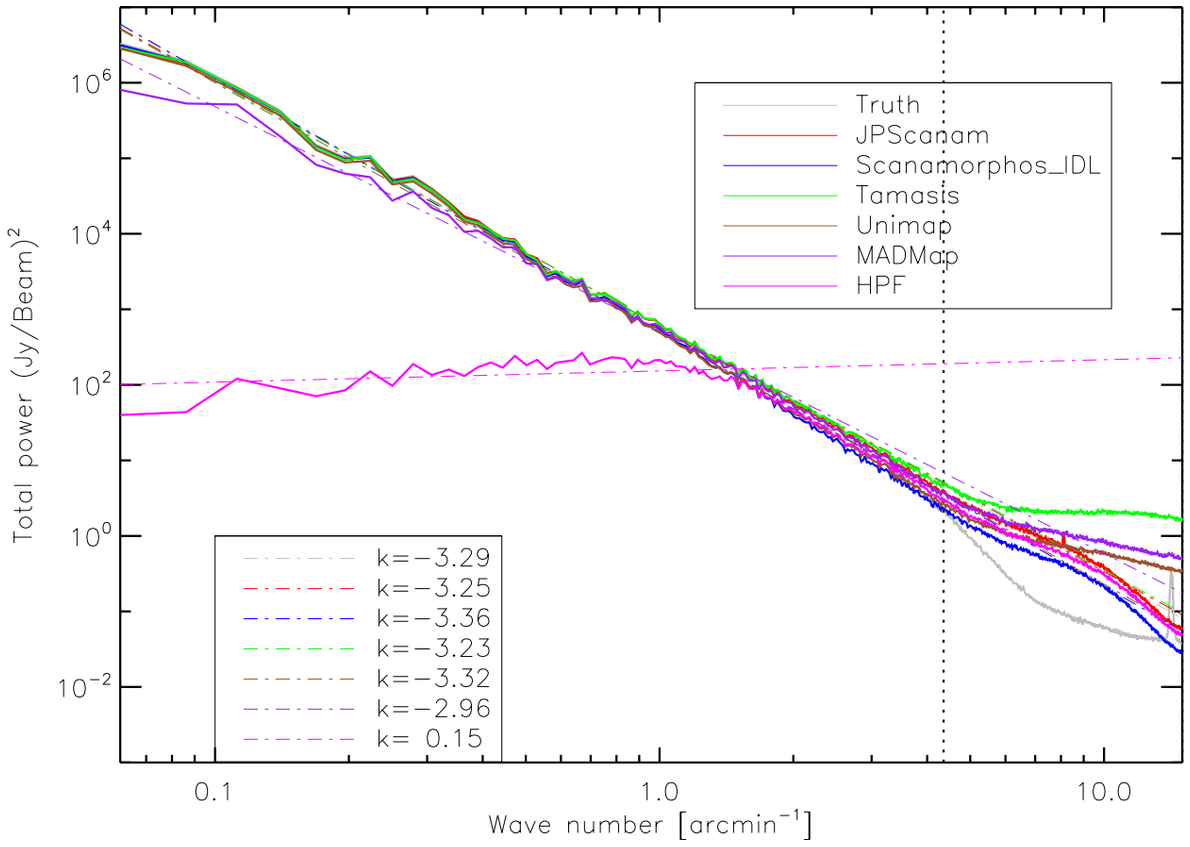
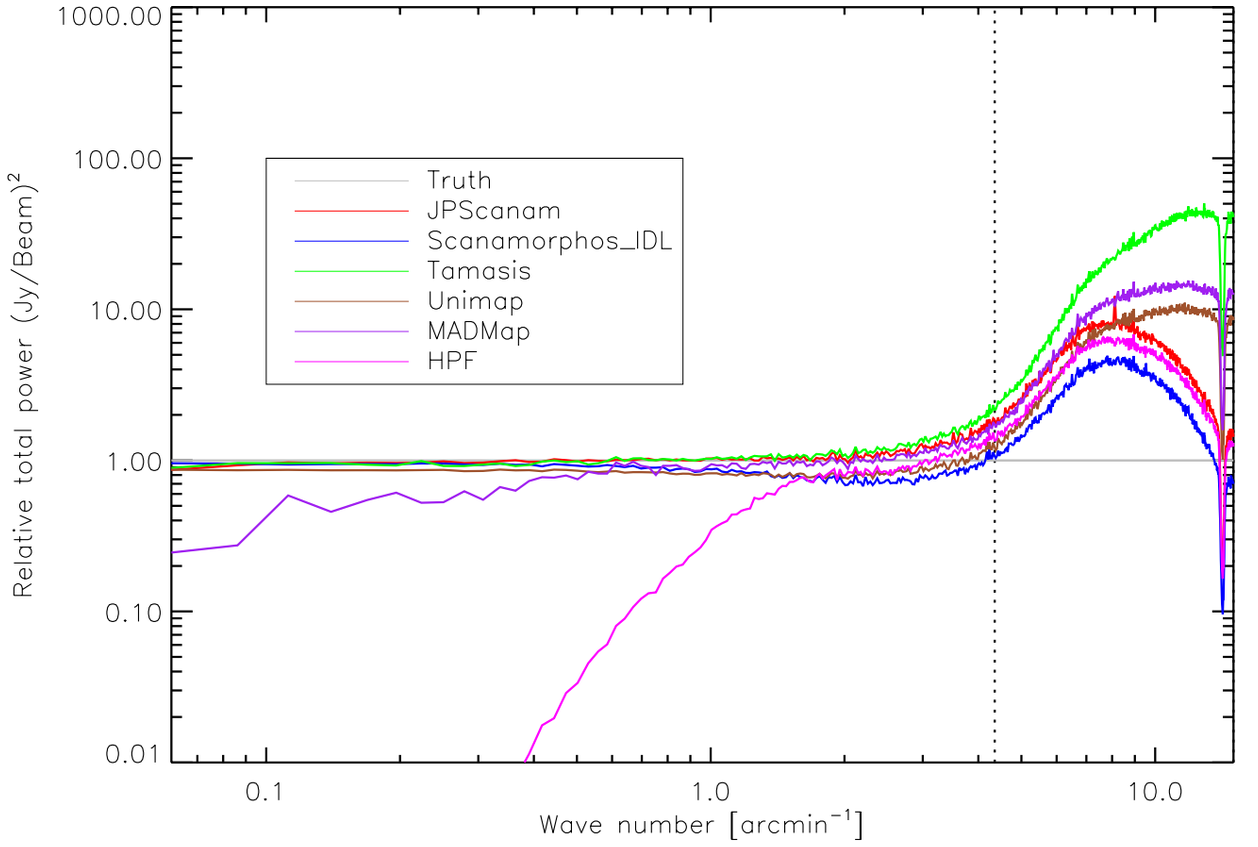
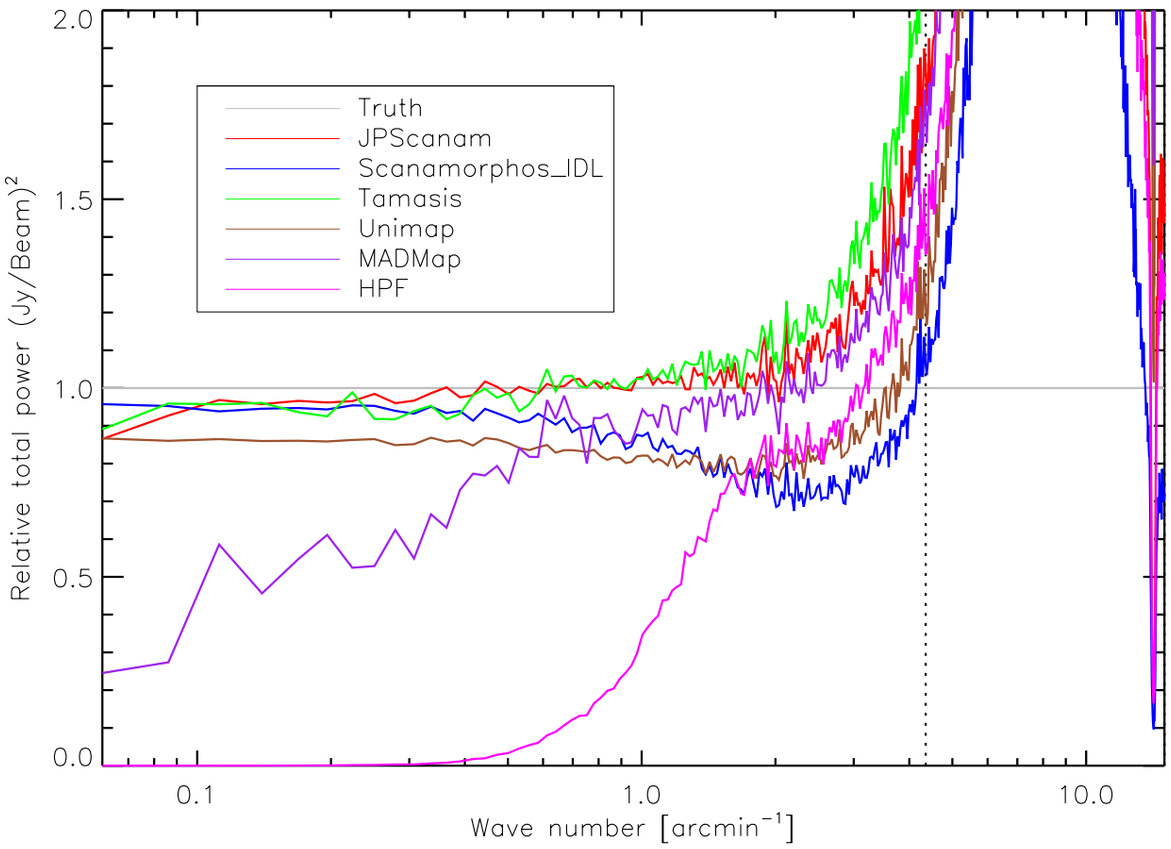
2) ESAC HSC

- IDL code provided by Jim Ingalls
  - Fourier Transform of the image
  - Normalisation by number of pixels
    - If beam-corrected, then FFT image is divided by the FFT of beam
  - Renormalisation of the average 2D power spectra by the summed square surface brightnesses in the original image
  - Setting up k-bins
  - Averaging values in bins
- Comparison with truth maps
  - Total power
  - Beam corrected power
- Power spectra of real data

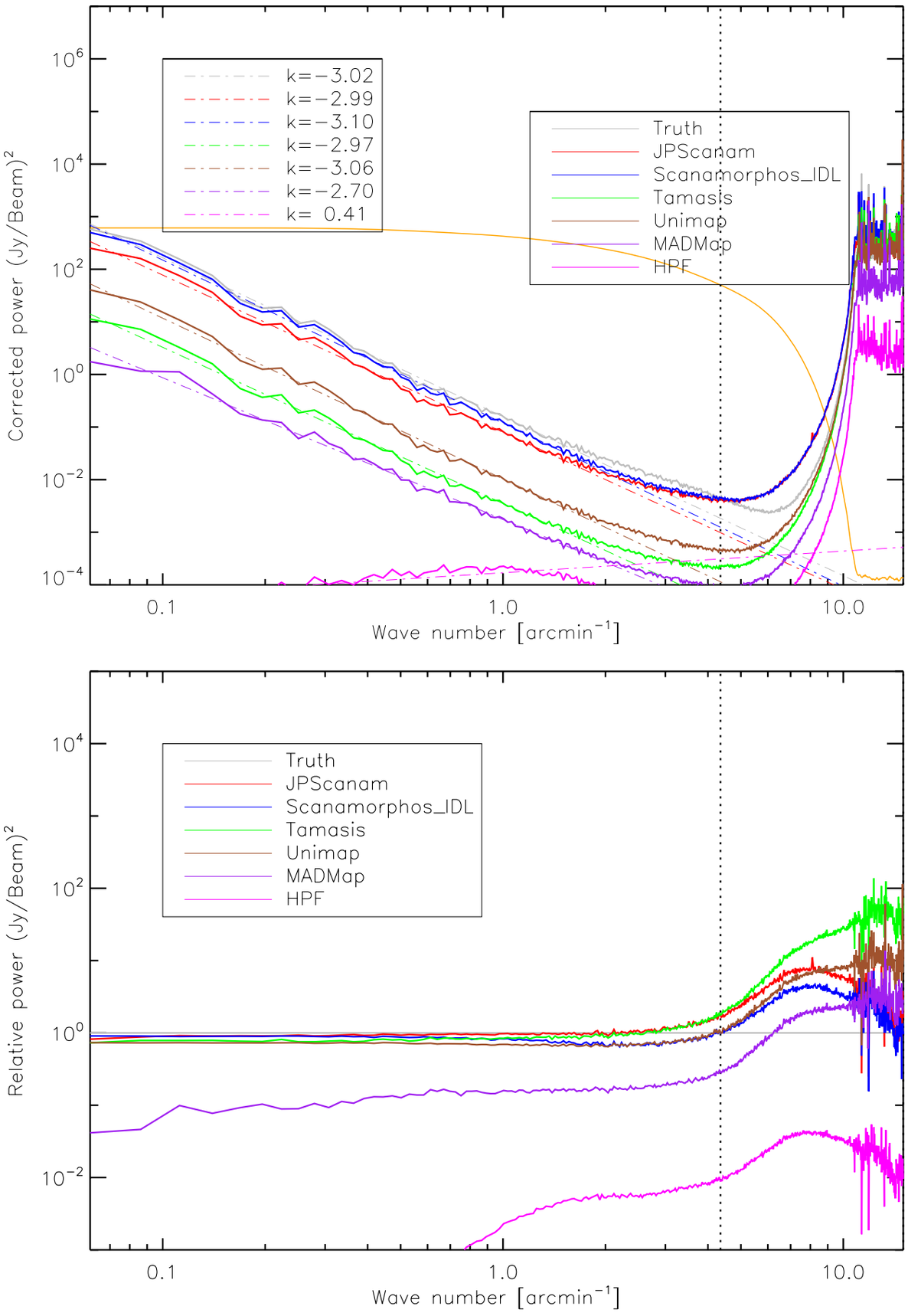
Bright blue reprojected - without correction

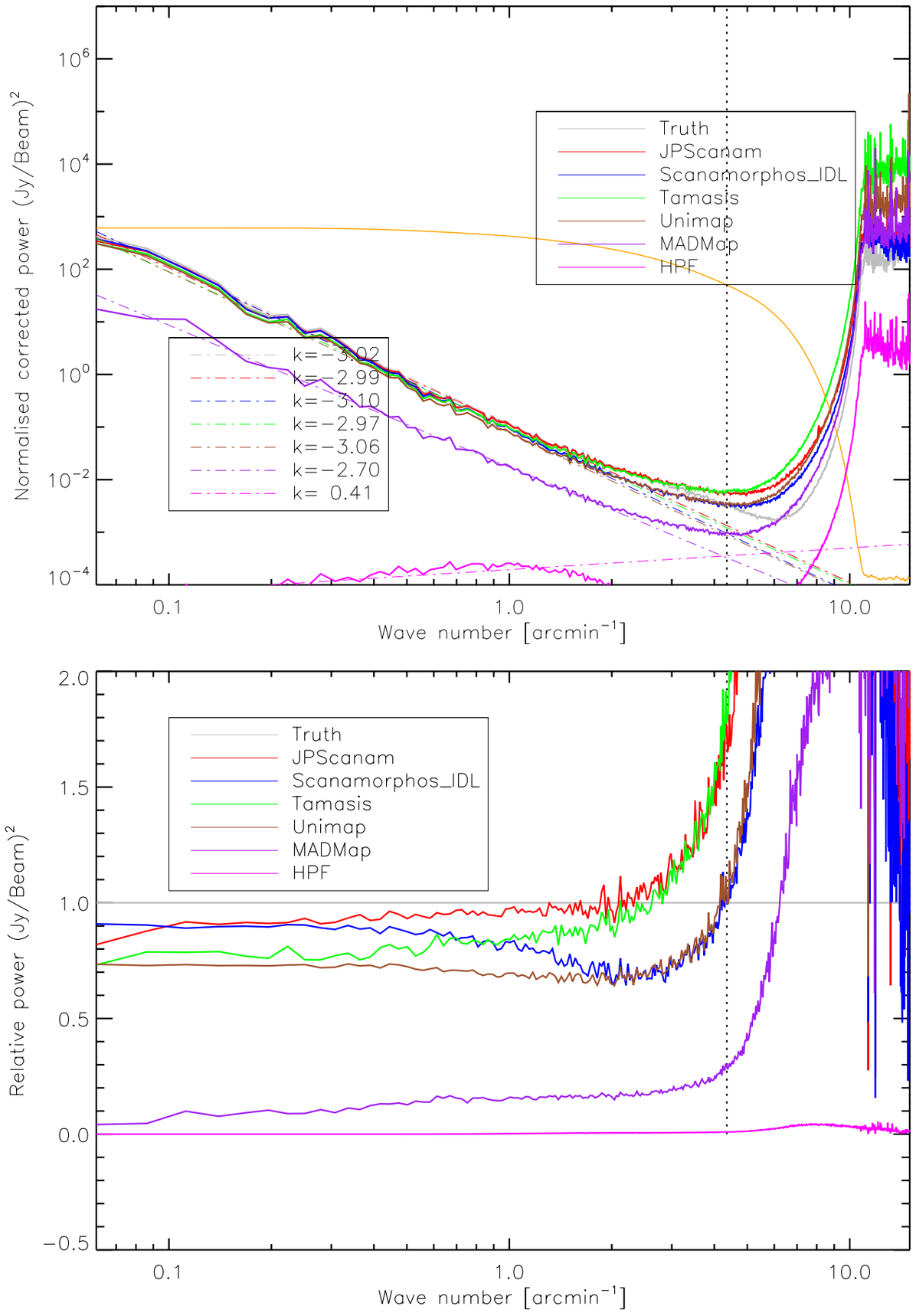




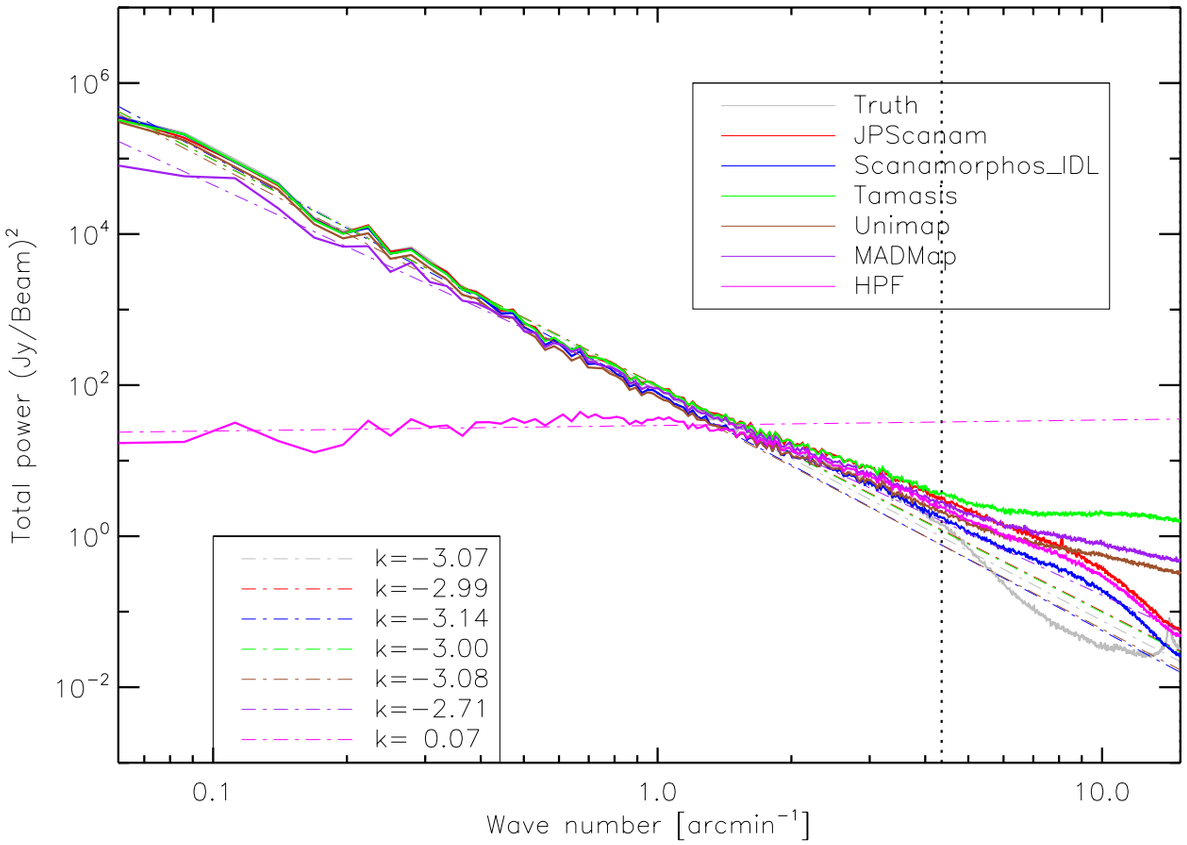


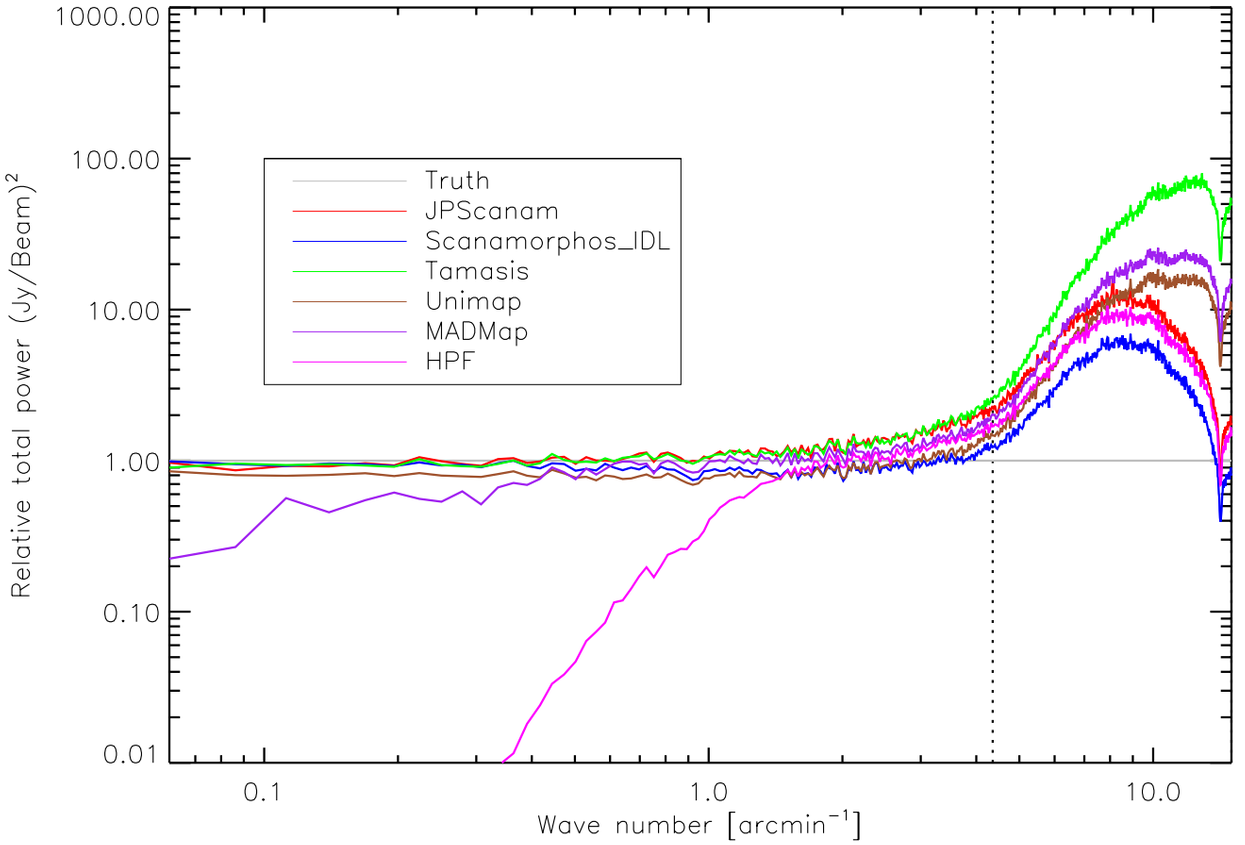
Bright blue reprojected - corrected

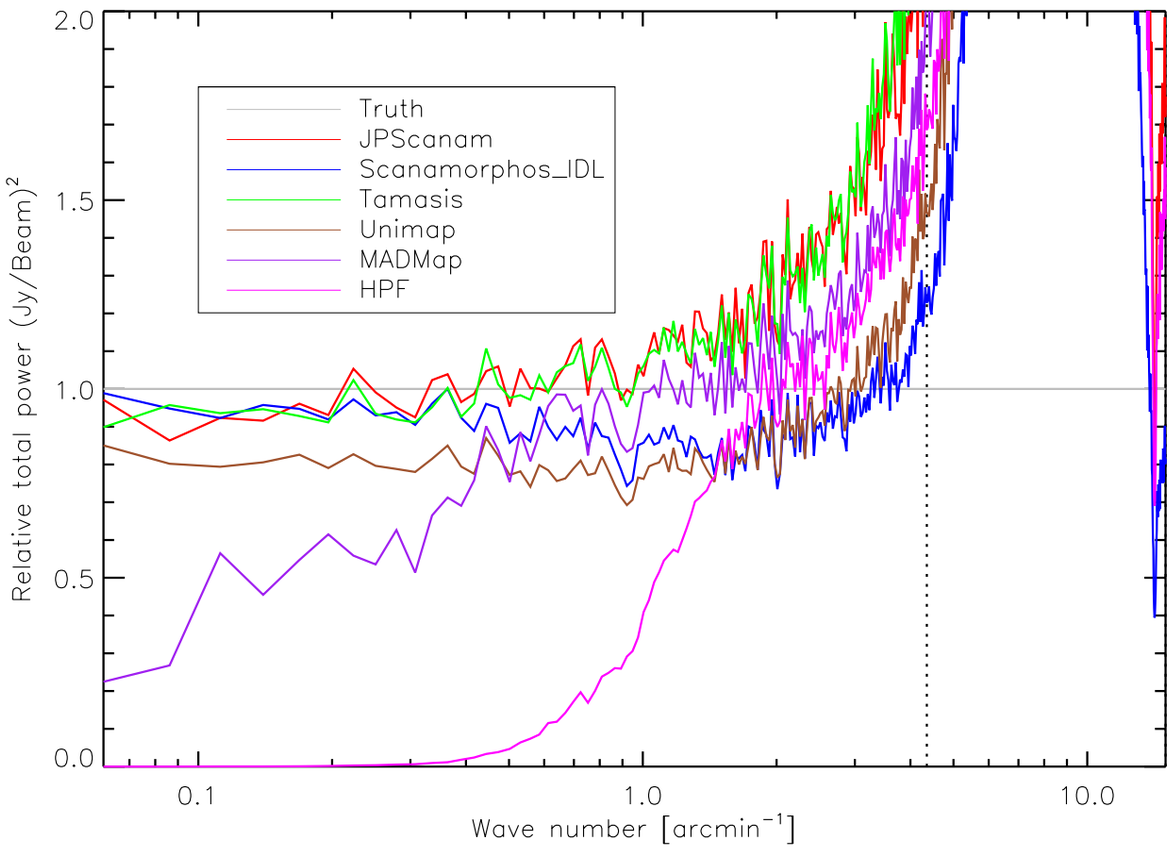




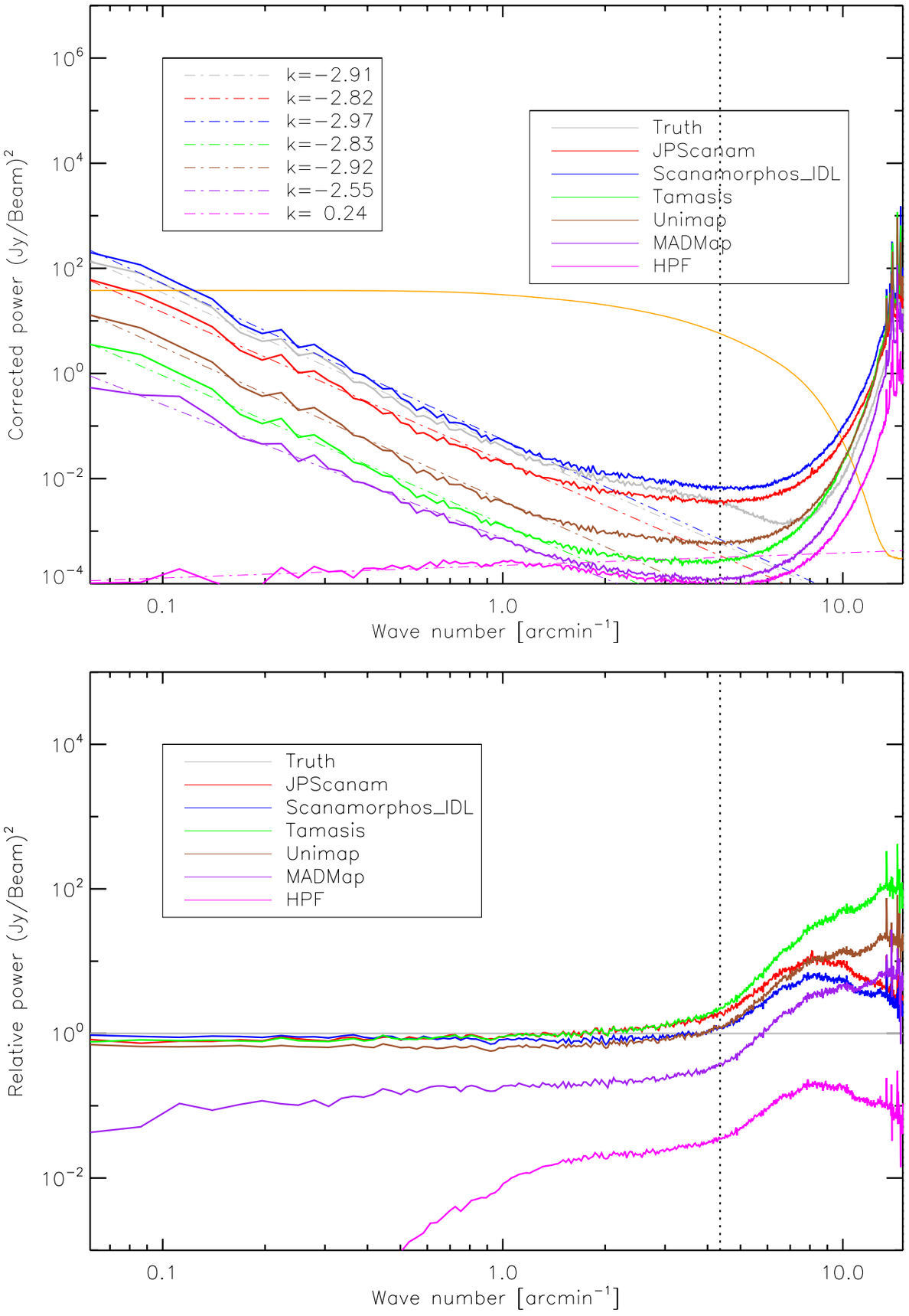
Faint blue reprojected - without correction

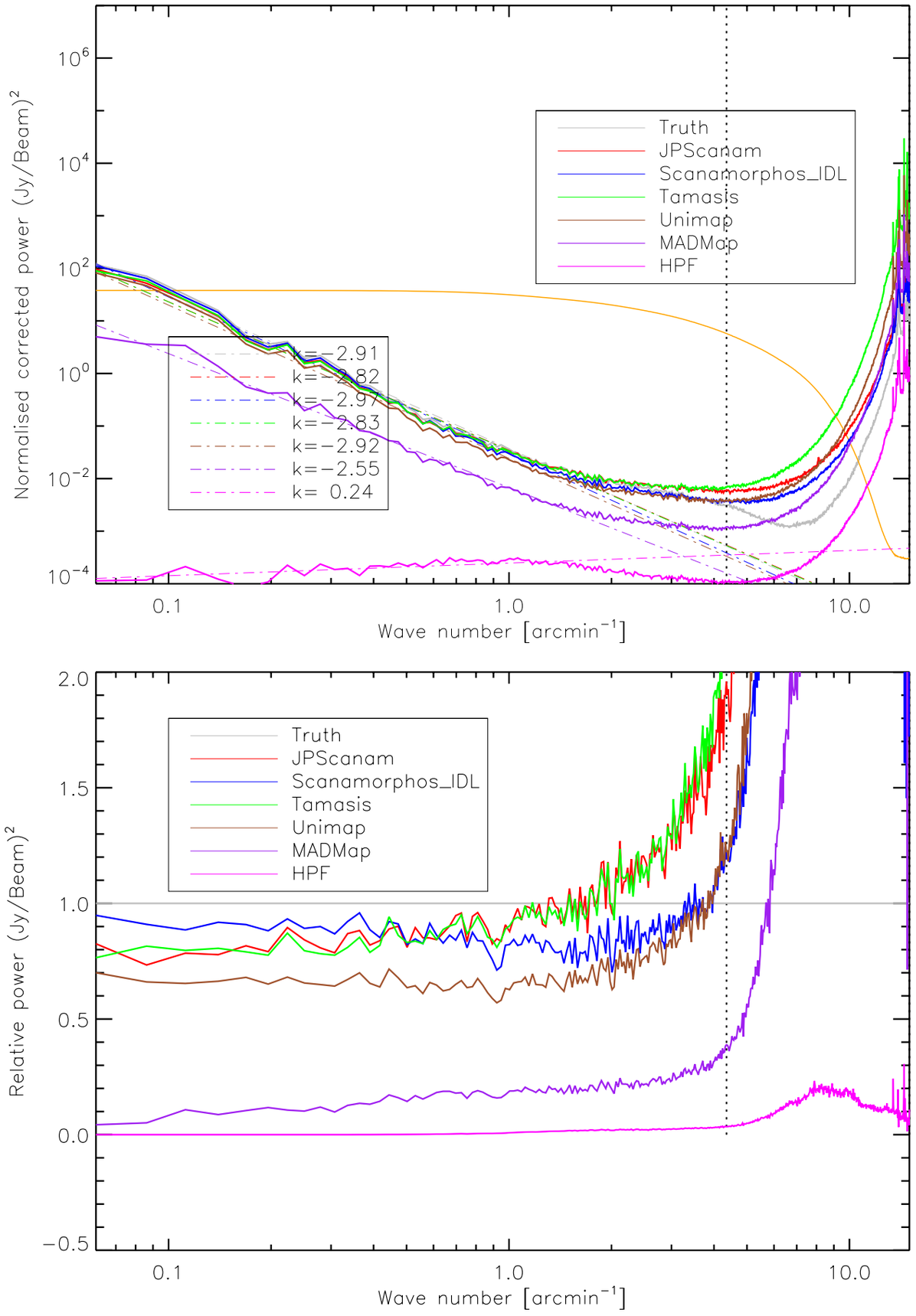




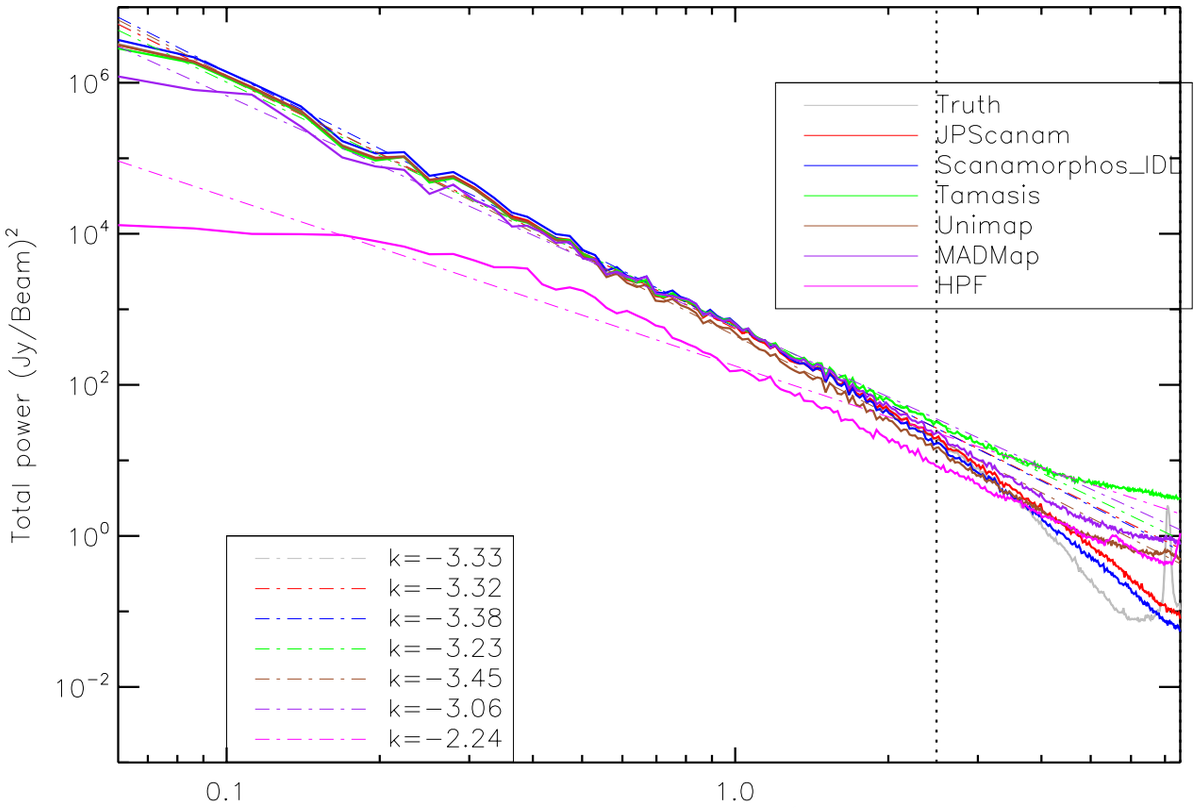


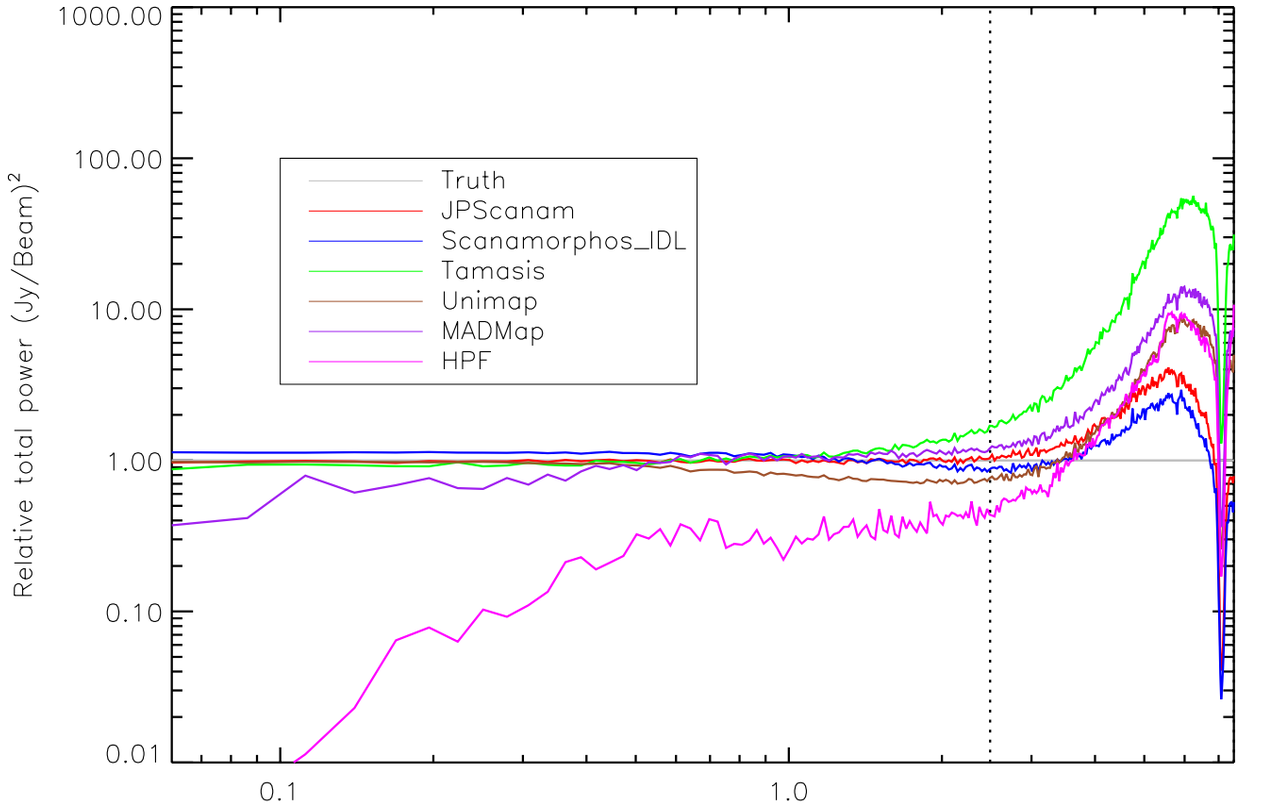
Faint blue reprojected - corrected

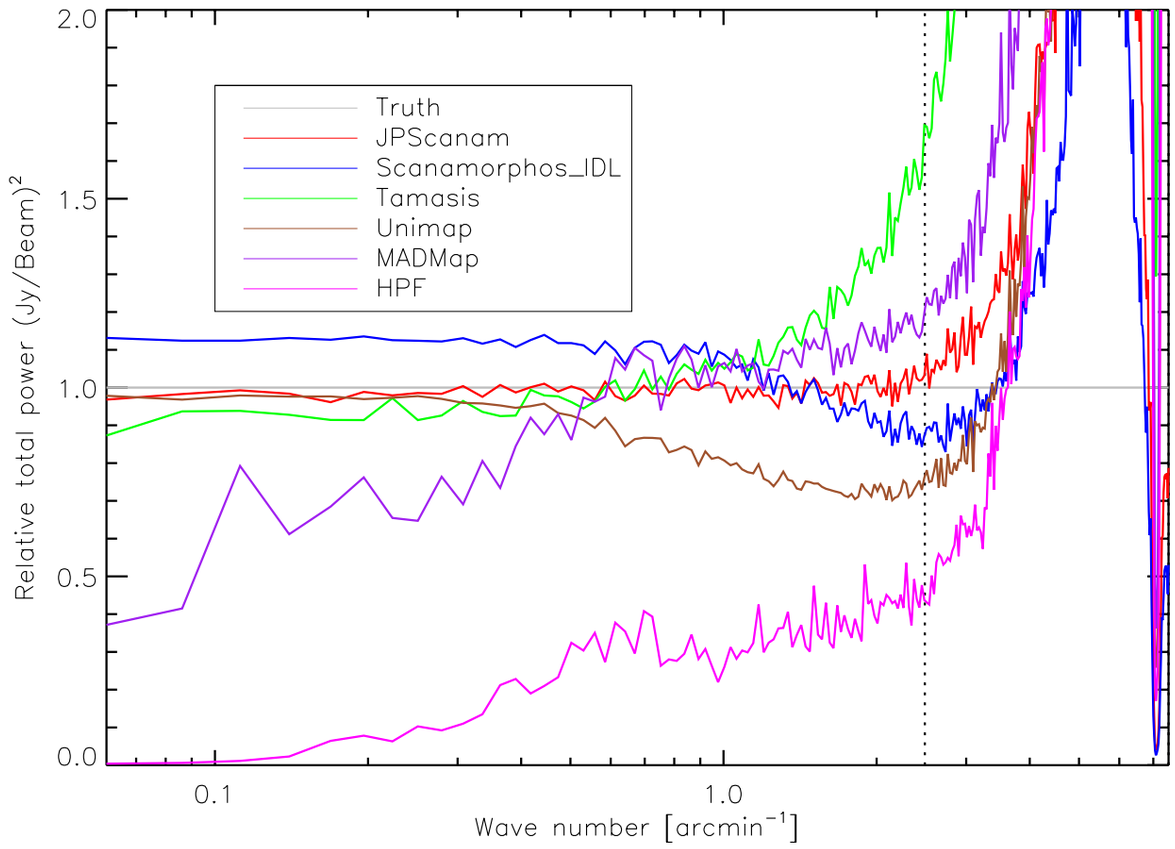




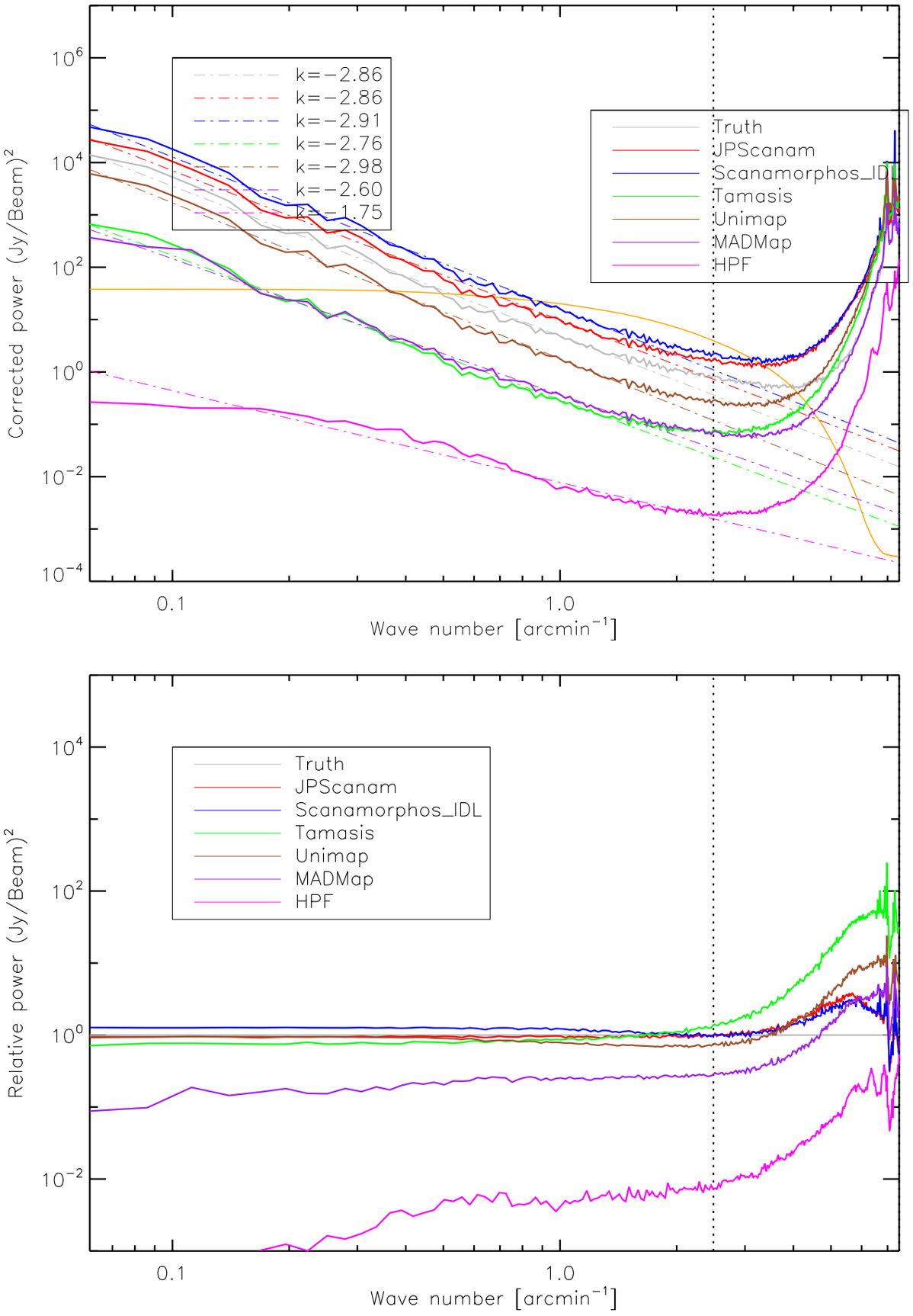
Bright red reprojected - without correction

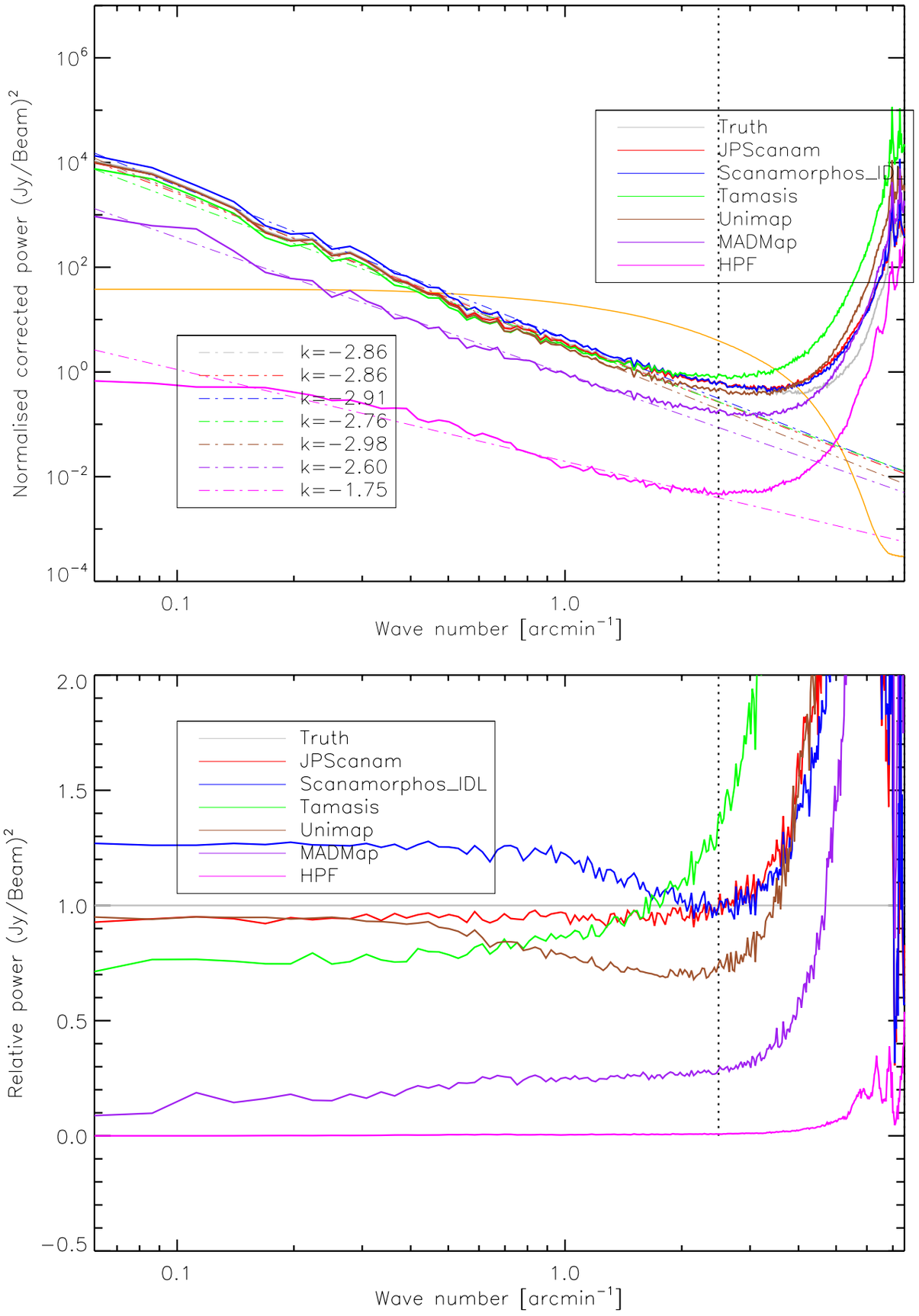




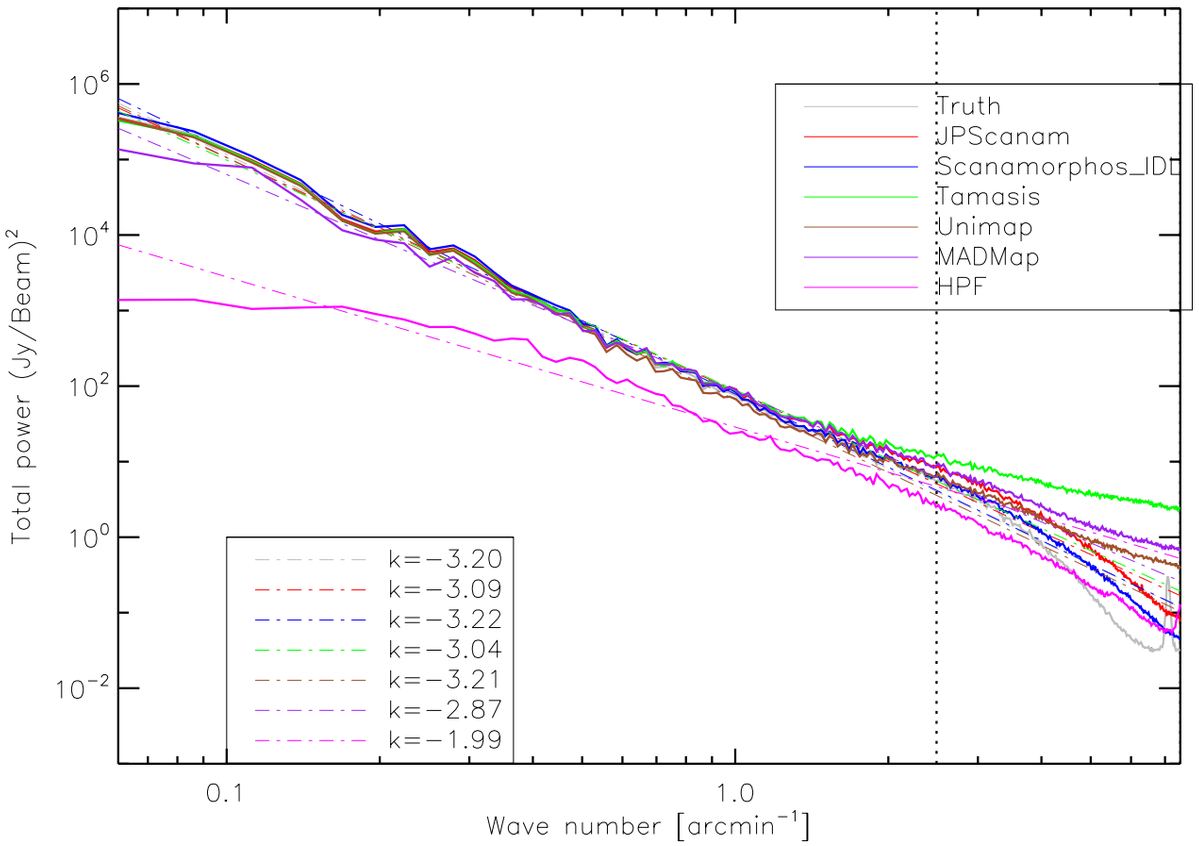


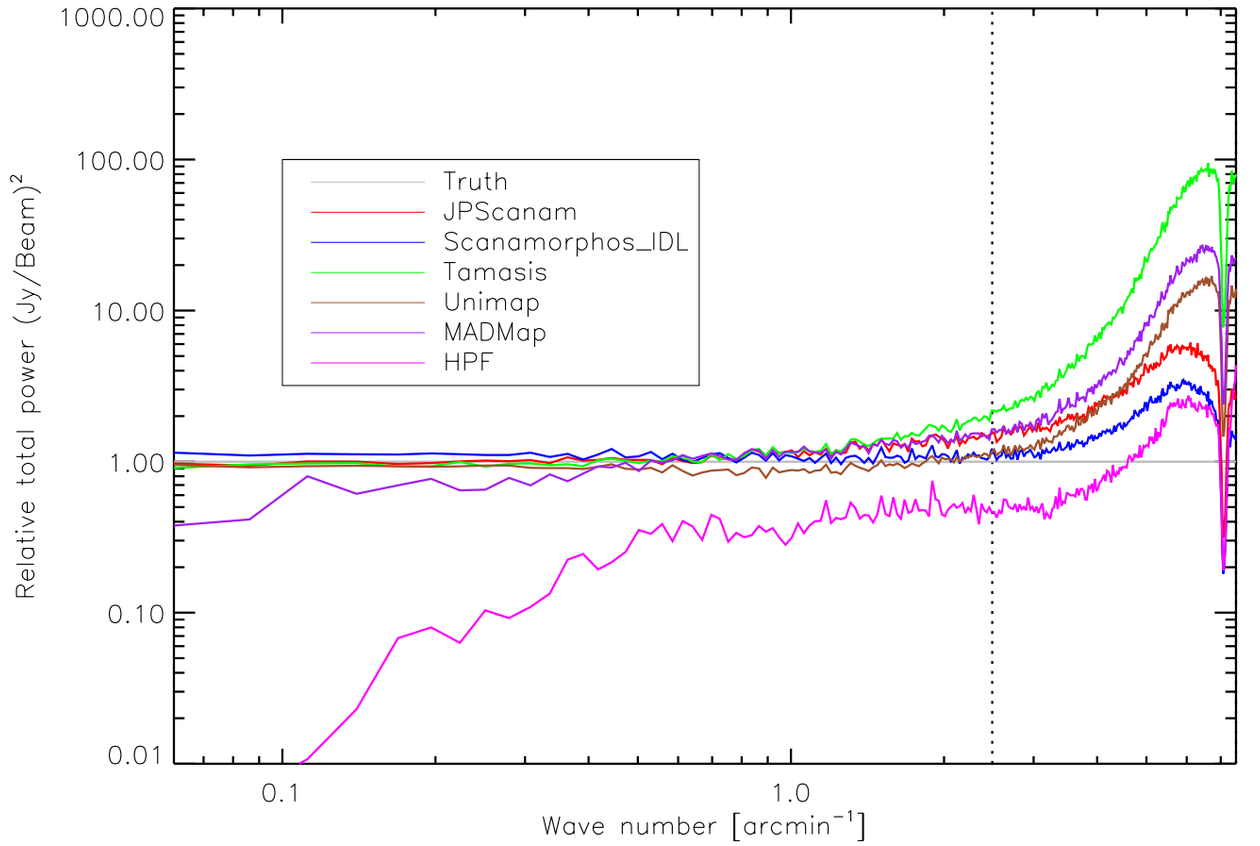
Bright red reprojected - corrected

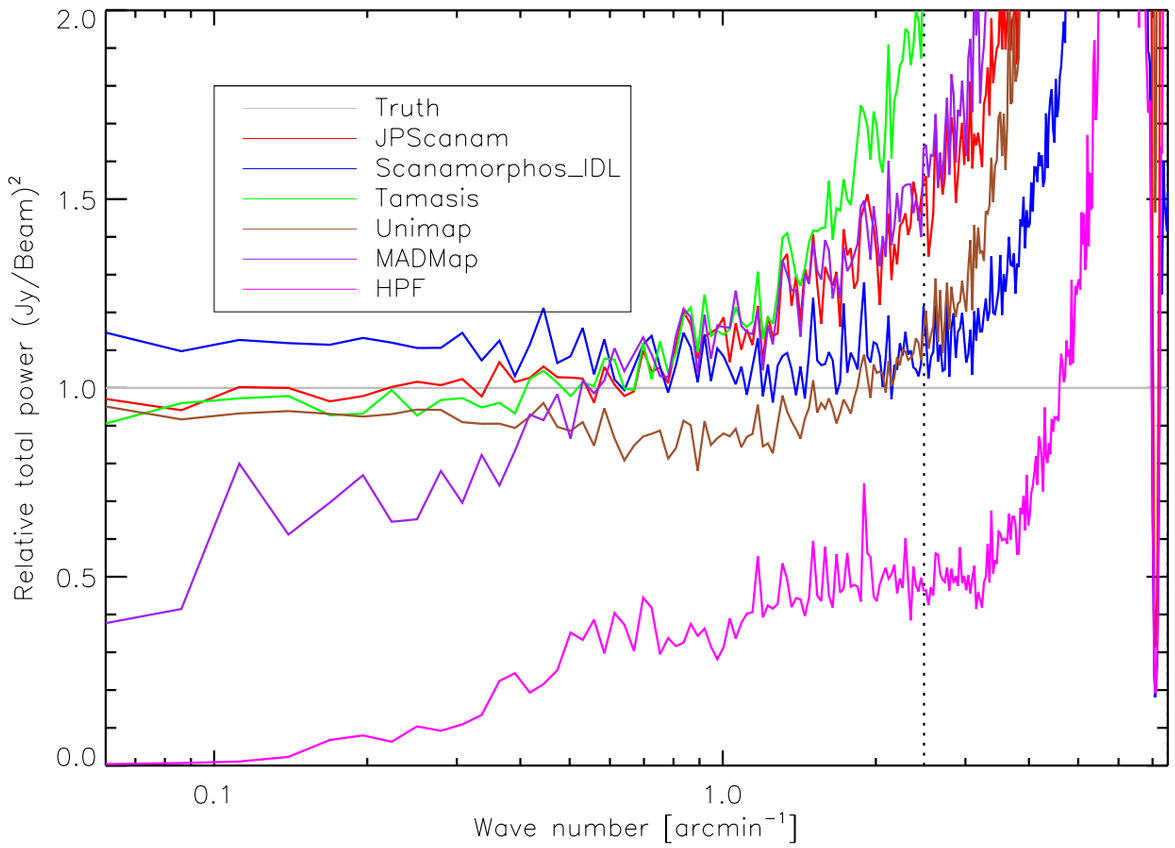




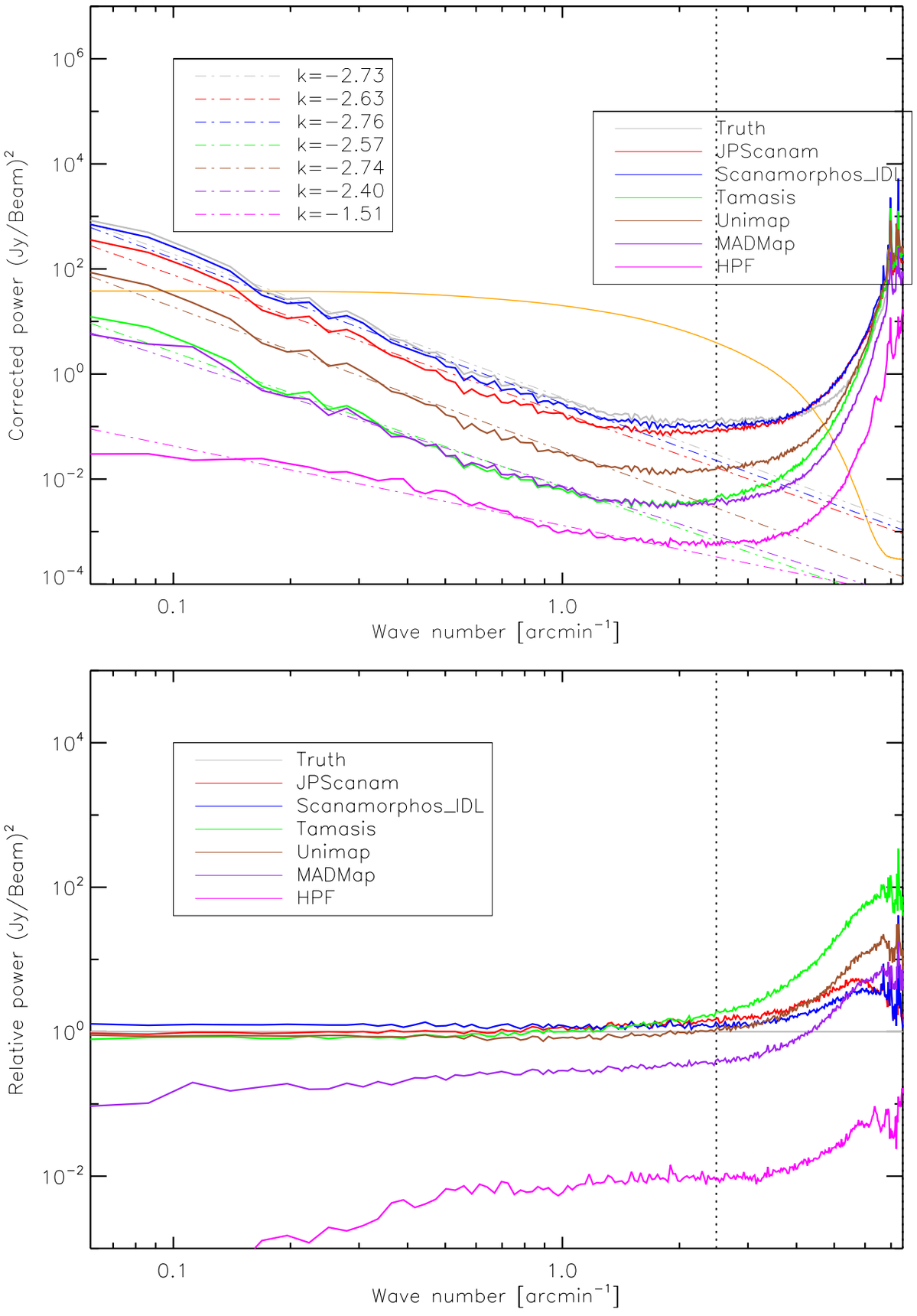
Faint red reprojected - without correction

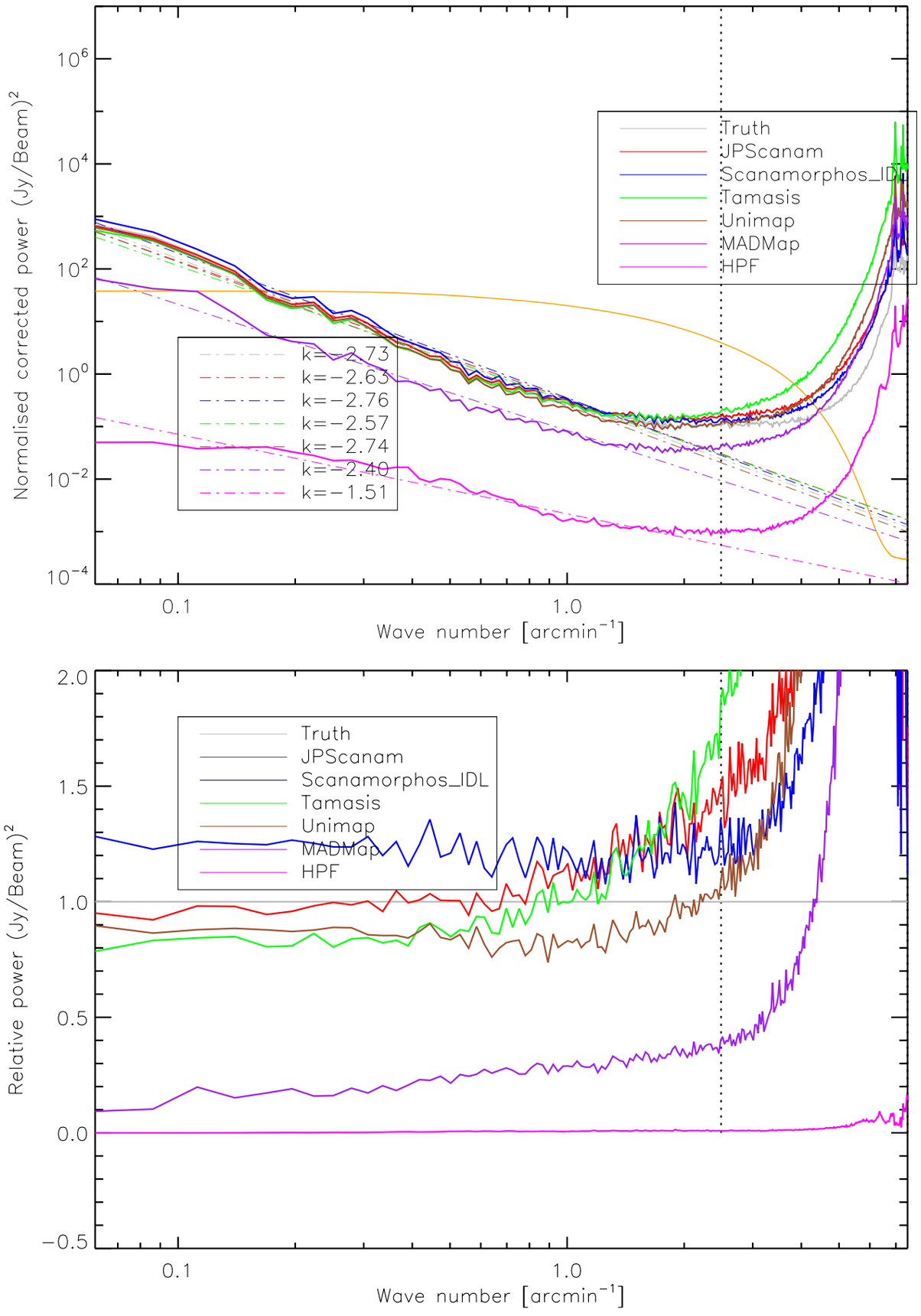




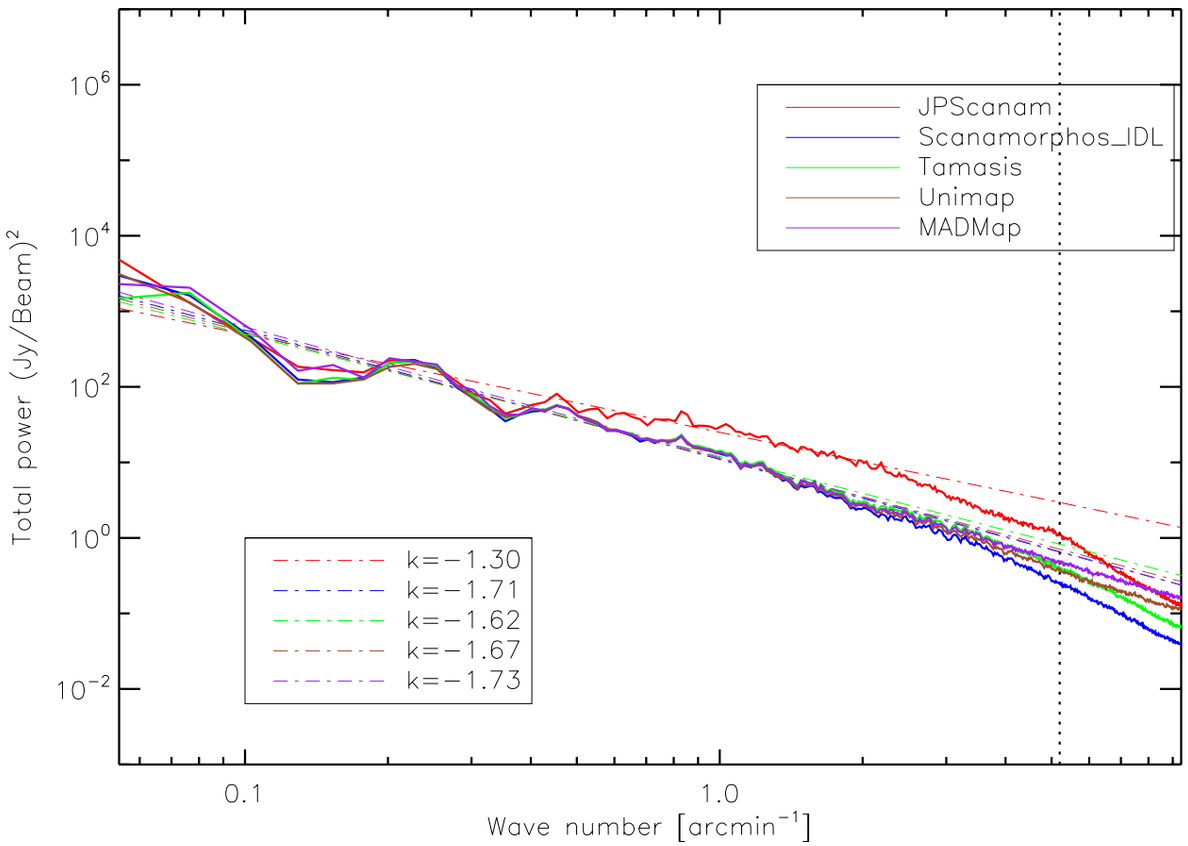


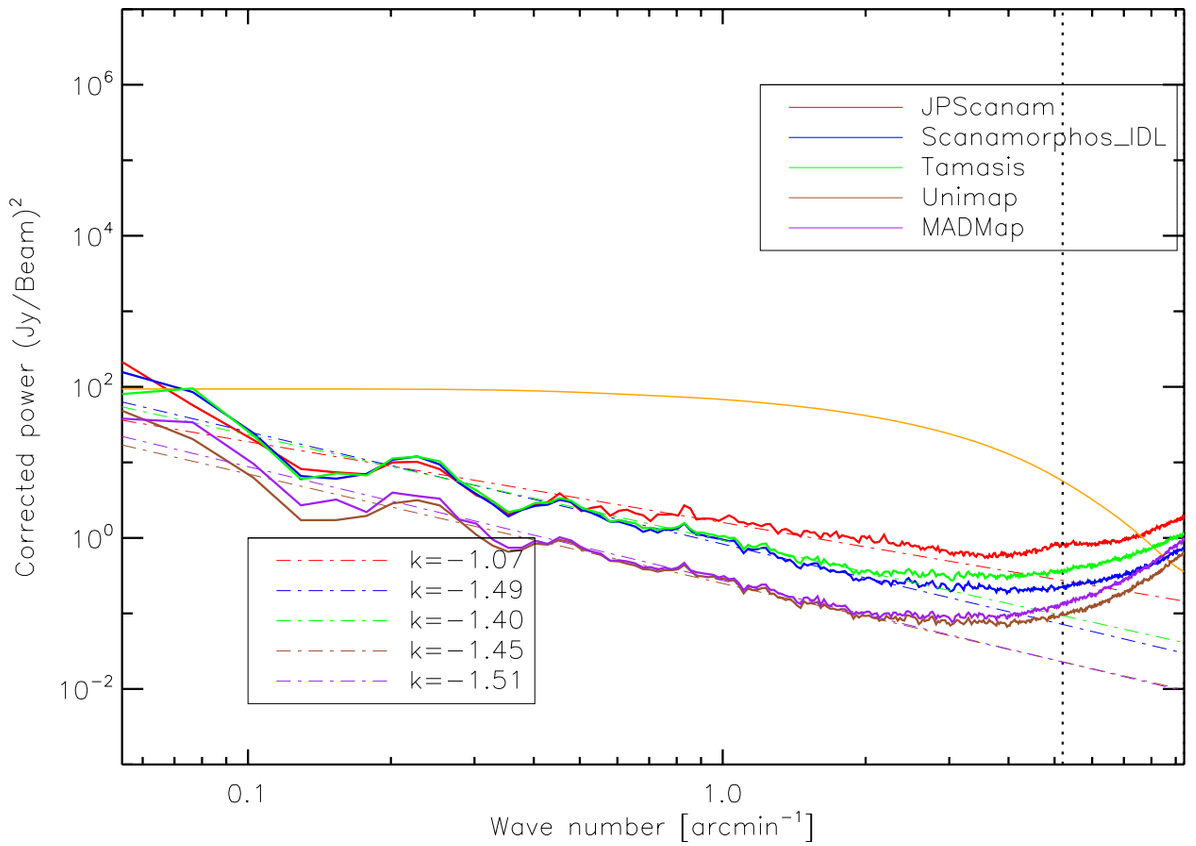
Faint red reprojected - corrected

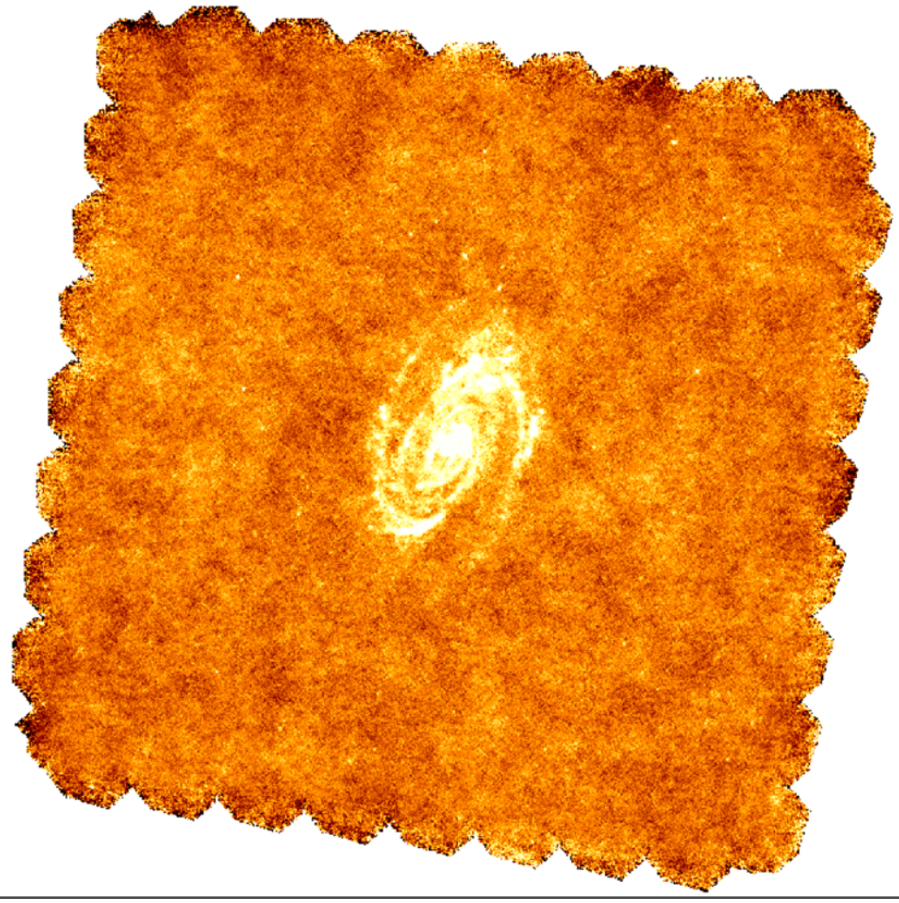




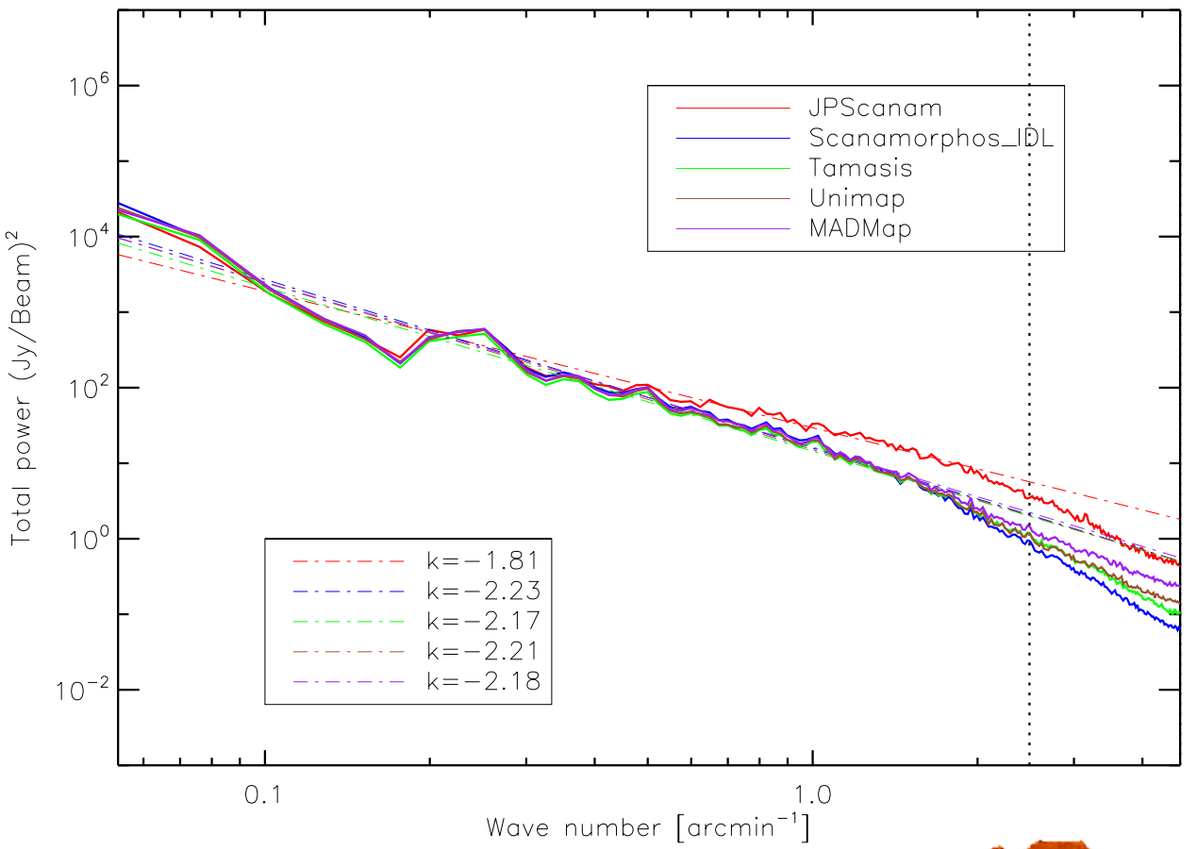
M81 - blue

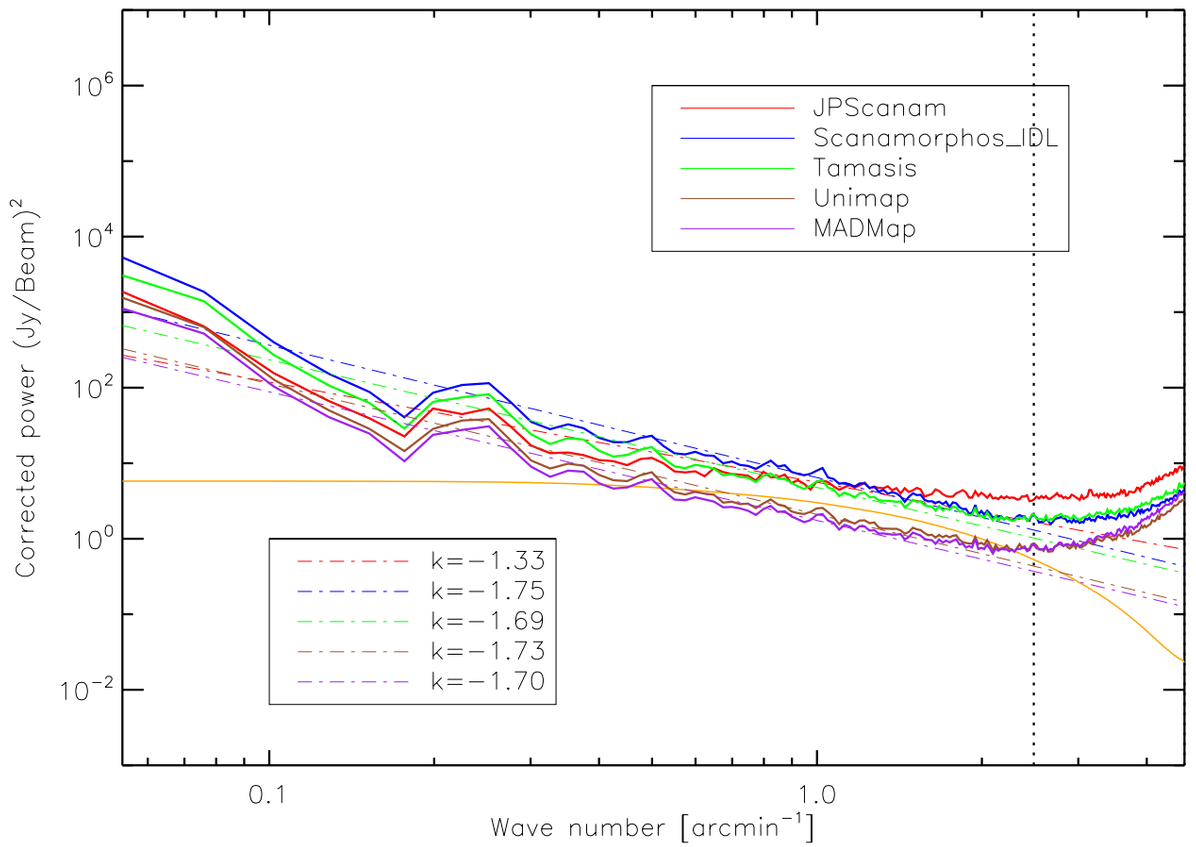

JPScanam
Scanamorphos_IDL
Tamasis
Unimap
MADMap
k=−1.30
k=−1.71
k=−1.62
k=−1.67
k=−1.73
Total power (Jy/Beam)²
Wave number [arcmin⁻¹]

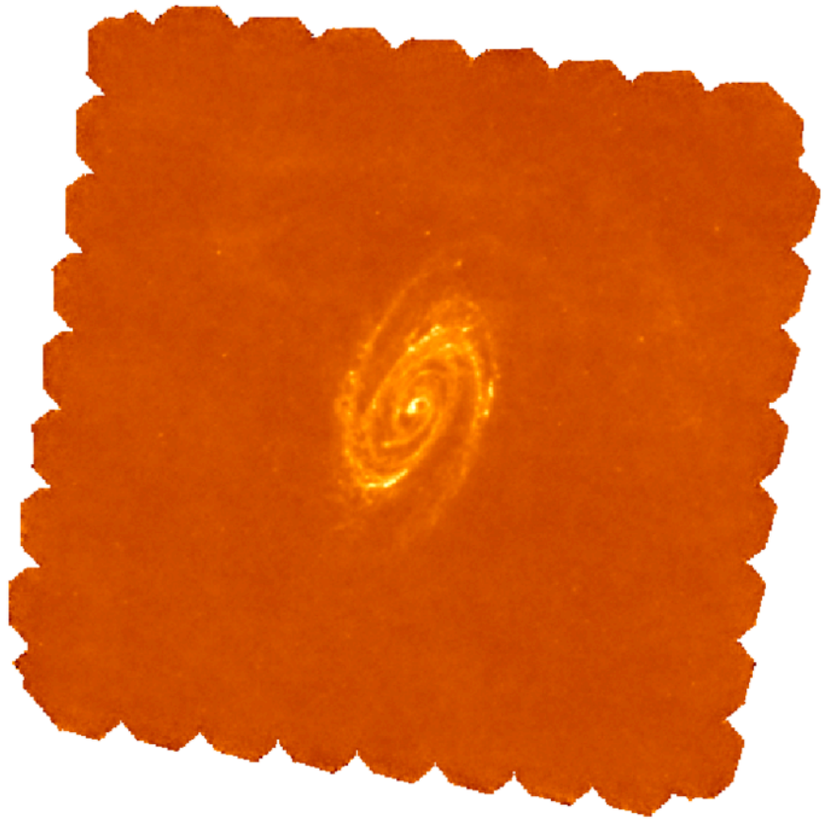

JPScanam
Scanamorphos_IDL
Tamasis
Unimap
MADMap
k=−1.07
k=−1.49
k=−1.40
k=−1.45
k=−1.51
Corrected power (Jy/Beam)²
Wave number [arcmin⁻¹]



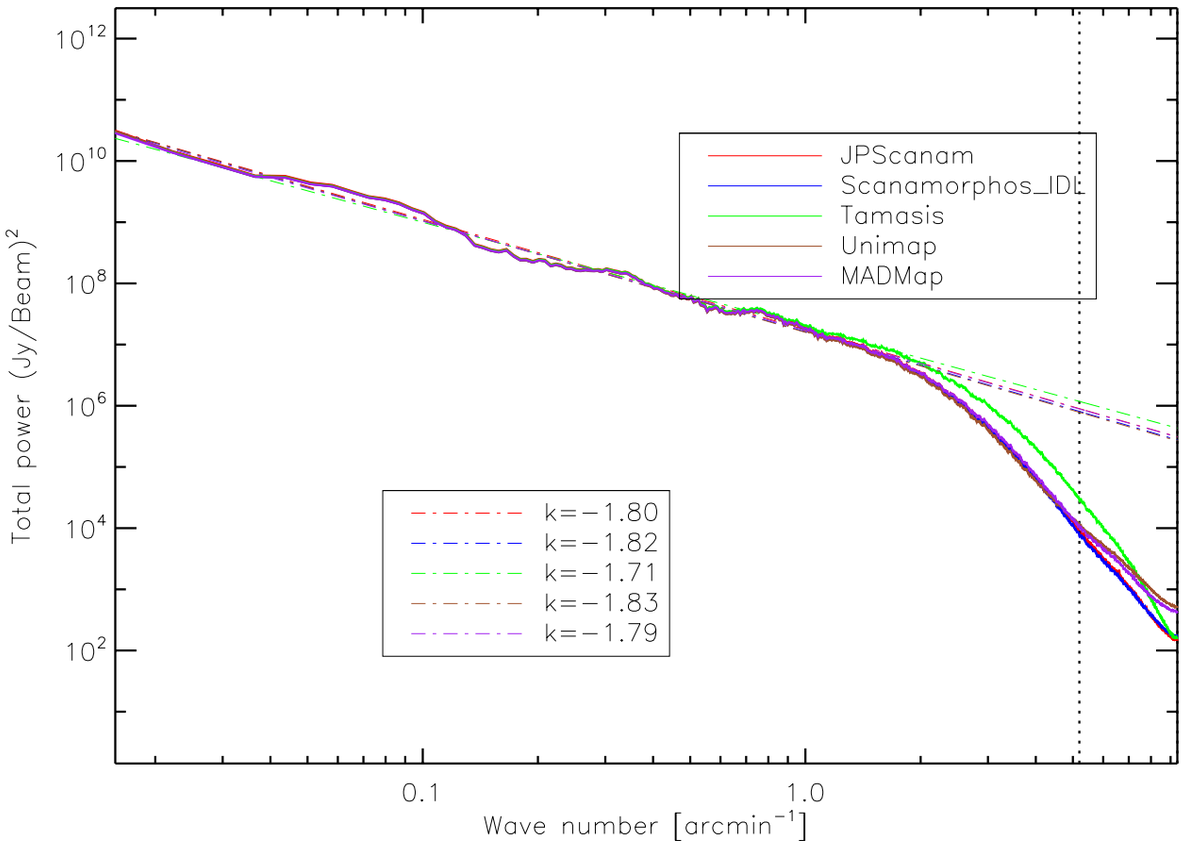
M81 - red

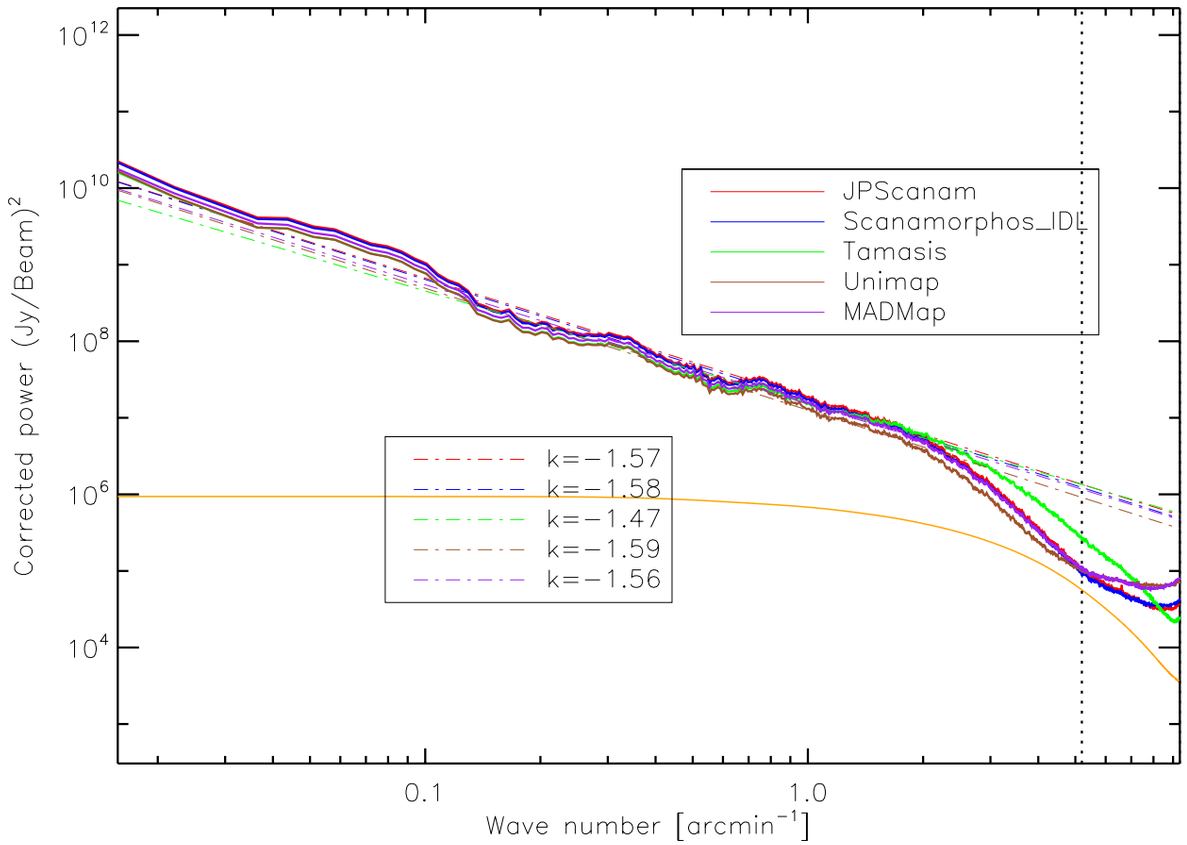

JPScanam
Scanamorphos_IDL
Tamasis
Unimap
MADMap
k=−1.81
k=−2.23
k=−2.17
k=−2.21
k=−2.18
Total power (Jy/Beam)²
Wave number [arcmin⁻¹]

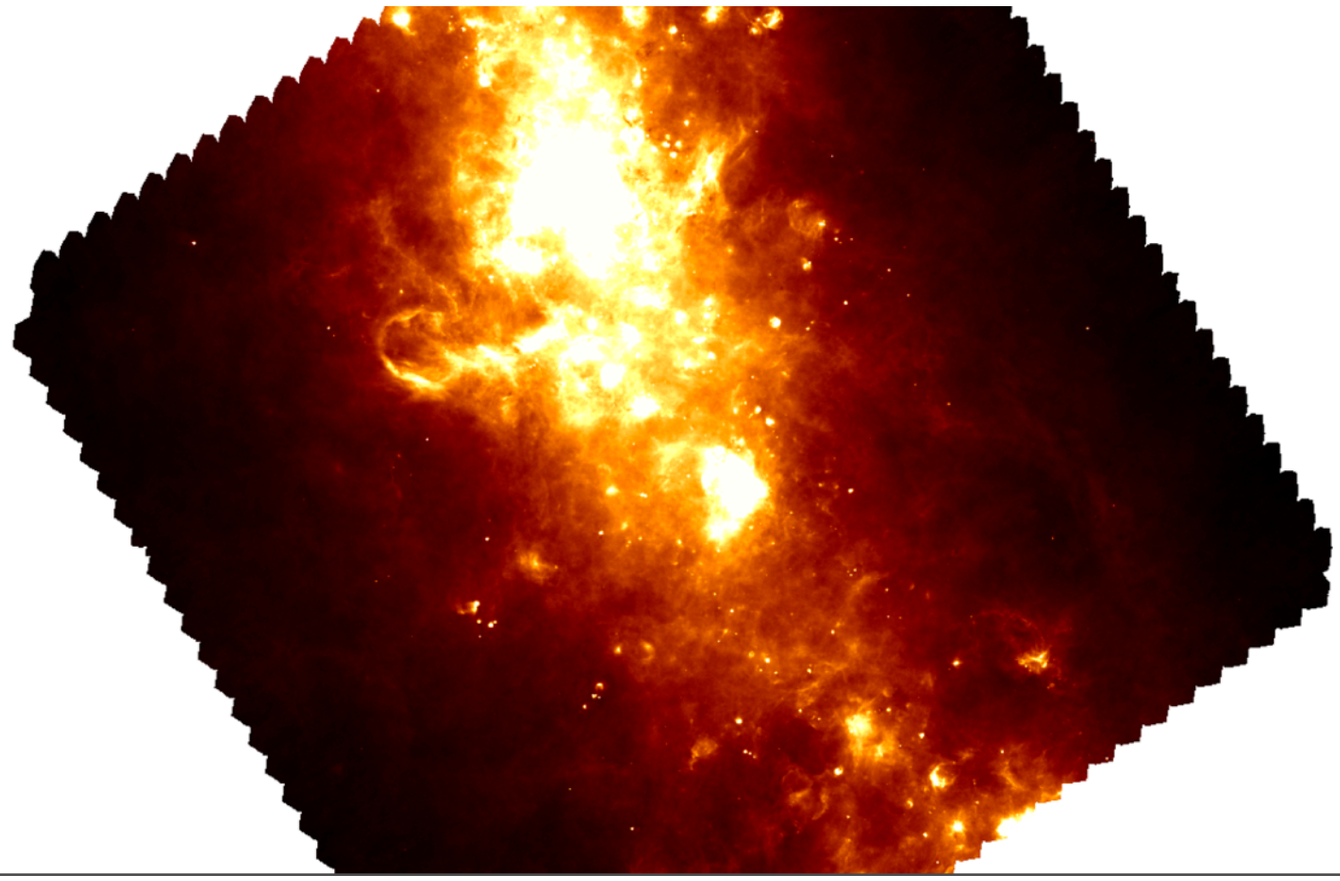

JPScanam
Scanamorphos_IDL
Tamasis
Unimap
MADMap
k=−1.33
k=−1.75
k=−1.69
k=−1.73
k=−1.70
Corrected power (Jy/Beam)²
Wave number [arcmin⁻¹]



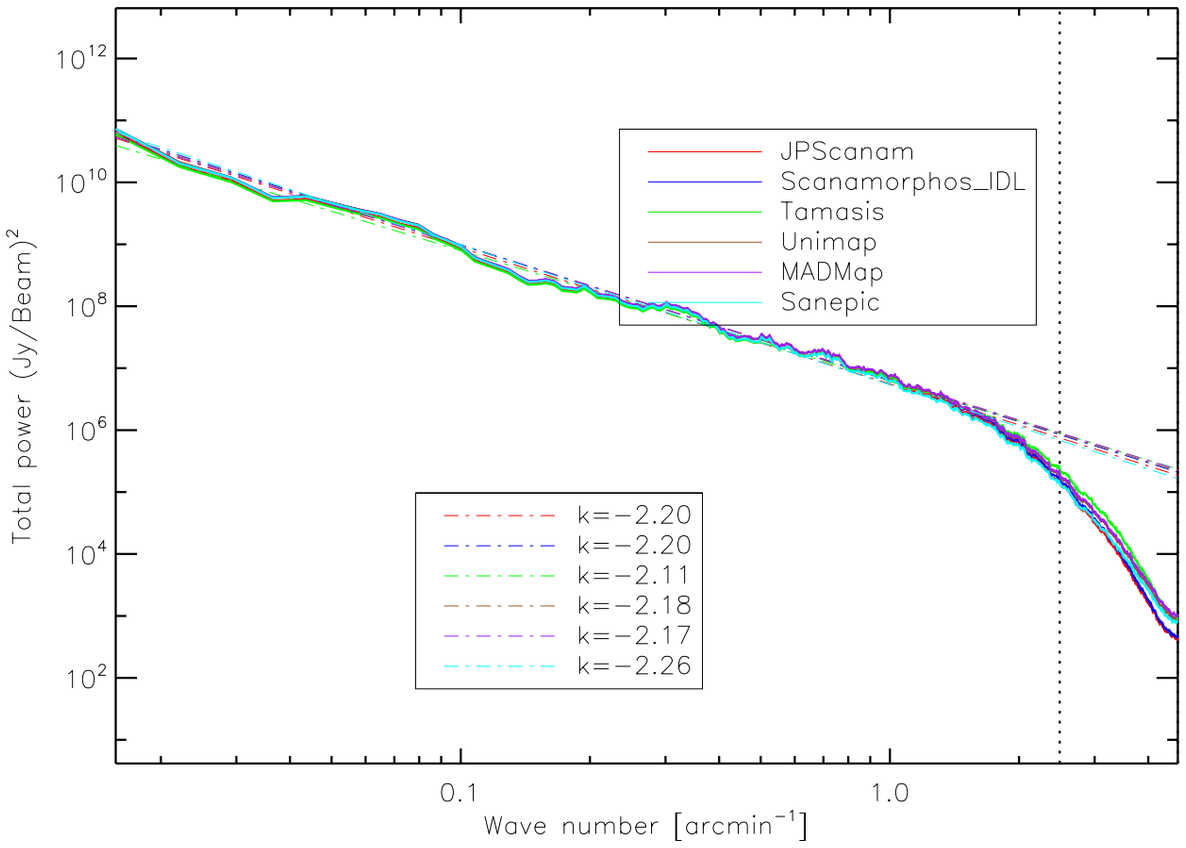
HiGAL-L30 - blue

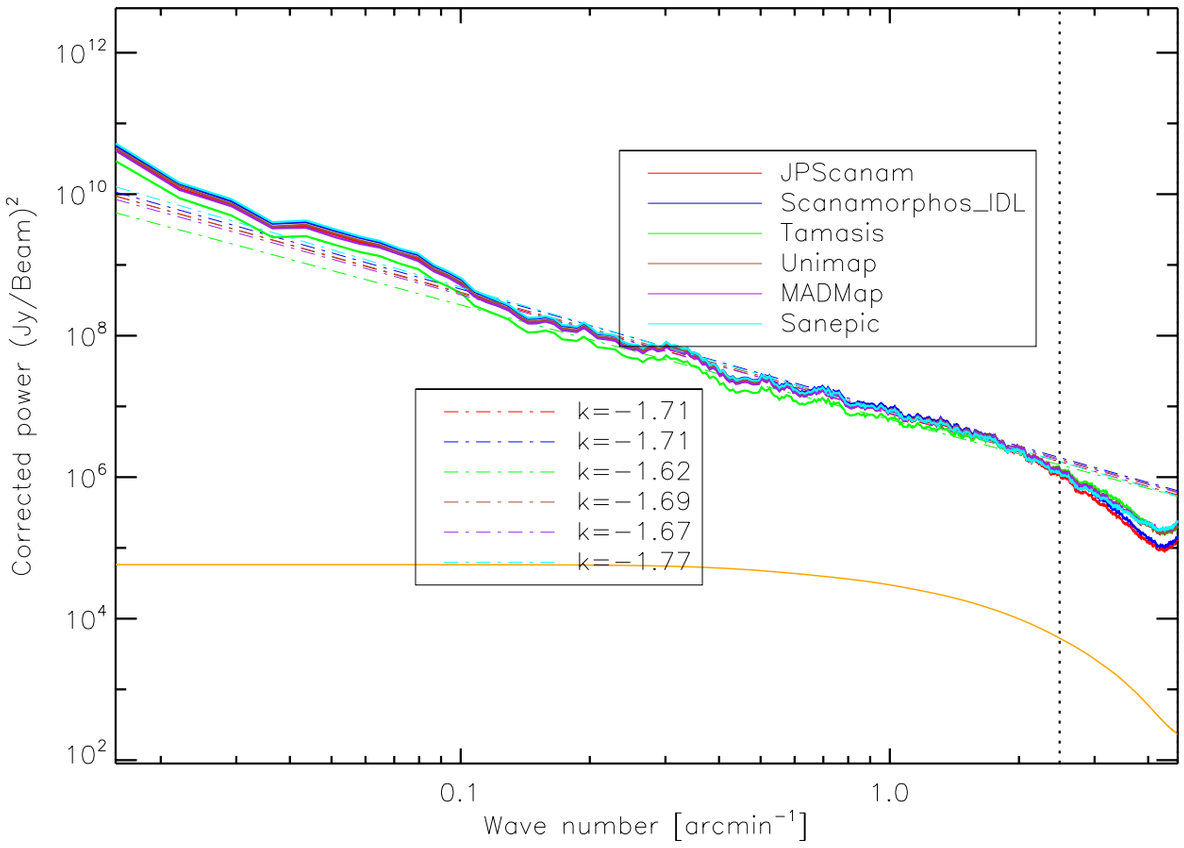


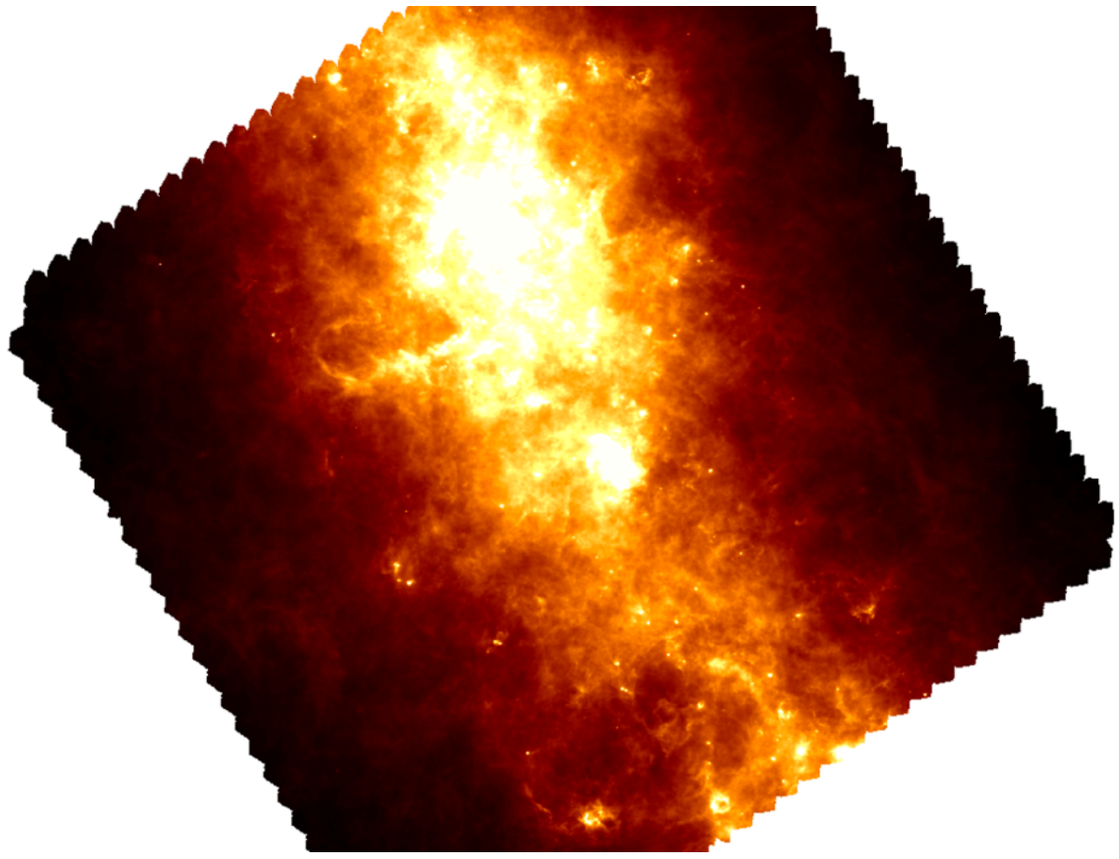




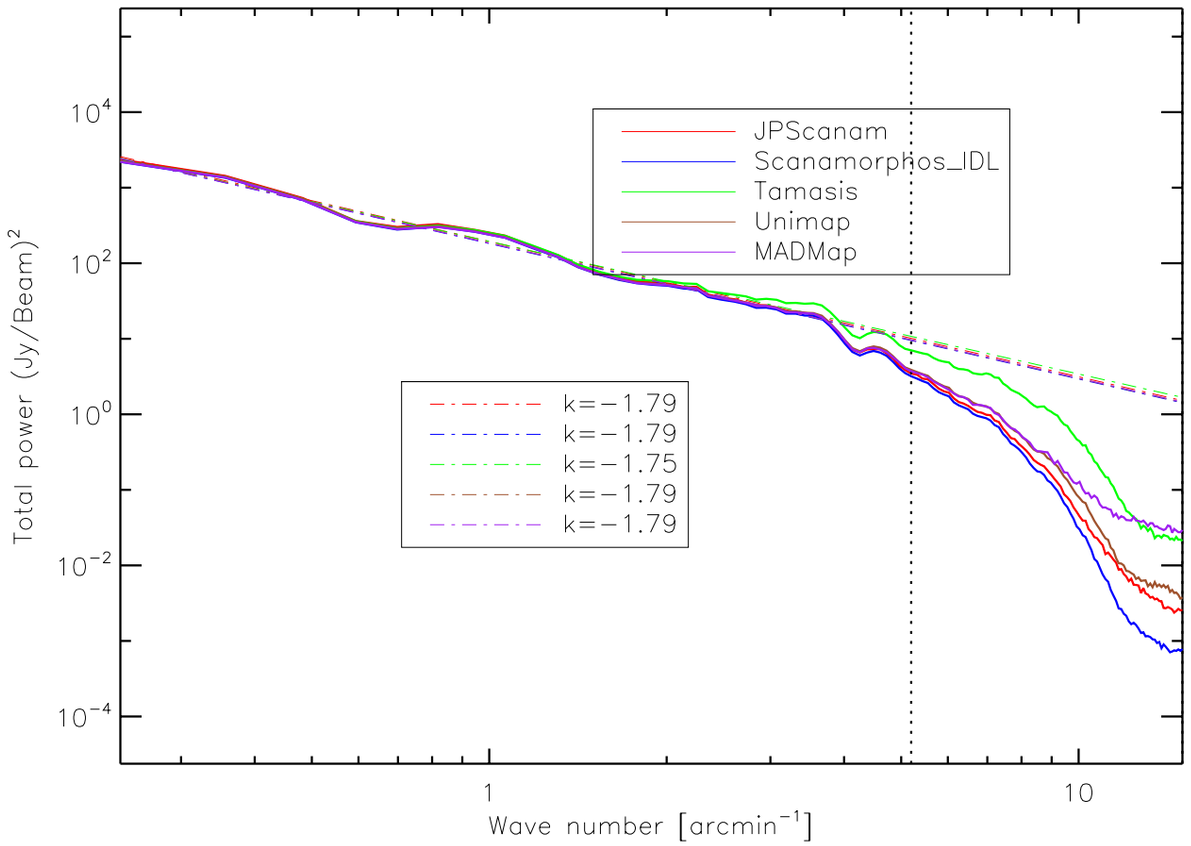
HiGAL-L30 - red

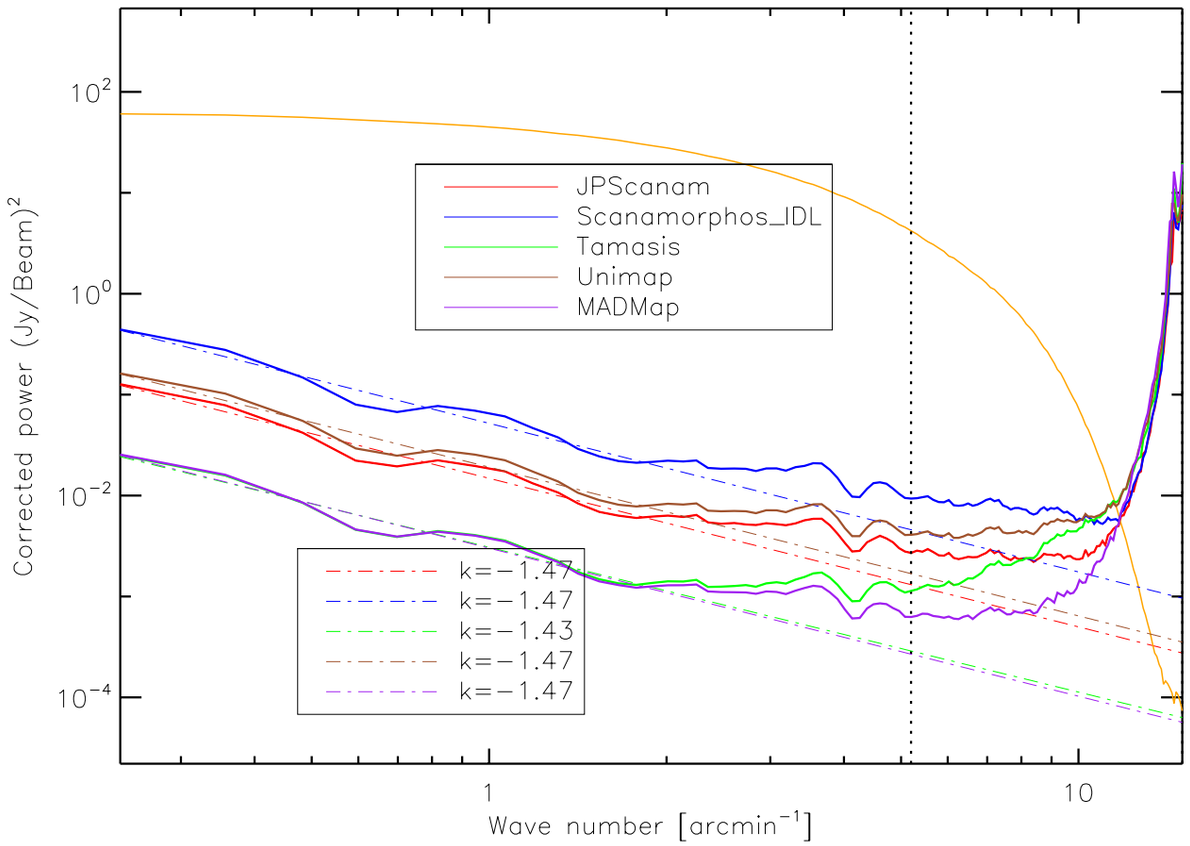


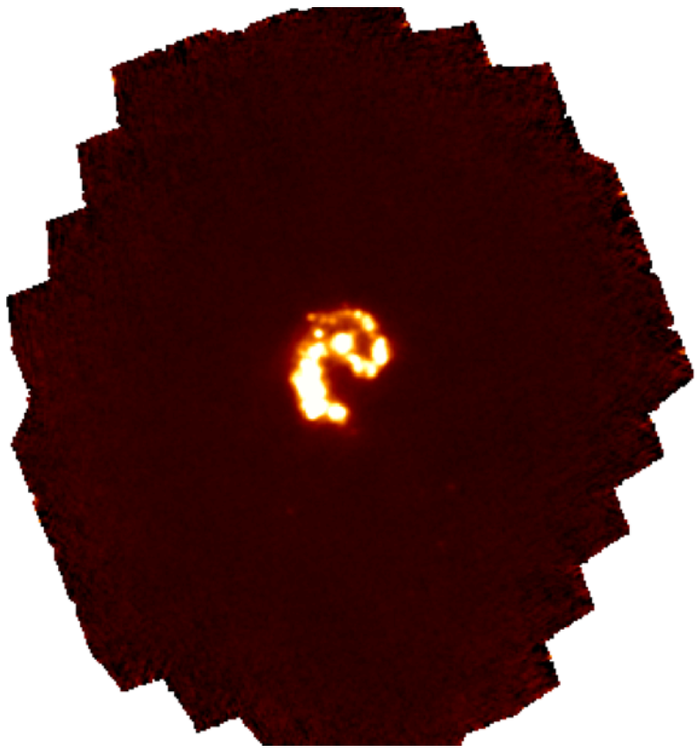




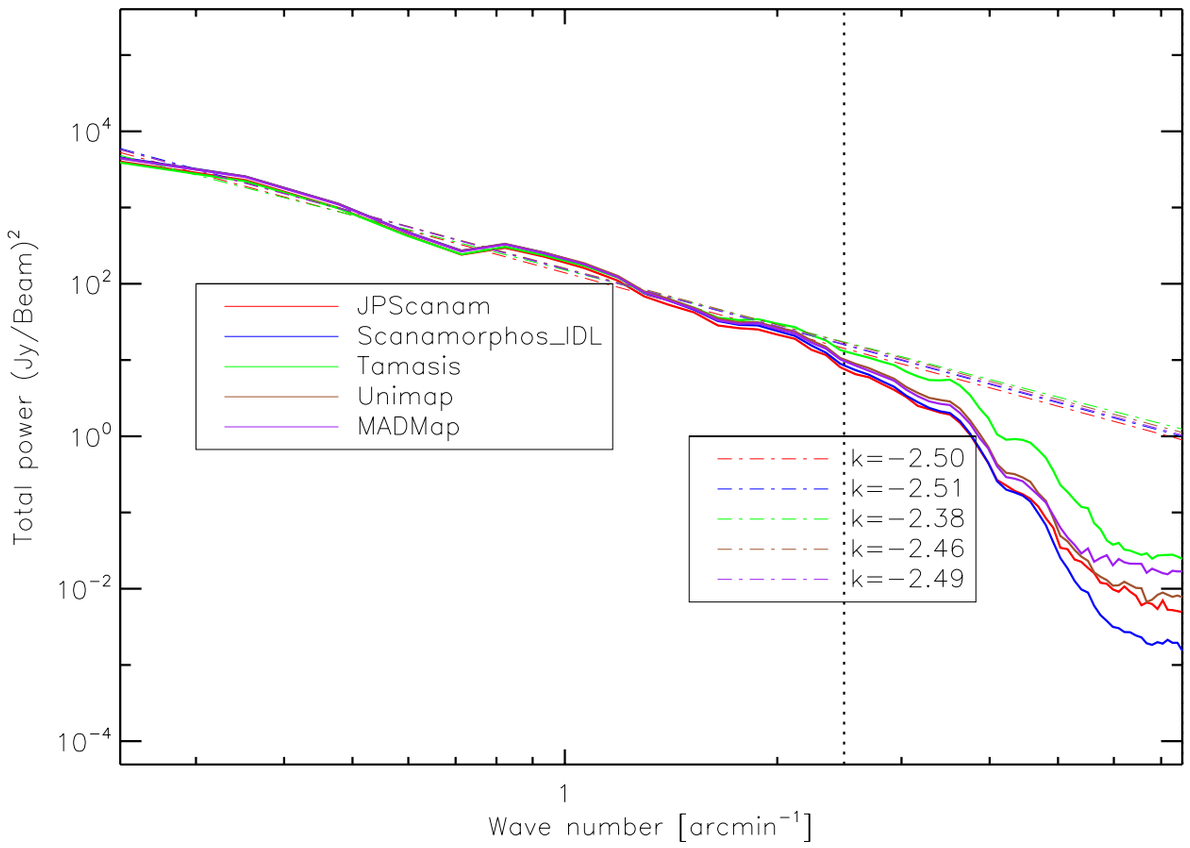
Antennae - blue

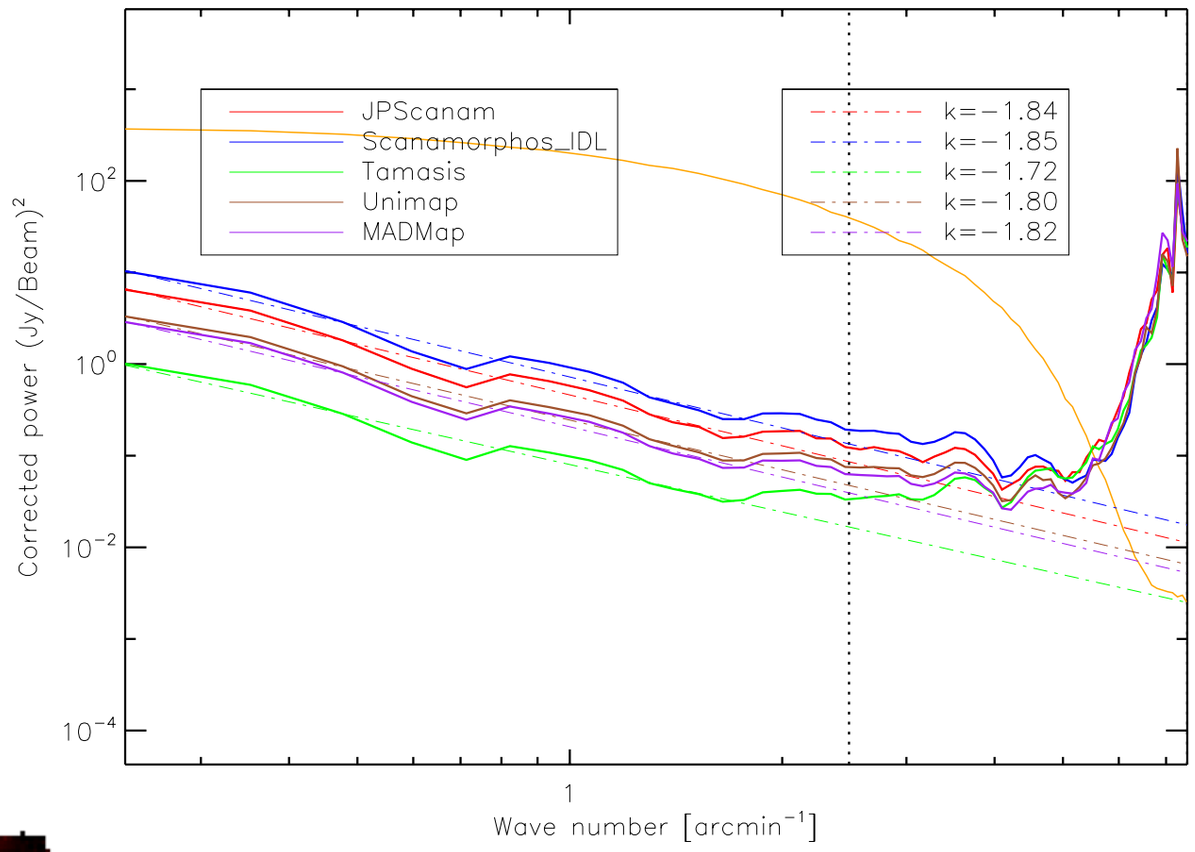




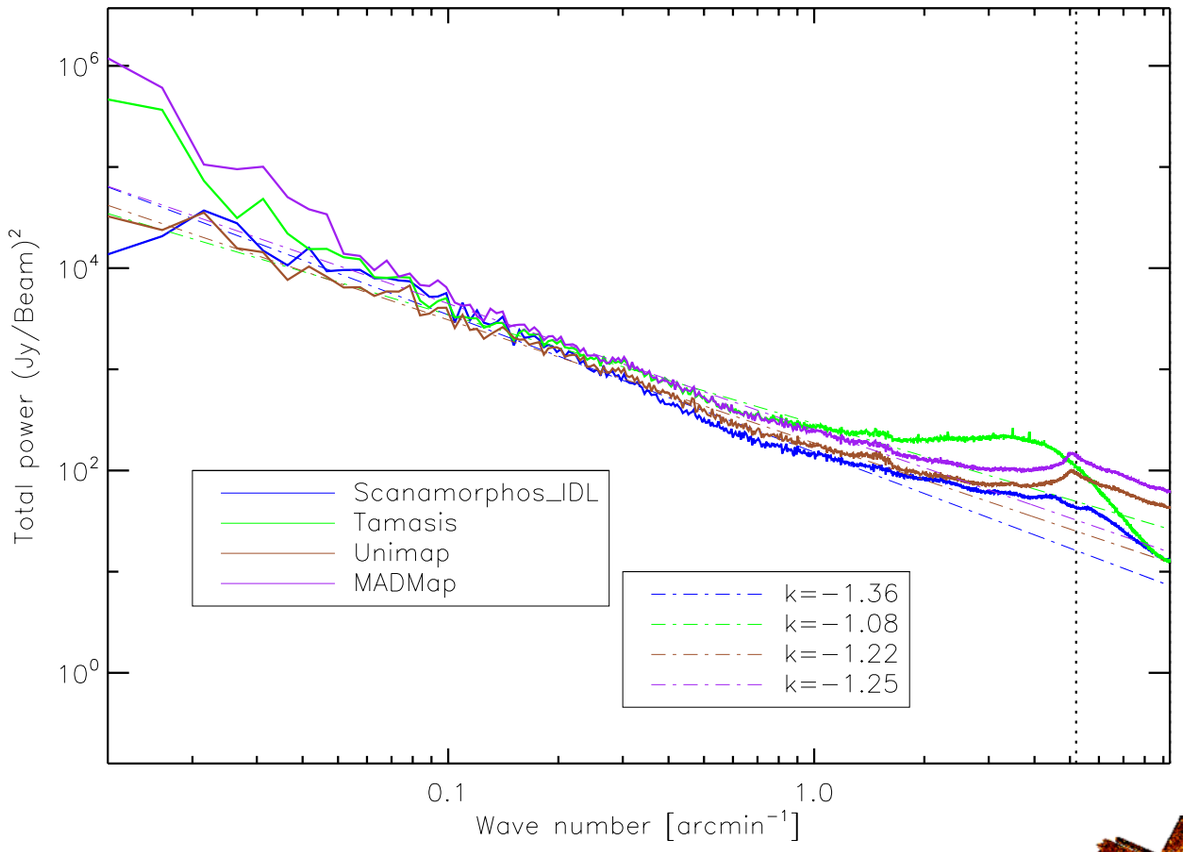


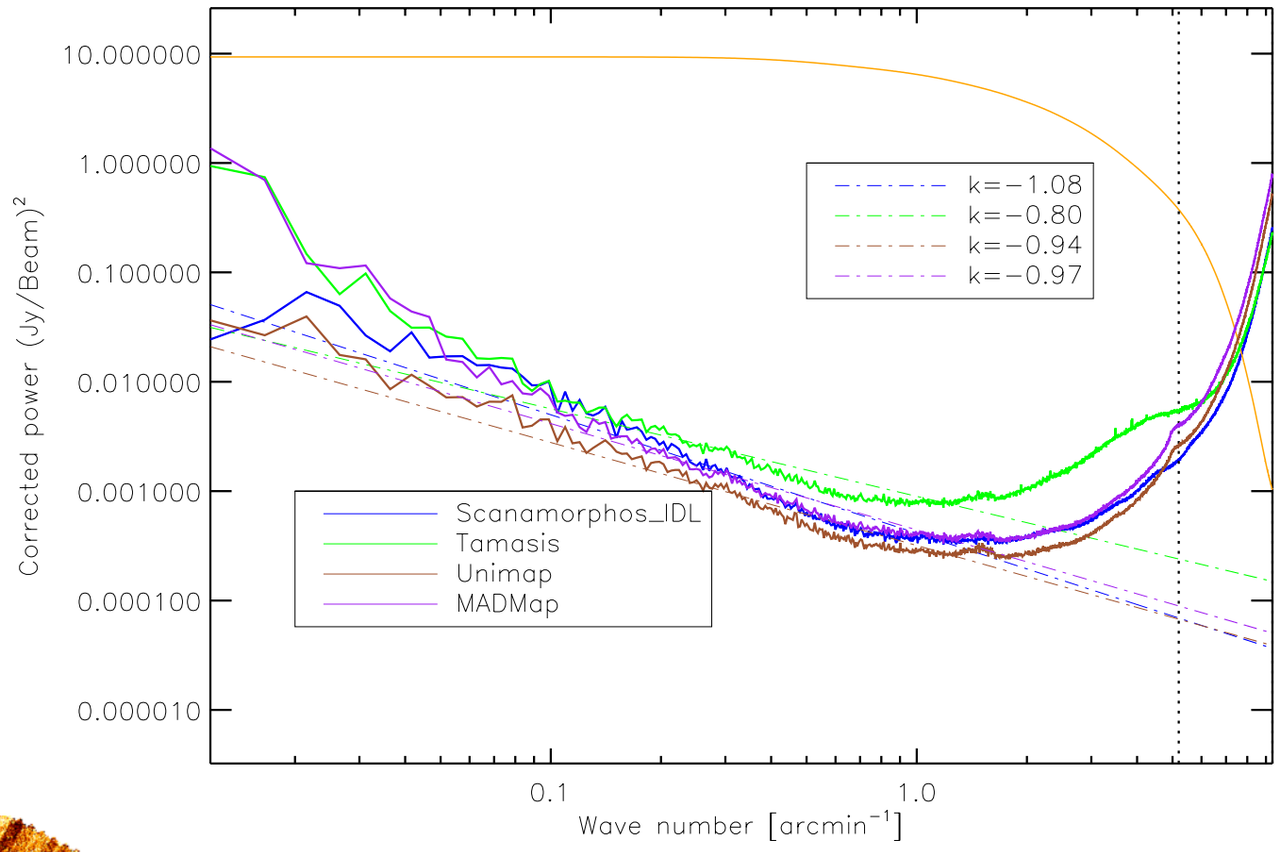
Antennae - red

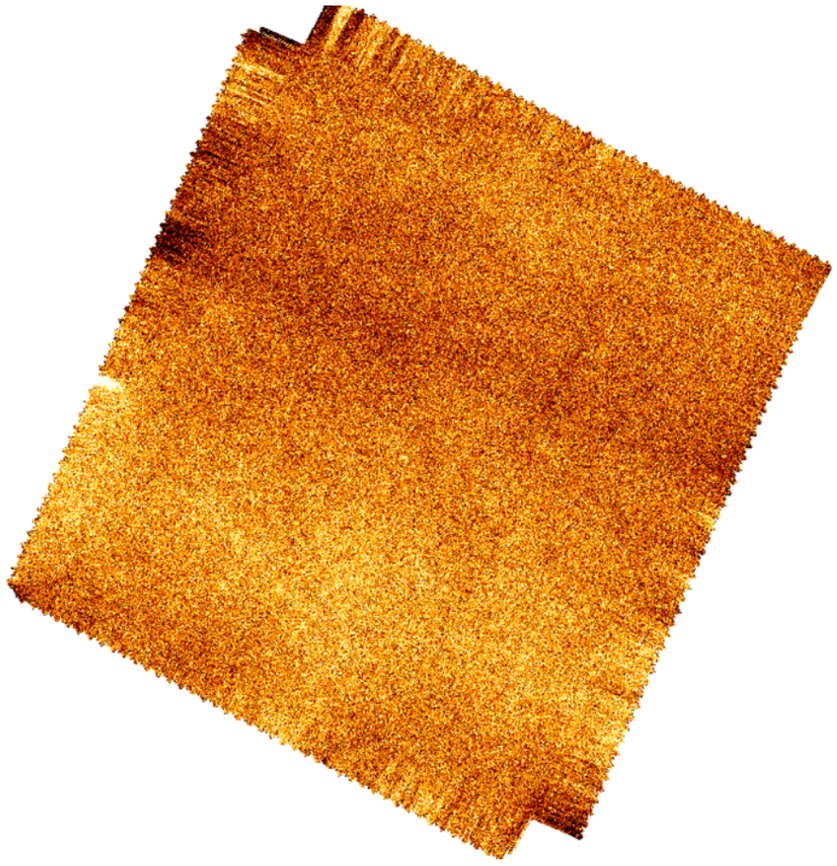




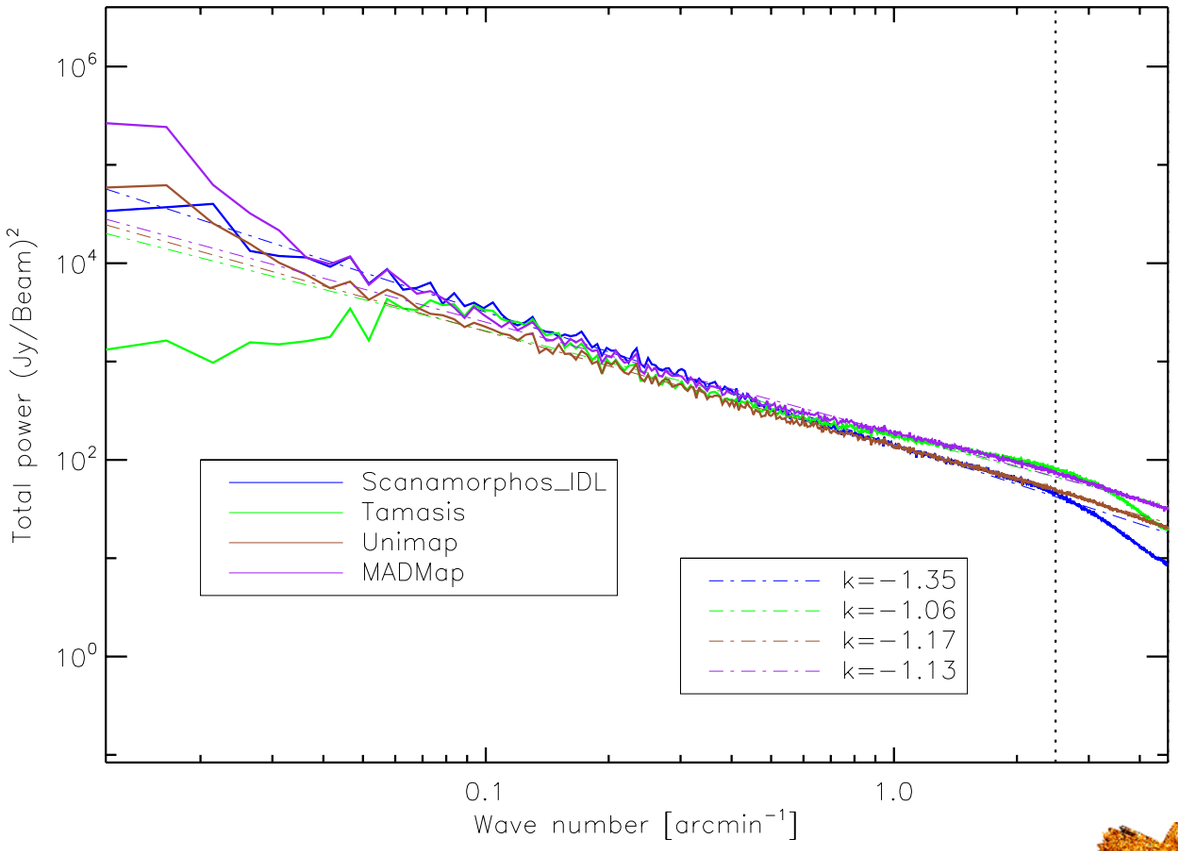
Atlas - blue

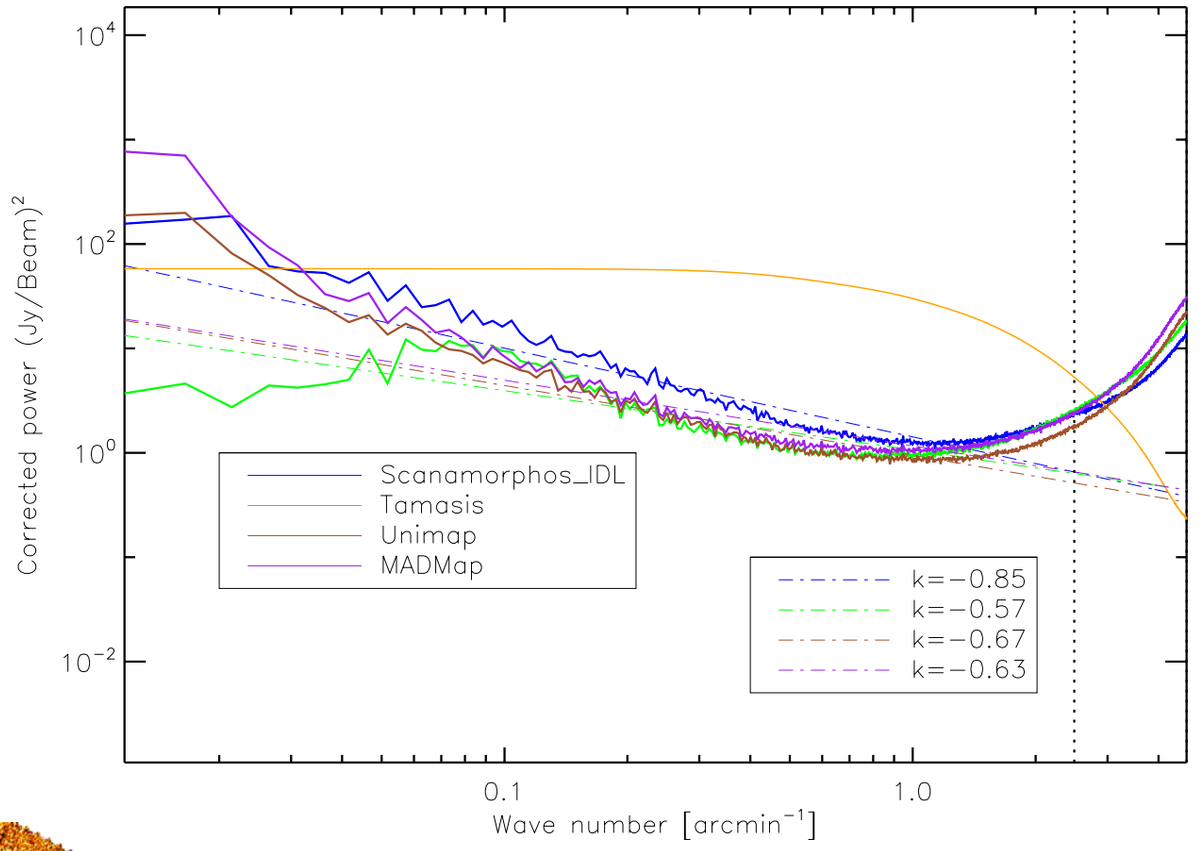

Total power (Jy/Beam)^2
10^6
10^4
10^2
10^0
0.1
1.0
Wave number [arcmin^{-1}]
Scanamorphos_IDL
Tamasis
Unimap
MADMap
k=−1.36
k=−1.08
k=−1.22
k=−1.25

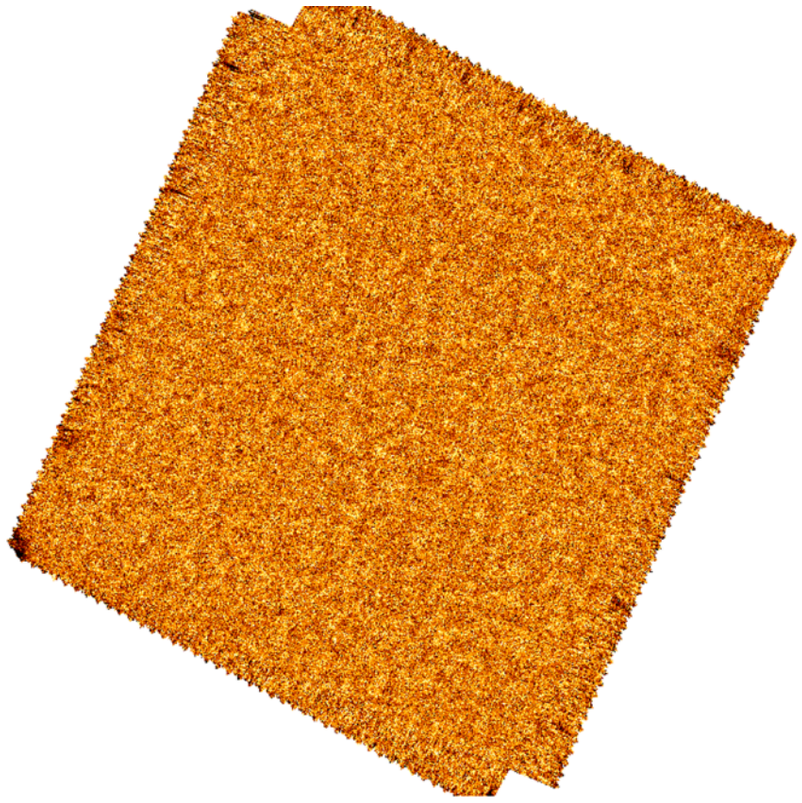

Corrected power (Jy/Beam)^2
10.000000
1.000000
0.100000
0.010000
0.001000
0.000100
0.000010
0.1
1.0
Wave number [arcmin^{-1}]
k=−1.08
k=−0.80
k=−0.94
k=−0.97
Scanamorphos_IDL
Tamasis
Unimap
MADMap



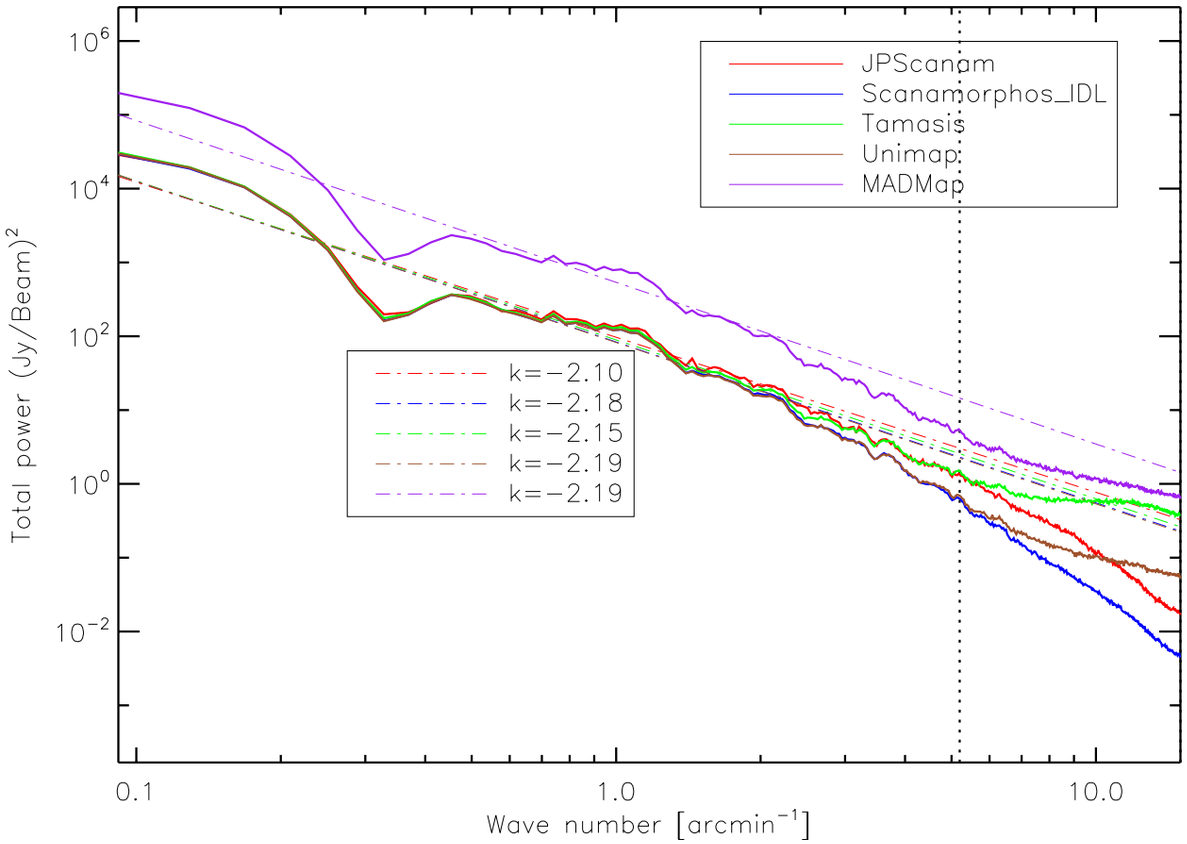
Atlas - red

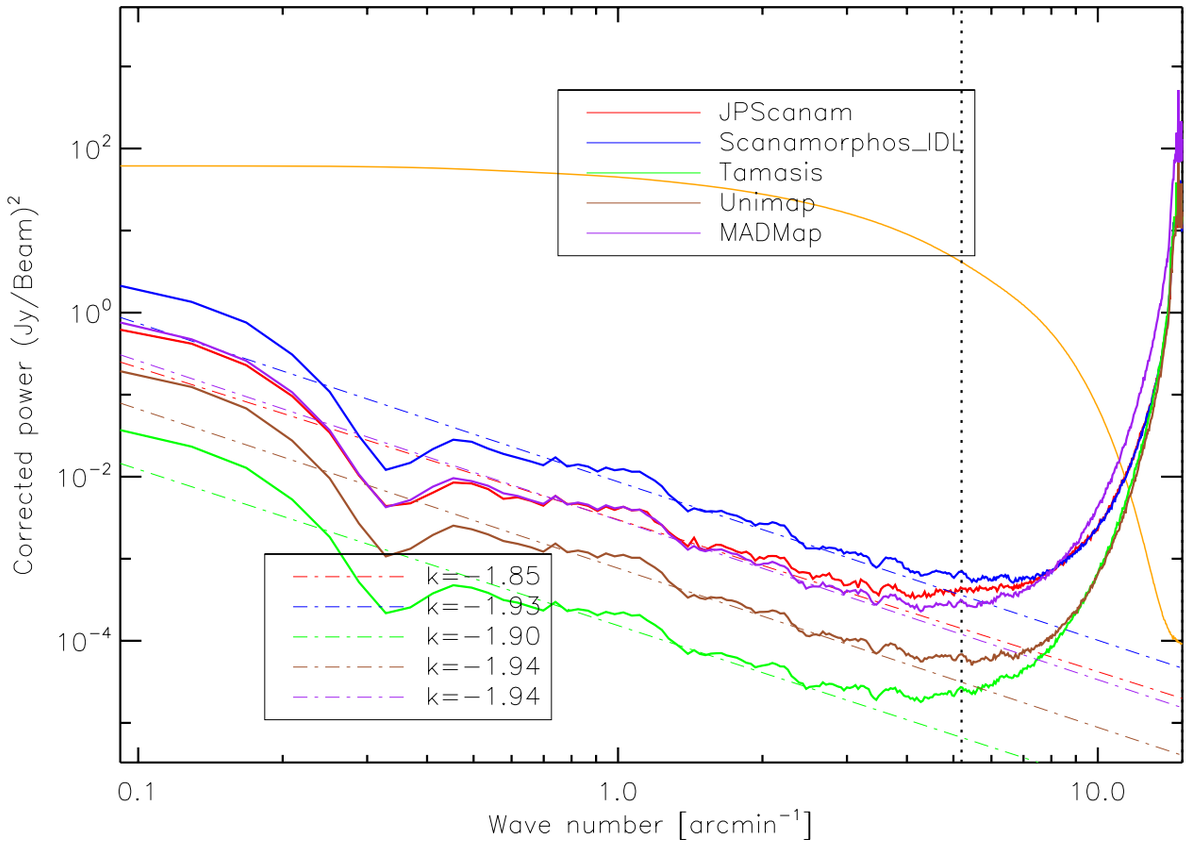

Total power (Jy/Beam)^2
10^6
10^4
10^2
10^0
Scanamorphos_IDL
Tamasis
Unimap
MADMap
k=−1.35
k=−1.06
k=−1.17
k=−1.13
0.1
1.0
Wave number [arcmin^{-1}]

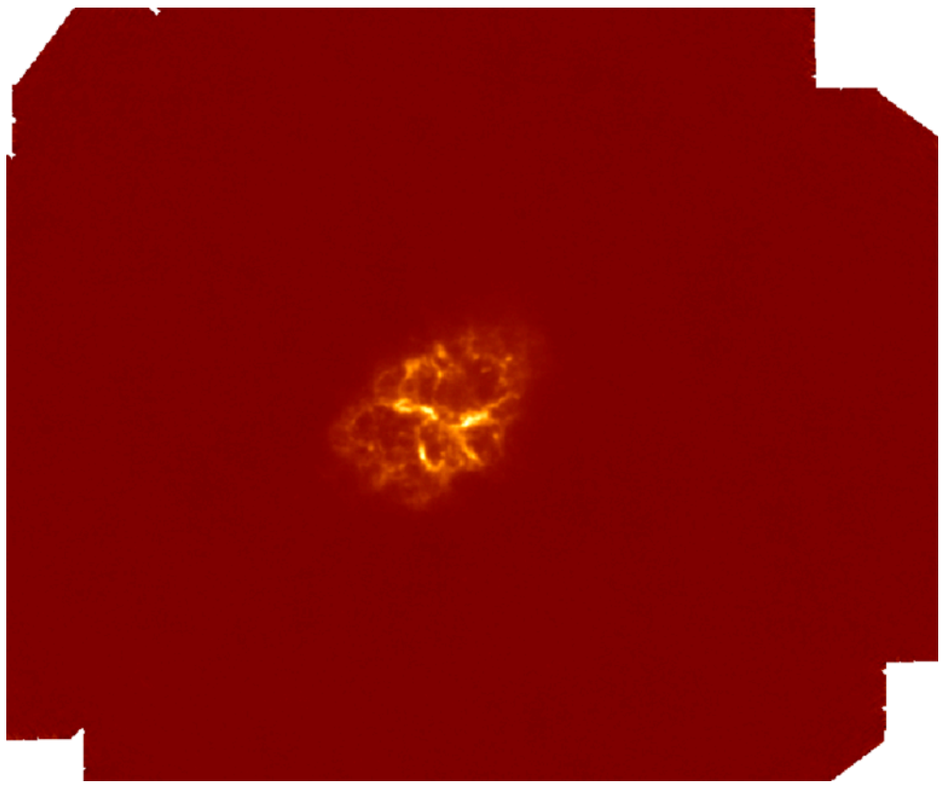

Corrected power (Jy/Beam)^2
10^4
10^2
10^0
10^{-2}
Scanamorphos_IDL
Tamasis
Unimap
MADMap
k=−0.85
k=−0.57
k=−0.67
k=−0.63
0.1
1.0
Wave number [arcmin^{-1}]



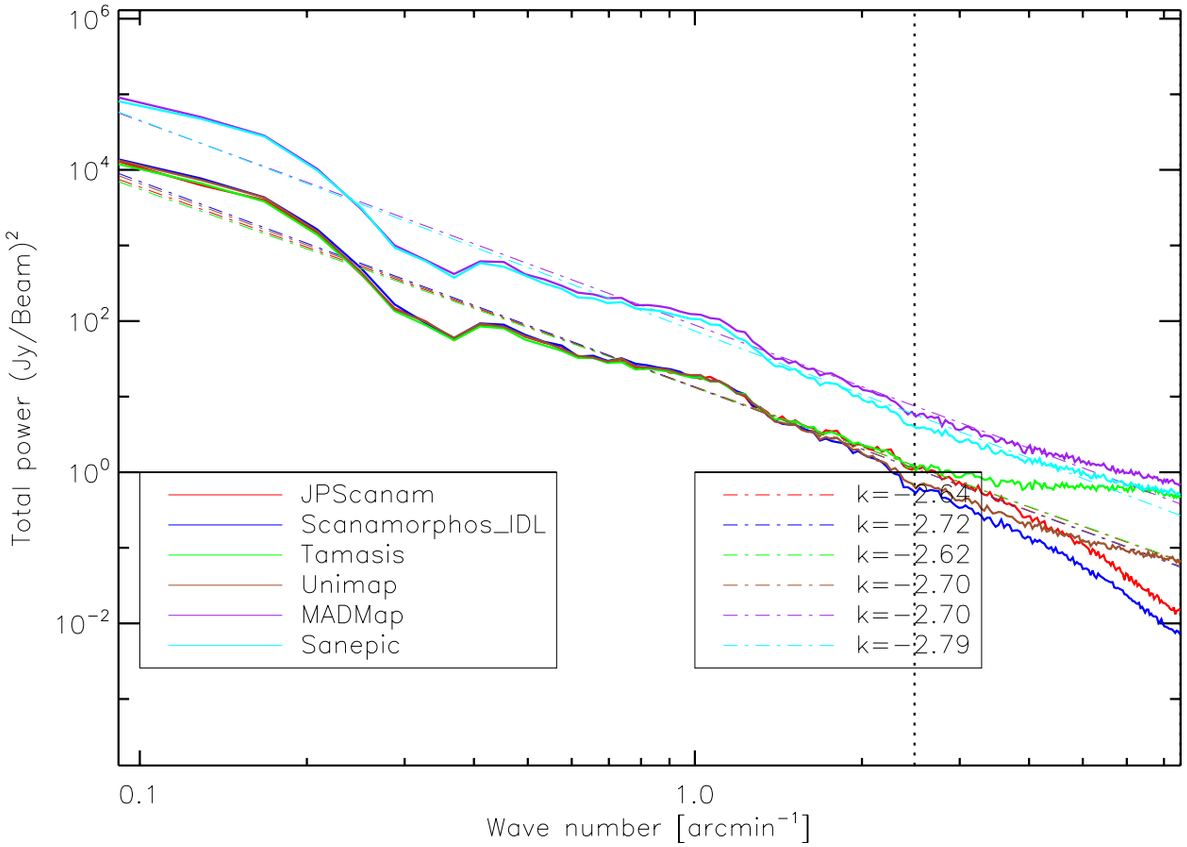
Crab - blue

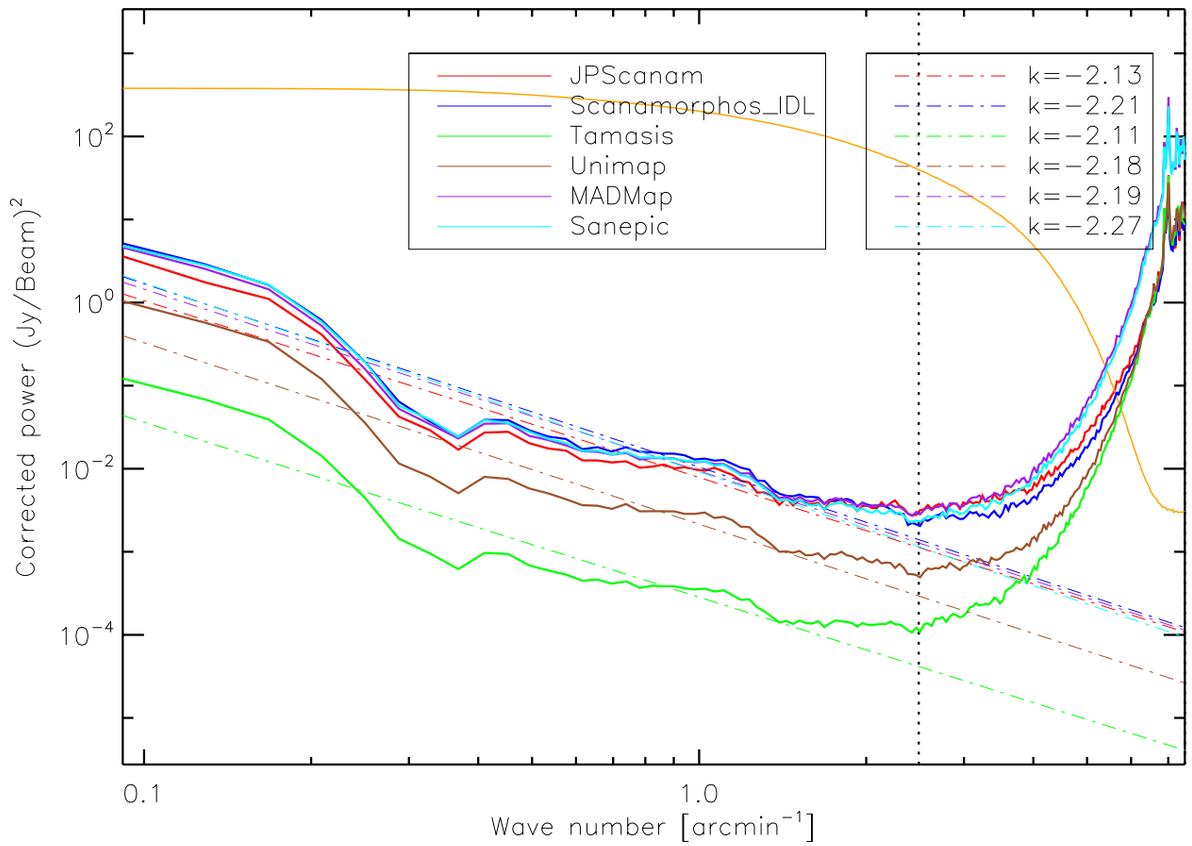

JPScanam
Scanamorphos_IDL
Tamasis
Unimap
MADMap
k=−2.10
k=−2.18
k=−2.15
k=−2.19
k=−2.19
Total power (Jy/Beam)^2
10^6
10^4
10^2
10^0
10^{-2}
0.1
1.0
10.0
Wave number [arcmin^{-1}]

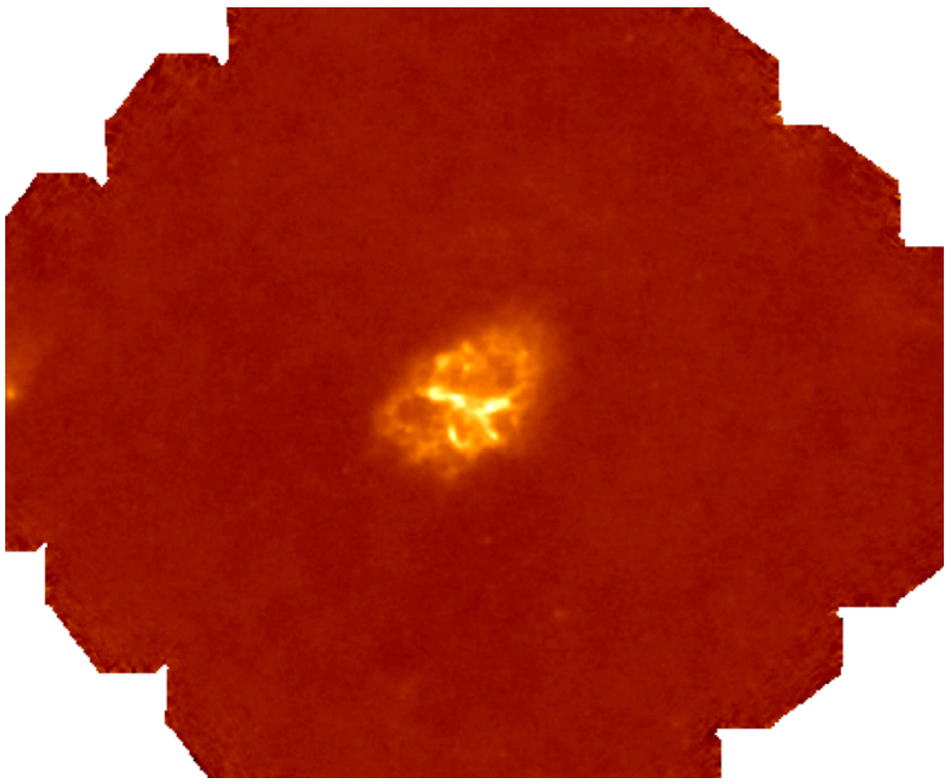

JPScanam
Scanamorphos_IDL
Tamasis
Unimap
MADMap
k=−1.85
k=−1.93
k=−1.90
k=−1.94
k=−1.94
Corrected power (Jy/Beam)^2
10^2
10^0
10^{-2}
10^{-4}
0.1
1.0
10.0
Wave number [arcmin^{-1}]



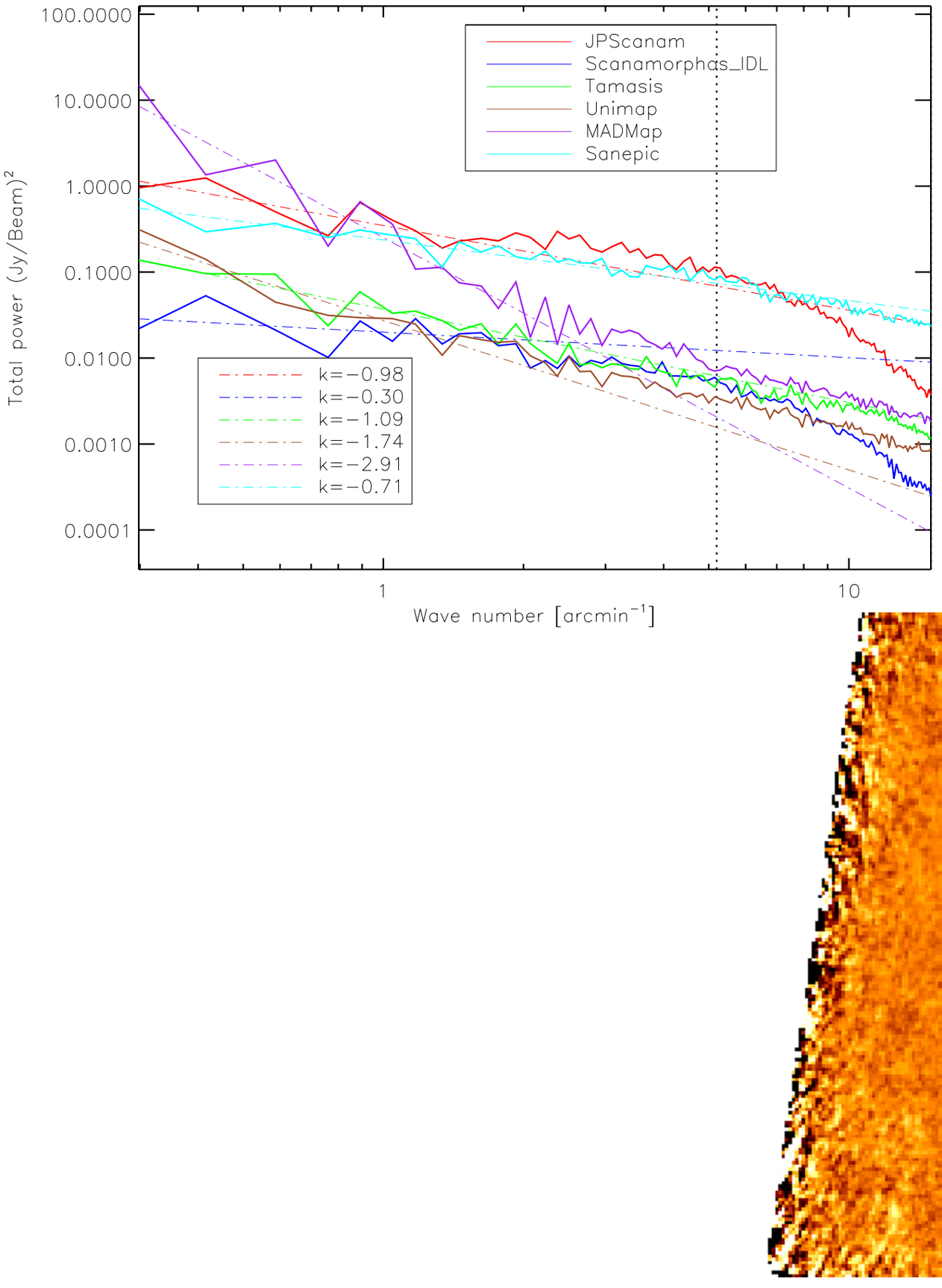
Crab - blue

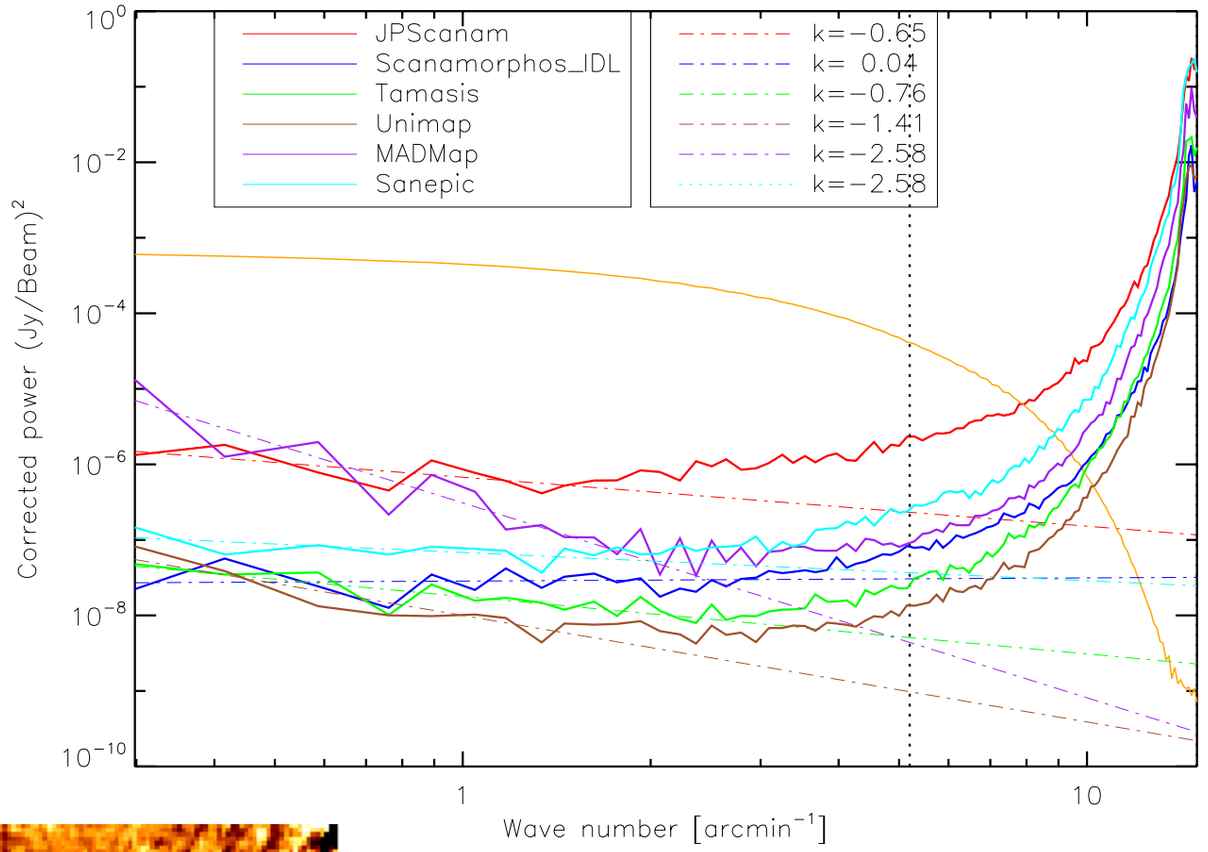

Total power (Jy/Beam)^2
10^6
10^4
10^2
10^0
10^{-2}
JPScanam
Scanamorphos_IDL
Tamasis
Unimap
MADMap
Sanepic
k=−2.64
k=−2.72
k=−2.62
k=−2.70
k=−2.70
k=−2.79
0.1
1.0
Wave number [arcmin^{-1}]

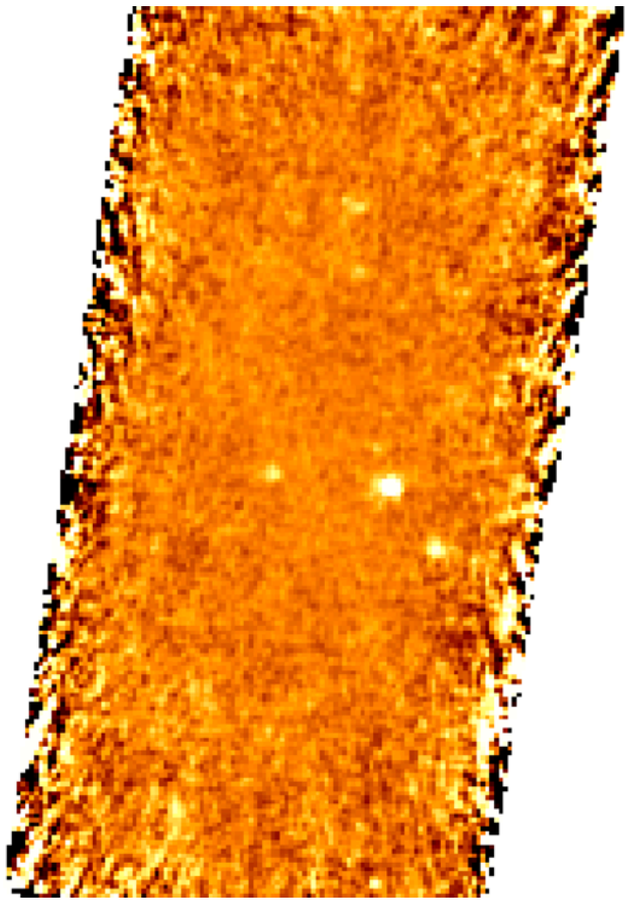

Corrected power (Jy/Beam)^2
10^2
10^0
10^{-2}
10^{-4}
JPScanam
Scanamorphos_IDL
Tamasis
Unimap
MADMap
Sanepic
k=−2.13
k=−2.21
k=−2.11
k=−2.18
k=−2.19
k=−2.27
0.1
1.0
Wave number [arcmin^{-1}]



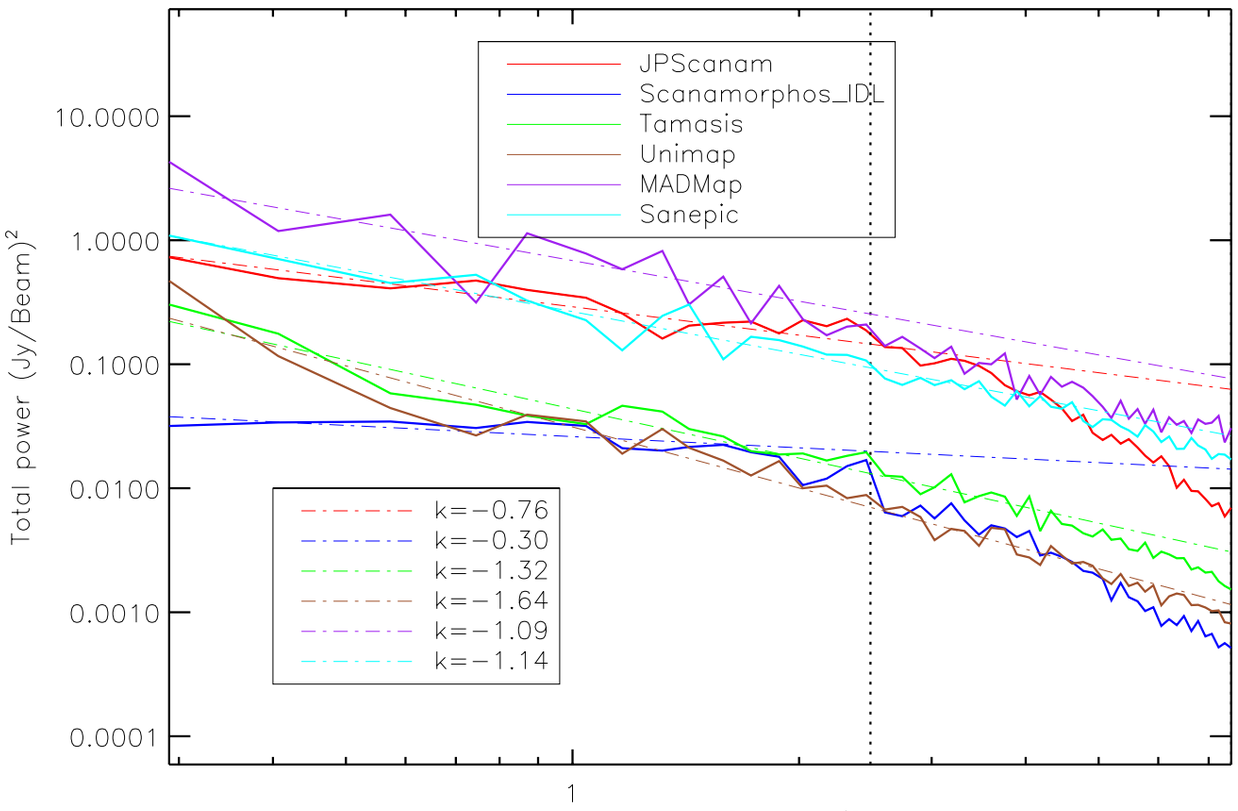
GRB 110422A - blue

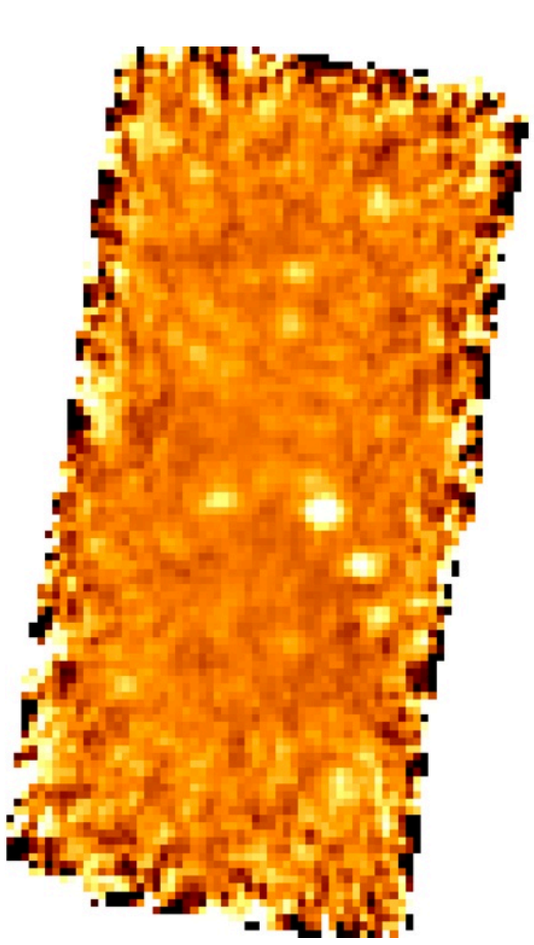


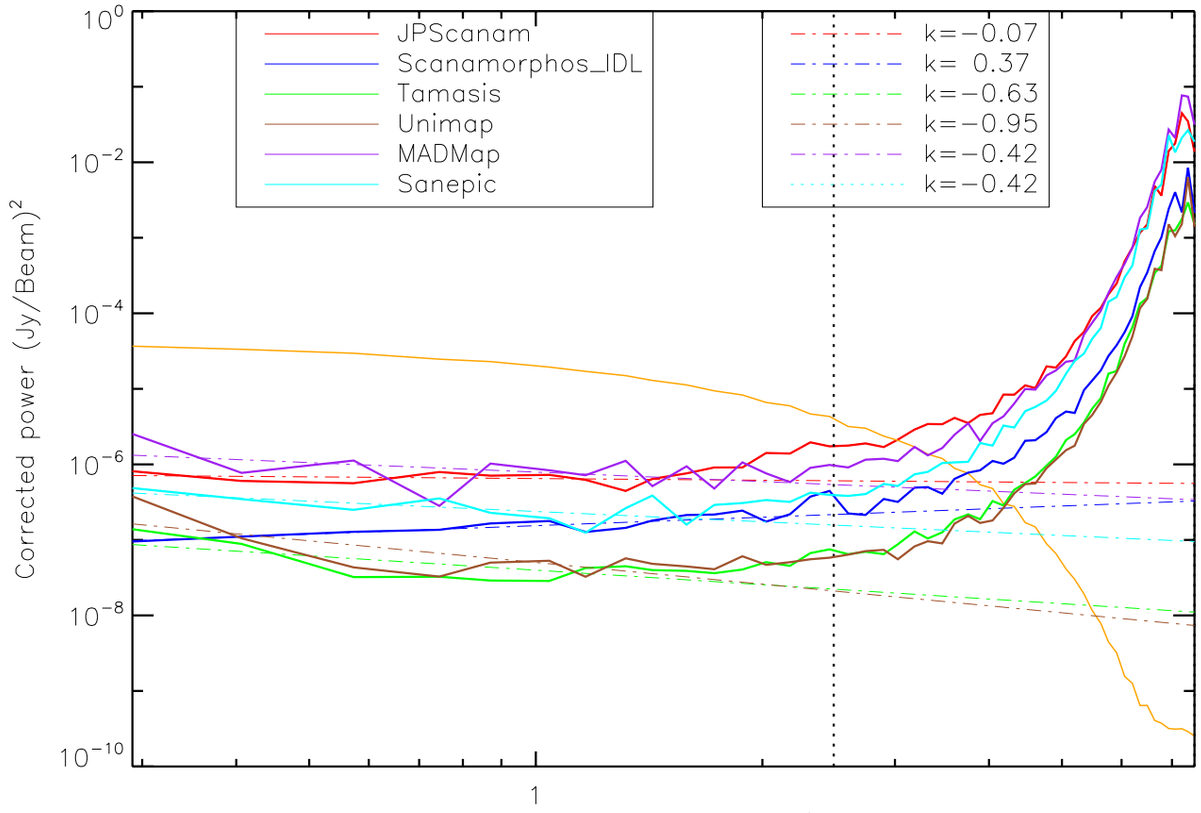




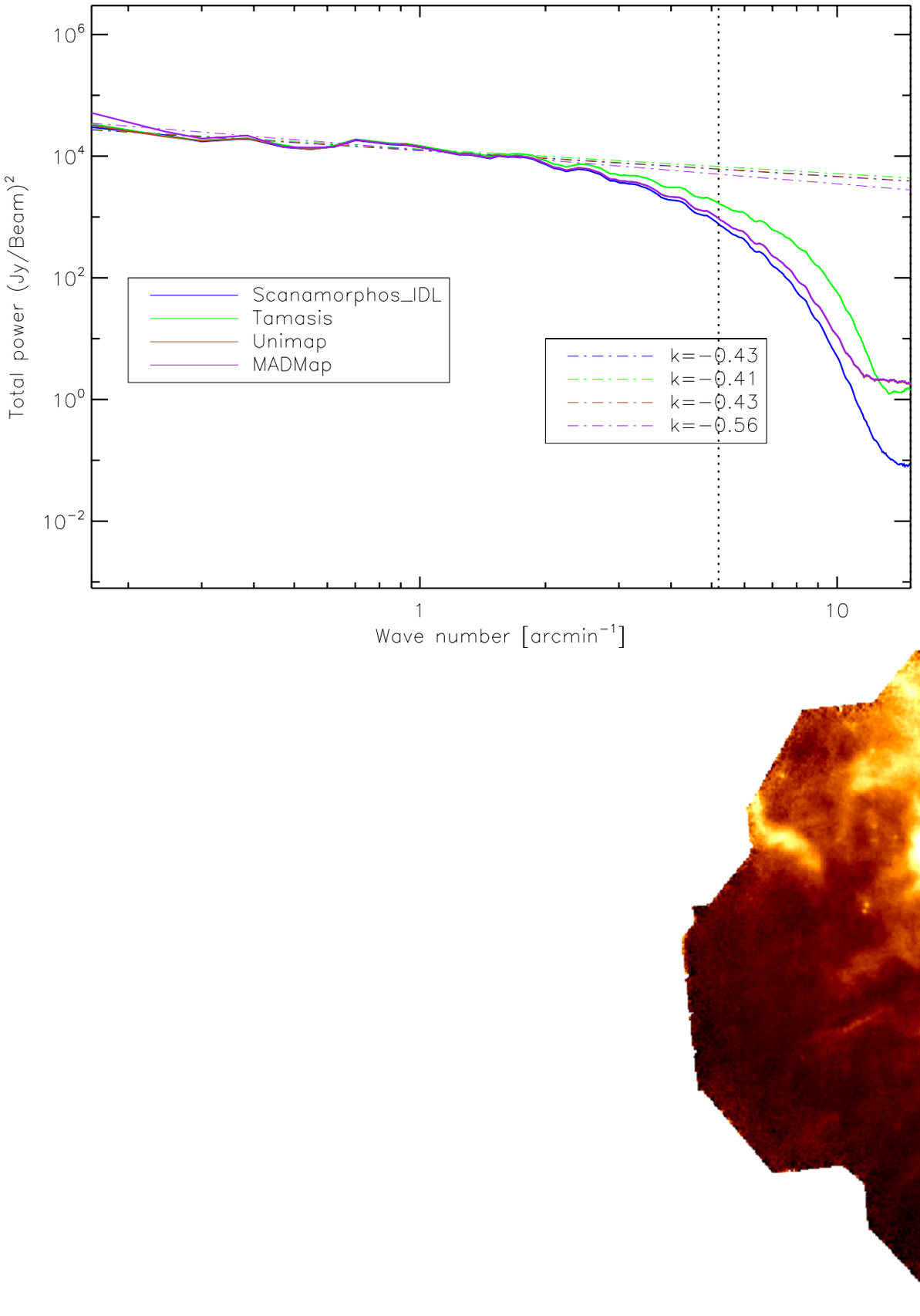
GRB 110422A - red

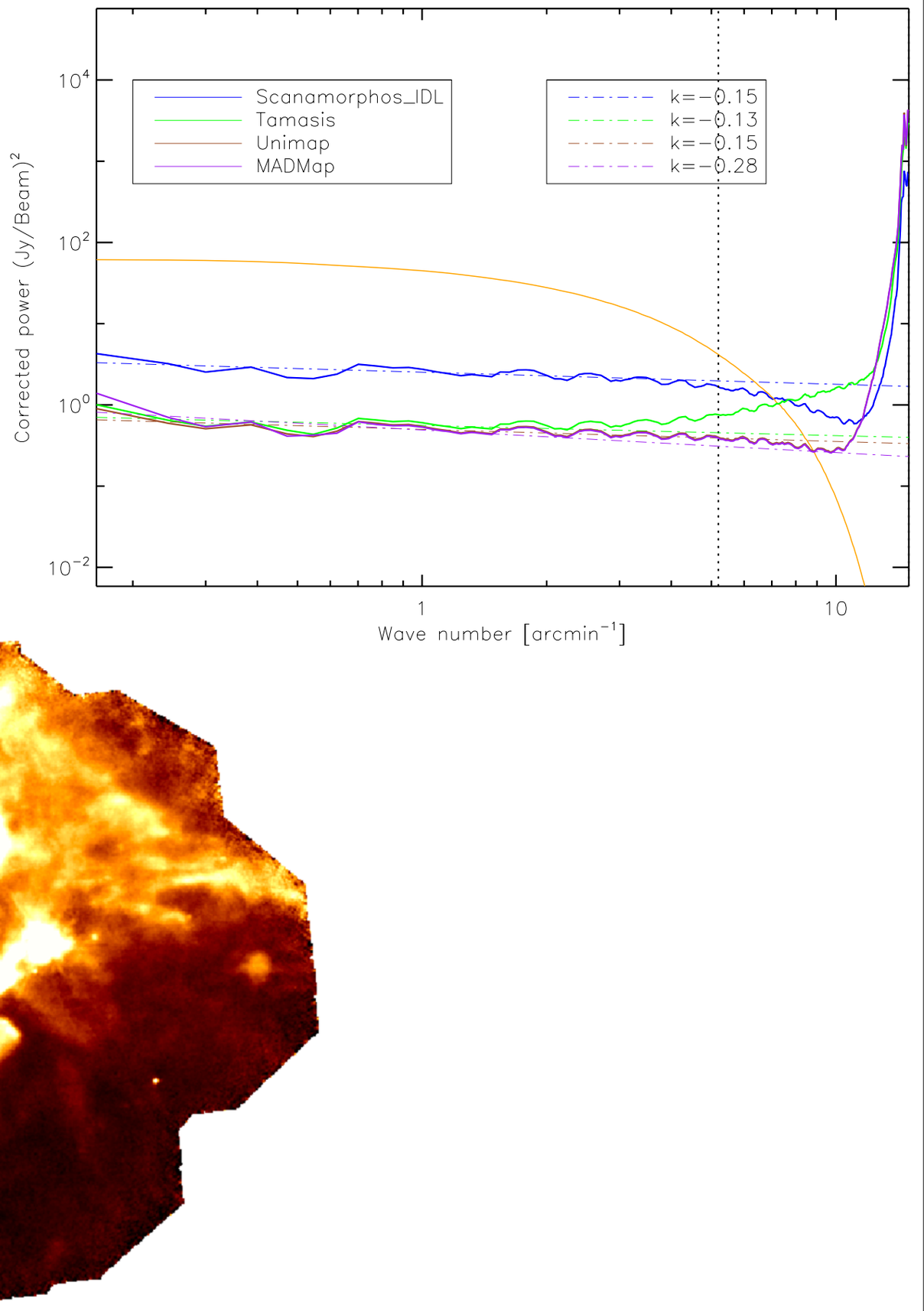




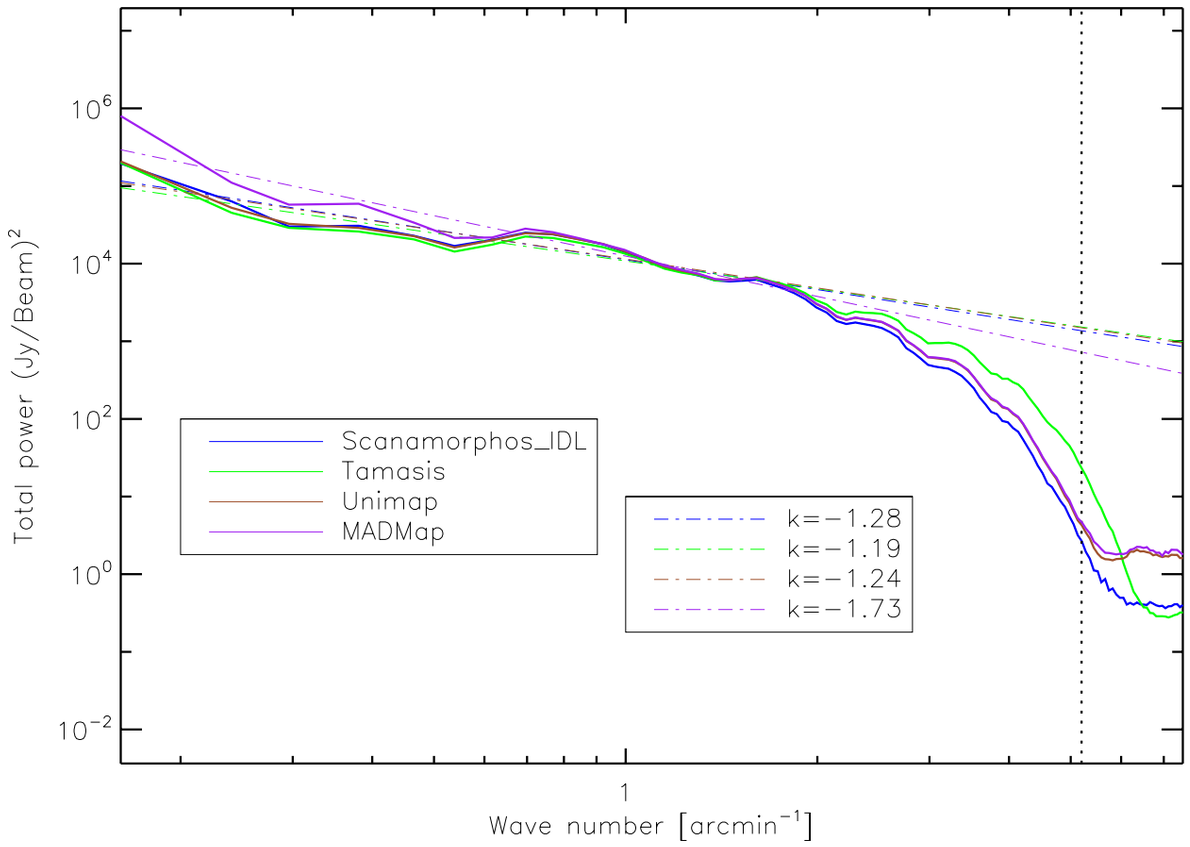


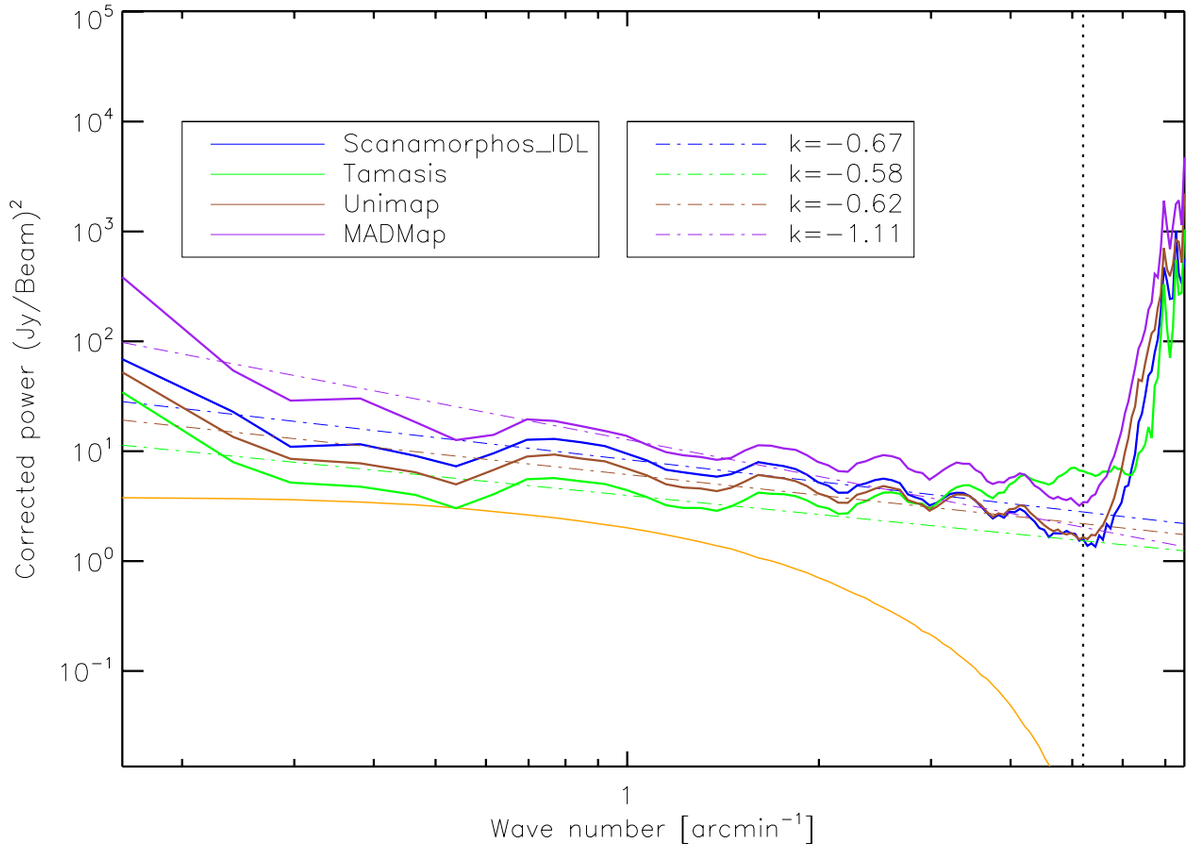
HOPS Group 38 - blue

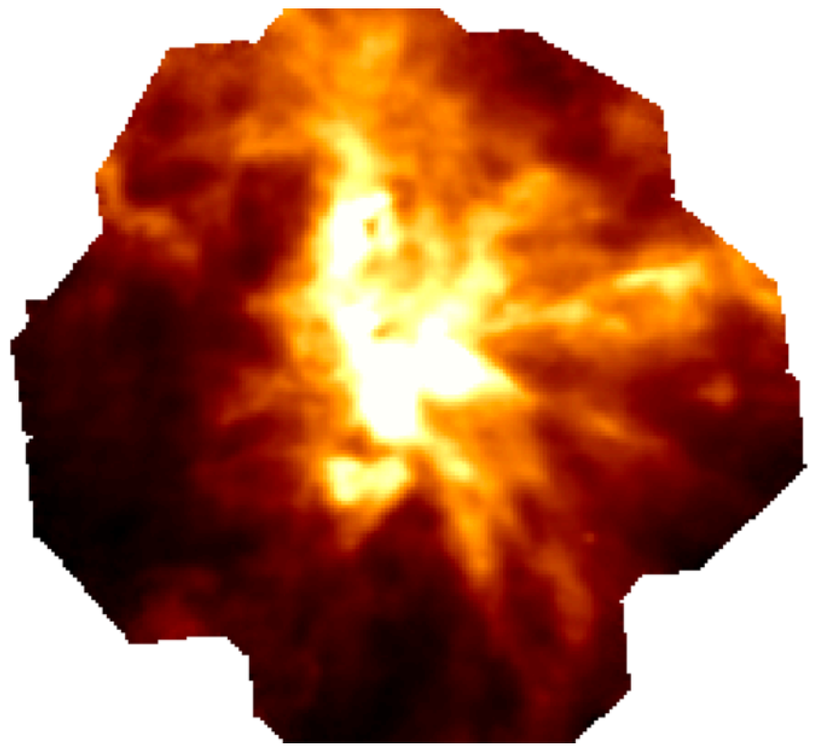




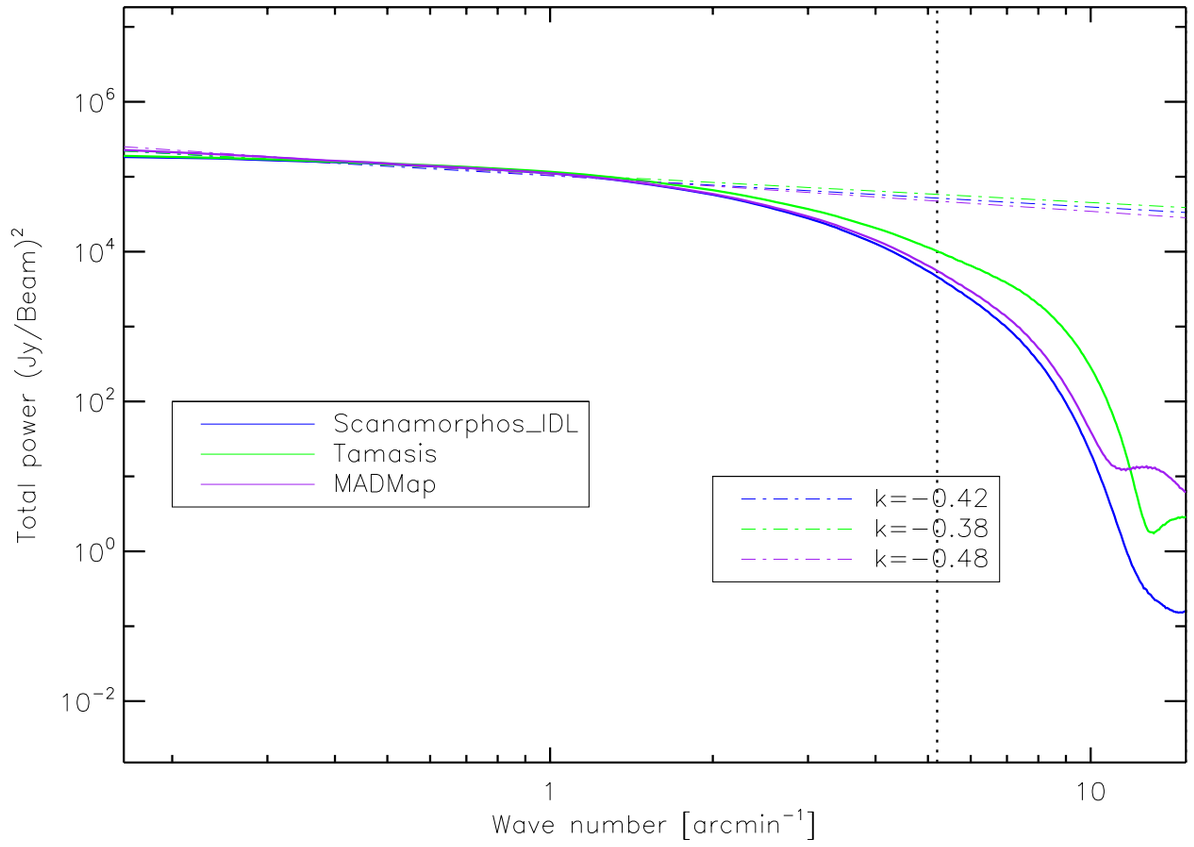
HOPS Group 38 - red

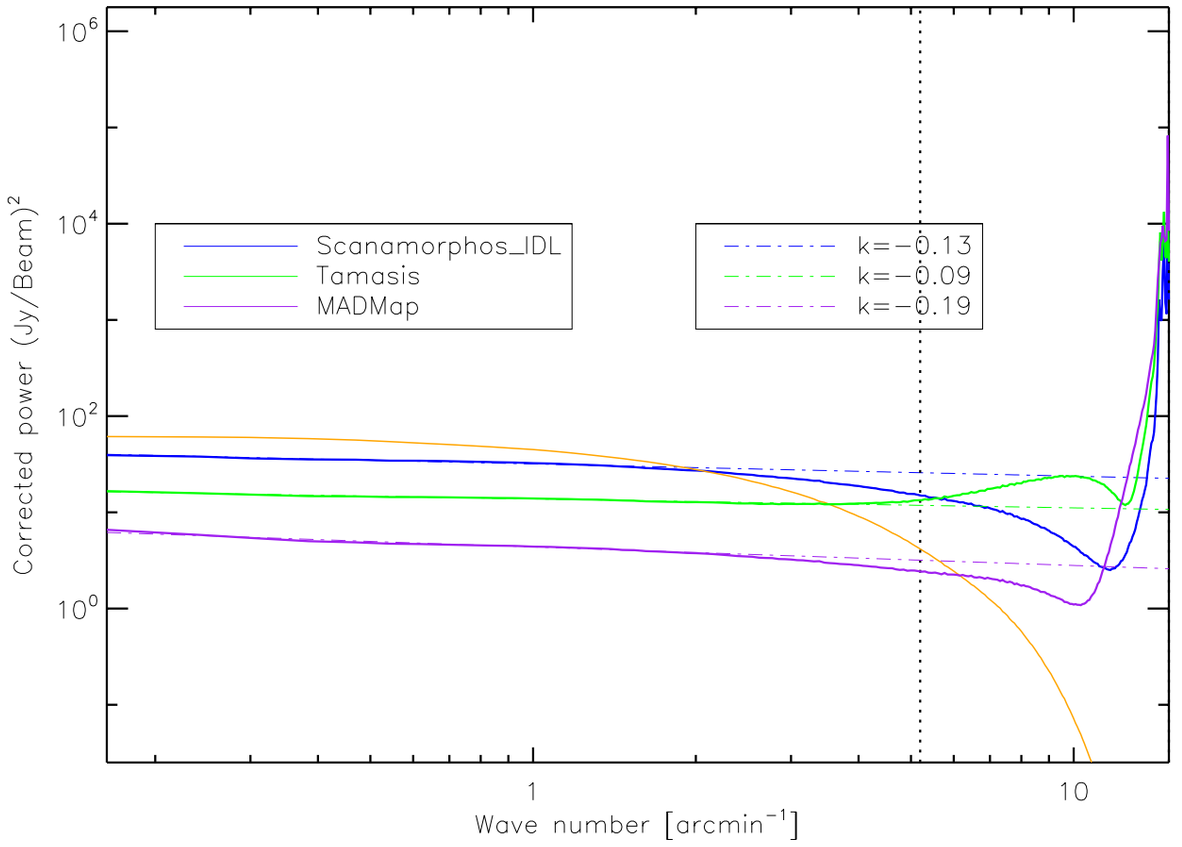


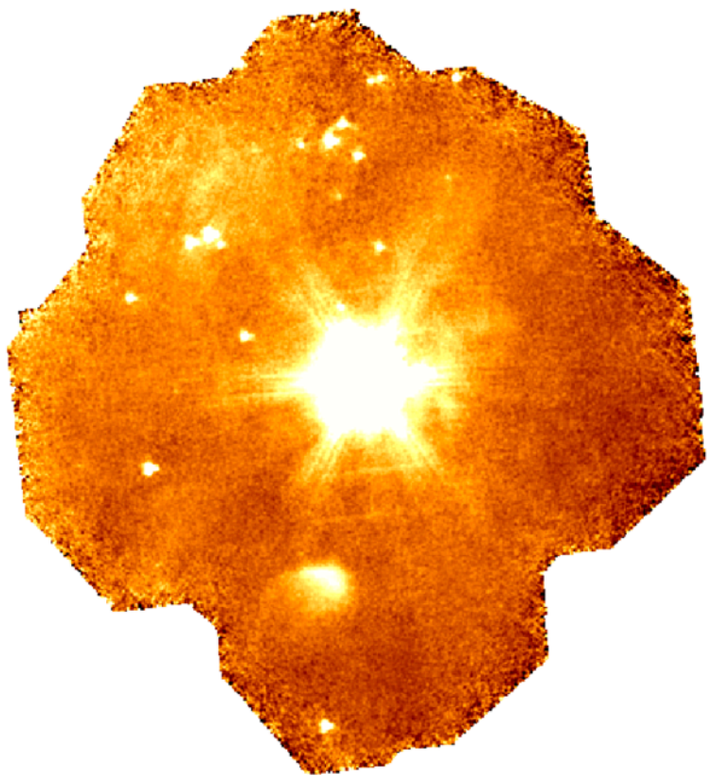




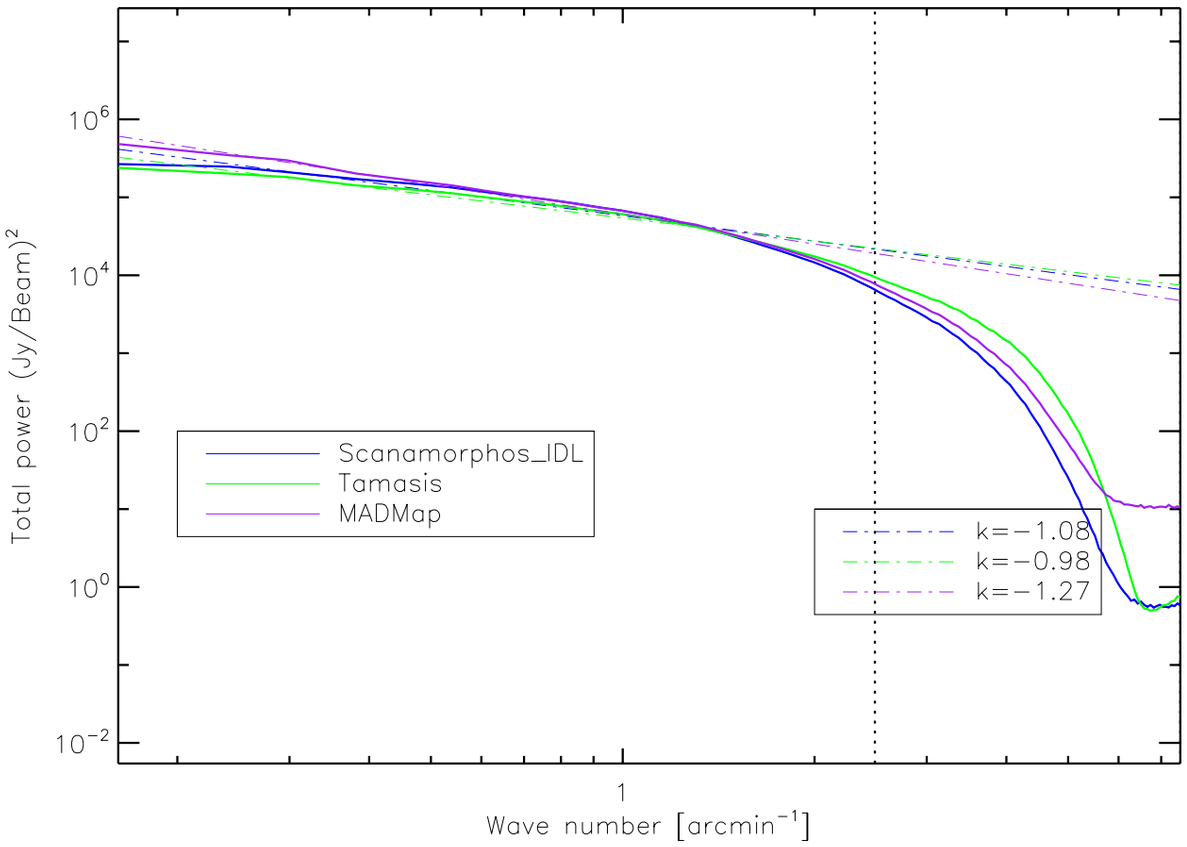
HOPS Group 79 - blue

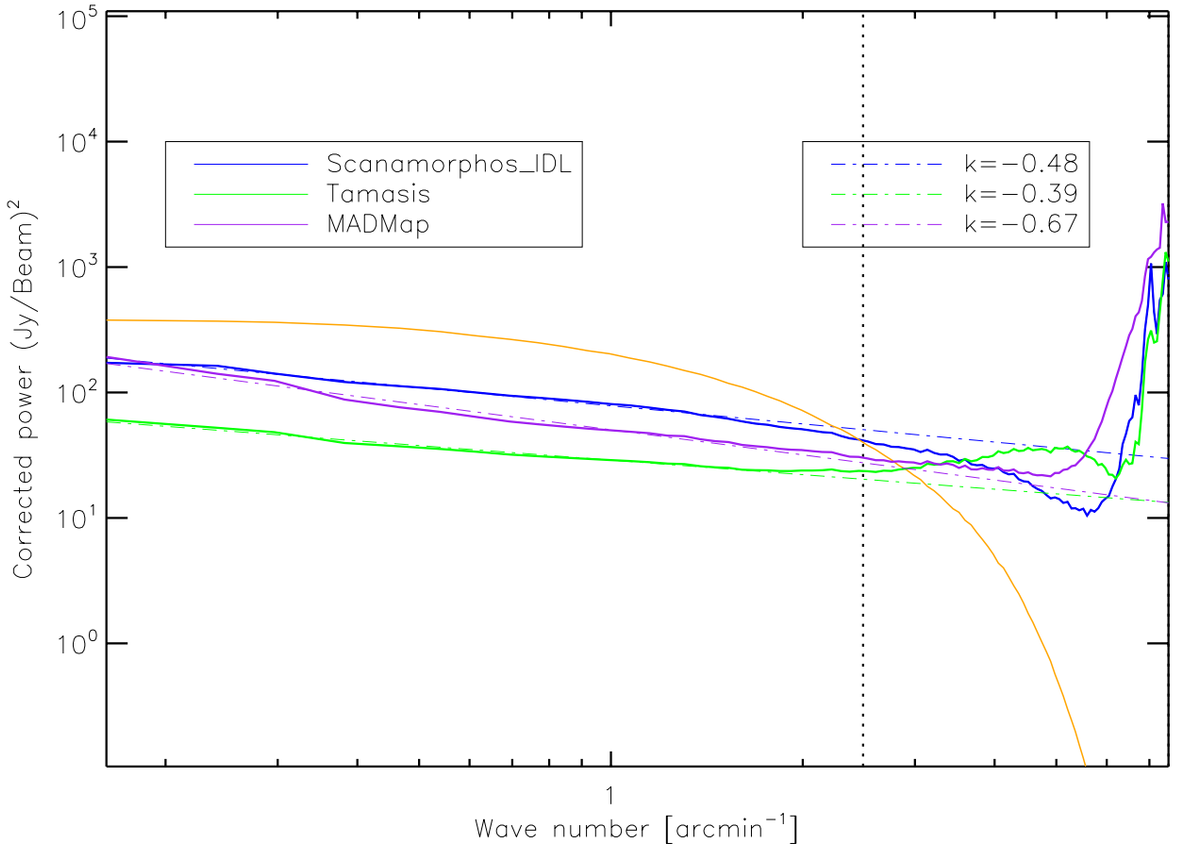


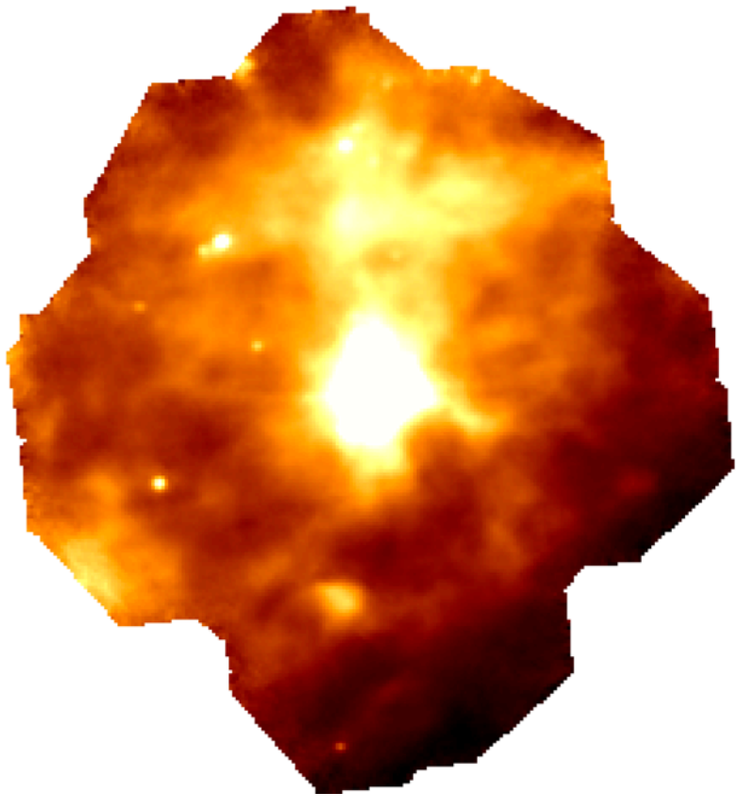




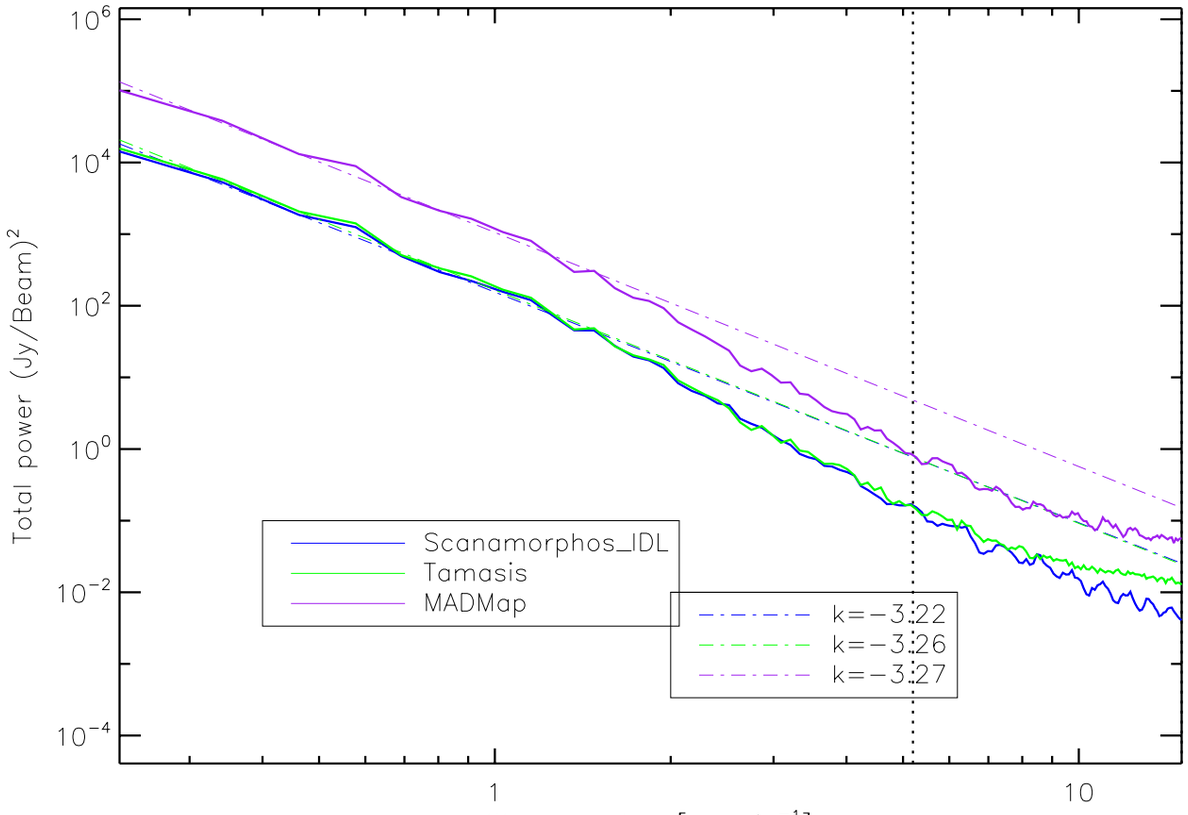
HOPS Group 79 - red

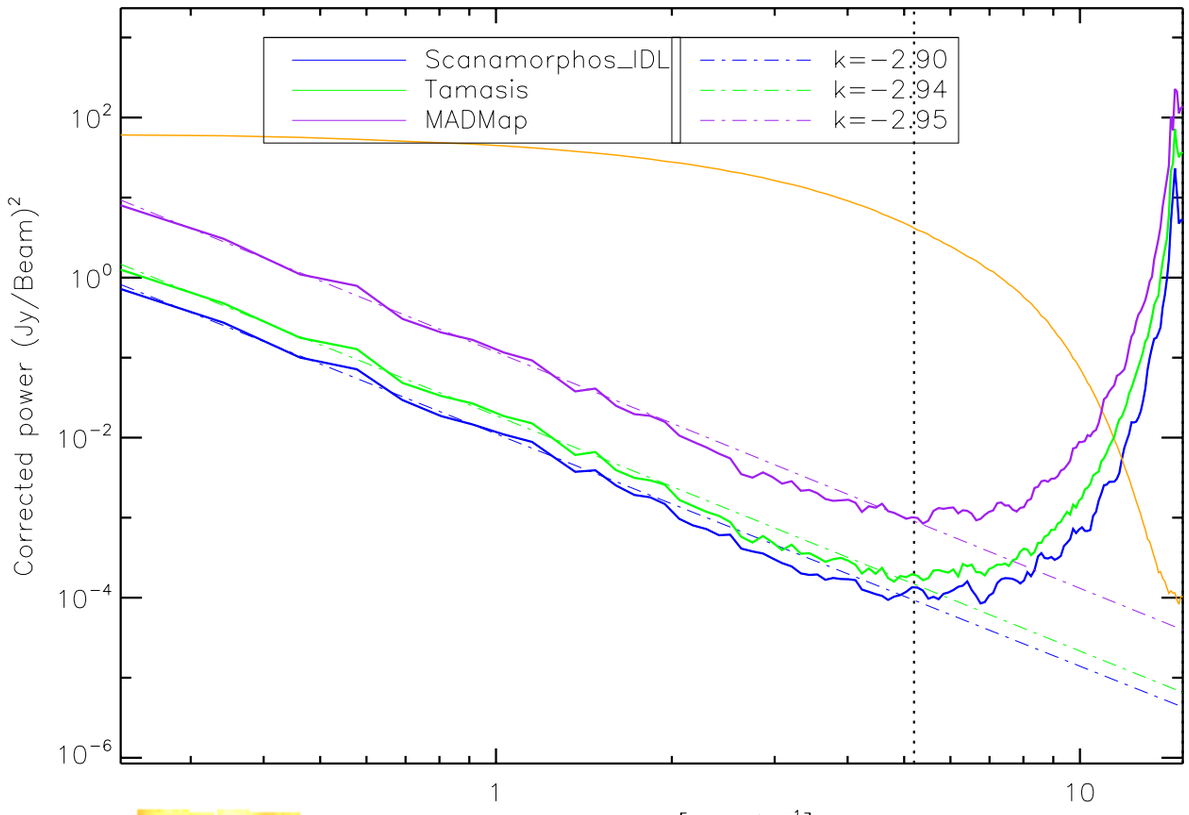


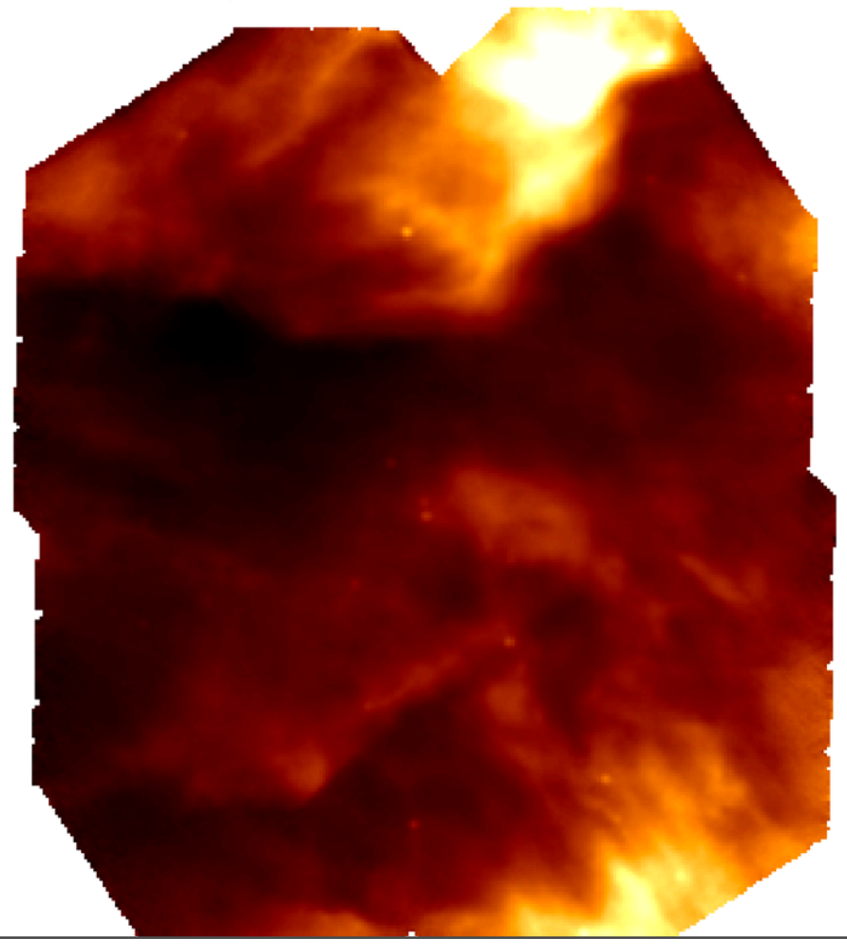




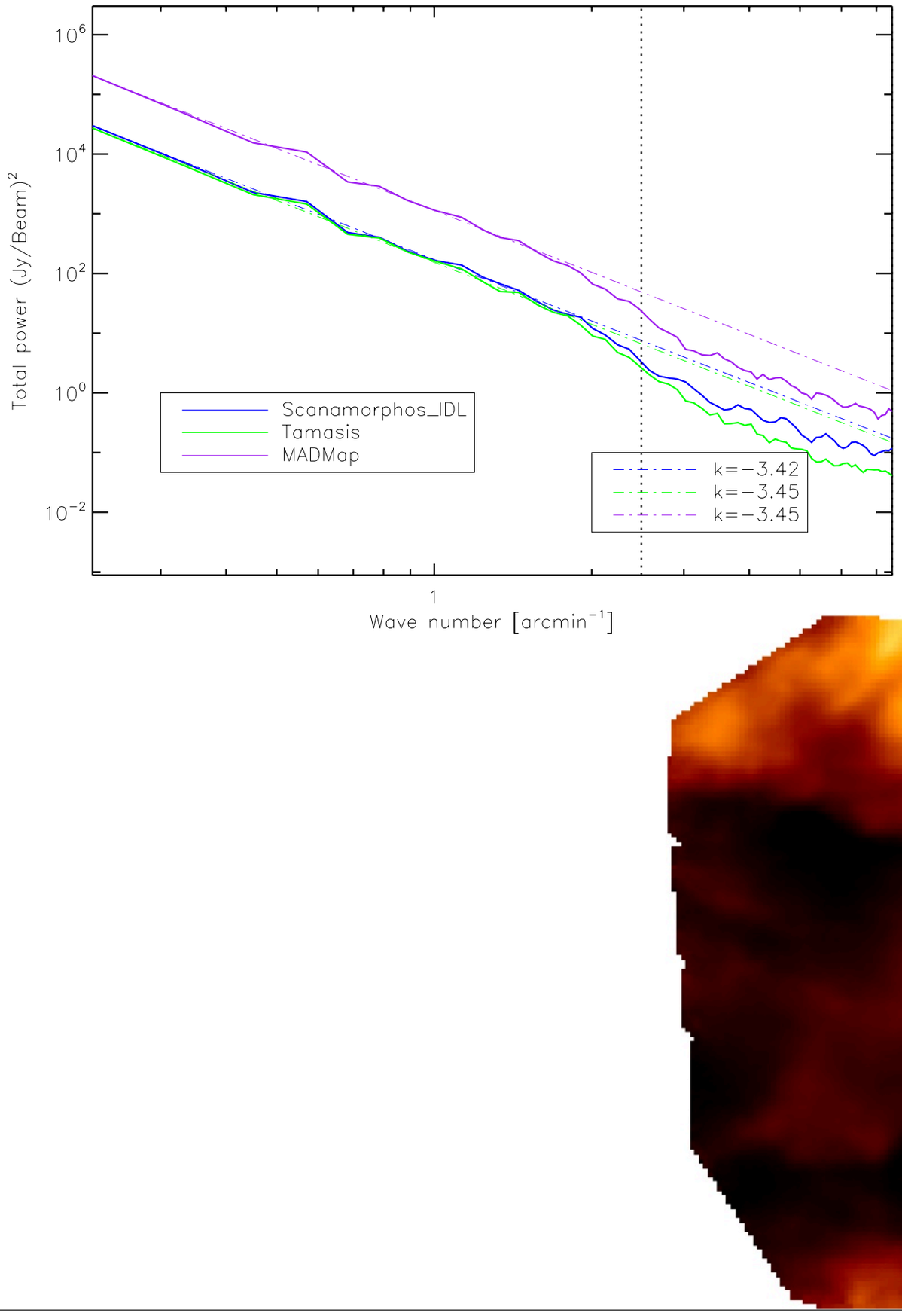
HOPS Group 306 - blue

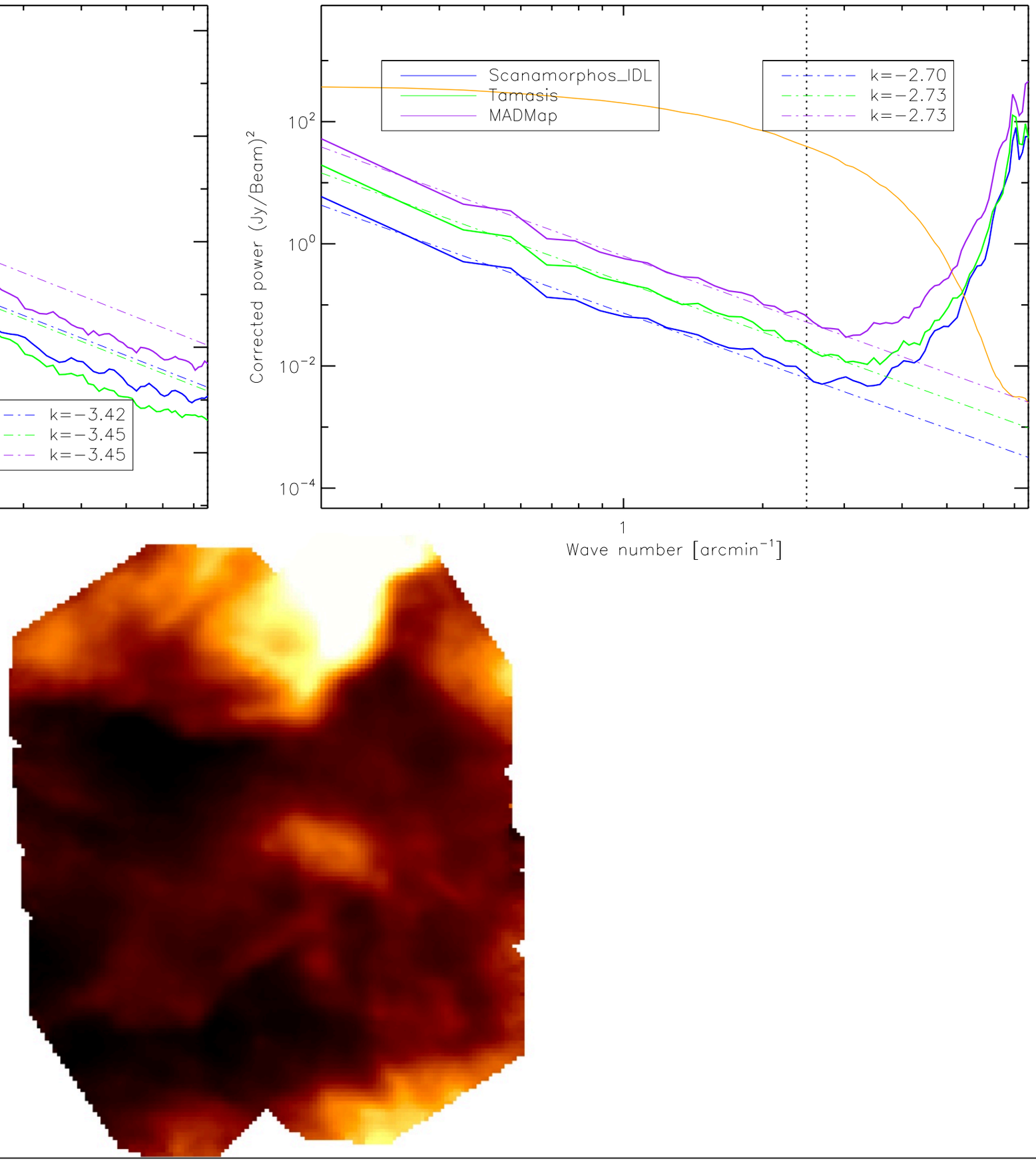




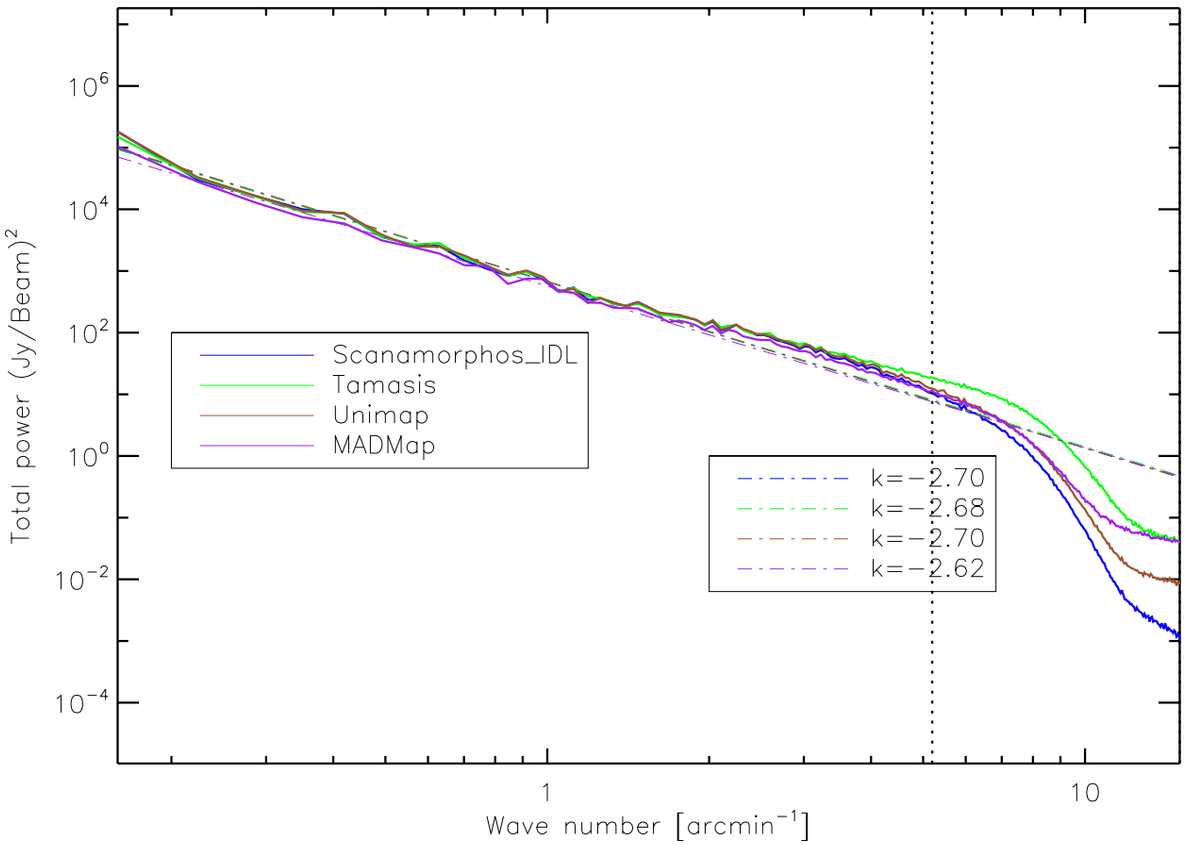


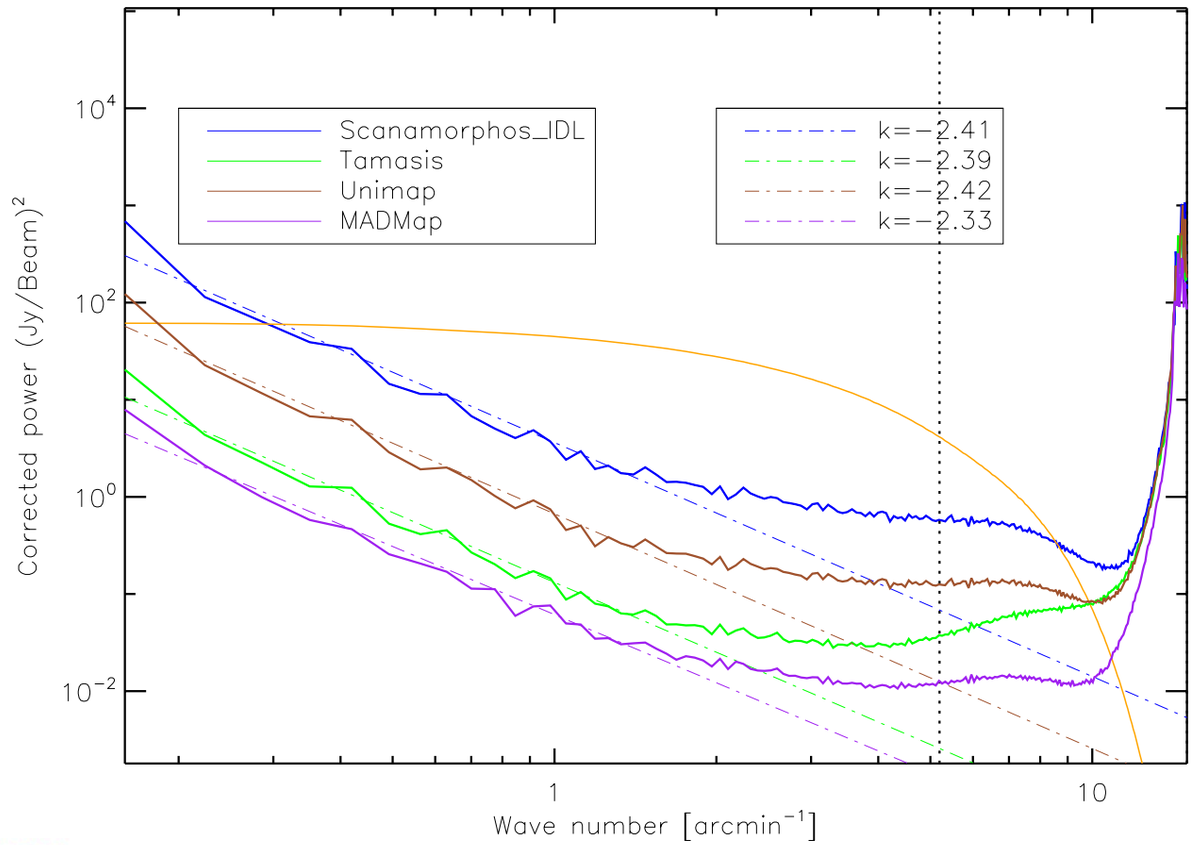
HOPS Group 306 - red

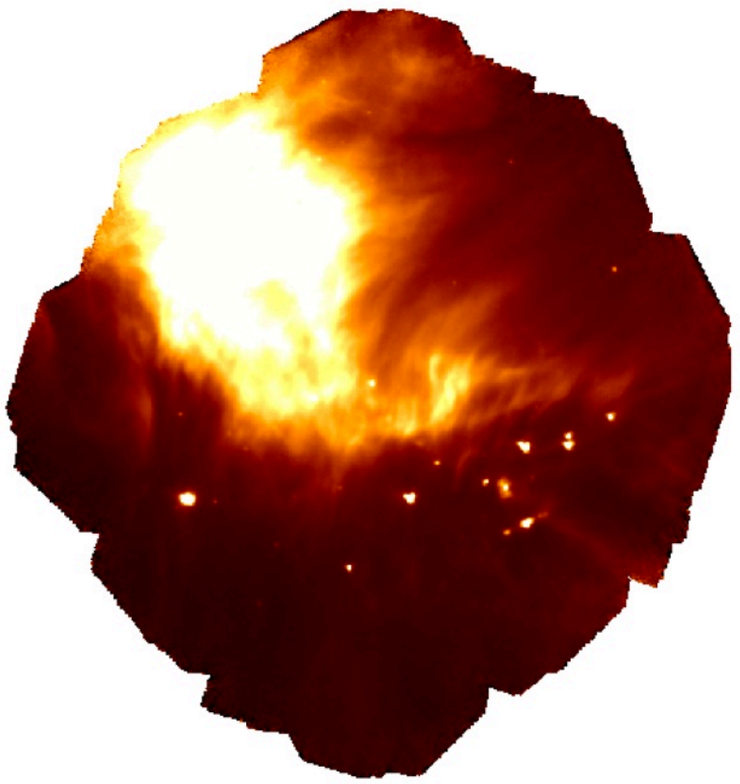




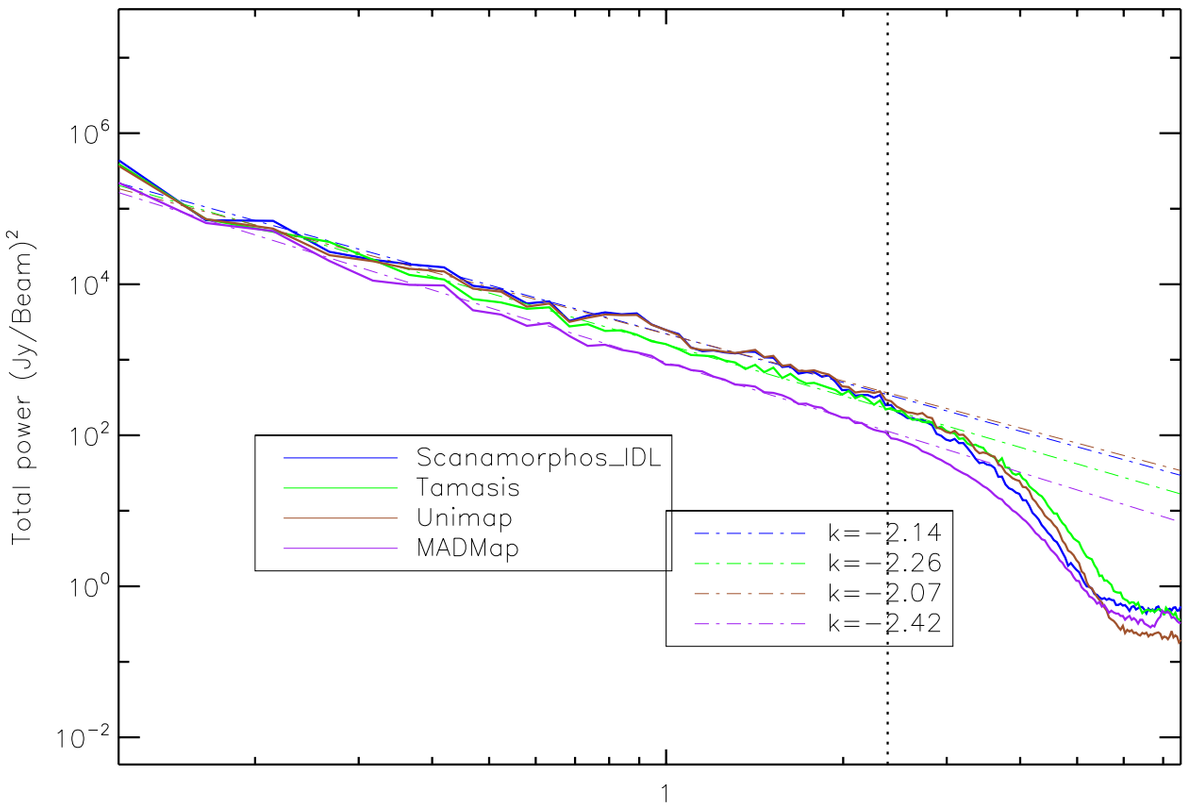
IC348 - blue

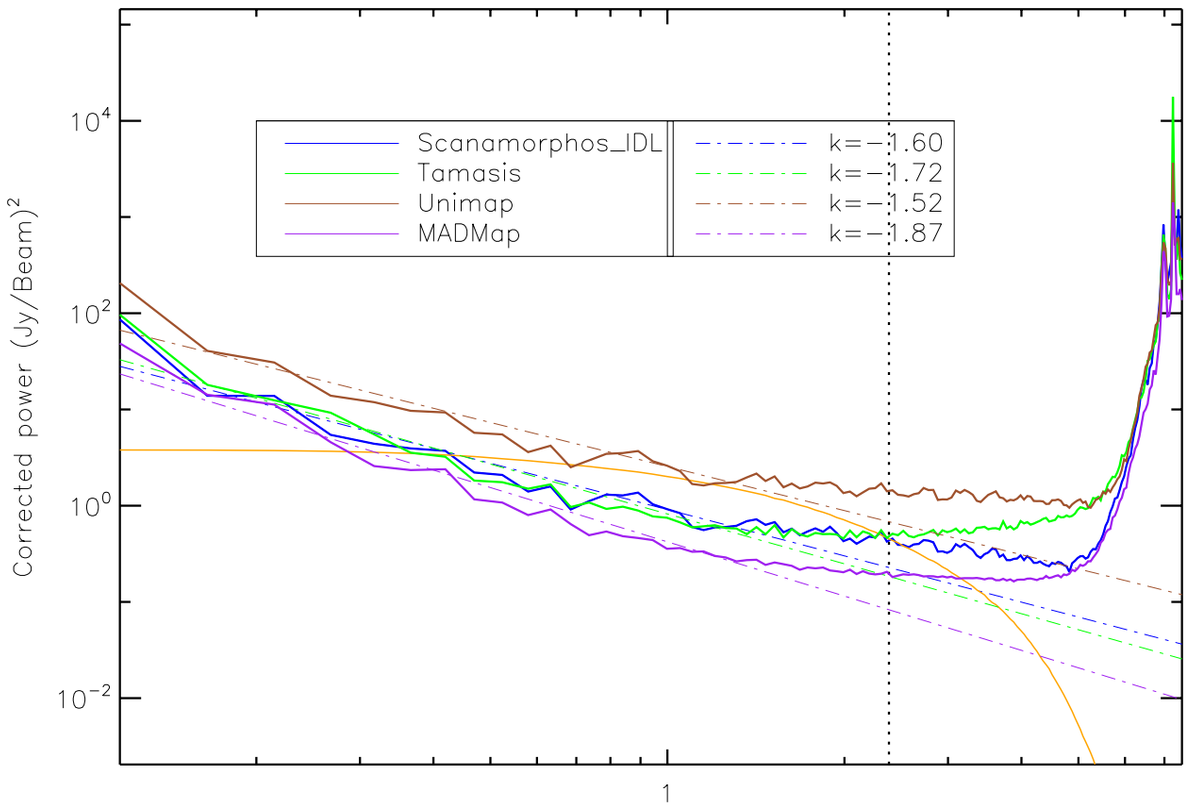

Total power (Jy/Beam)^2
10^6
10^4
10^2
10^0
10^{-2}
10^{-4}
Scanamorphos_IDL
Tamasis
Unimap
MADMap
k=−2.70
k=−2.68
k=−2.70
k=−2.62
1
10
Wave number [arcmin^{-1}]

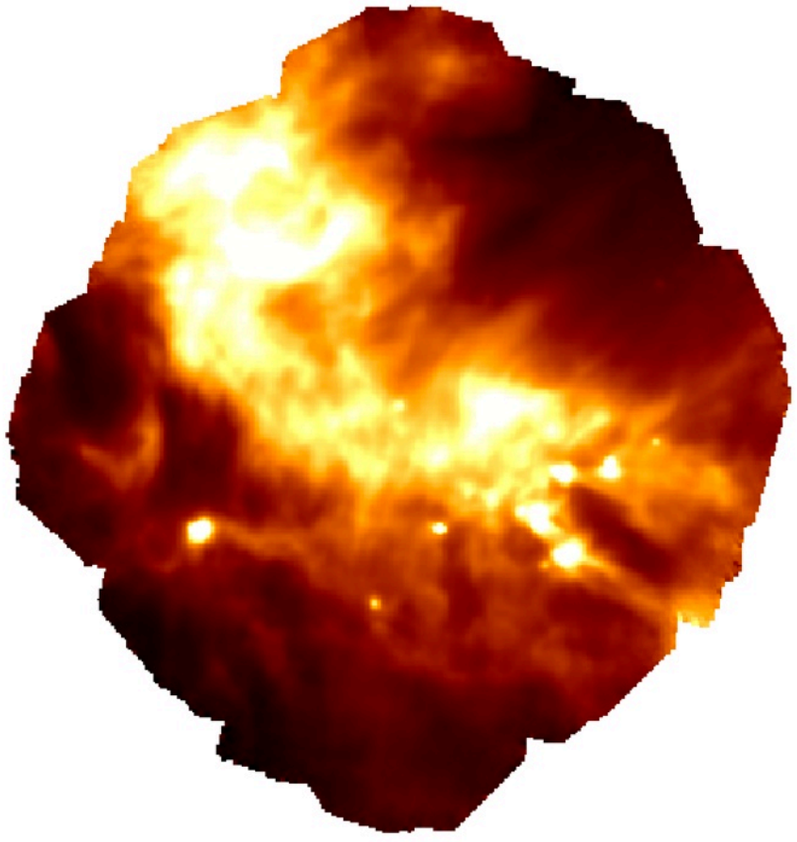

Corrected power (Jy/Beam)^2
10^4
10^2
10^0
10^{-2}
Scanamorphos_IDL
Tamasis
Unimap
MADMap
k=−2.41
k=−2.39
k=−2.42
k=−2.33
1
10
Wave number [arcmin^{-1}]



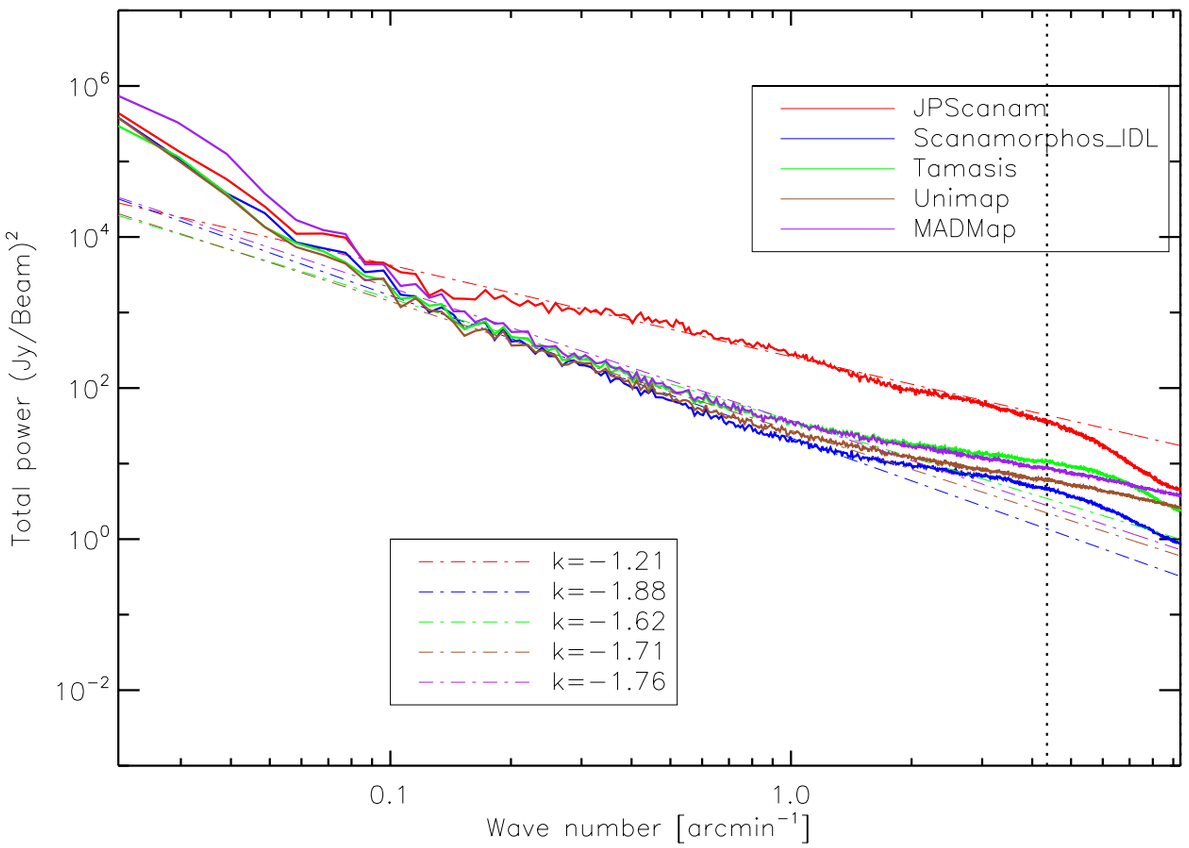
IC348 - red

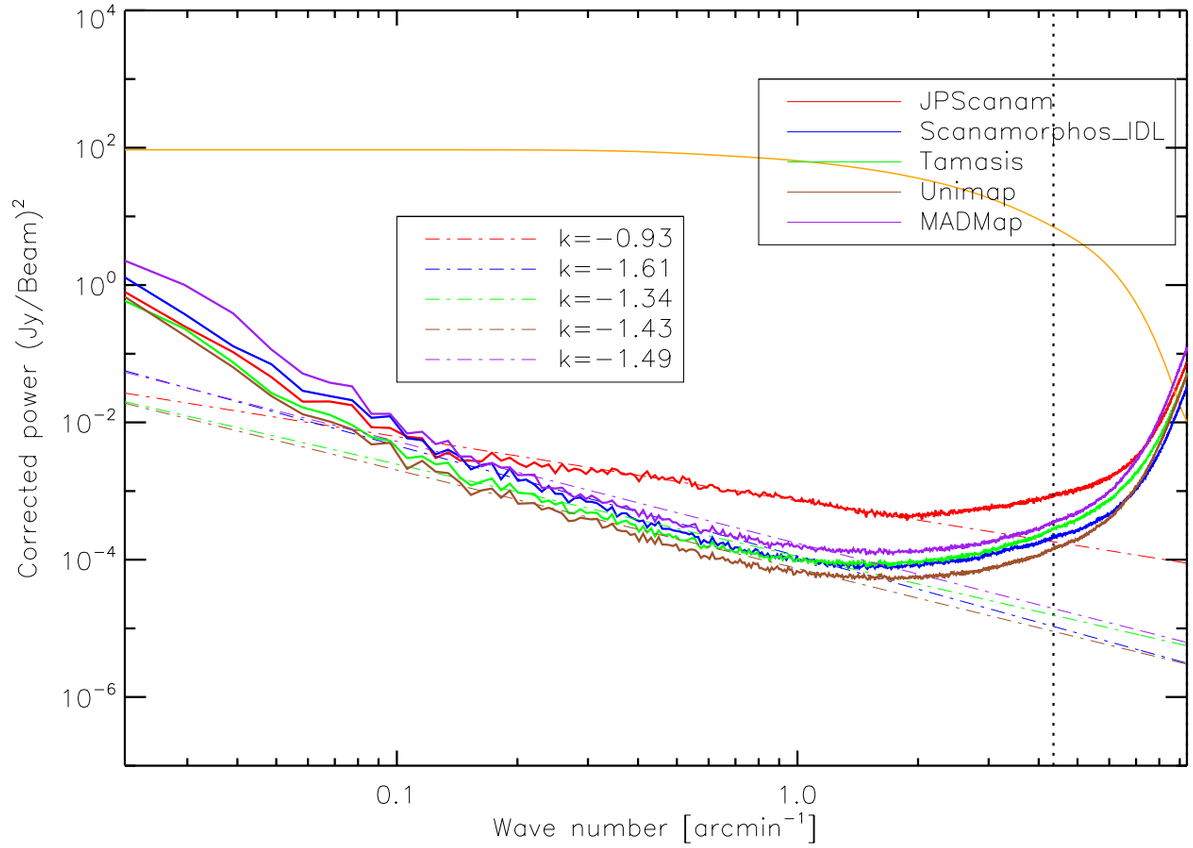

Total power (Jy/Beam)^2
10^6
10^4
10^2
10^0
10^{-2}
Scanamorphos_IDL
Tamasis
Unimap
MADMap
k=−2.14
k=−2.26
k=−2.07
k=−2.42
1
Wave number [arcmin^{-1}]

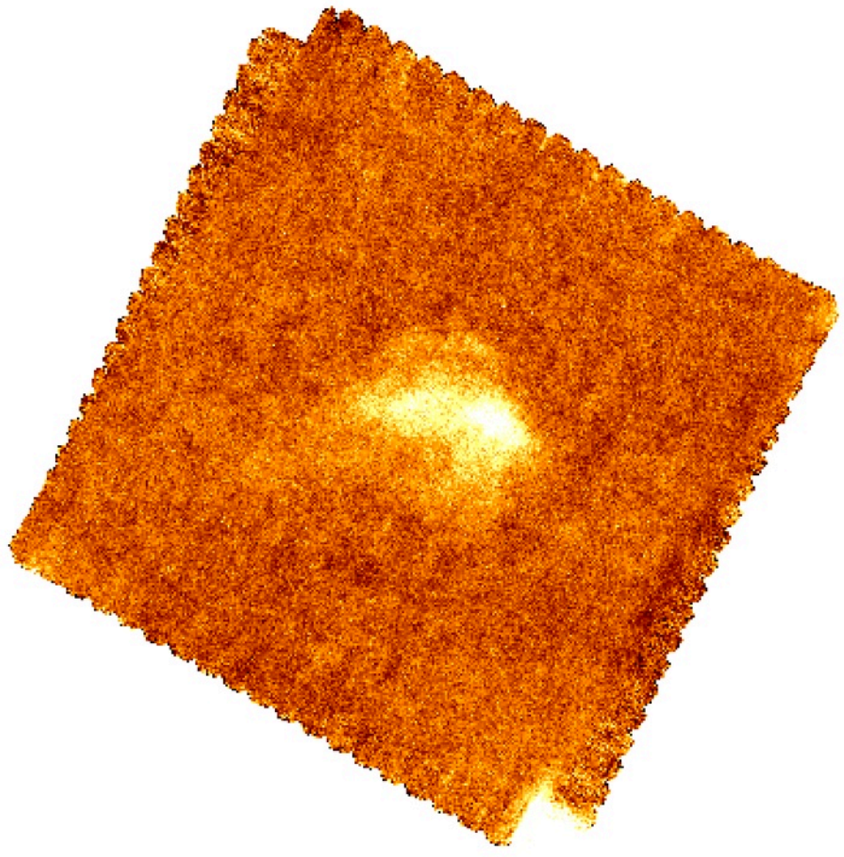

Corrected power (Jy/Beam)^2
10^4
10^2
10^0
10^{-2}
Scanamorphos_IDL
Tamasis
Unimap
MADMap
k=−1.60
k=−1.72
k=−1.52
k=−1.87
1
Wave number [arcmin^{-1}]



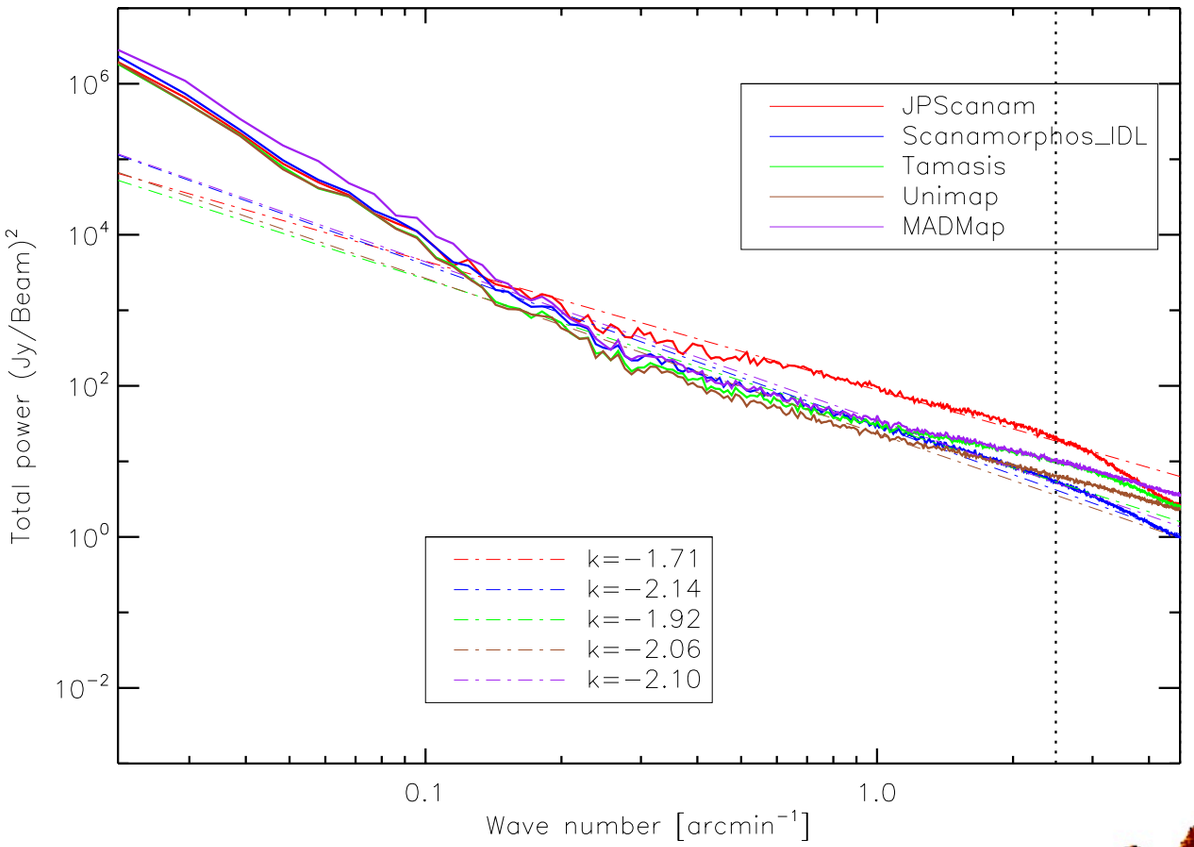
LDN 1780 - blue

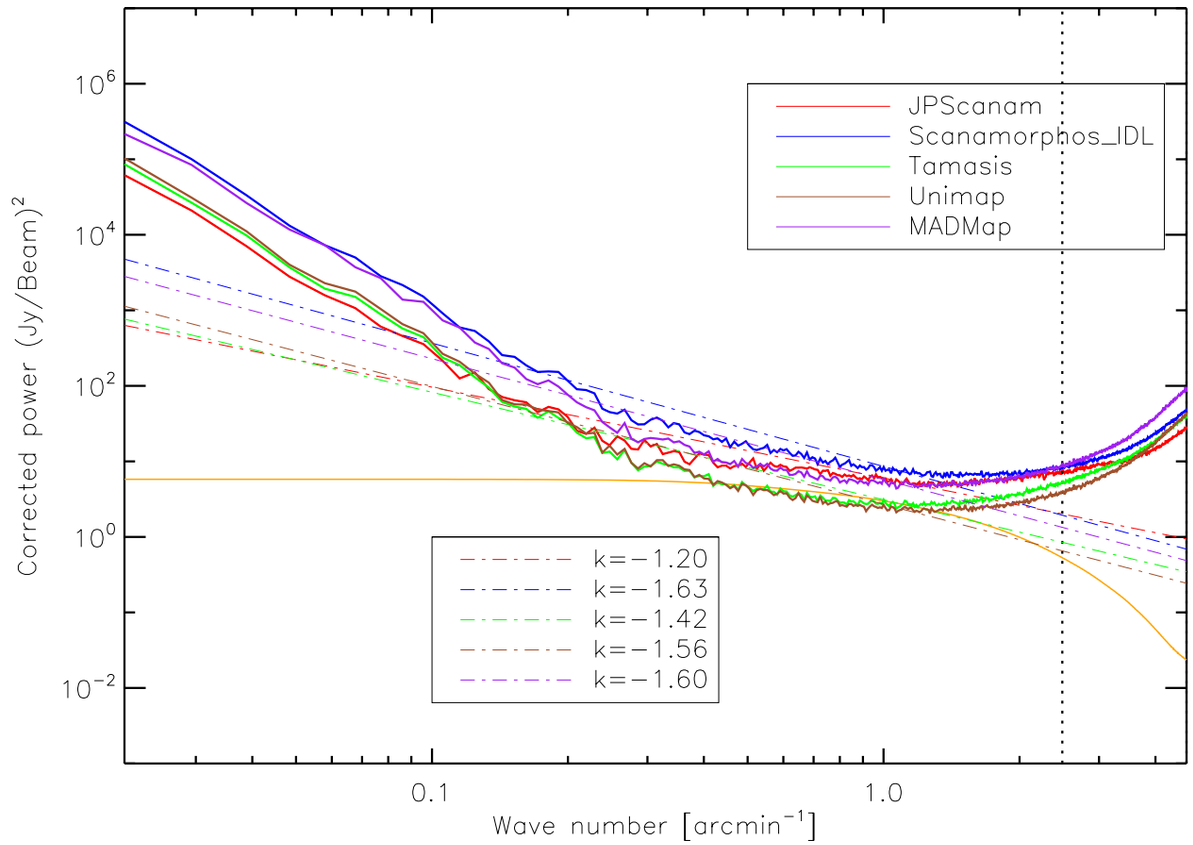


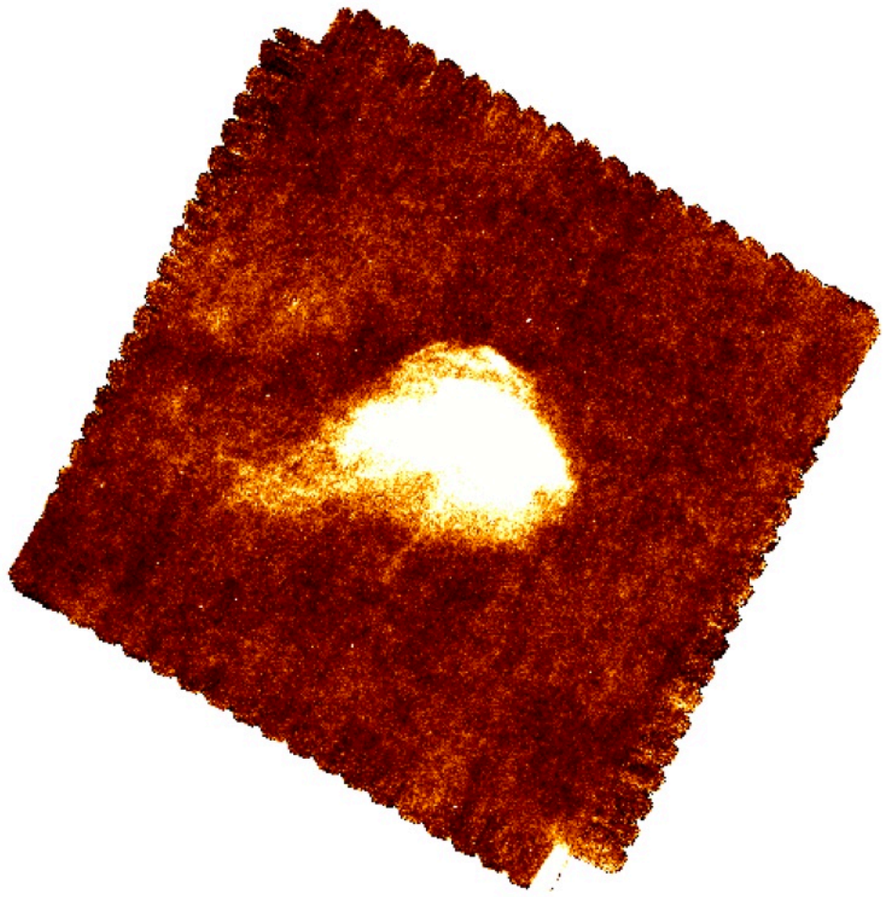




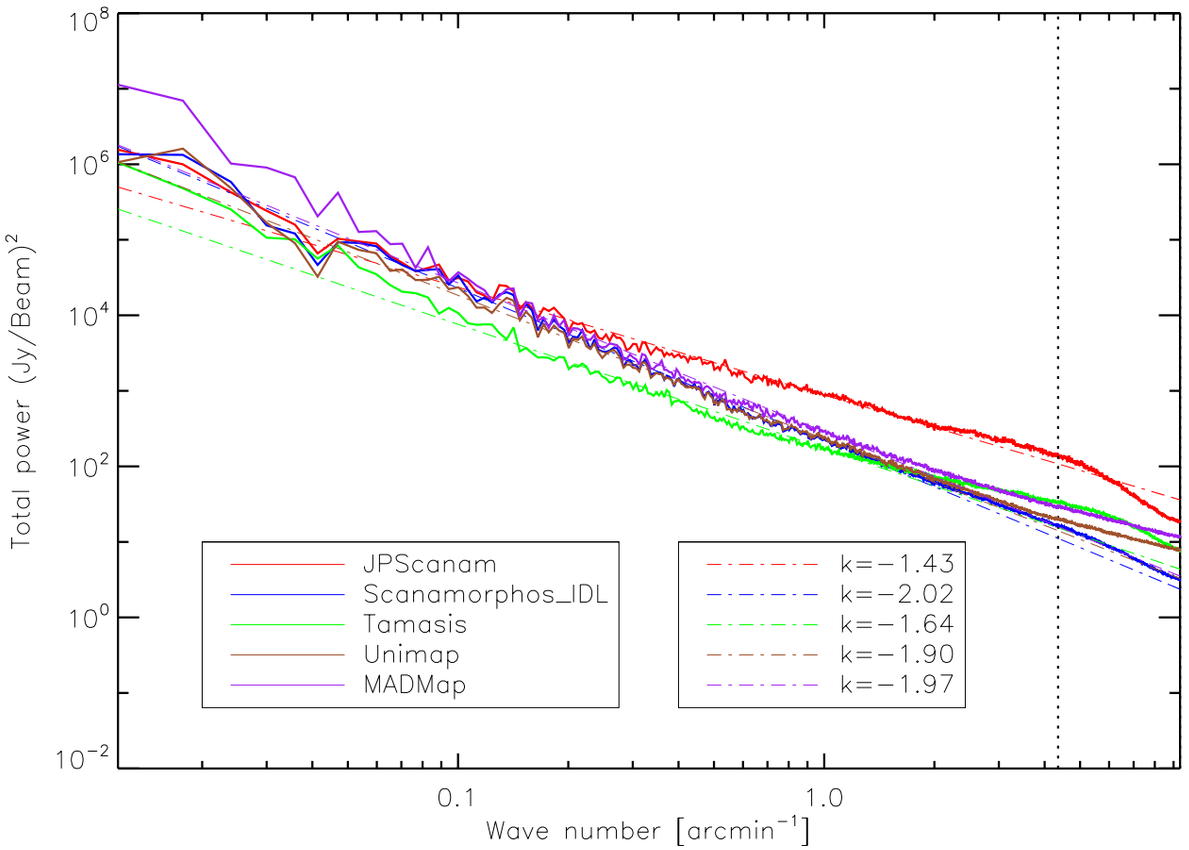
LDN 1780 - red

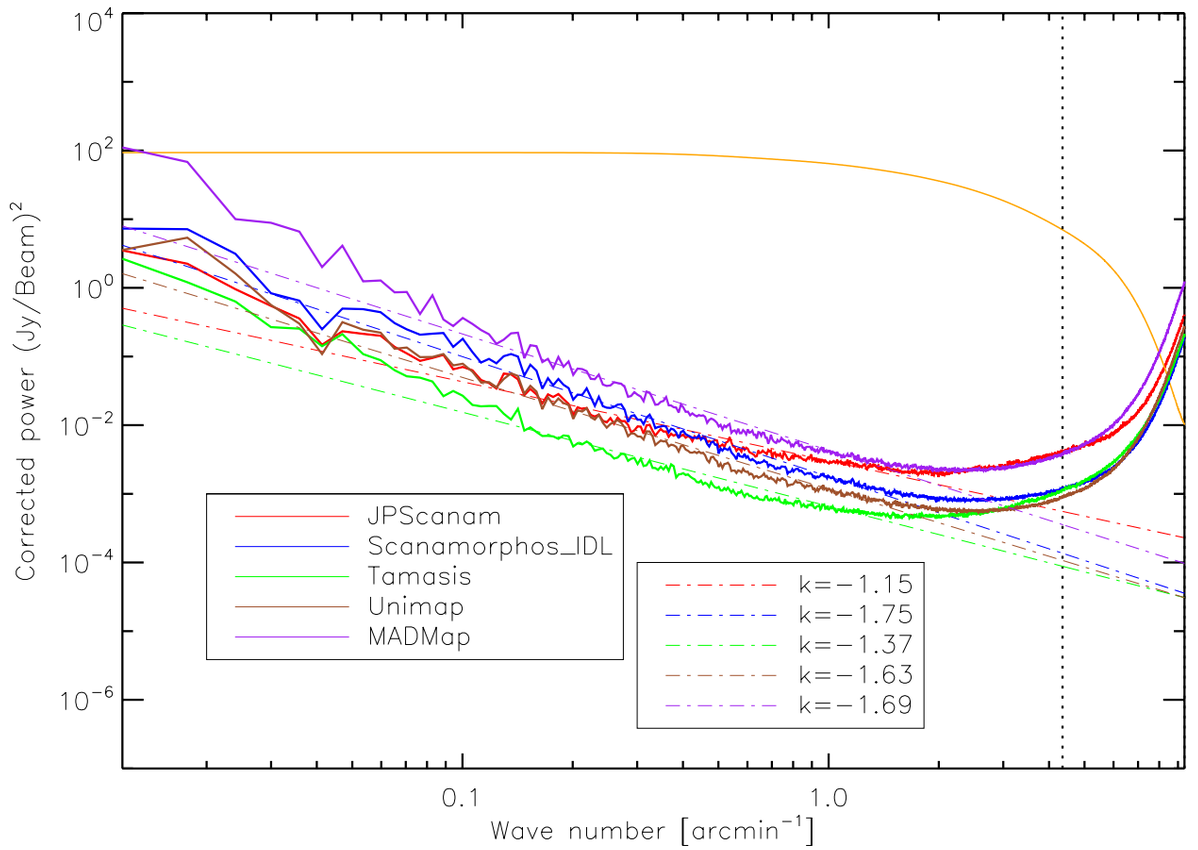

JPScanam
Scanamorphos_IDL
Tamasis
Unimap
MADMap
k=−1.71
k=−2.14
k=−1.92
k=−2.06
k=−2.10
Total power (Jy/Beam)^2
10^6
10^4
10^2
10^0
10^{-2}
0.1
1.0
Wave number [arcmin^{-1}]

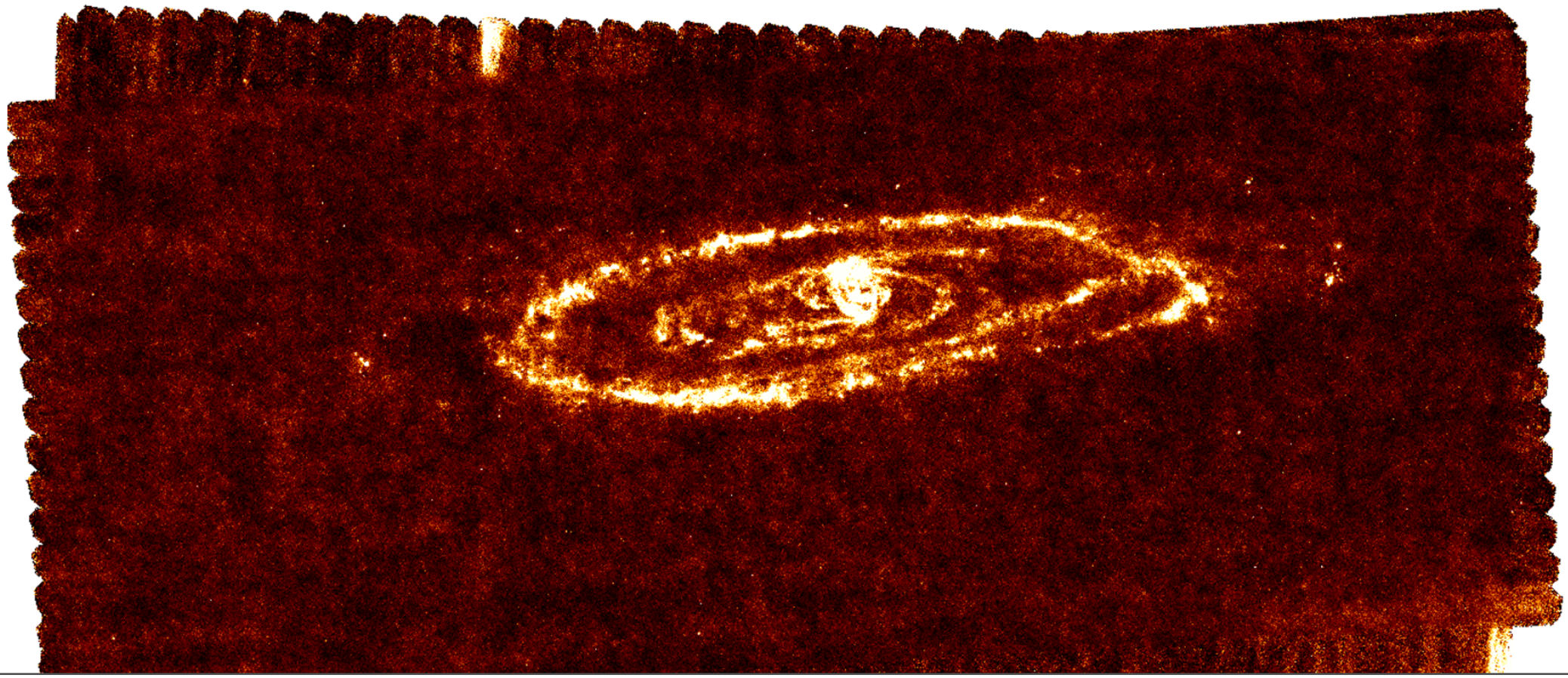

JPScanam
Scanamorphos_IDL
Tamasis
Unimap
MADMap
k=−1.20
k=−1.63
k=−1.42
k=−1.56
k=−1.60
Corrected power (Jy/Beam)^2
10^6
10^4
10^2
10^0
10^{-2}
0.1
1.0
Wave number [arcmin^{-1}]



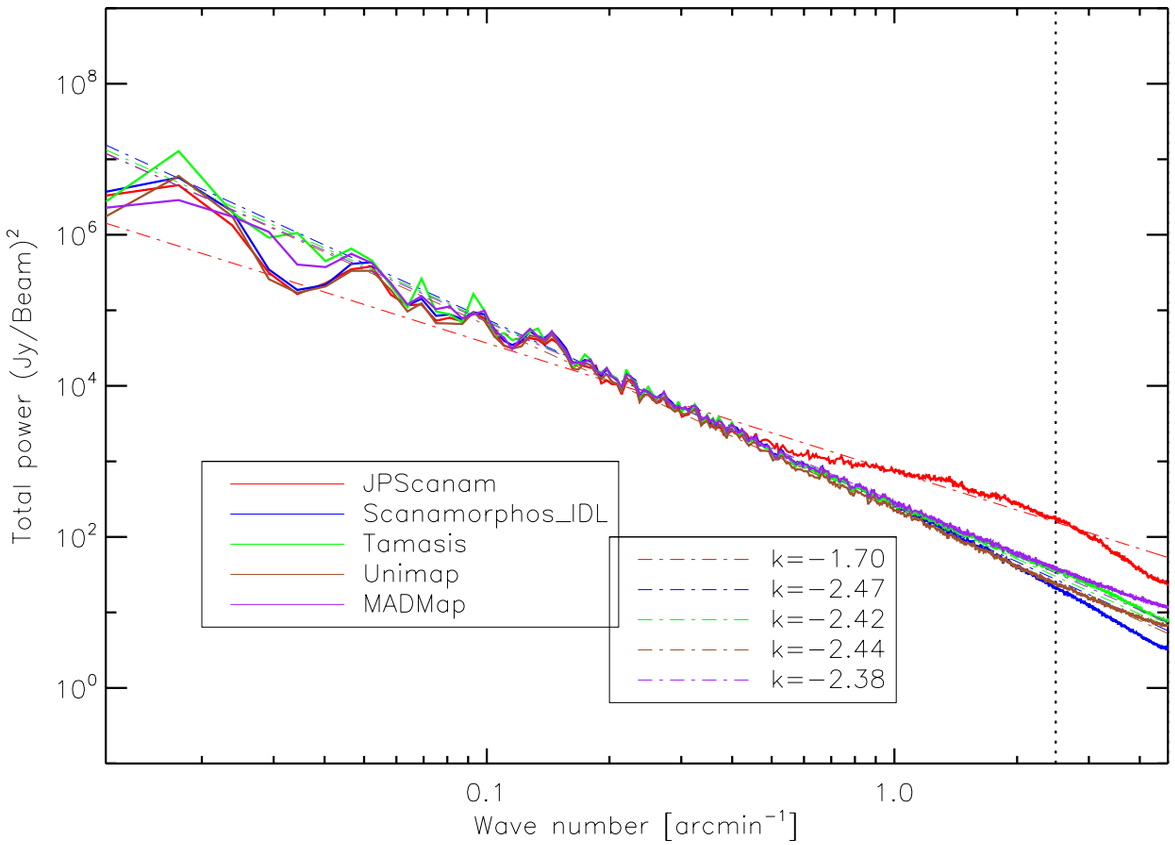
M31 - blue

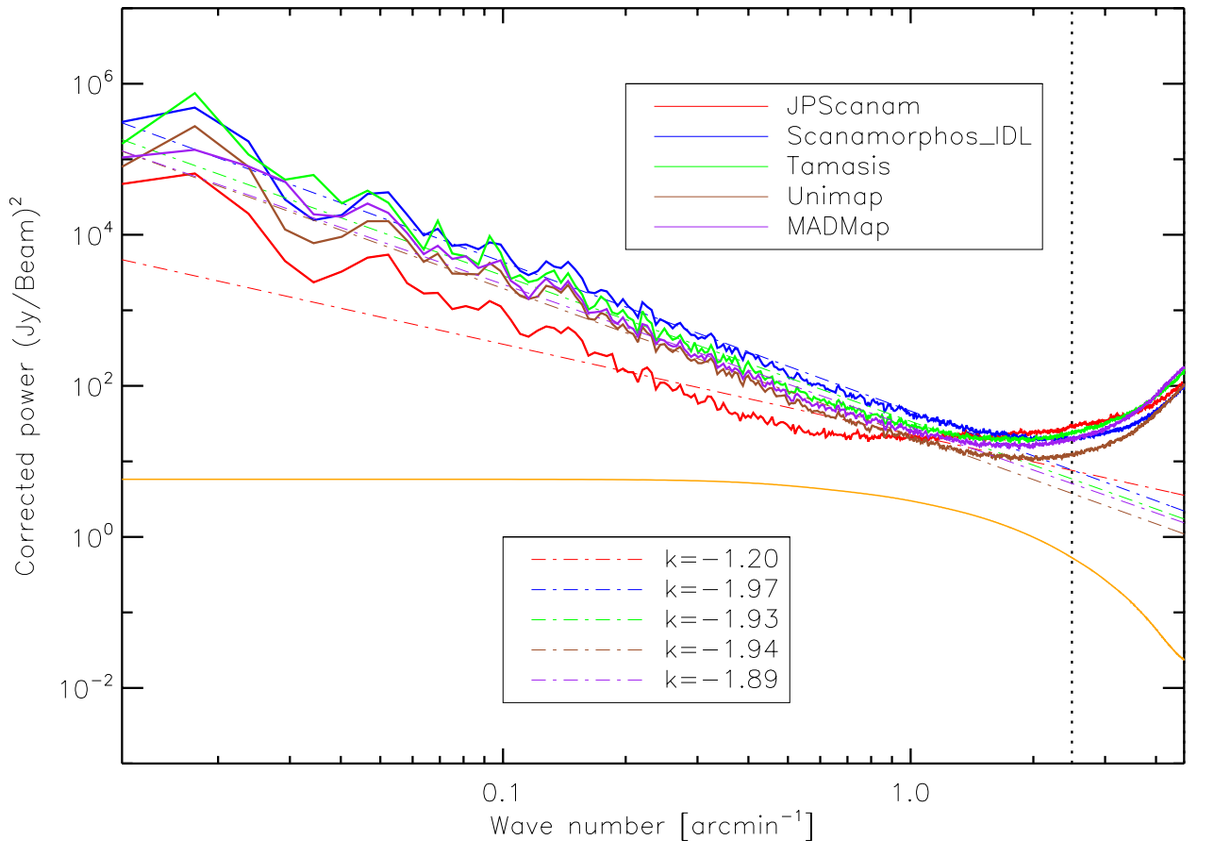

Total power (Jy/Beam)^2
10^8
10^6
10^4
10^2
10^0
10^{-2}
0.1
1.0
Wave number [arcmin^{-1}]
JPScanam
Scanamorphos_IDL
Tamasis
Unimap
MADMap
k=−1.43
k=−2.02
k=−1.64
k=−1.90
k=−1.97

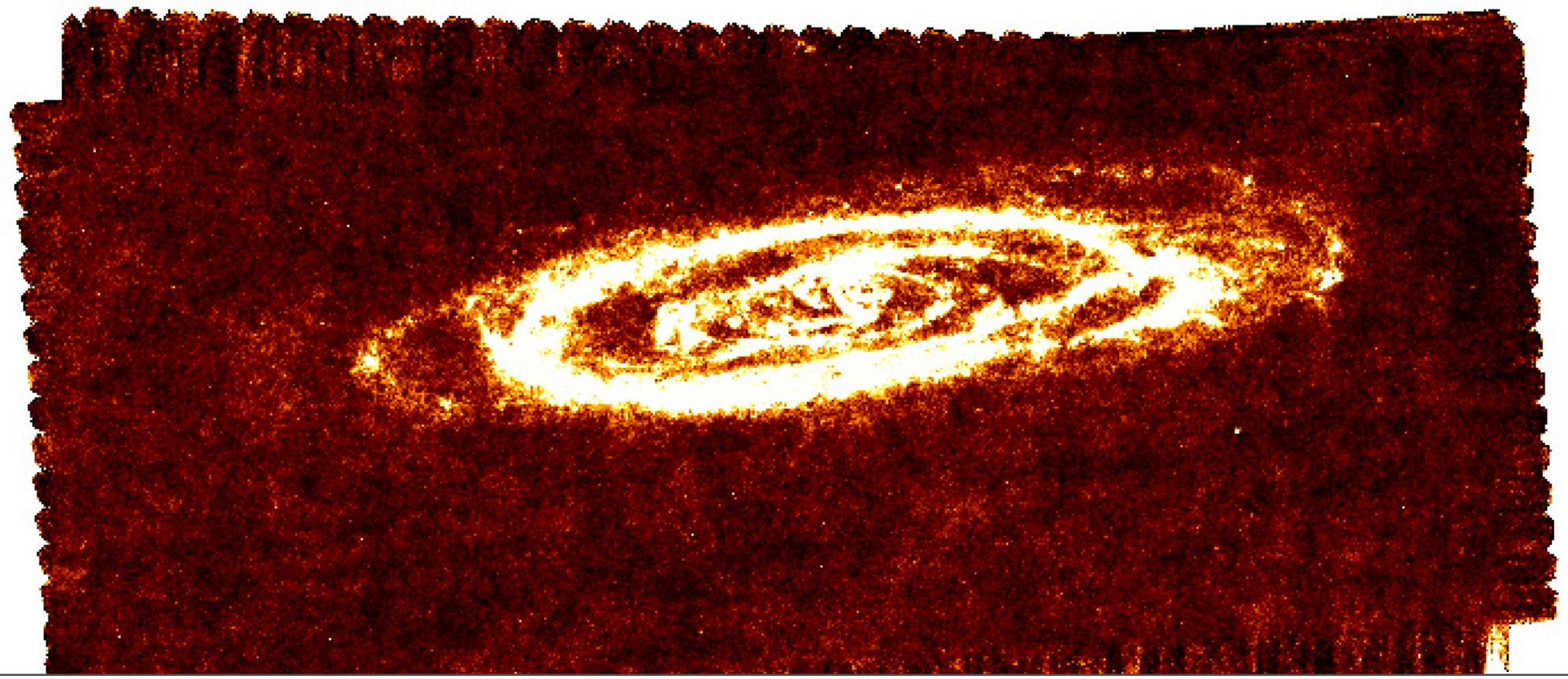

Corrected power (Jy/Beam)^2
10^4
10^2
10^0
10^{-2}
10^{-4}
10^{-6}
0.1
1.0
Wave number [arcmin^{-1}]
JPScanam
Scanamorphos_IDL
Tamasis
Unimap
MADMap
k=−1.15
k=−1.75
k=−1.37
k=−1.63
k=−1.69



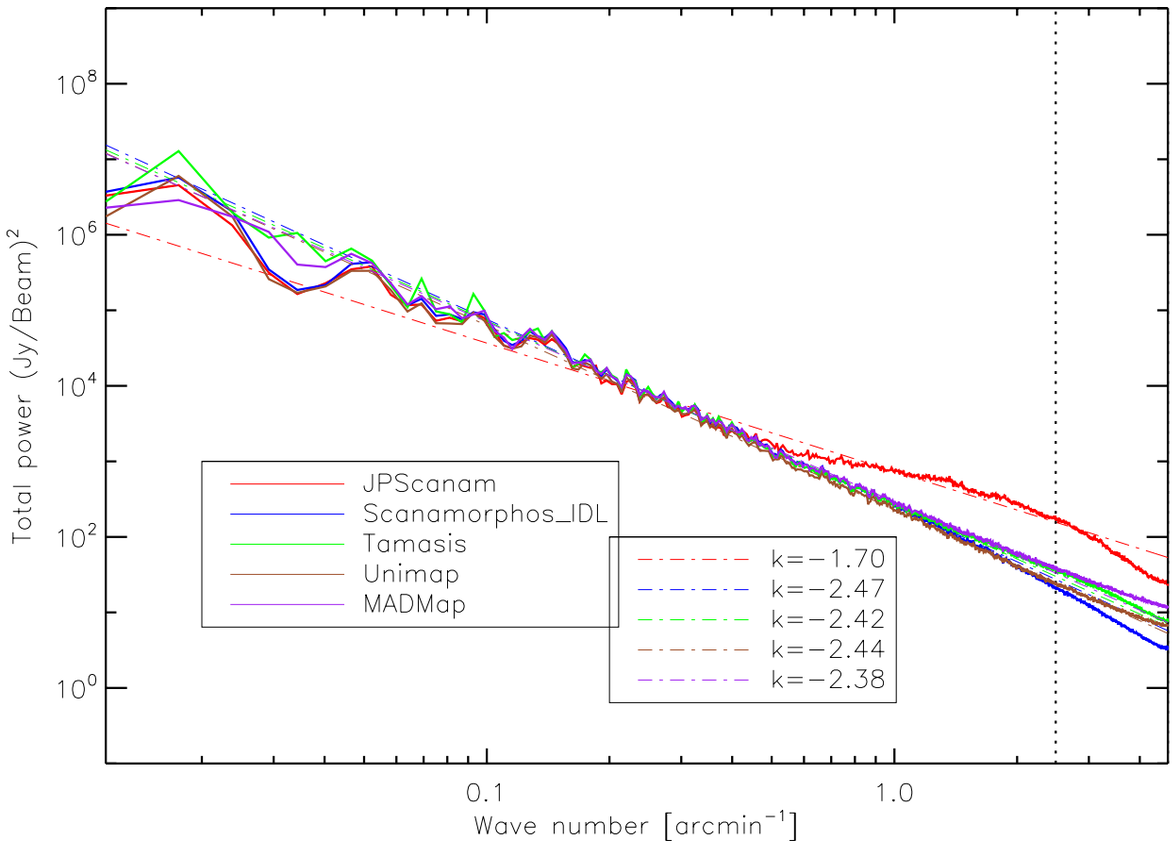
M31 - red

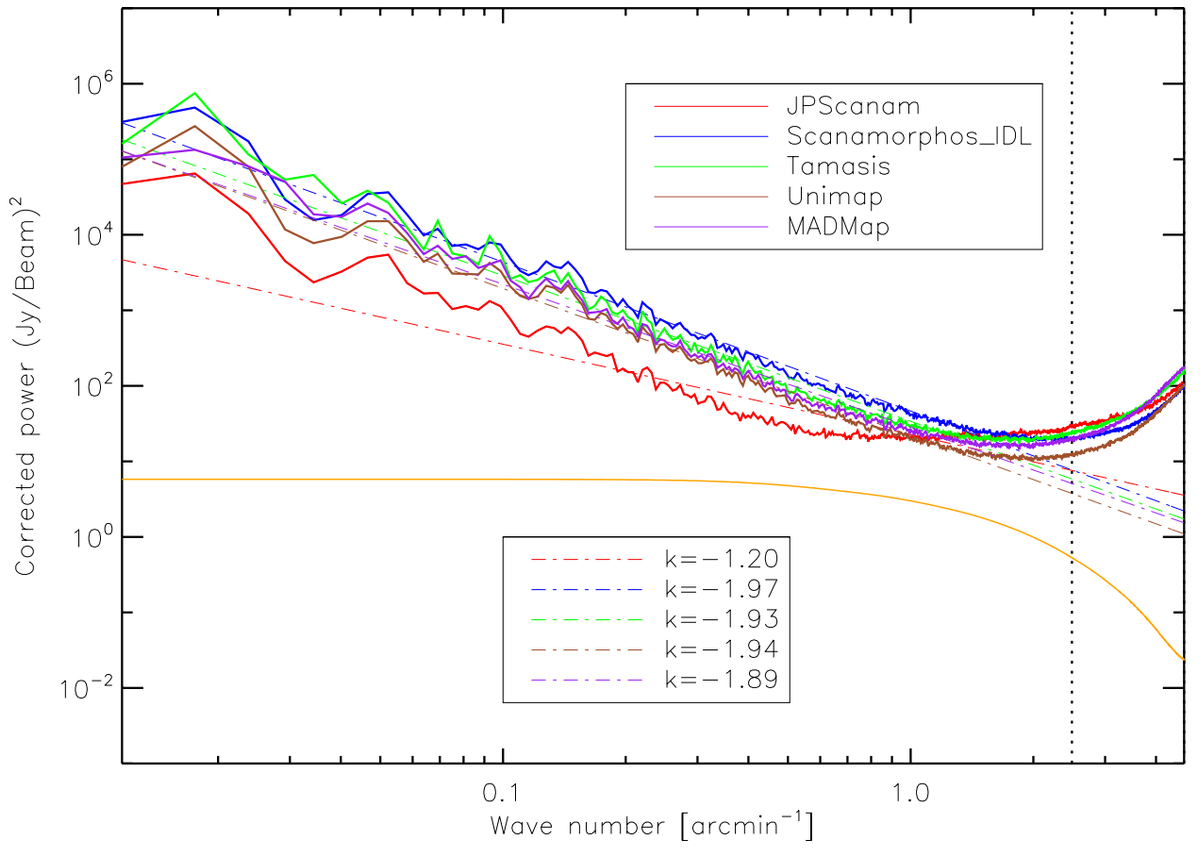

Total power (Jy/Beam)^2
10^8
10^6
10^4
10^2
10^0
JPScanam
Scanamorphos_IDL
Tamasis
Unimap
MADMap
k=−1.70
k=−2.47
k=−2.42
k=−2.44
k=−2.38
0.1
1.0
Wave number [arcmin^{-1}]


Corrected power (Jy/Beam)^2
10^6
10^4
10^2
10^0
10^{-2}
JPScanam
Scanamorphos_IDL
Tamasis
Unimap
MADMap
k=−1.20
k=−1.97
k=−1.93
k=−1.94
k=−1.89
0.1
1.0
Wave number [arcmin^{-1}]

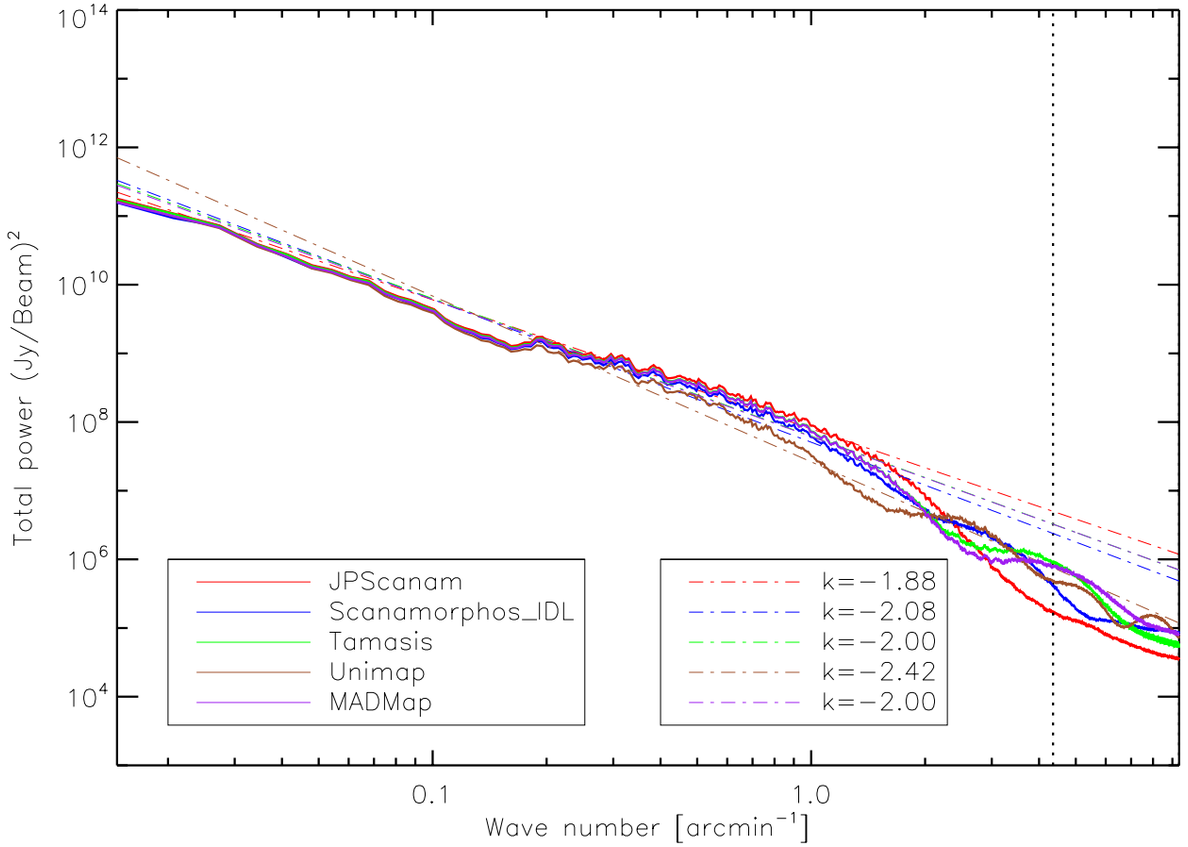


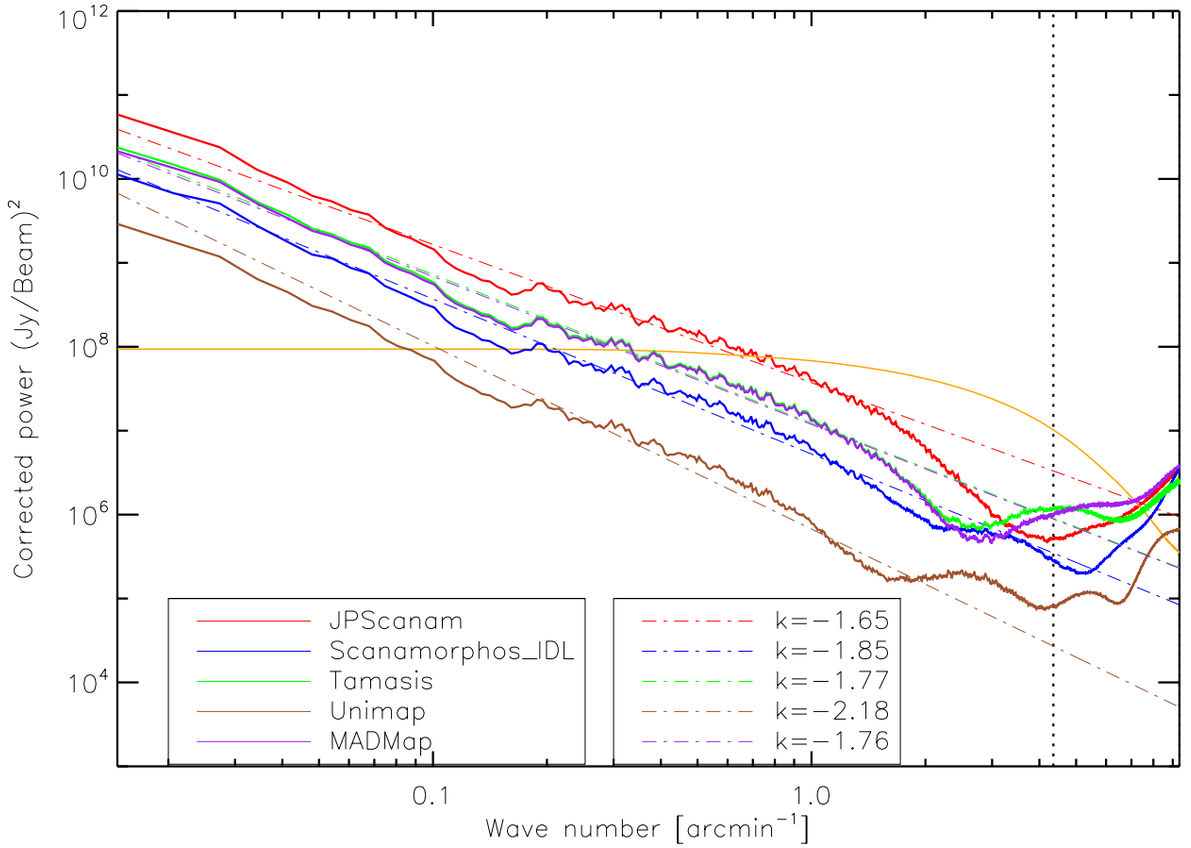
M31 - red

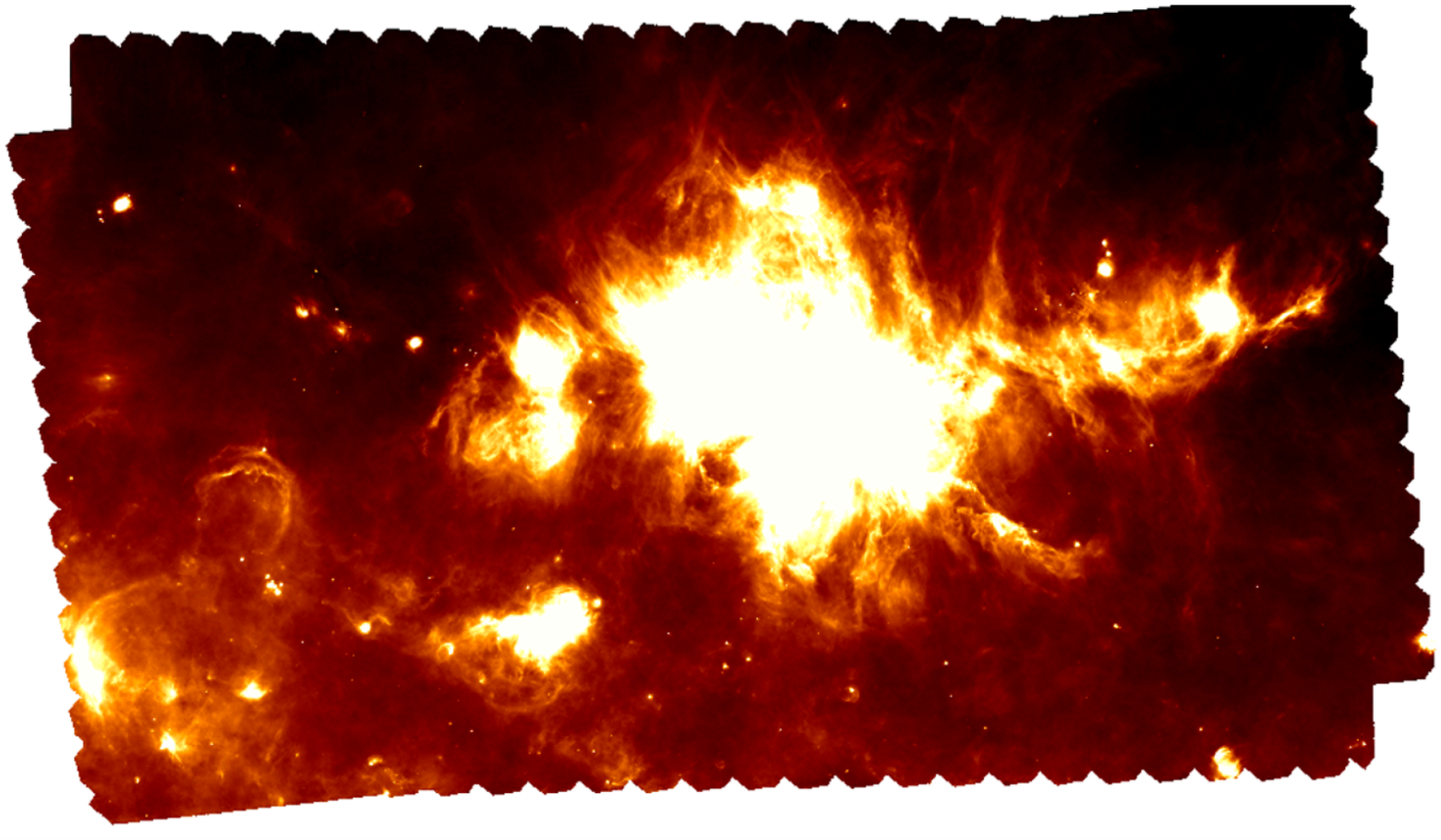

Total power (Jy/Beam)^2
10^8
10^6
10^4
10^2
10^0
JPScanam
Scanamorphos_IDL
Tamasis
Unimap
MADMap
k=−1.70
k=−2.47
k=−2.42
k=−2.44
k=−2.38
0.1
1.0
Wave number [arcmin^{-1}]


Corrected power (Jy/Beam)^2
10^6
10^4
10^2
10^0
10^{-2}
JPScanam
Scanamorphos_IDL
Tamasis
Unimap
MADMap
k=−1.20
k=−1.97
k=−1.93
k=−1.94
k=−1.89
0.1
1.0
Wave number [arcmin^{-1}]

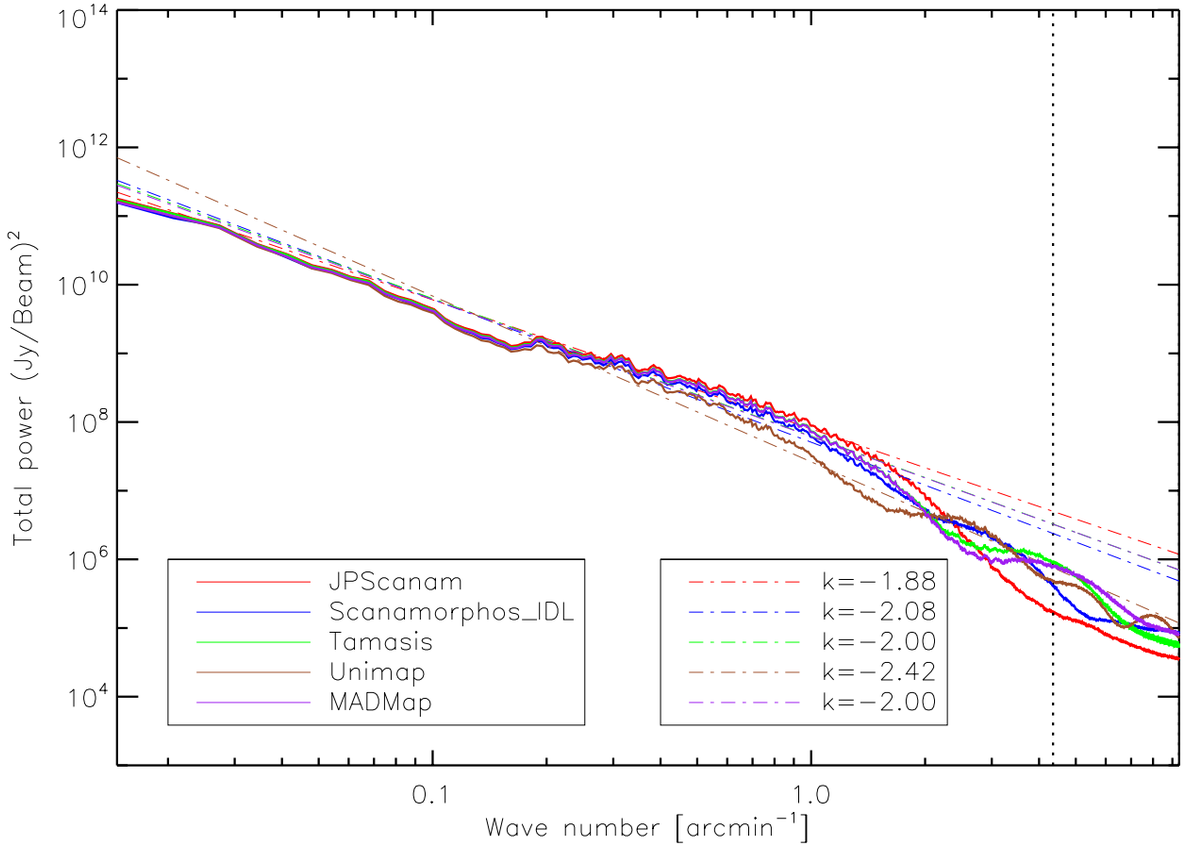
NGC6334 - blue

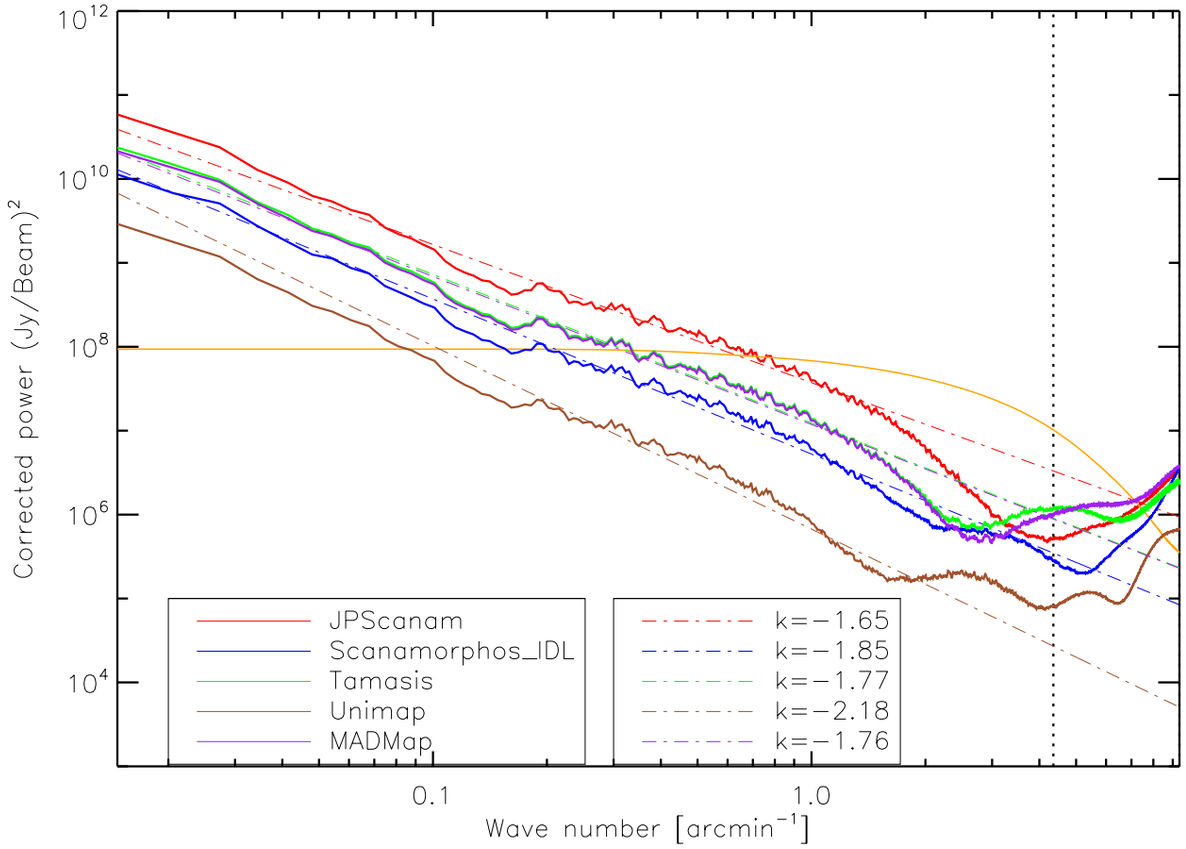




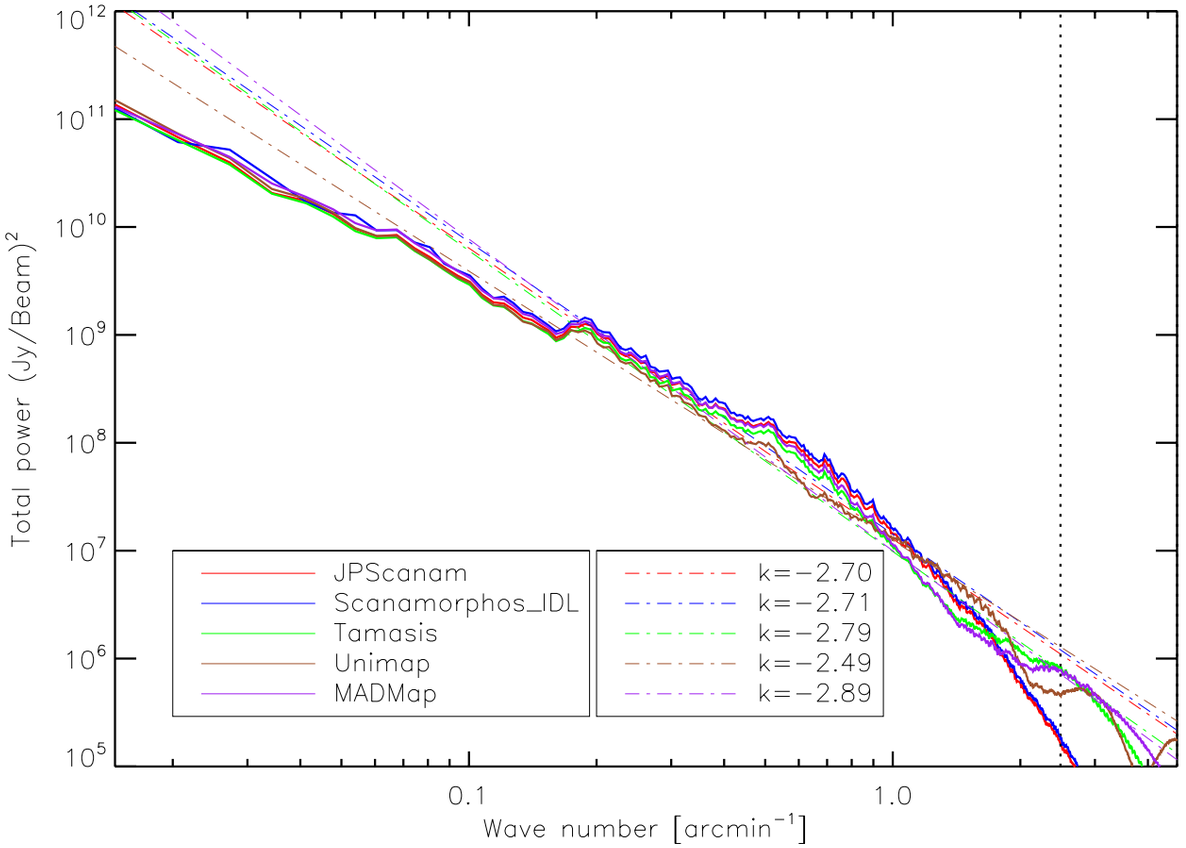


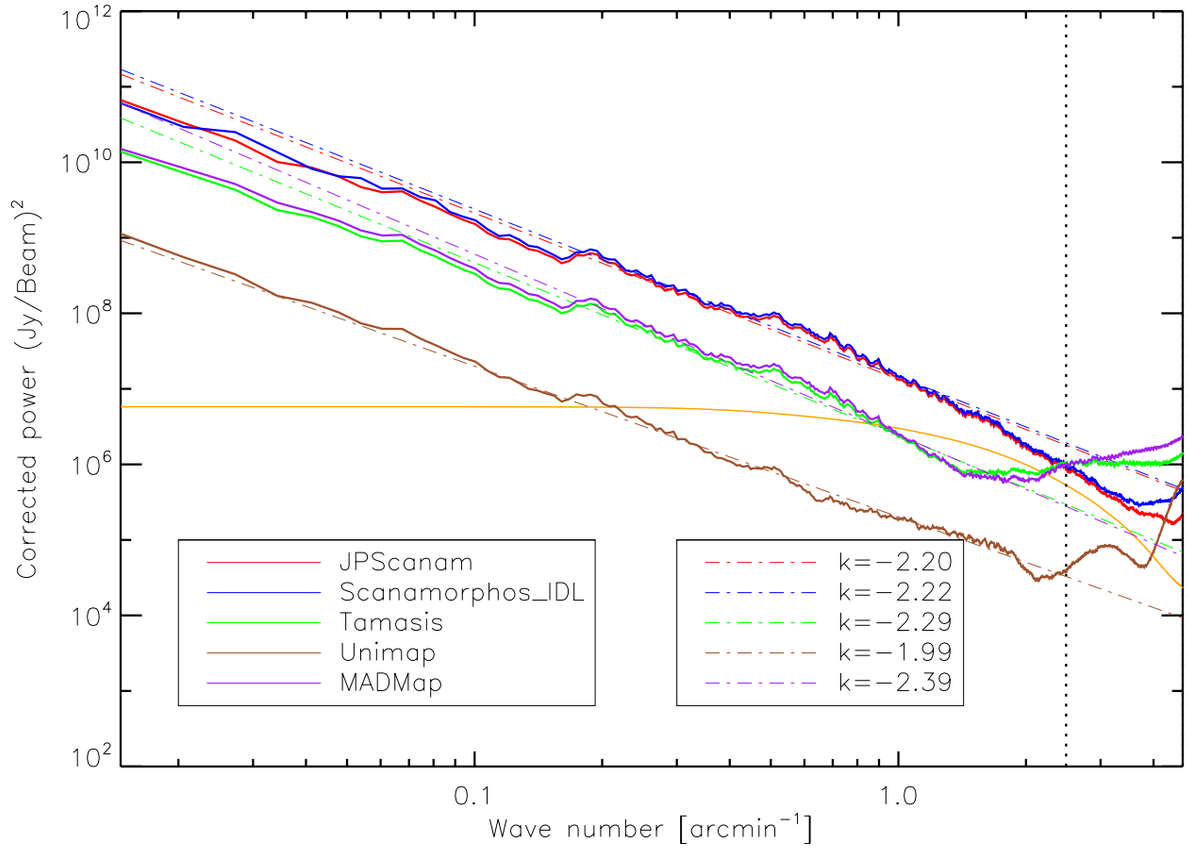
NGC6334 - blue

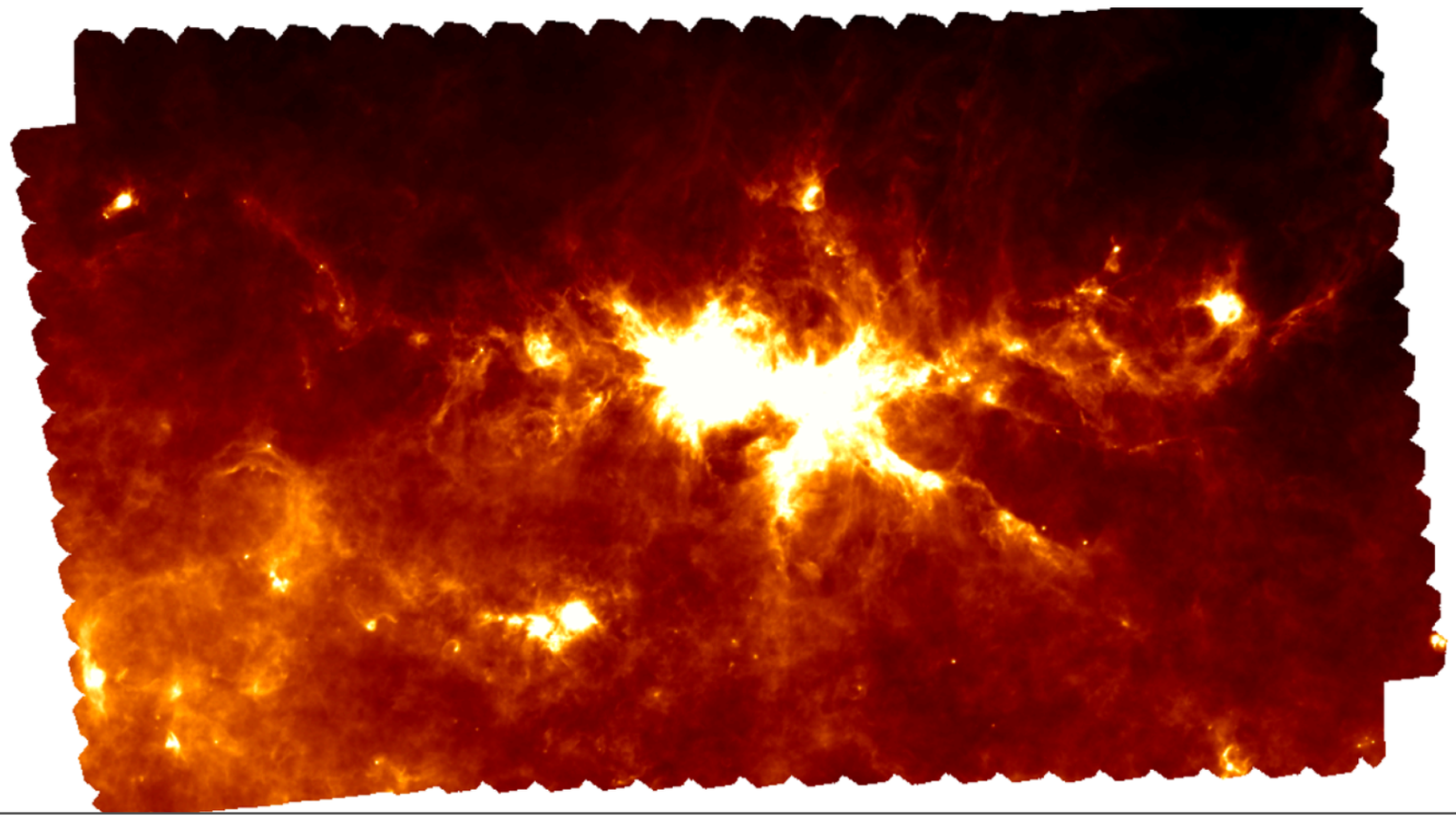




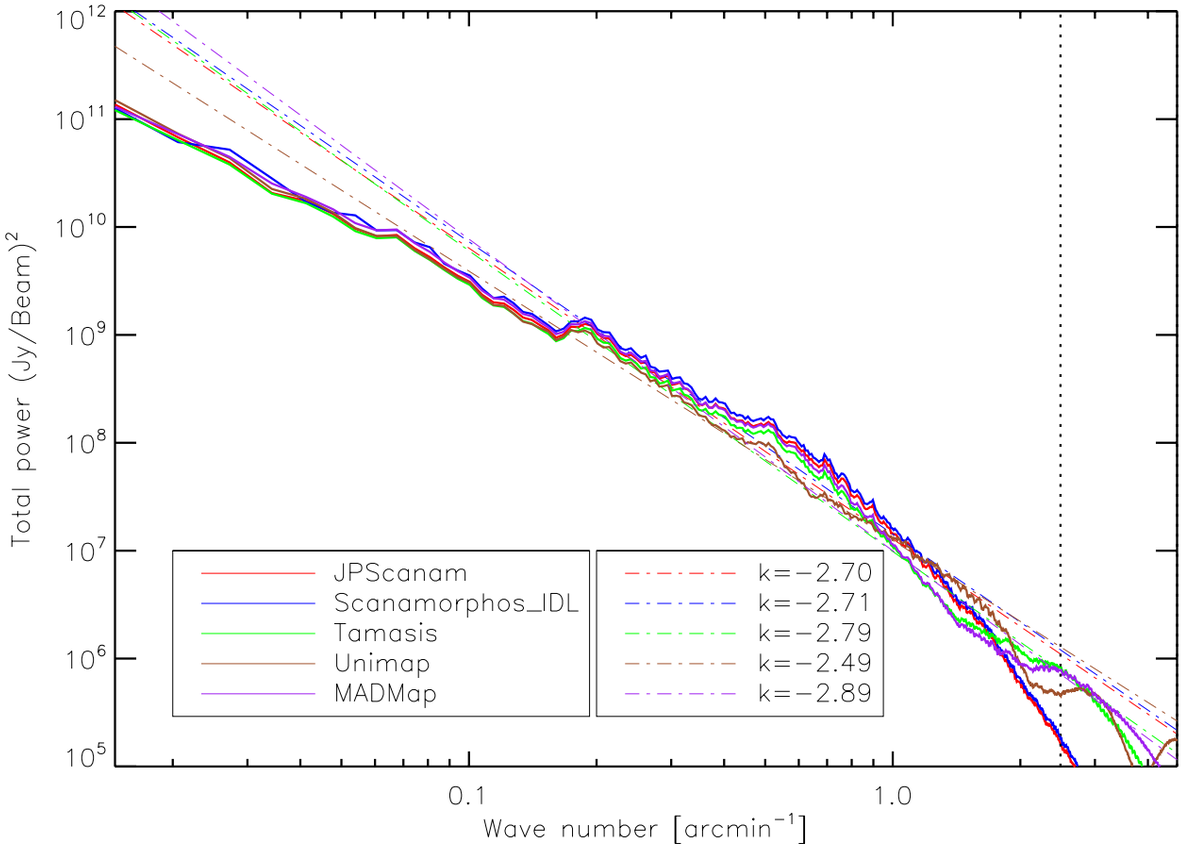
NGC6334 - red

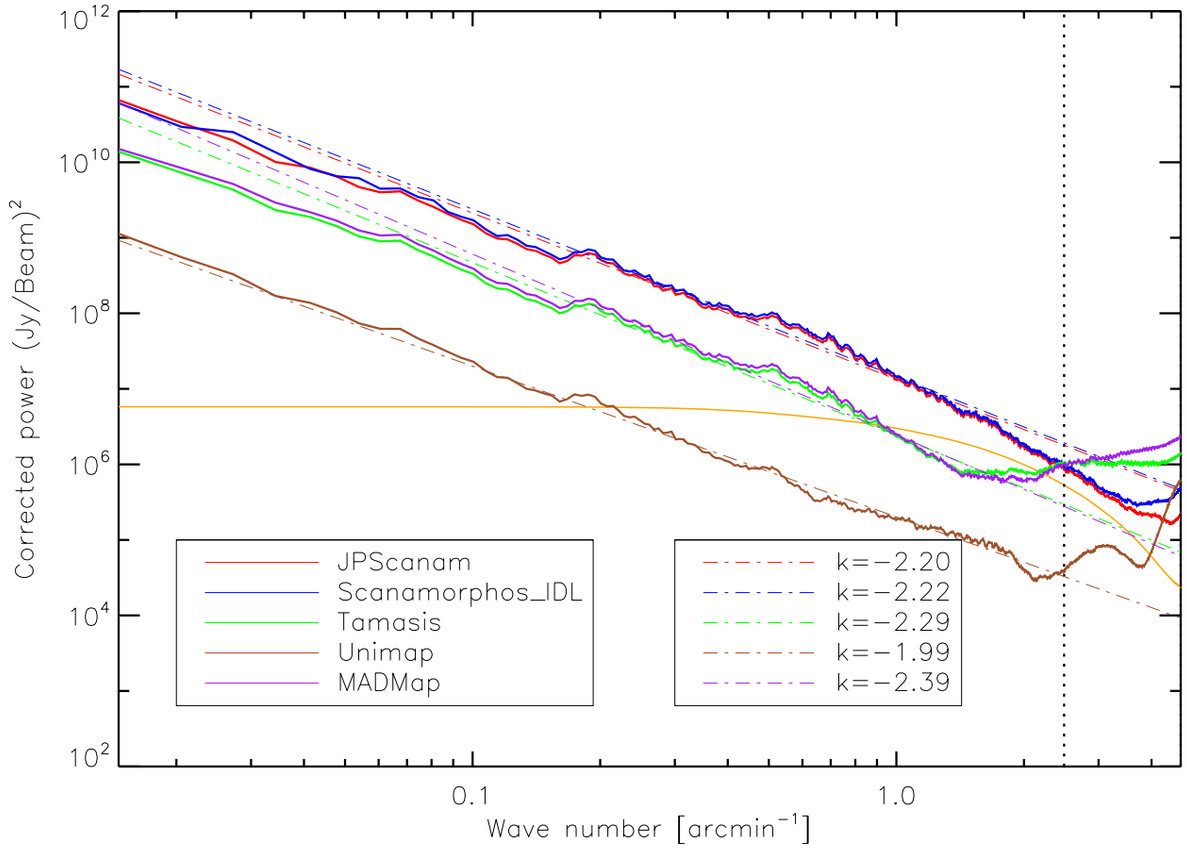

Total power (Jy/Beam)^2
10^{12}
10^{11}
10^{10}
10^{9}
10^{8}
10^{7}
10^{6}
10^{5}
JPScanam
Scanamorphos_IDL
Tamasis
Unimap
MADMap
k=−2.70
k=−2.71
k=−2.79
k=−2.49
k=−2.89
0.1
1.0
Wave number [arcmin^{-1}]


Corrected power (Jy/Beam)^2
10^{12}
10^{10}
10^{8}
10^{6}
10^{4}
10^{2}
JPScanam
Scanamorphos_IDL
Tamasis
Unimap
MADMap
k=−2.20
k=−2.22
k=−2.29
k=−1.99
k=−2.39
0.1
1.0
Wave number [arcmin^{-1}]

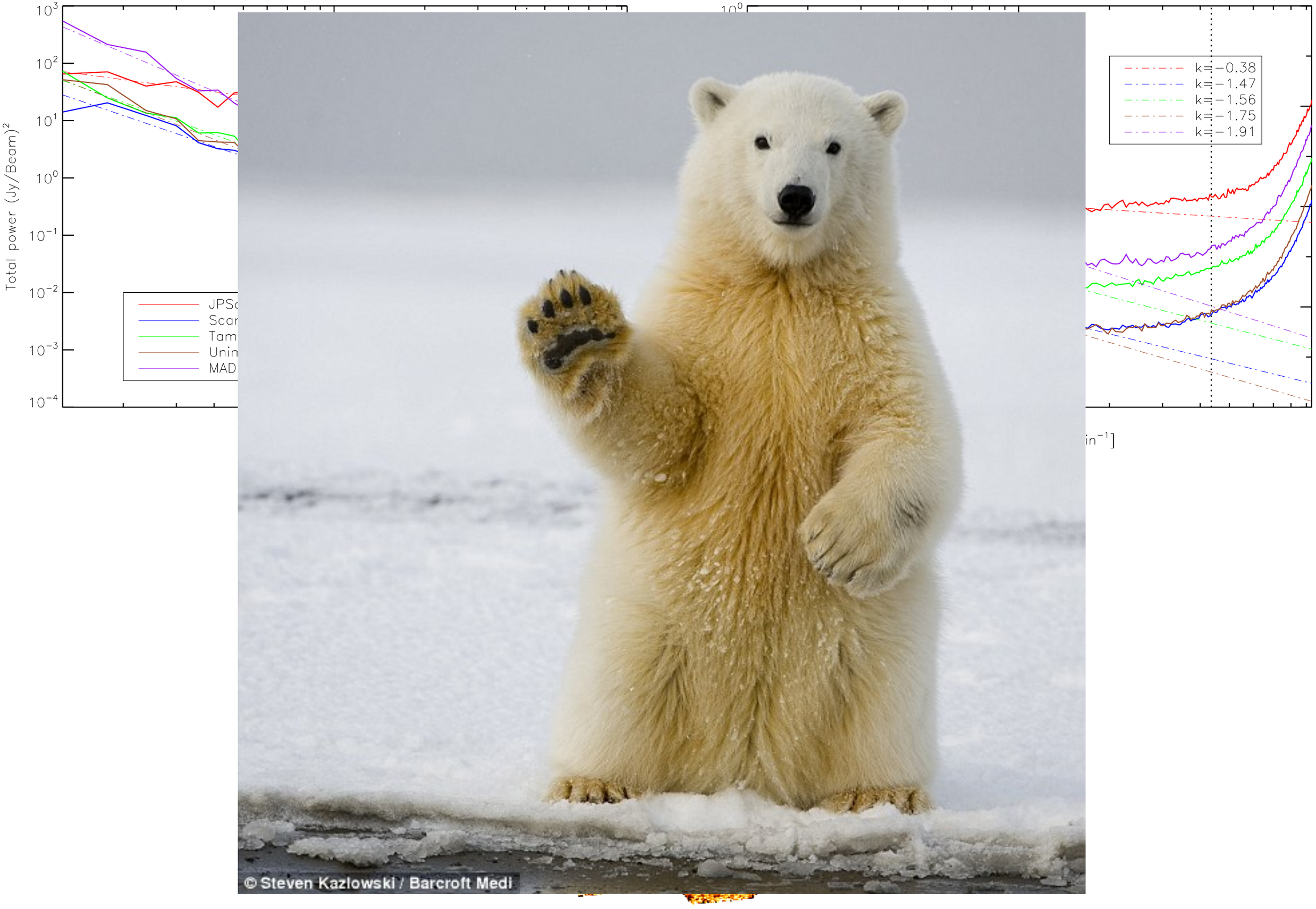


NGC6334 - red

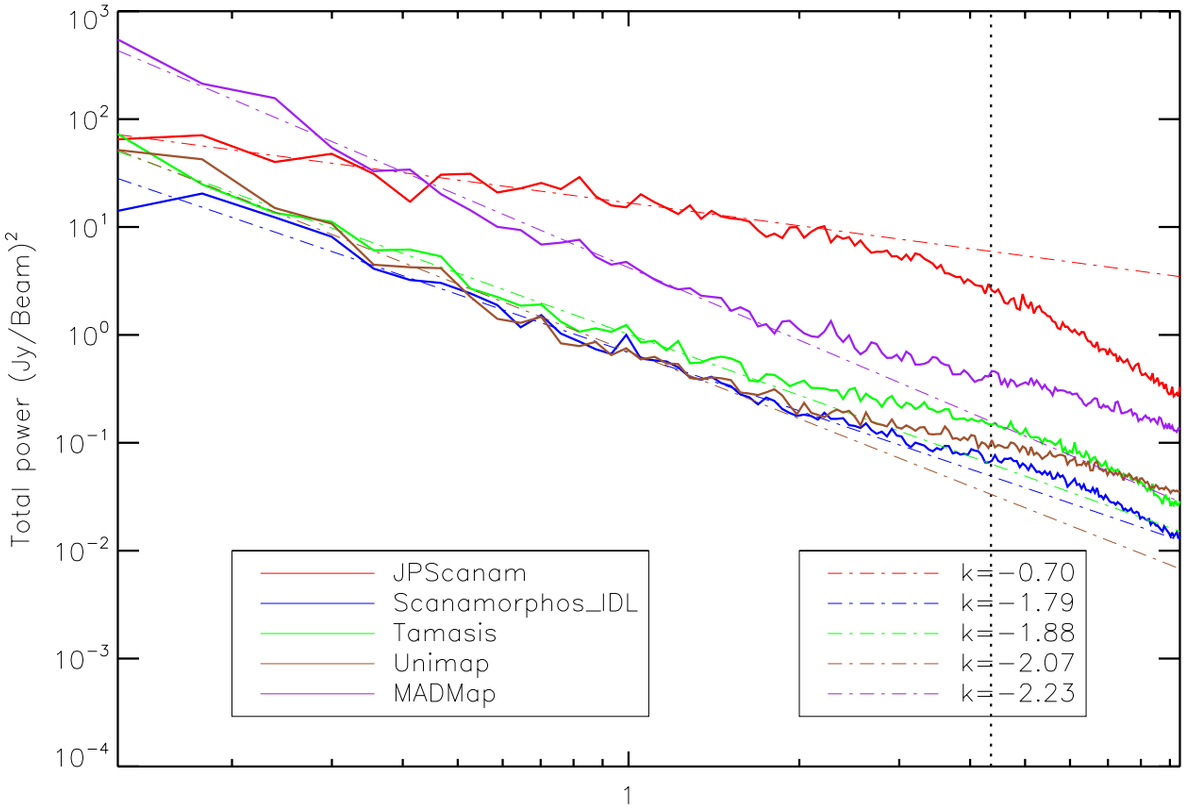

Total power (Jy/Beam)^2
10^{12}
10^{11}
10^{10}
10^{9}
10^{8}
10^{7}
10^{6}
10^{5}
JPScanam
Scanamorphos_IDL
Tamasis
Unimap
MADMap
k=−2.70
k=−2.71
k=−2.79
k=−2.49
k=−2.89
0.1
1.0
Wave number [arcmin^{-1}]

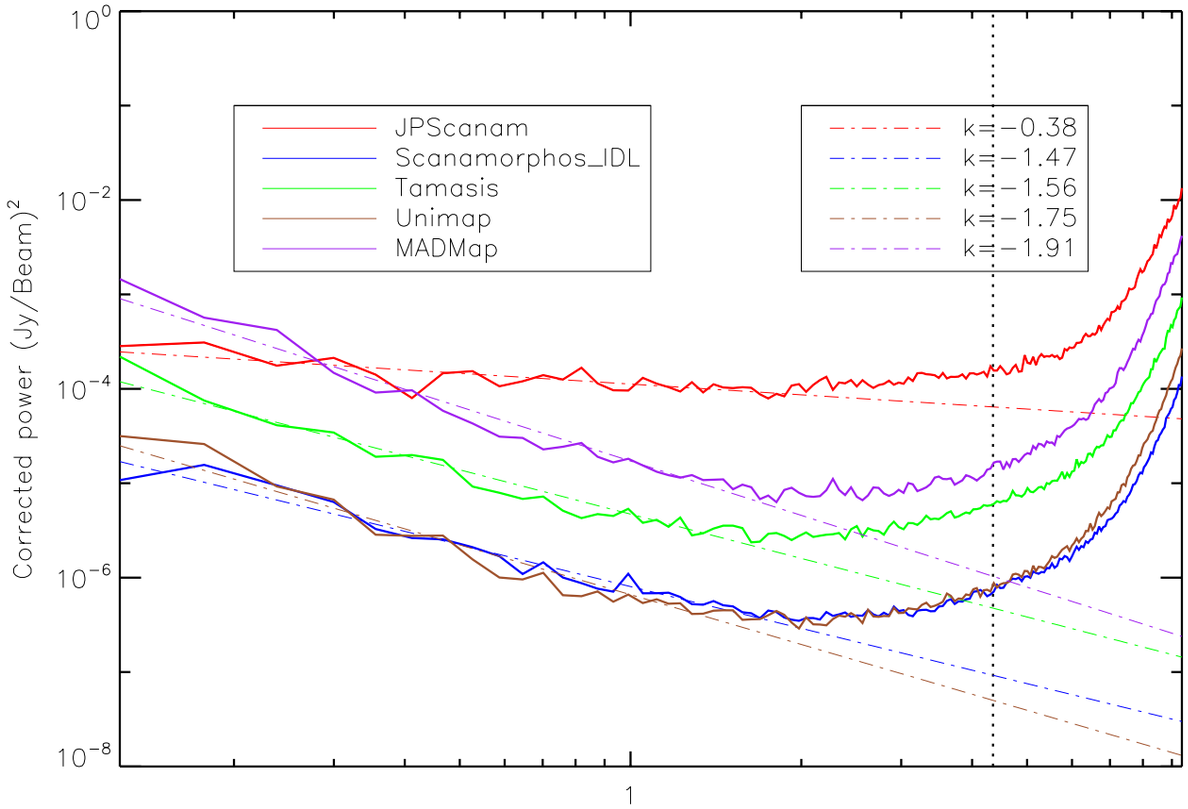

Corrected power (Jy/Beam)^2
10^{12}
10^{10}
10^{8}
10^{6}
10^{4}
10^{2}
JPScanam
Scanamorphos_IDL
Tamasis
Unimap
MADMap
k=−2.20
k=−2.22
k=−2.29
k=−1.99
k=−2.39
0.1
1.0
Wave number [arcmin^{-1}]

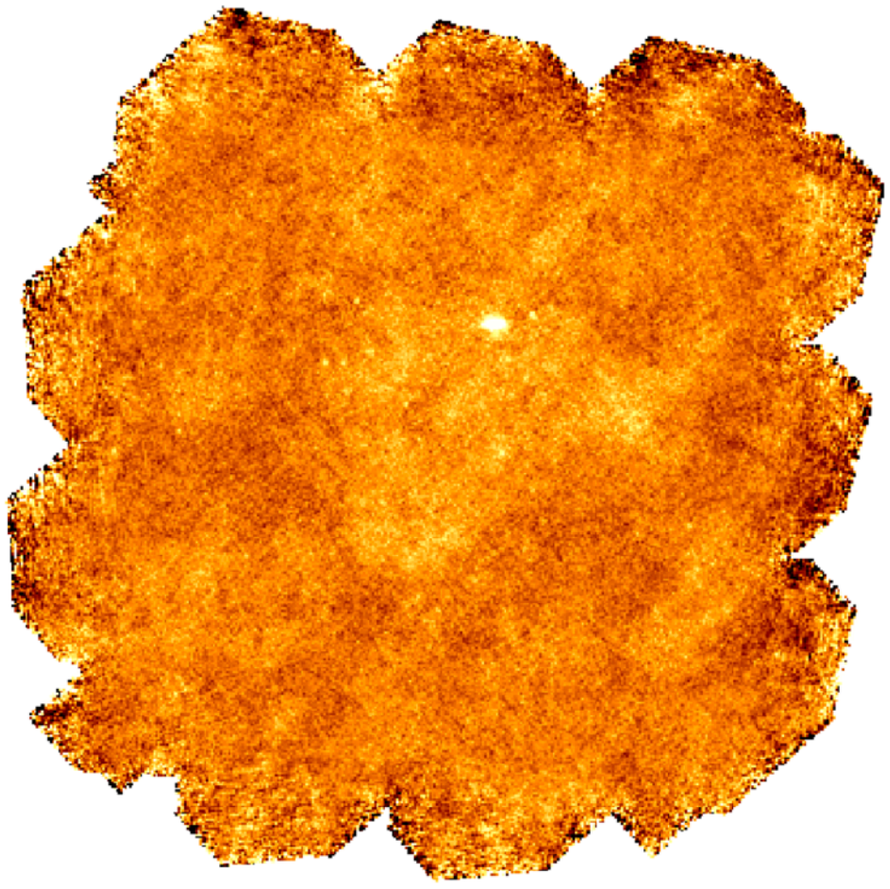
Polaris Bear - blue



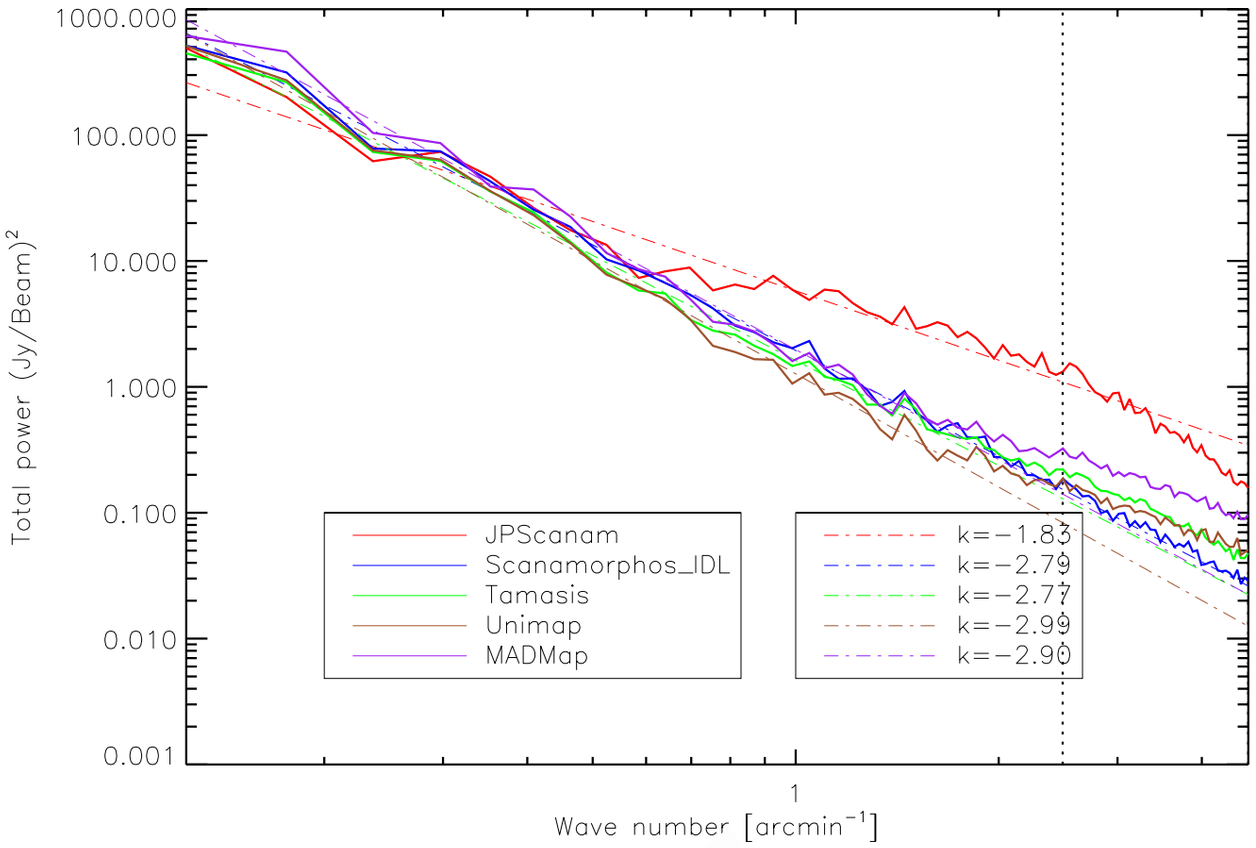
Polaris Bear - blue

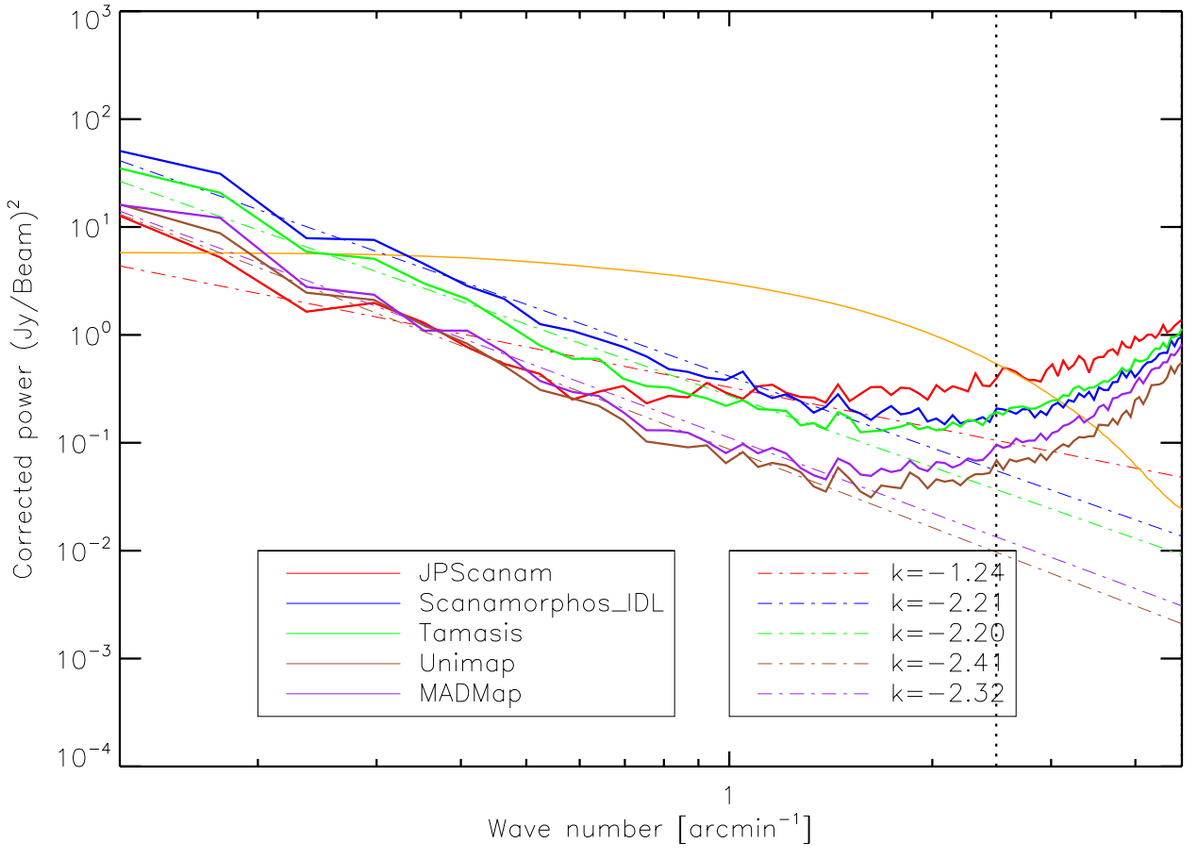


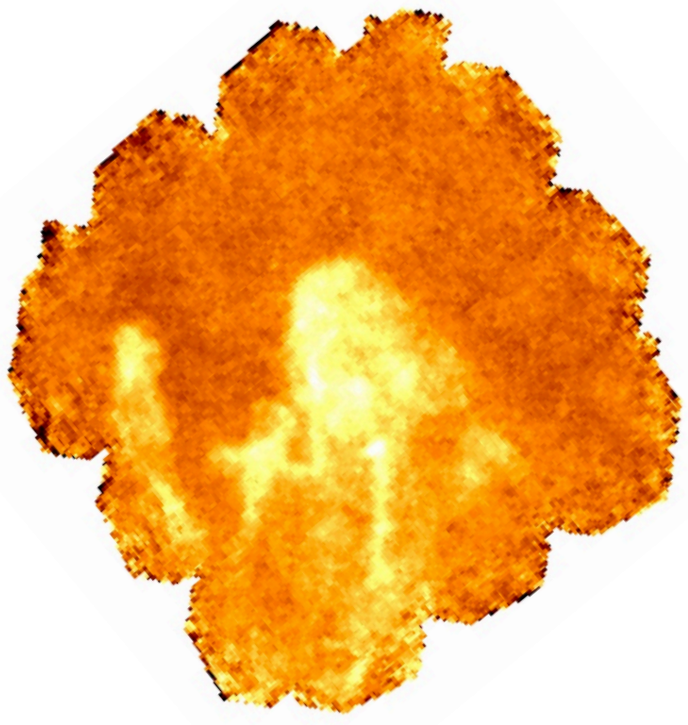




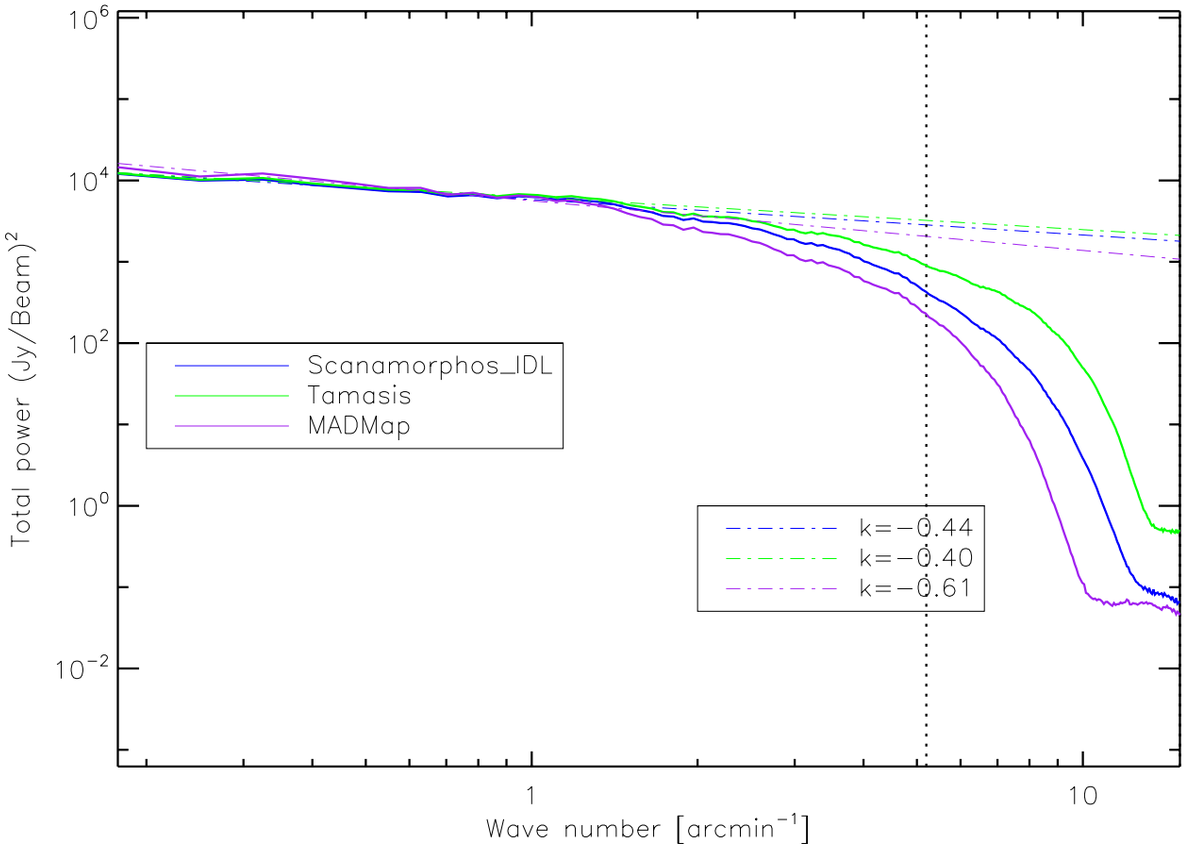
Polaris Bear - red

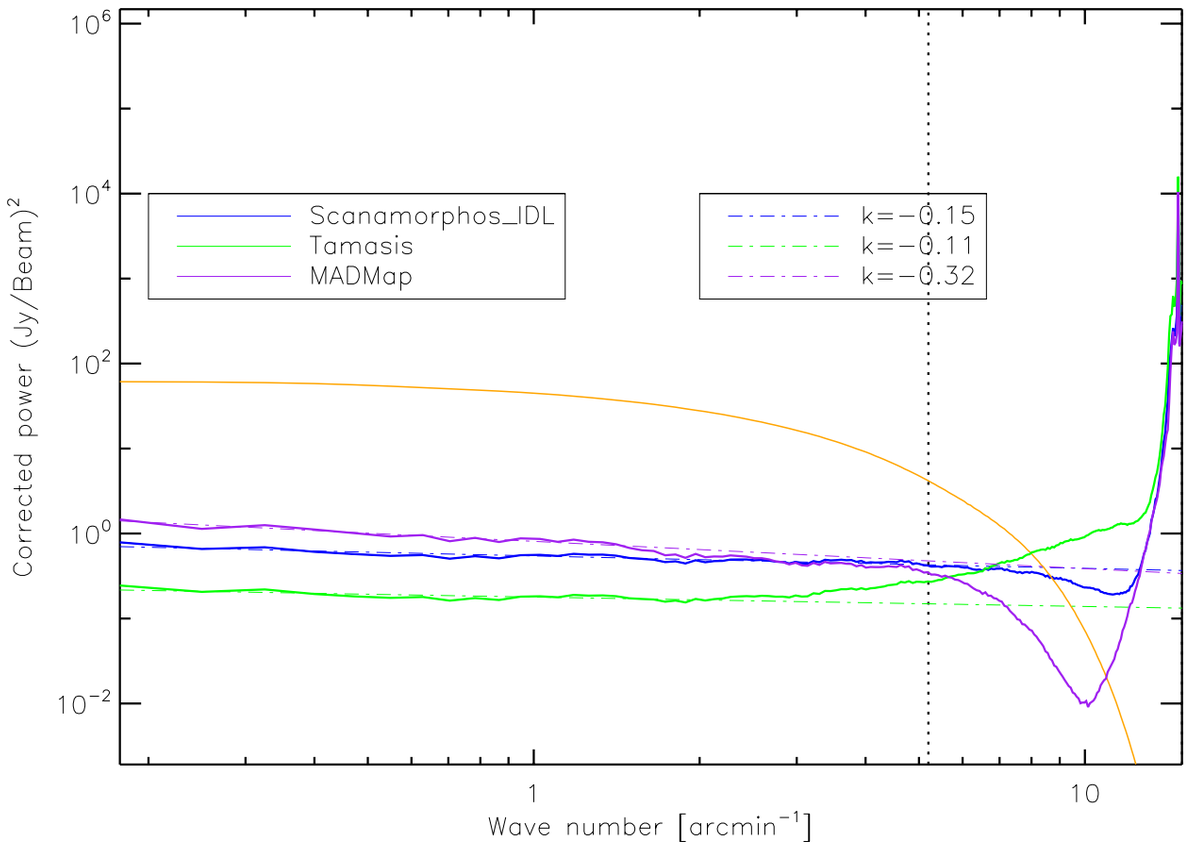


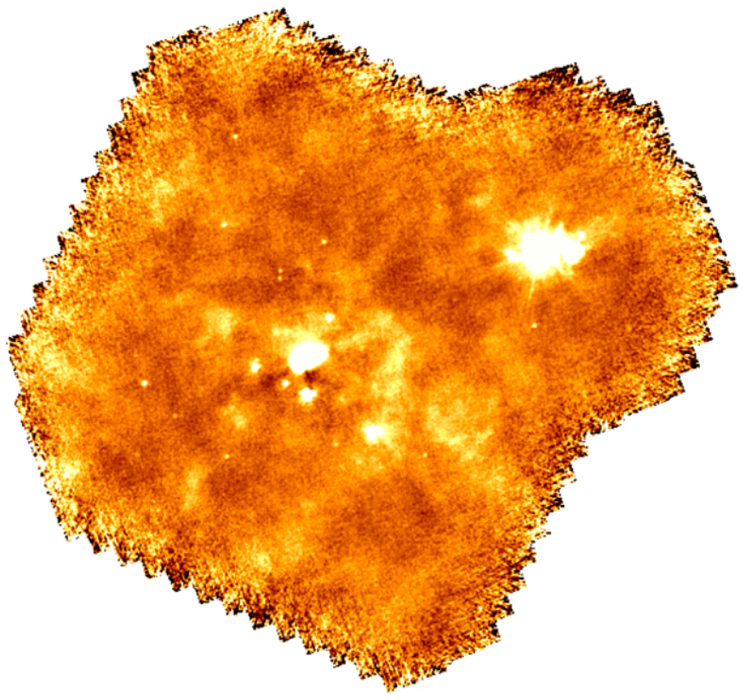




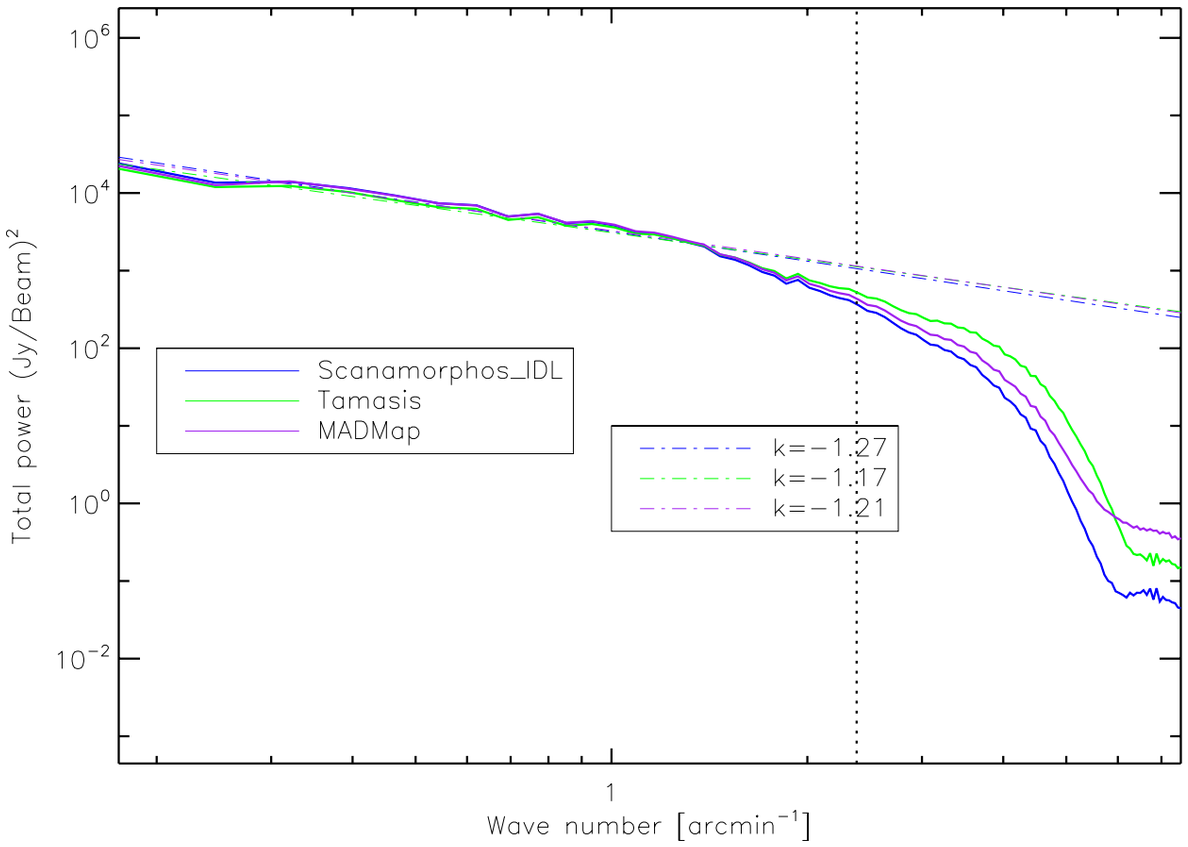
Sa187_188 BS - blue

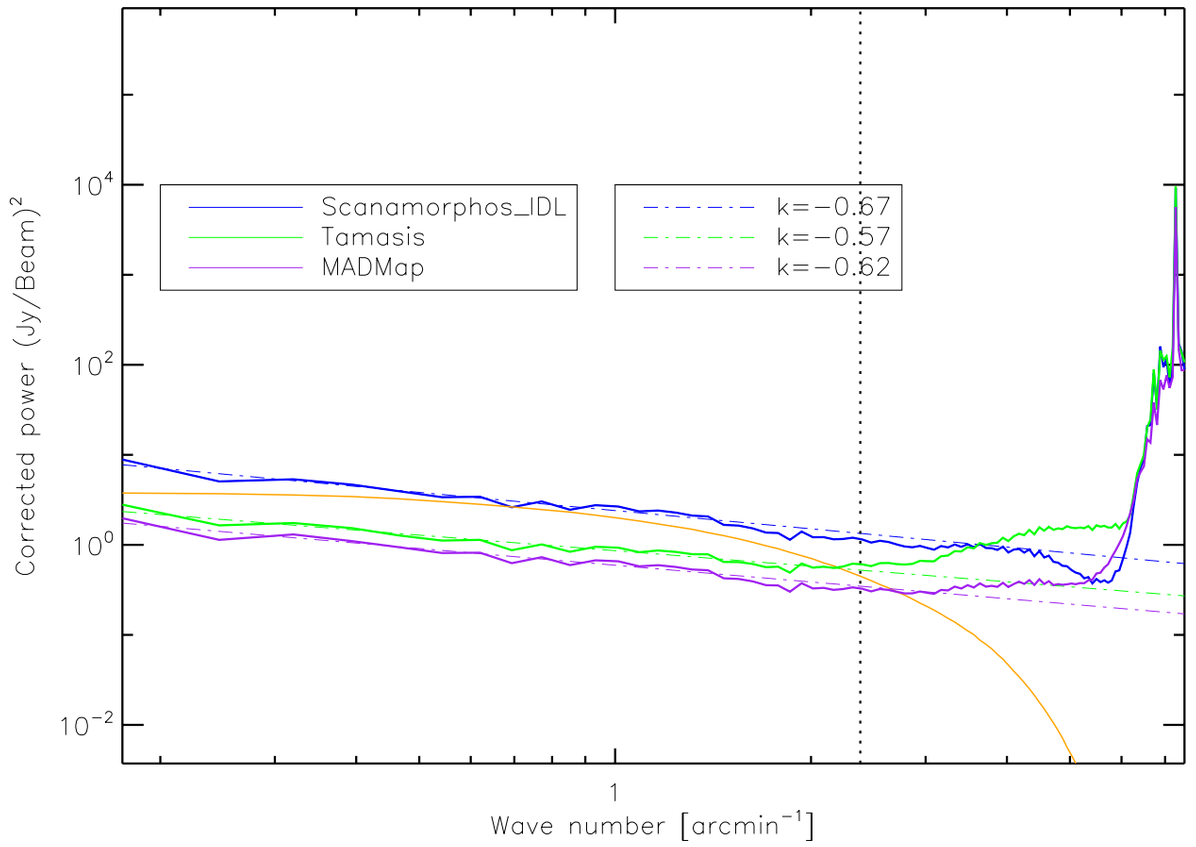


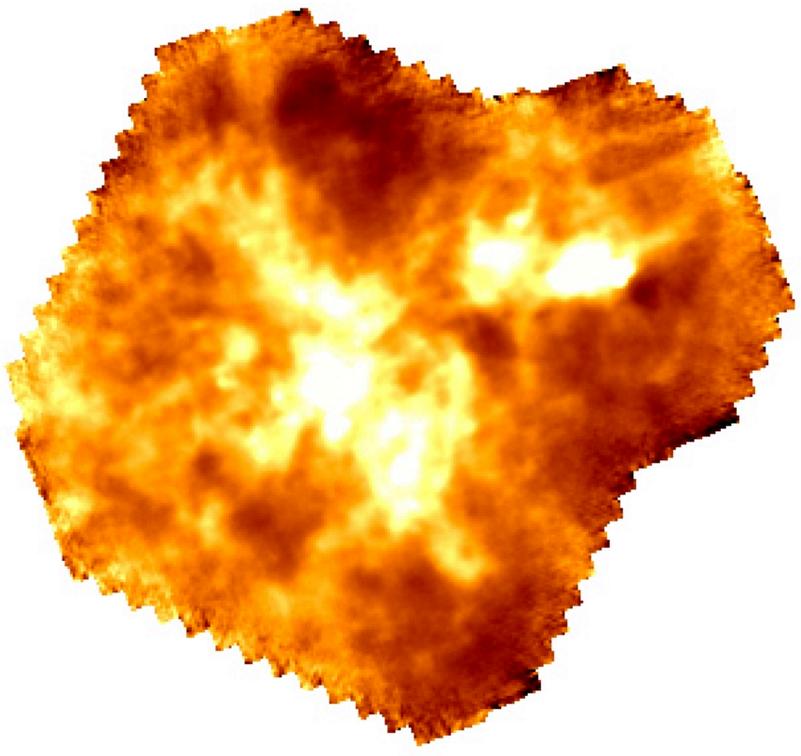




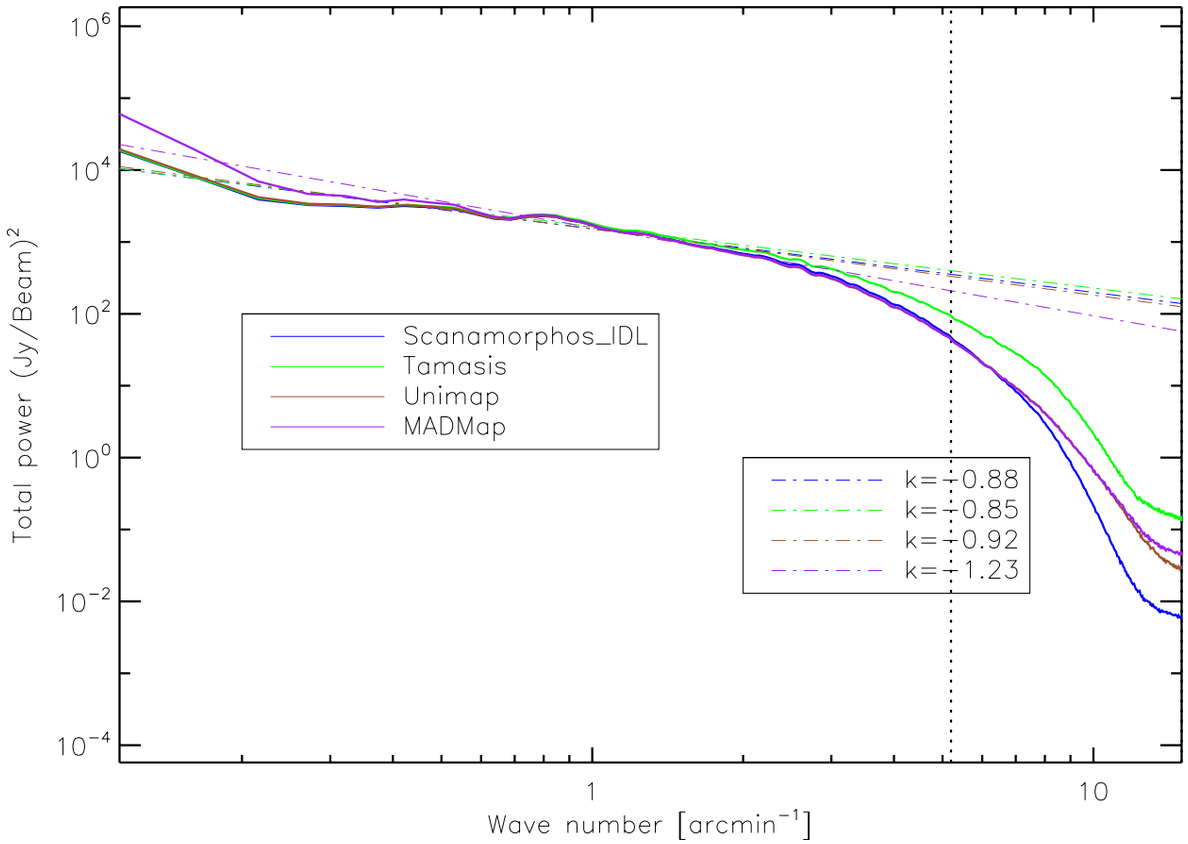
Sa187_188 BS - red

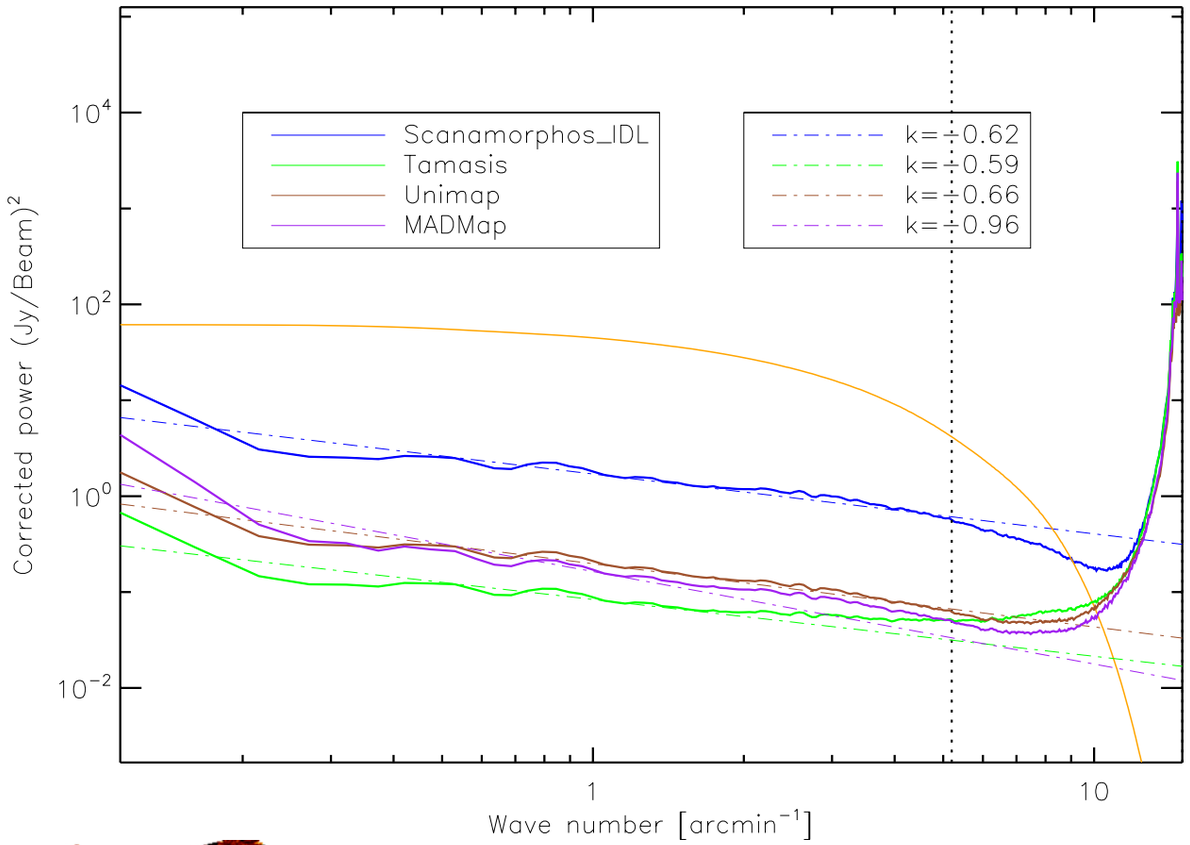


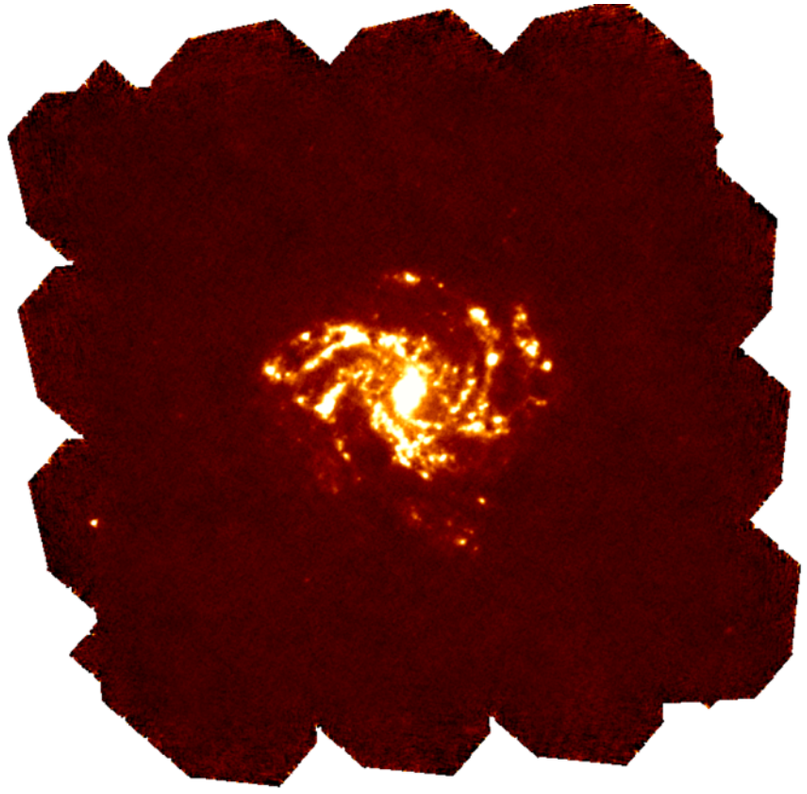




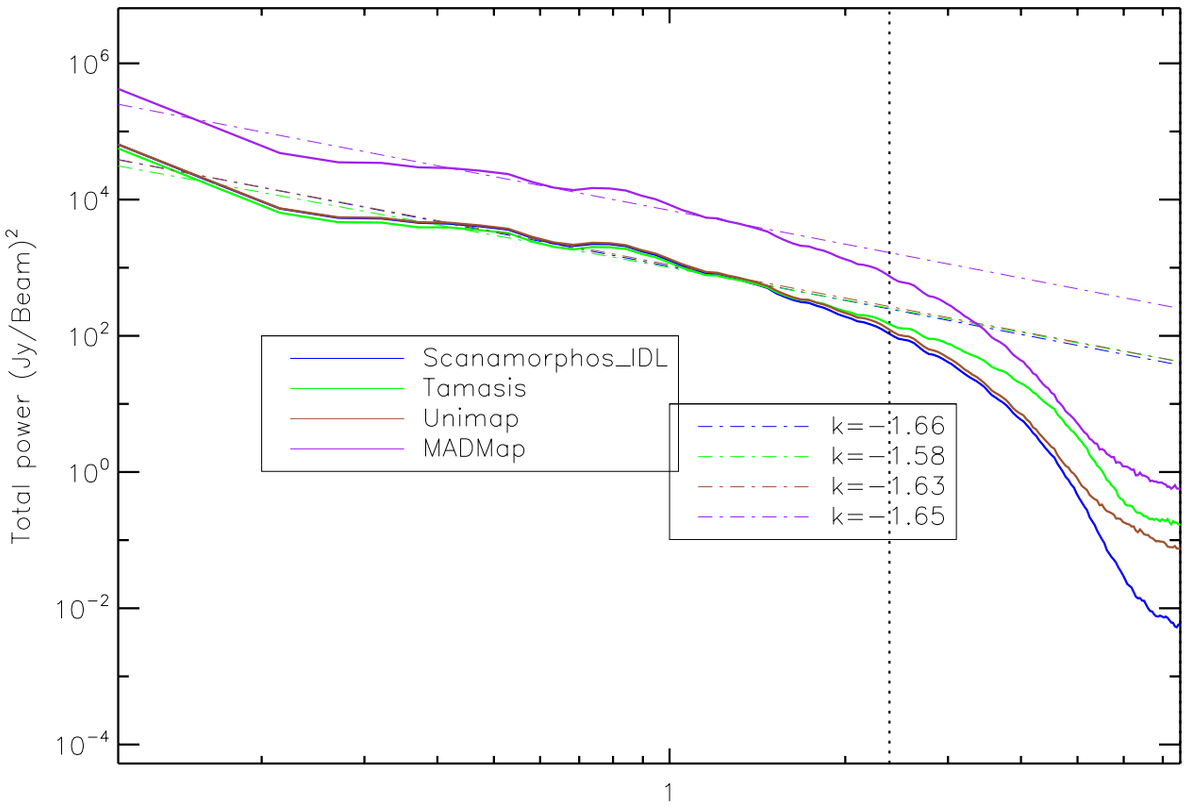
NGC 6946 BS - blue

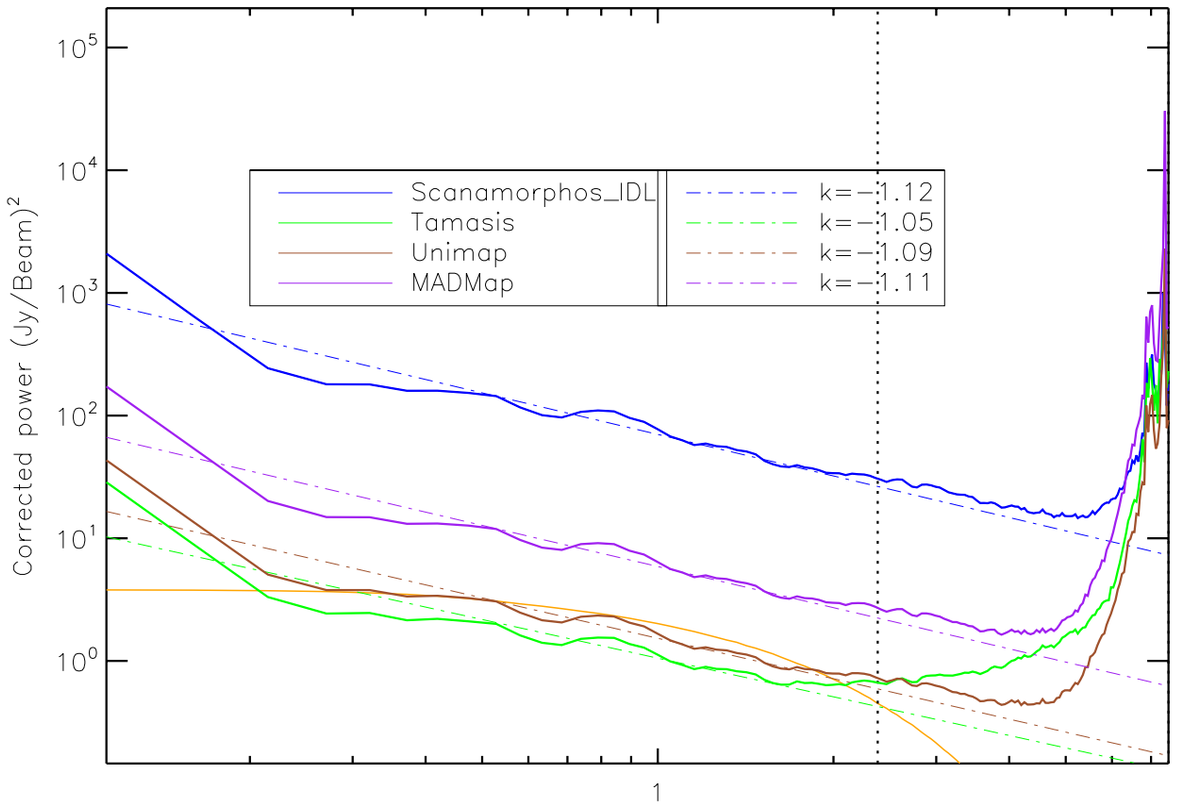


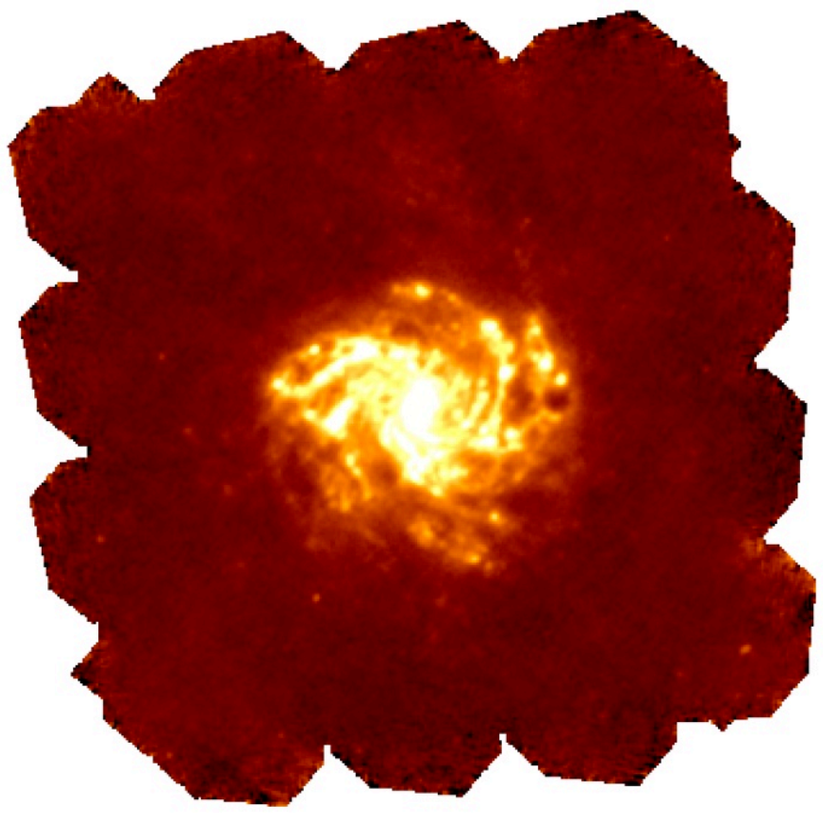




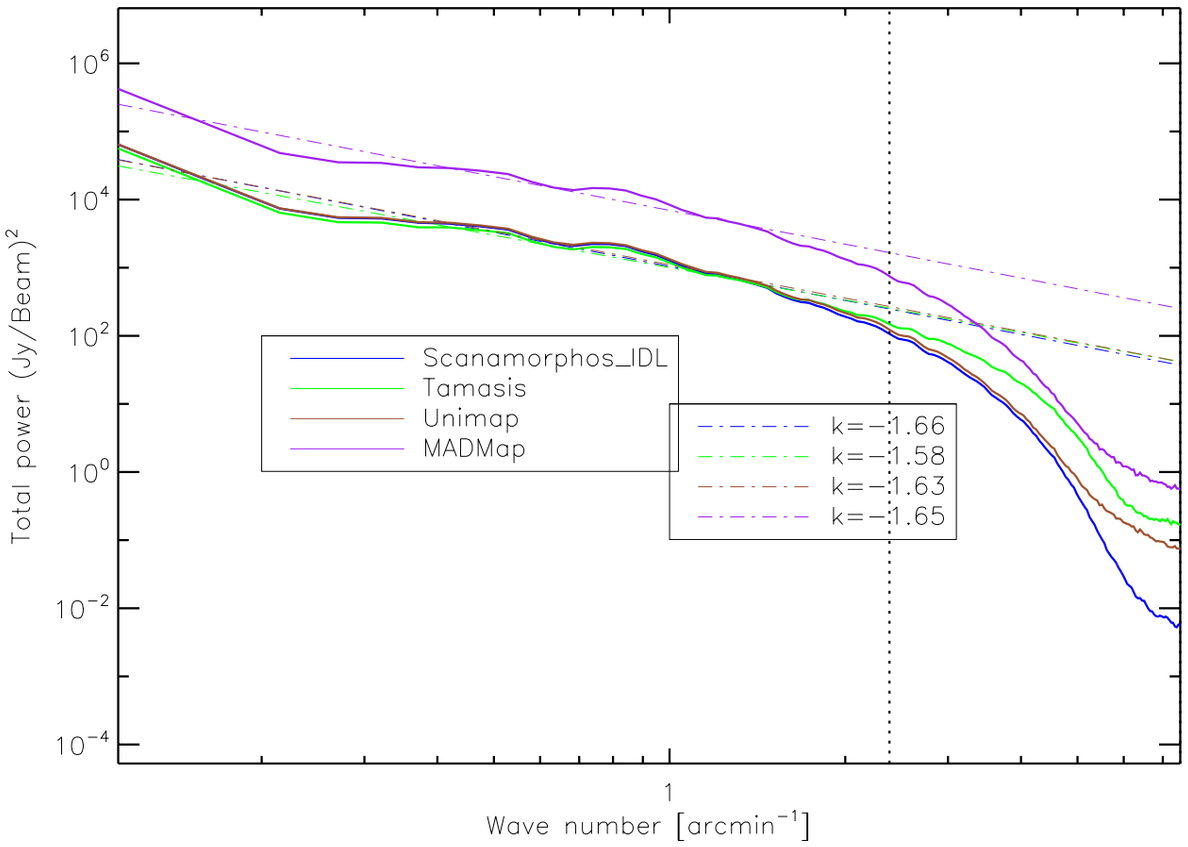
NGC 6946 BS - red

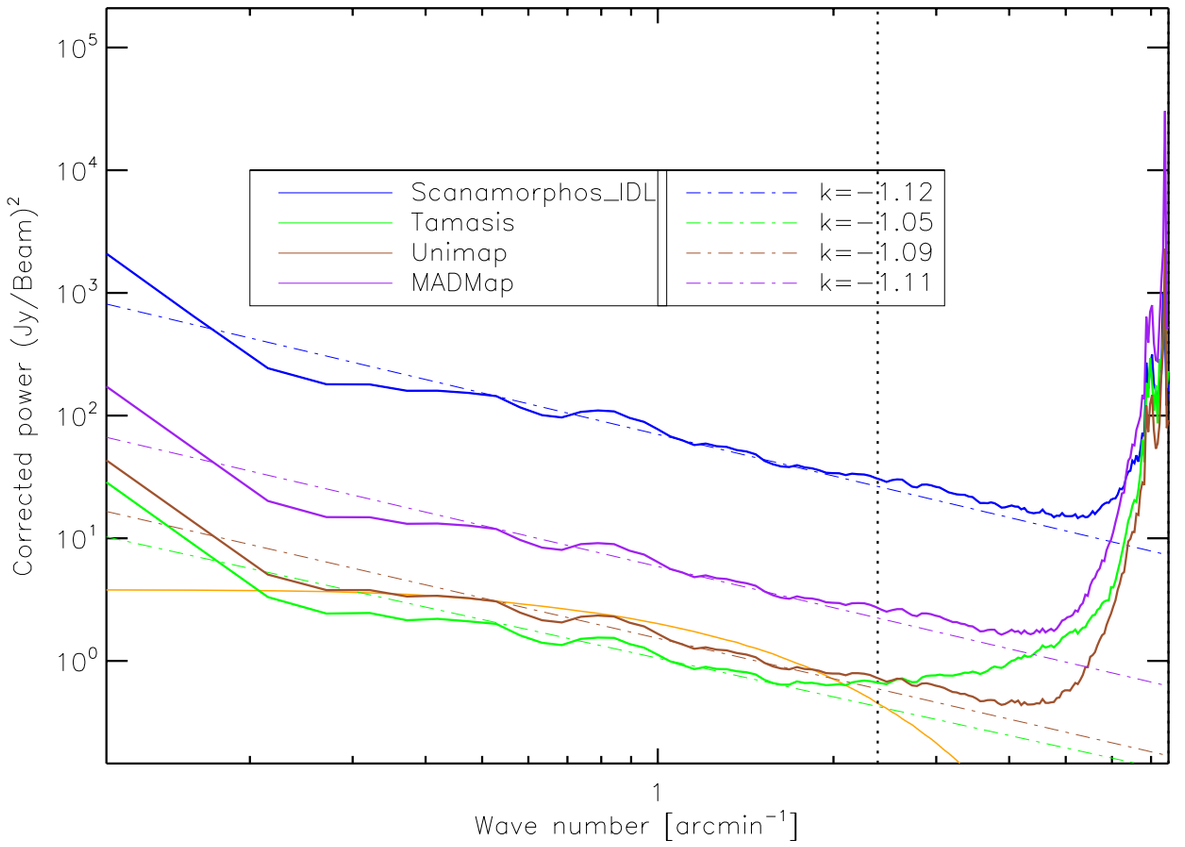




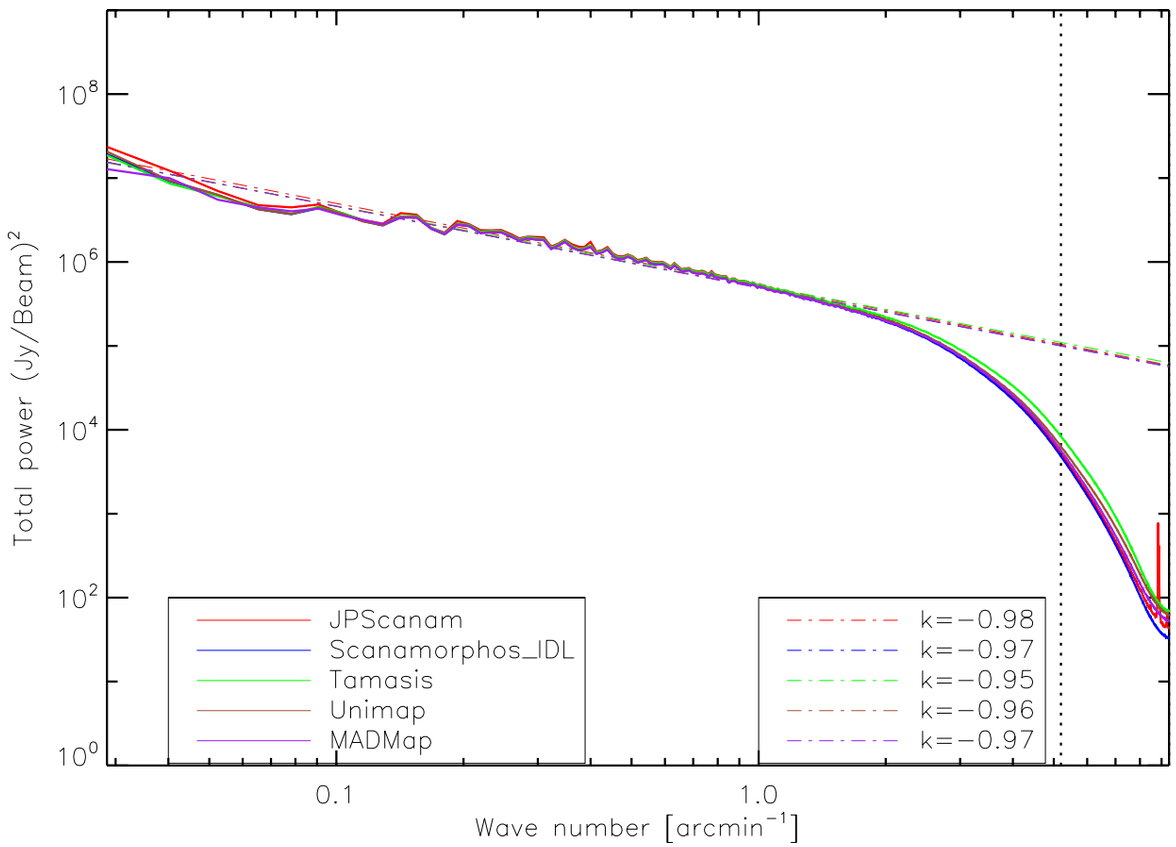


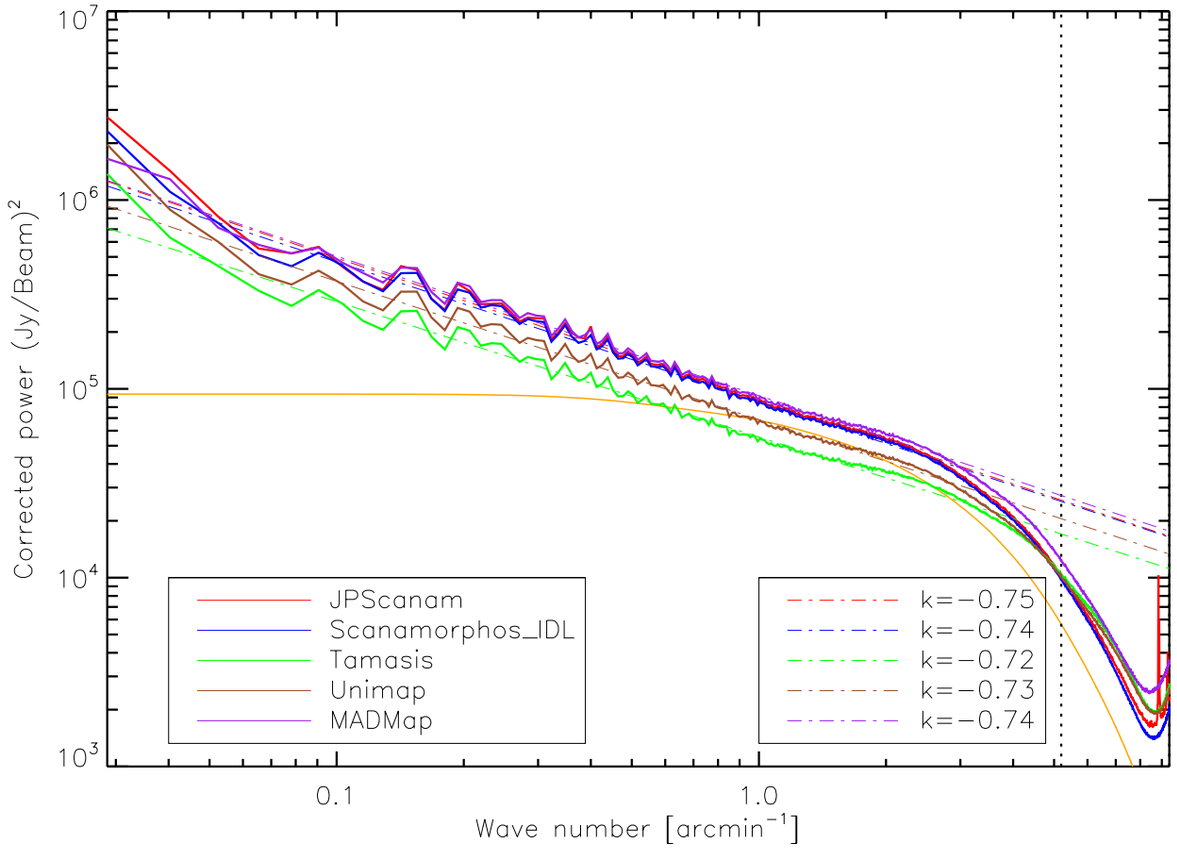
NGC 6946 BS - red

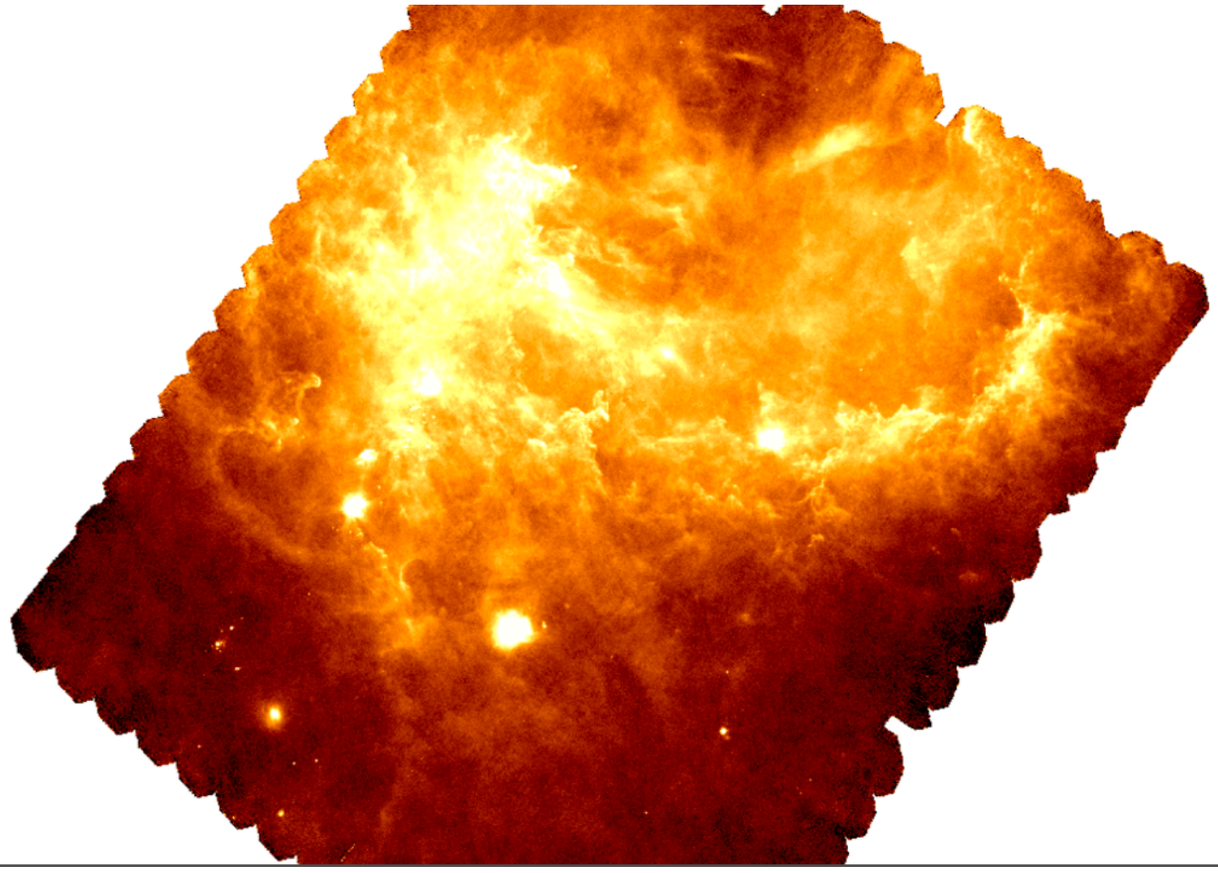




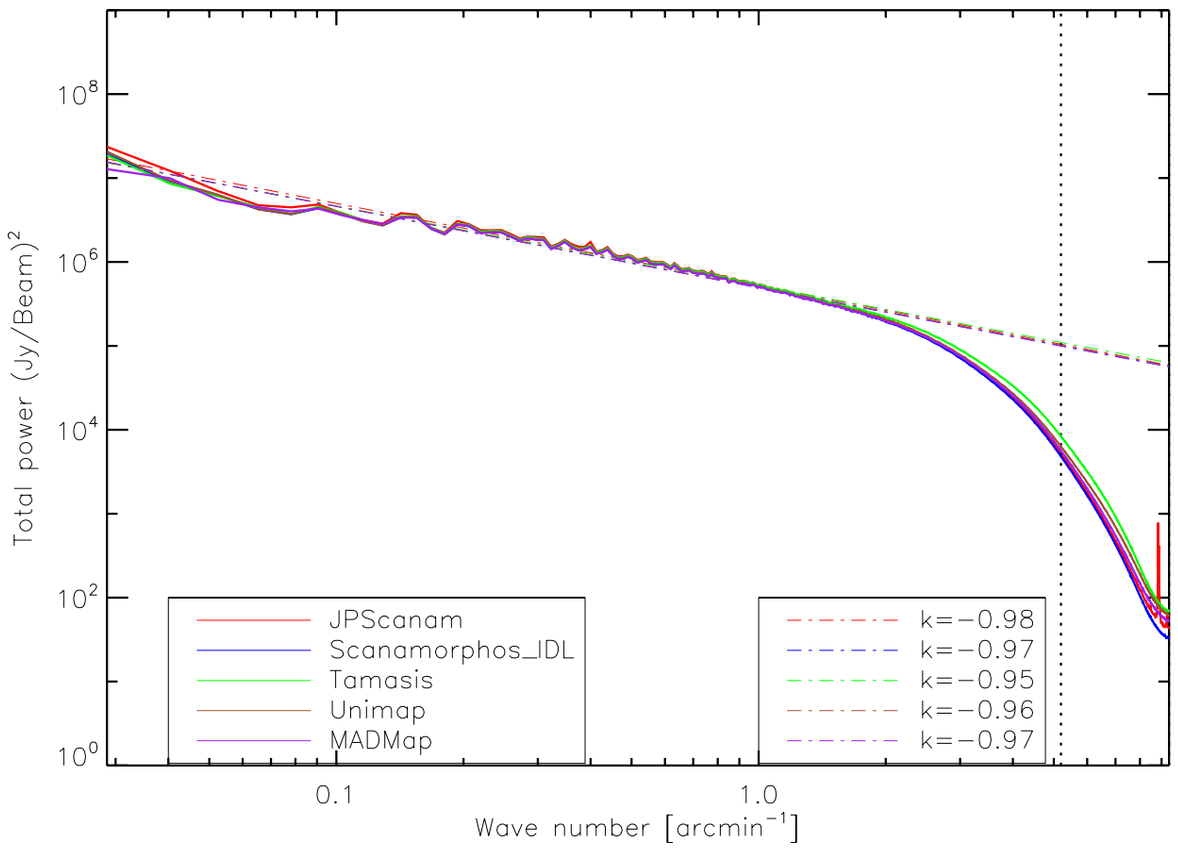
Rosette - blue

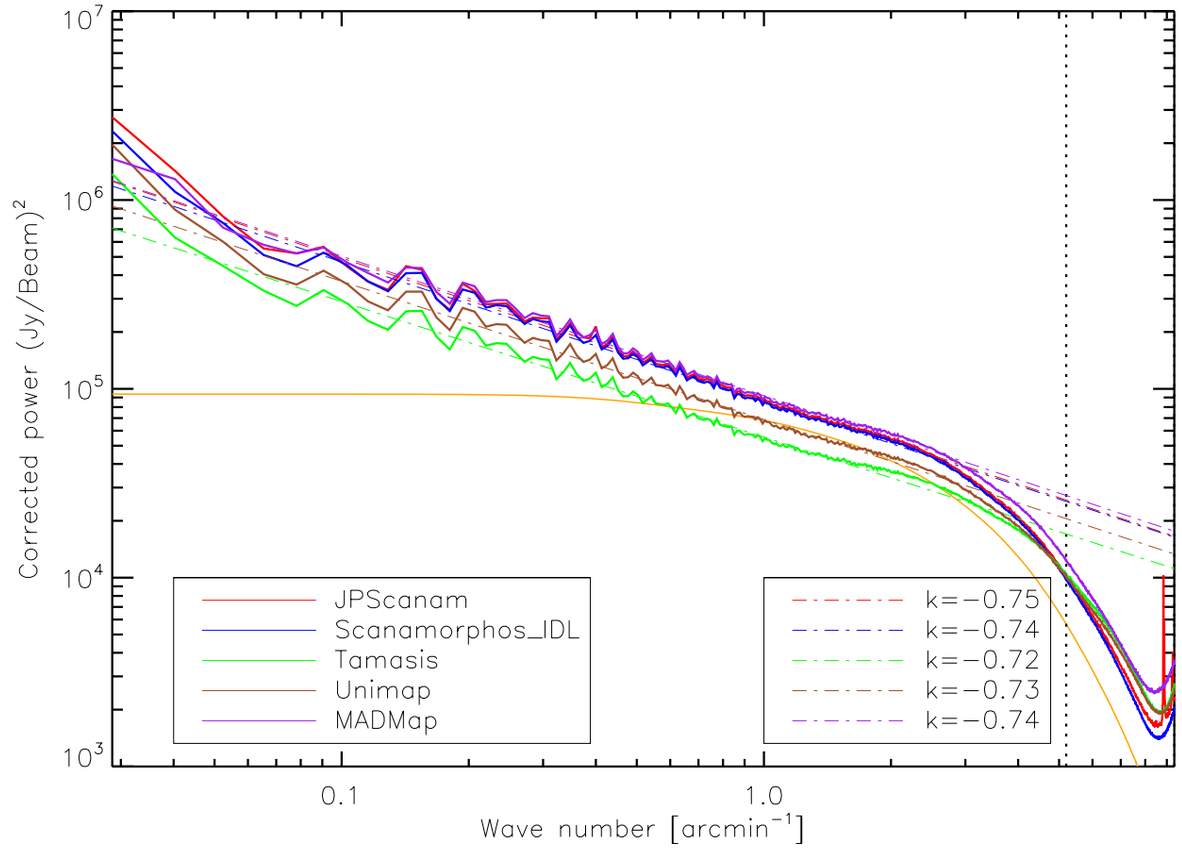




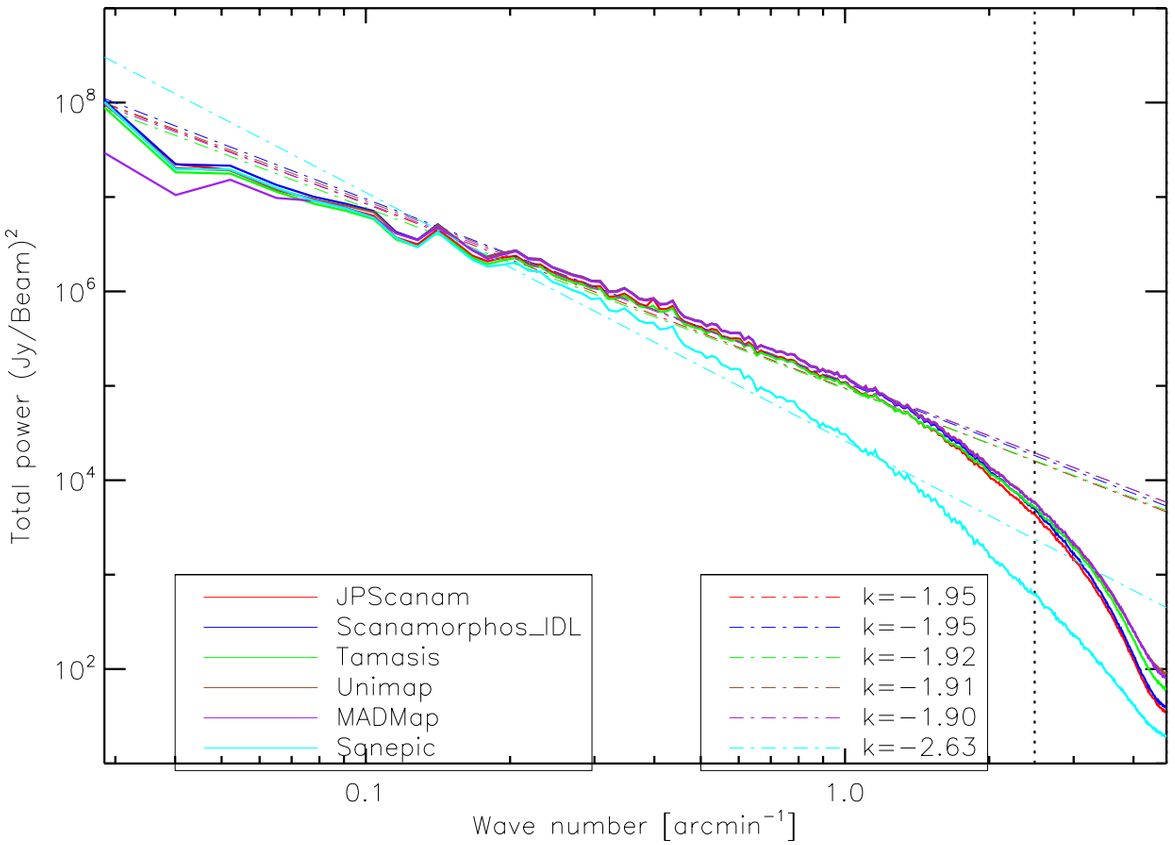


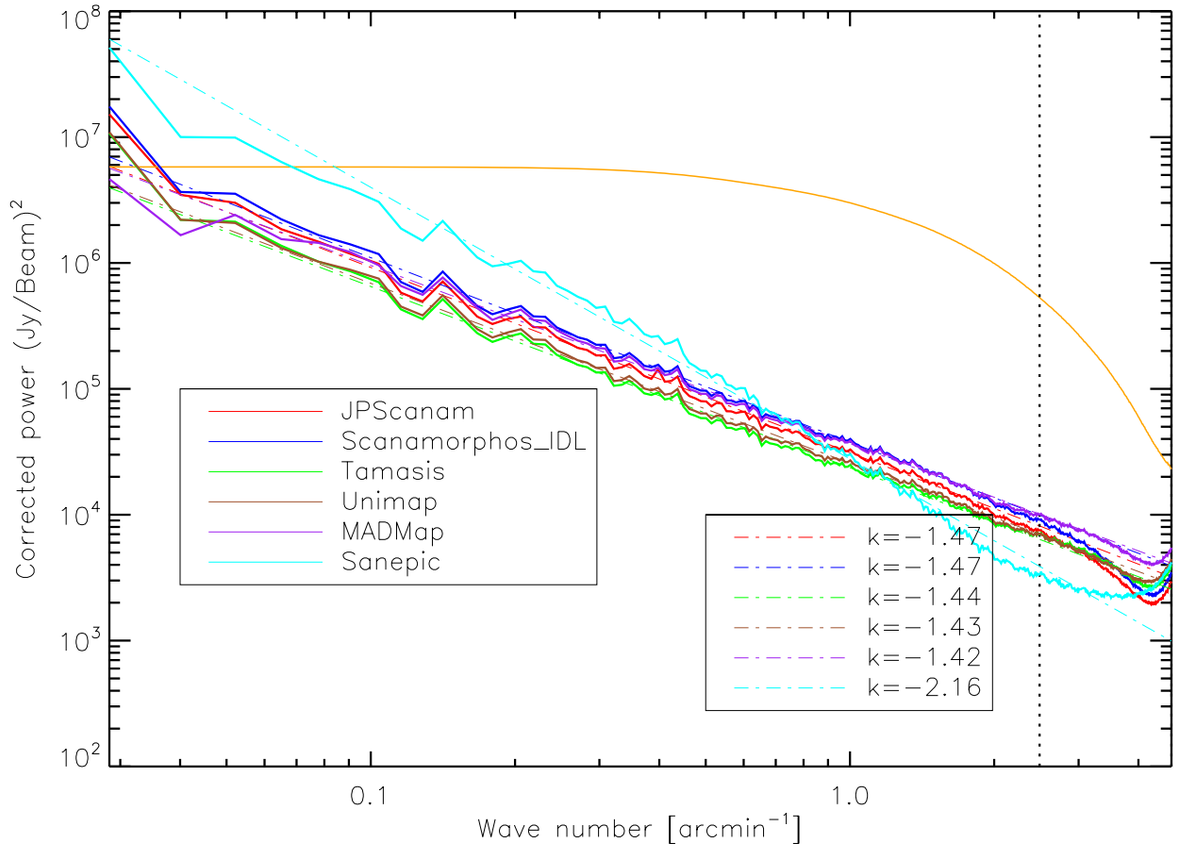
Rosette - blue

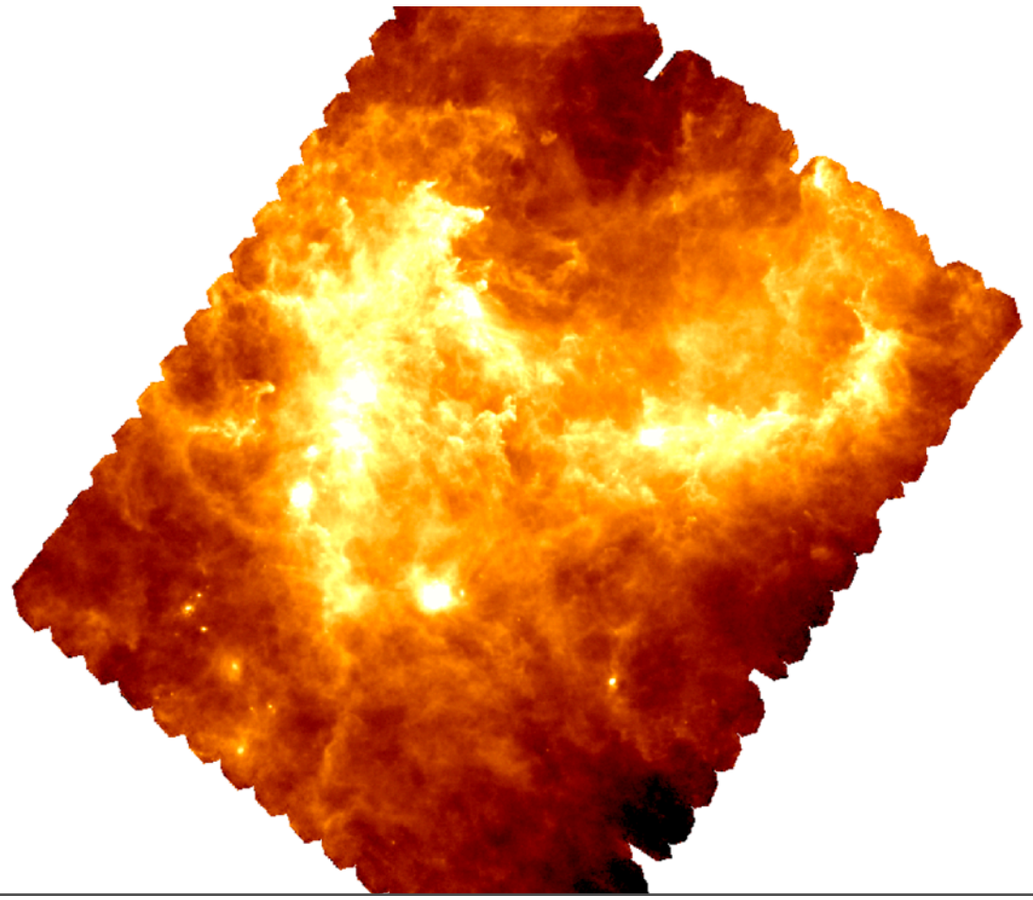




Rosette - red


Total power (Jy/Beam)^2
10^8
10^6
10^4
10^2
0.1
1.0
Wave number [arcmin^{-1}]
JPScanam
Scanamorphos_IDL
Tamasis
Unimap
MADMap
Sanepic
k=−1.95
k=−1.95
k=−1.92
k=−1.91
k=−1.90
k=−2.63


Corrected power (Jy/Beam)^2
10^8
10^7
10^6
10^5
10^4
10^3
10^2
0.1
1.0
Wave number [arcmin^{-1}]
JPScanam
Scanamorphos_IDL
Tamasis
Unimap
MADMap
Sanepic
k=−1.47
k=−1.47
k=−1.44
k=−1.43
k=−1.42
k=−2.16



Conclusions

- BLUE maps
  - W/O correction
    - On large scales
      - JPScanam has more power, and it's close to the truth in faint case, Scanamorphos has the less, but it's close to the truth in the bright case
    - On smaller scales
      - Scanamorphos & Unimap have less power - very close to the truth in both faint and bright cases
  - Corrected
    - Tamasis & Unimap have less power on large scales, "far" from truth in both faint and bright cases, Scanamorphos has more power, close to the truth in faint and bright
    - Unimap and Scanamorphos have the less power on smaller scales - they're close to the truth in both faint and bright case

Conclusions

- RED maps
  - W/O correction
    - On large scales
      - Unimap has the less power, but it's close to the truth in bright and faint case, too, MADMap has the most, but far from the truth
    - On smaller scales
      - Scanamorphos hase the less power, and close to the truth in faint case, JPScanam has the most power, and close to the truth in bright case
  - Corrected
    - Unimap and JPScanam have less power and they're close to the truth on large scales
    - Scanamorphos has the most power, and it's close to the truth in bright case, Unimap has the less power and it's close to the truth in fait case on smaller scales

Blue

W/O correction

	Bright	Faint
Large	Scanamorphos	JPScanam
Small	Scanamorphos	Scanamorphos

Corrected

	Bright	Faint
Large	Scanamorphos	Scanamorphos
Small	Unimap +Scanamorphos	Unimap +Scanamorphos

Red

W/O correction

	Bright	Faint
Large	Unimap	Unimap
Small	JPScanam	Scanamorphos

Corrected

	Bright	Faint
Large	Unimap +JPScanam	Unimap+JPScanam
Small	Scanamorphos	Unimap