Commander1 results on PICO PySM 90.92 simulations

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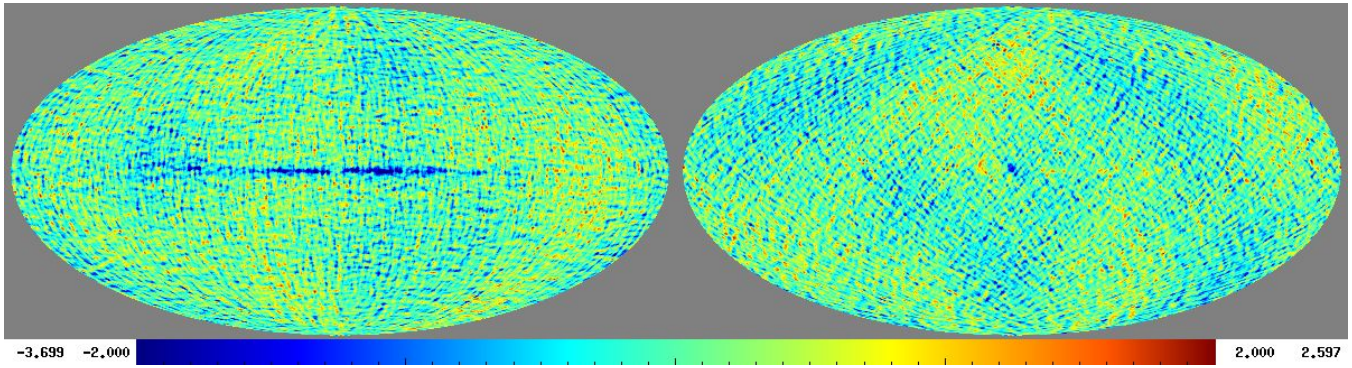
Analysis setup

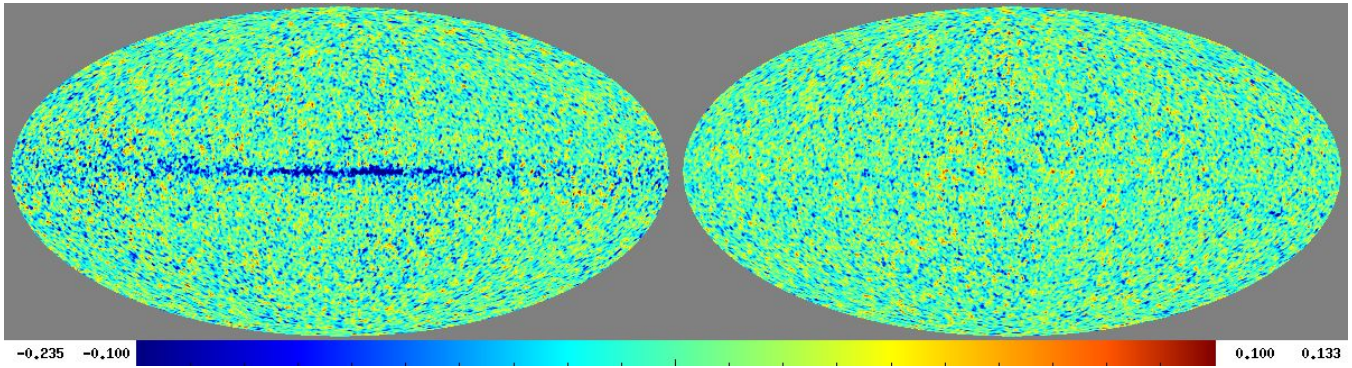
- Model 90.92
- Component separation performed with Commander1 at a common resolution of 60 arcmin FWHM and Nside 256
- Optimized 8 parameters per pixel
  - CMB (A_cmb)
  - Two independent dust models (A_dust, T_dust for each, as well as β for dust2)
  - Synchrotron model (A_synch, β_synch); runs with free C are currently running
  - CMB masked, 79% sky coverage
- In addition, β for the first dust component is fitted uniformly on the sky

- Power spectrum is derived with anafast cross-spectra between ds1 and ds2, after inpainting the mask with a constrain realization to minimize E-to-B coupling

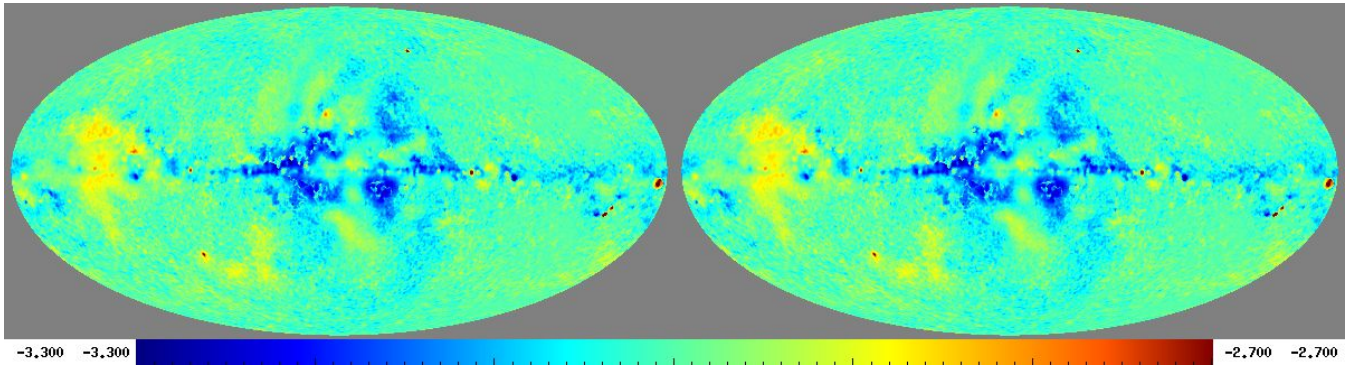
Reconstructed component maps: CMB ds1



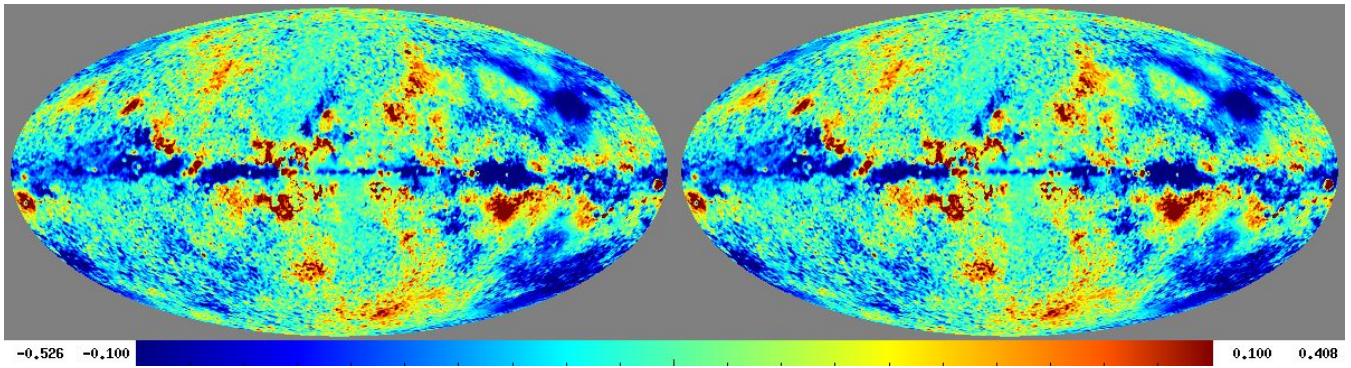
Difference ds1 - ds2



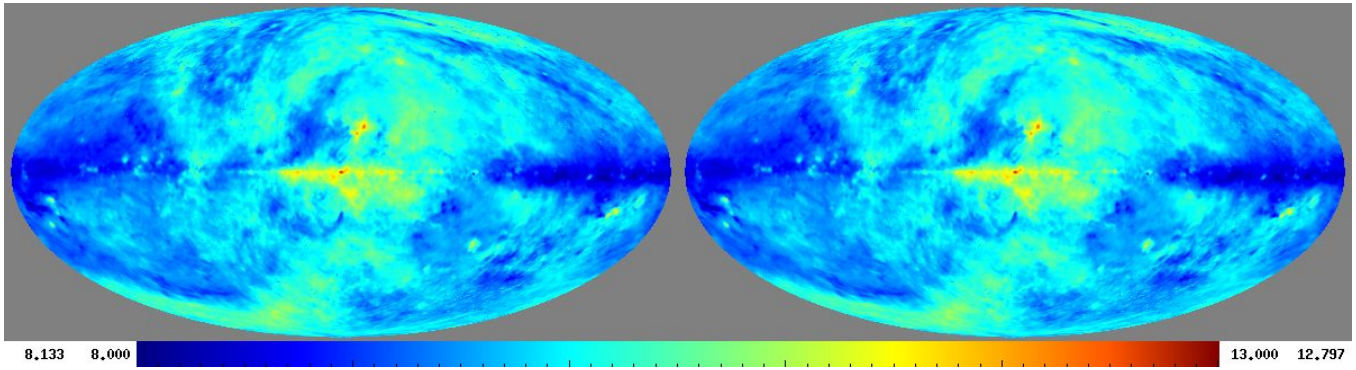
Reconstructed component maps: Synchrotron beta



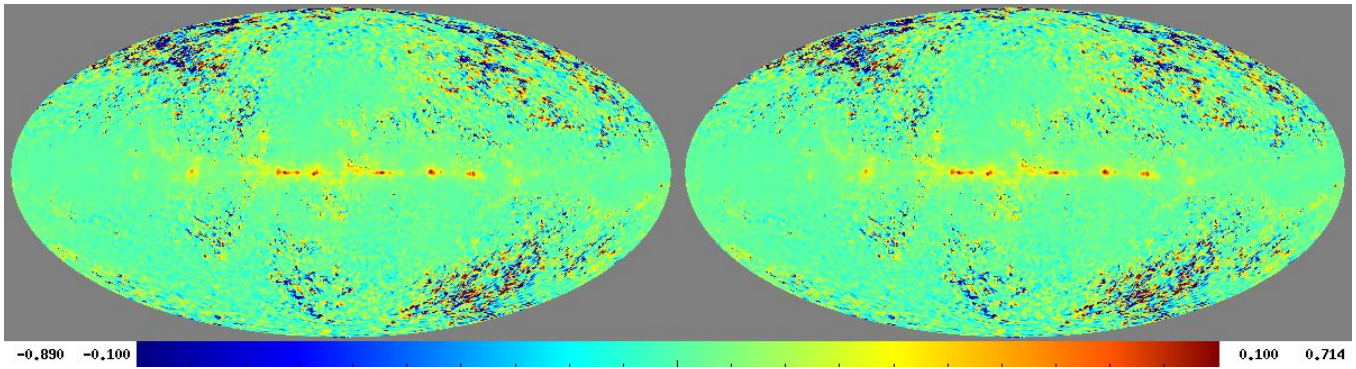
Difference Synchrotron beta: Commander - input



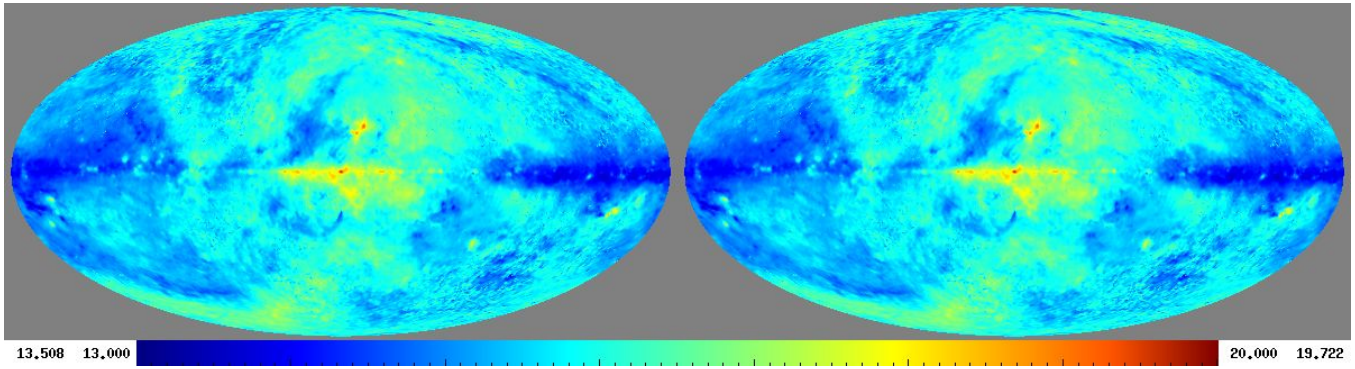
Reconstructed component maps: Thermal dust 1



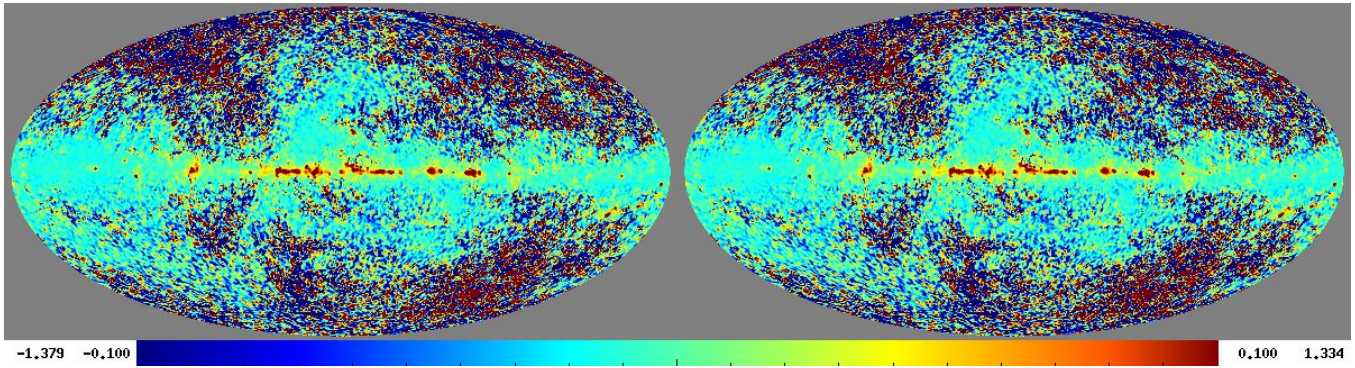
Difference Thermal dust 1: Commander - input



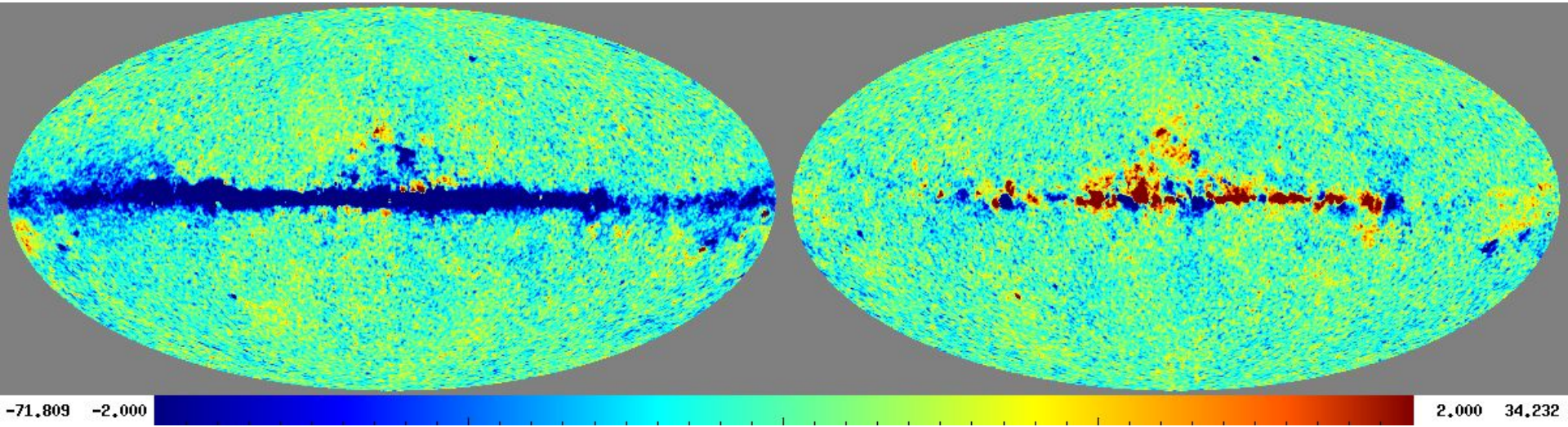
Reconstructed component maps: Thermal dust 2



Difference Thermal dust 2: Commander - input

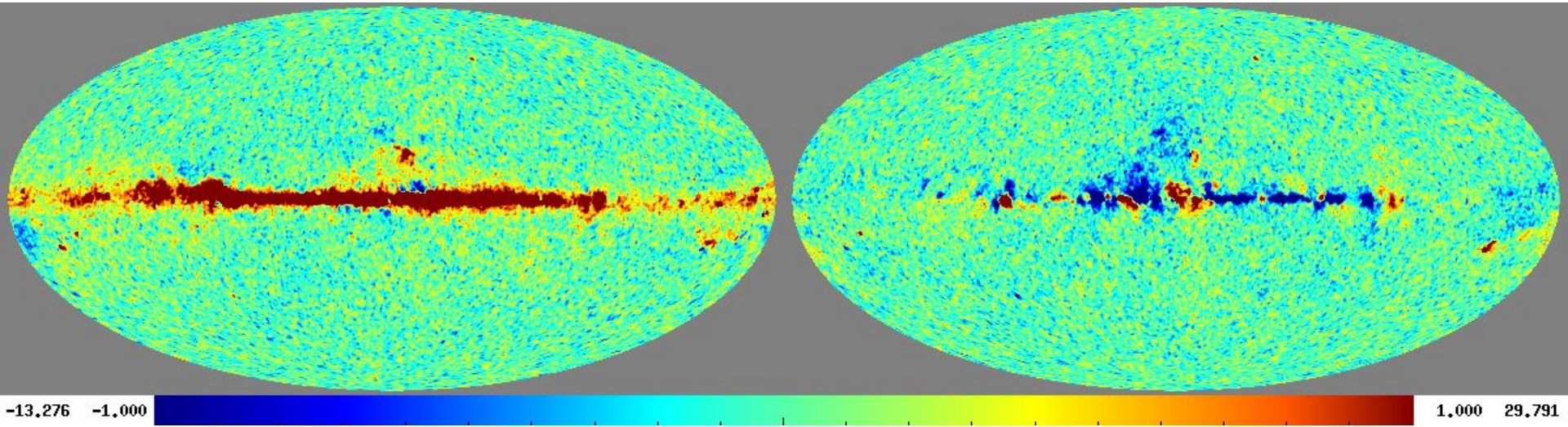


Selected residual maps: 21 GHz



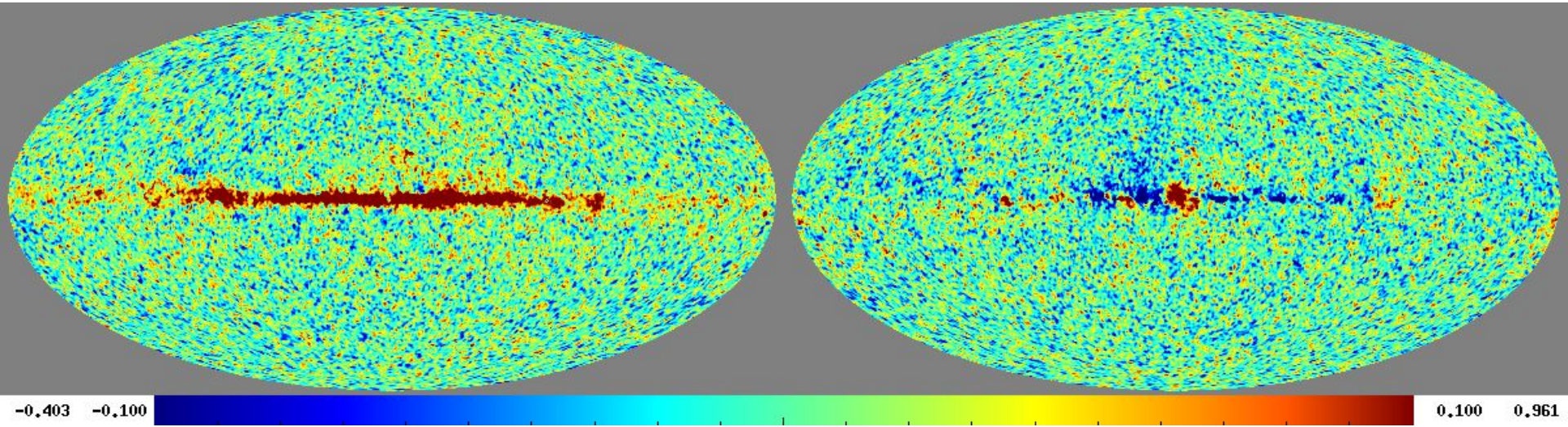
Color scale = +/- 2 μK

Selected residual maps: 30 GHz



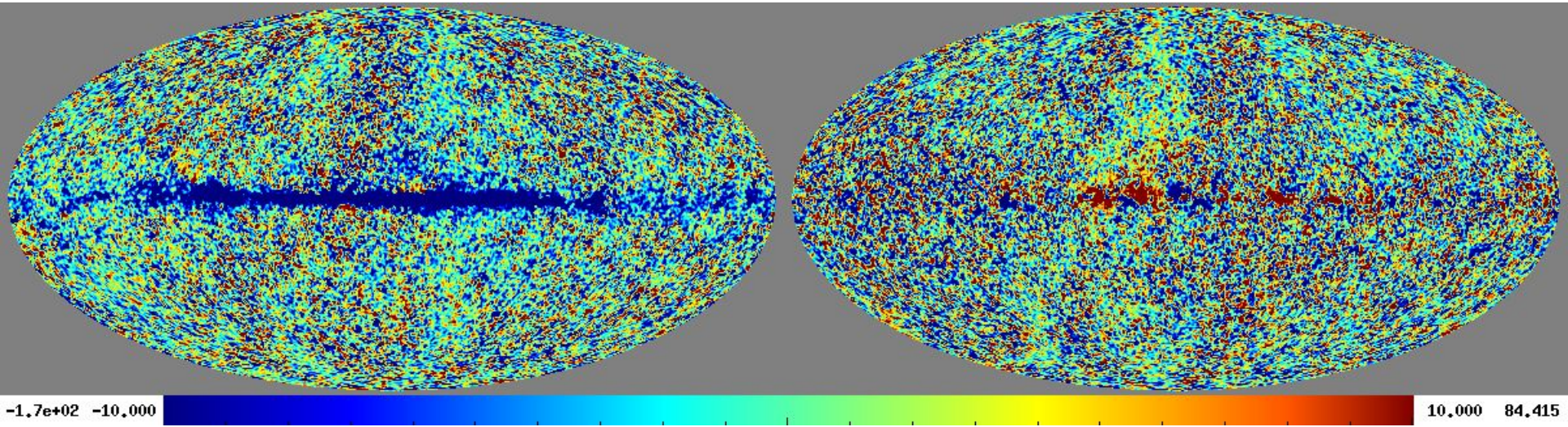
Color scale = +/- 1 μK

Selected residual maps: 129 GHz



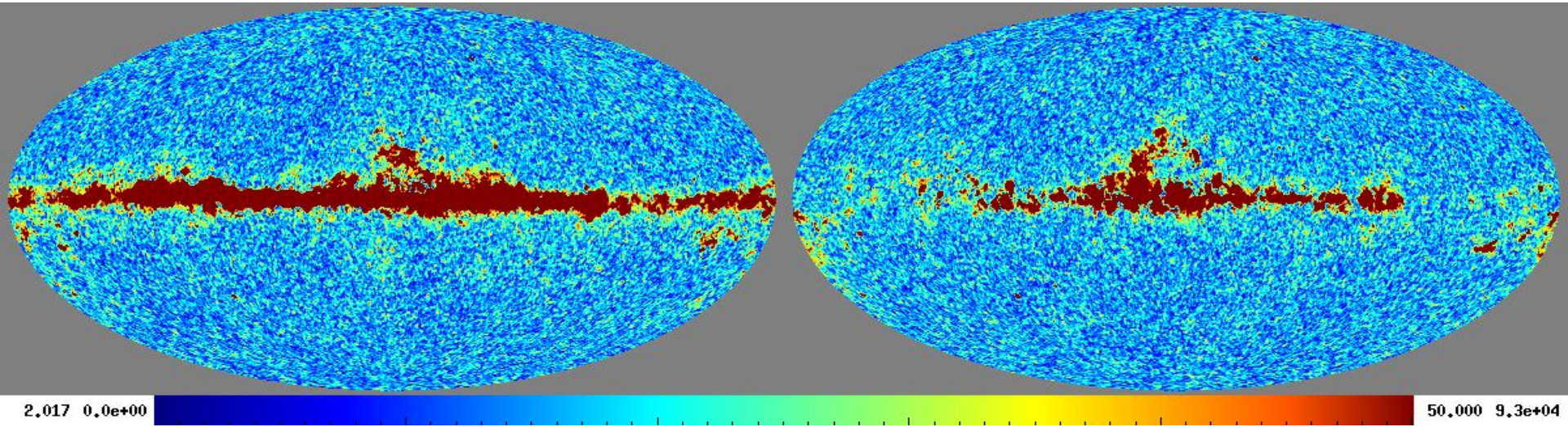
Color scale = +/- 0.1 μK

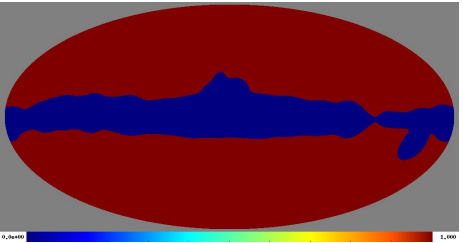
Selected residual maps: 799 GHz



Color scale = +/- 10 μK

Total chi-square map

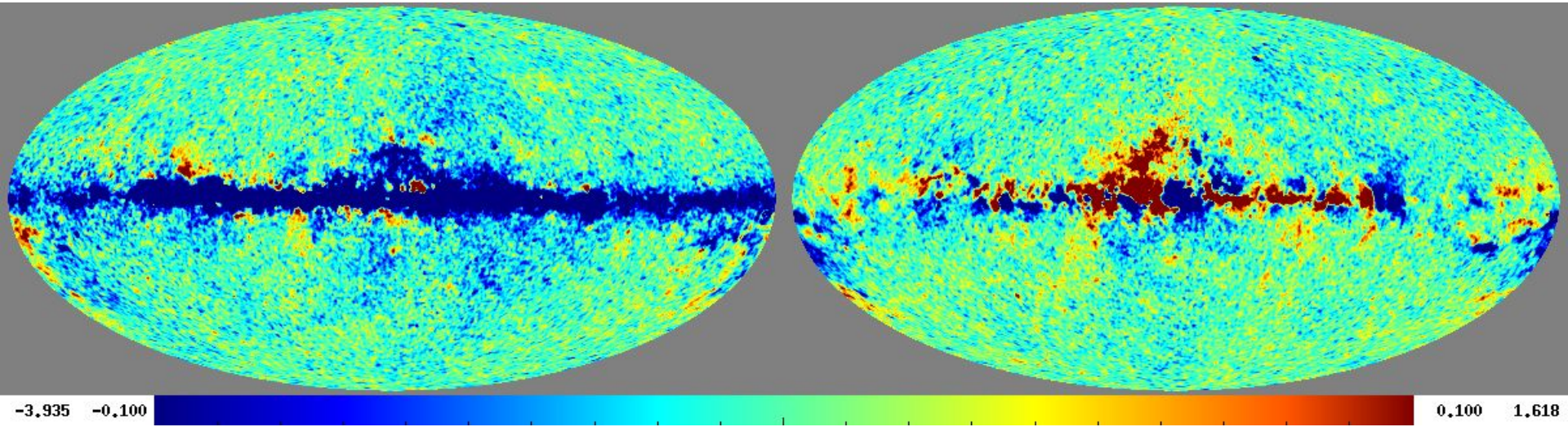




Color scale = 0-50

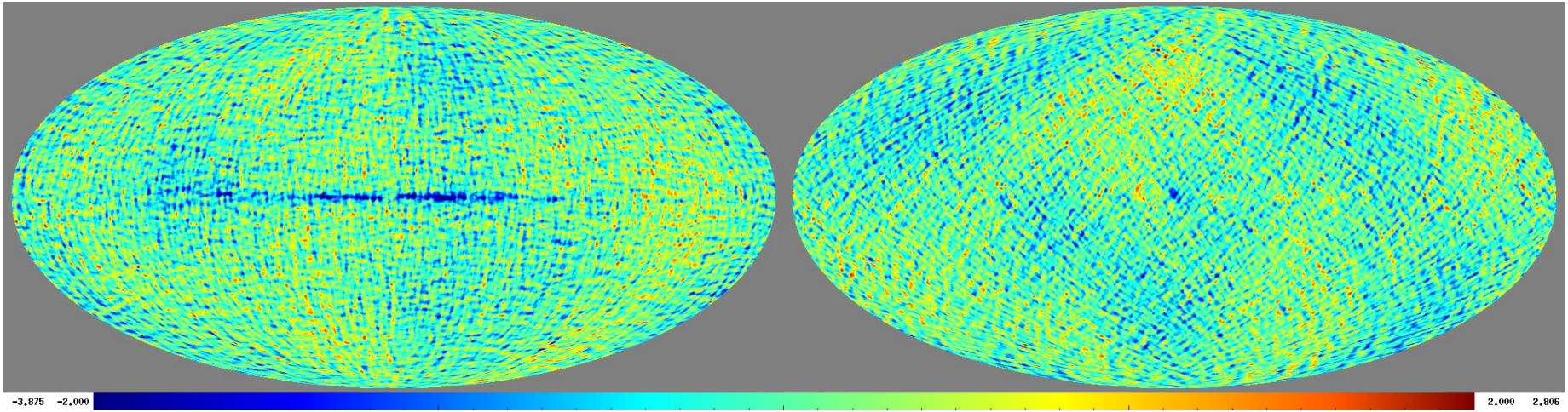
Mask made from chi-square

Difference CMB from Commander - input CMB



Color scale = +/- 0.1 μK
Synchrotron curvature fixed
Not fitted for AME

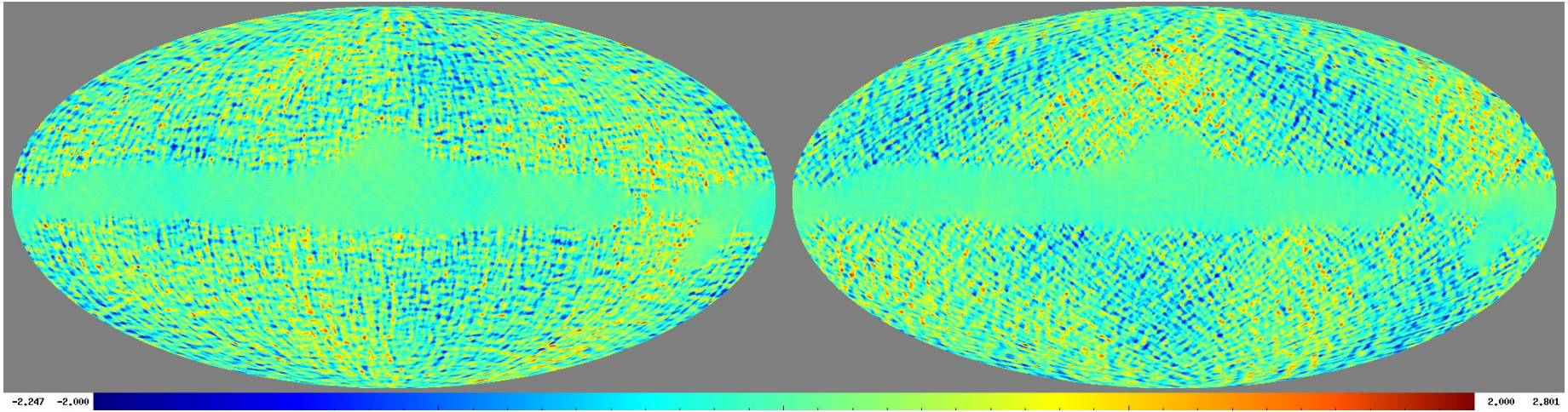
Cleaned CMB map



Color scale = +/- 2 μK

Synchrotron curvature fixed at input

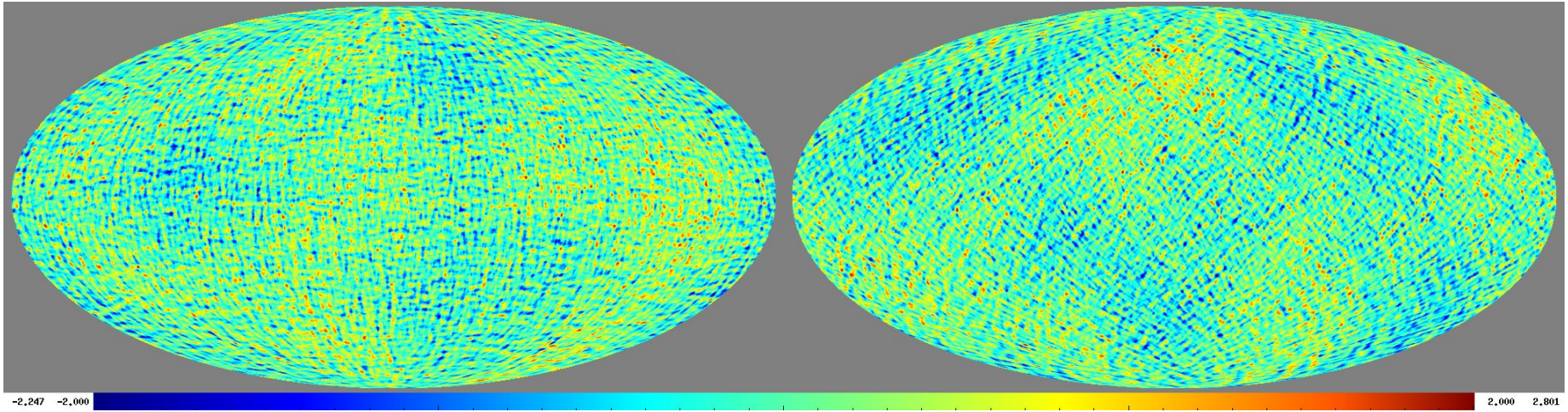
Masked and Wiener filtered CMB map



Color scale = +/- 2 μK

Synchrotron curvature fixed at input

Masked and in-painted CMB map



Color scale = +/- 2 μK

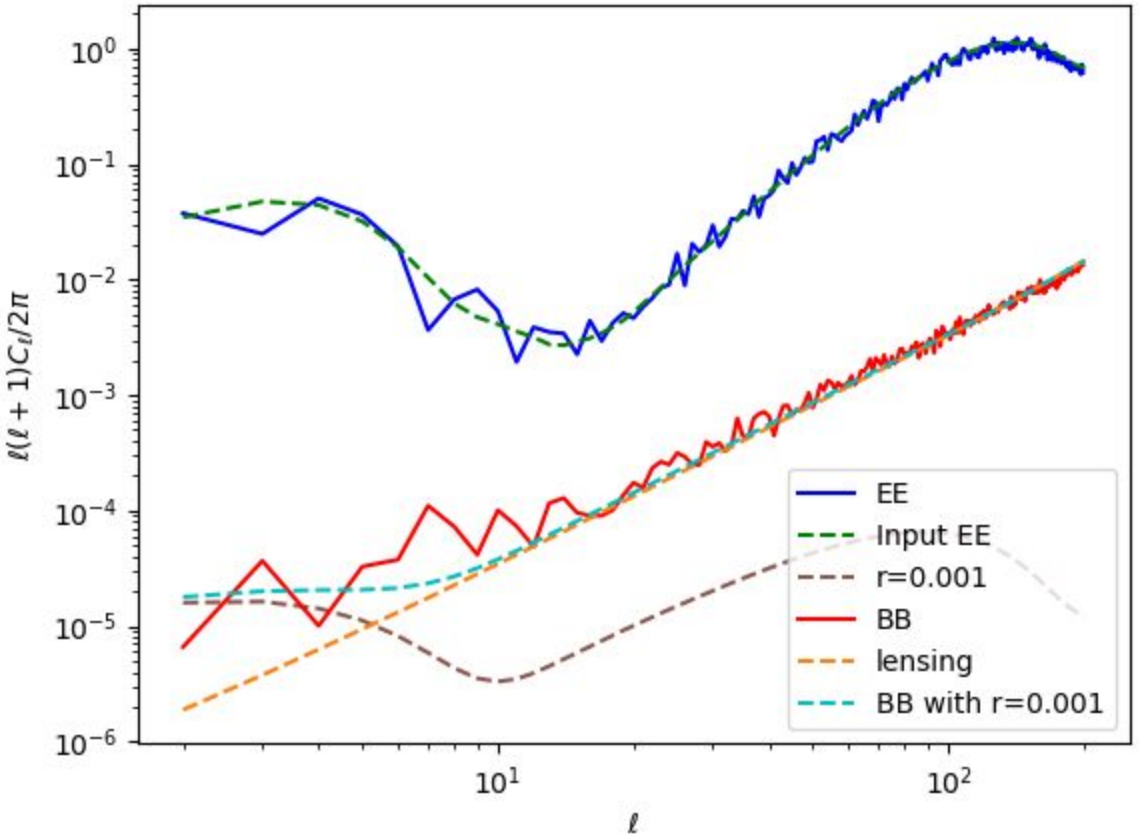
Synchrotron curvature fixed at input

Power spectra

Cross spectrum of masked and in-painted ds1 and ds2 CMB maps.

90.92 model,
0000 realization with r=0.001

Red (BB) and blue (EE) curve from reconstructed CMB map



Analysis 2: Commander1 on Nside=16 with brute-force likelihood tensor-to-scalar ratio estimation

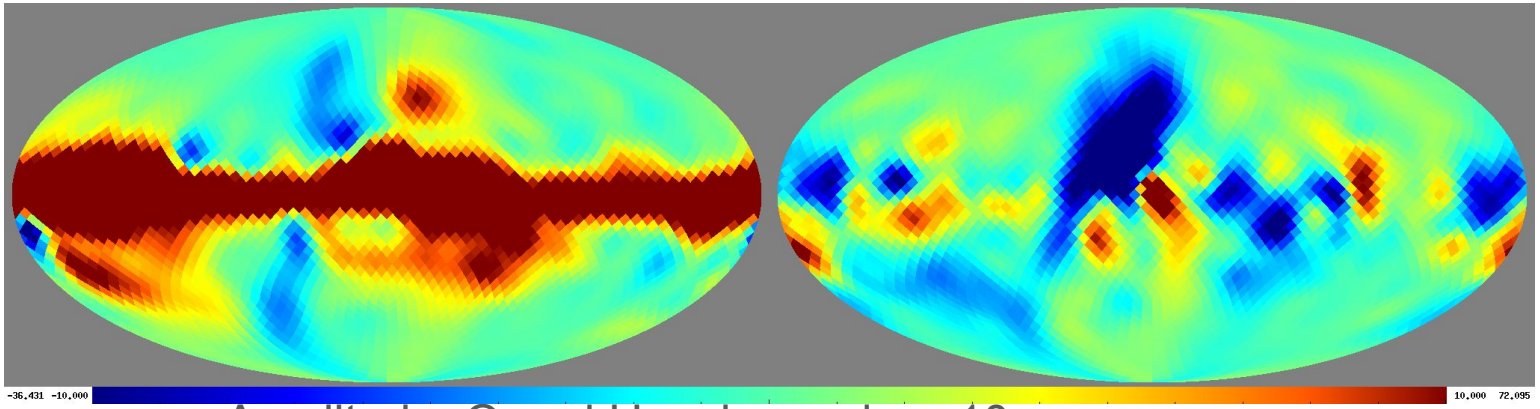
Analysis setup 2

- Component separation performed with Commander1 at a common resolution of 10 deg FWHM and Nside=16

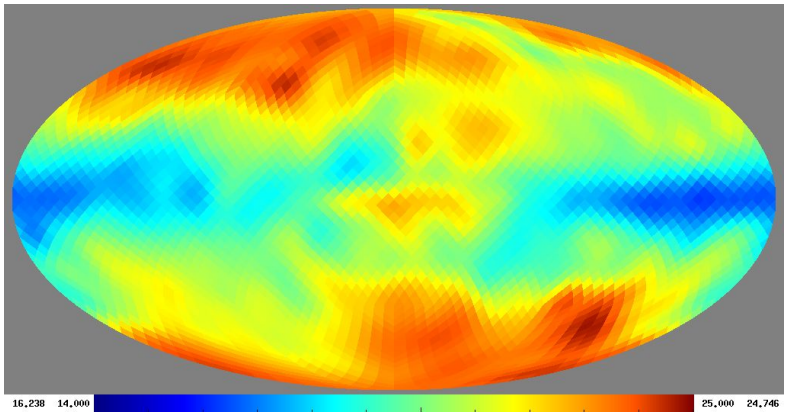
- Foreground model from PySM, case with one bb dust plus synchrotron. Spatial variable spectral parameters; co-added directly at Nside=16 to eliminate downgrading artefacts
- CMB r=0.01, tau=0.06, 4 different noise realisations
- Delta function band-pass, white noise from Pico sensitivity
- Fitted 6 parameters per pixel
  - CMB (A_{cmb}),
  - One bb dust model, (A_{dust}, β_{dust}, T_{dust})
  - Synchrotron power law model (A_{synch}, β_{synch}) (no curvature)
  - Analysis mask, 73% sky coverage

- Compute r from brute-force map-based likelihood using $2 \leq l \leq 12$

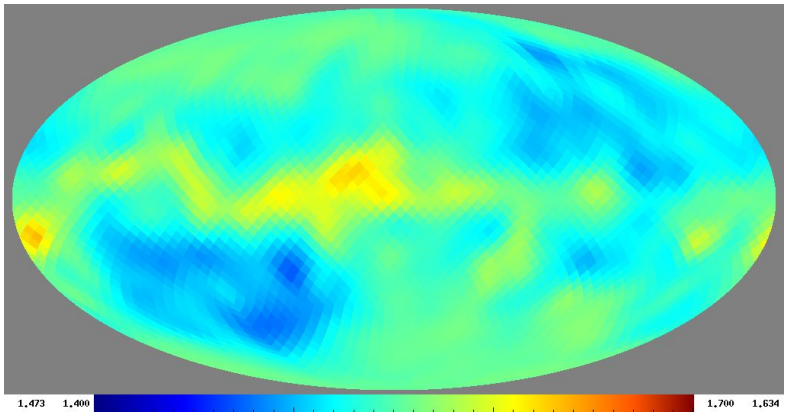
Dust foreground model, from PySM



Amplitude, Q and U, color scale +-10μK

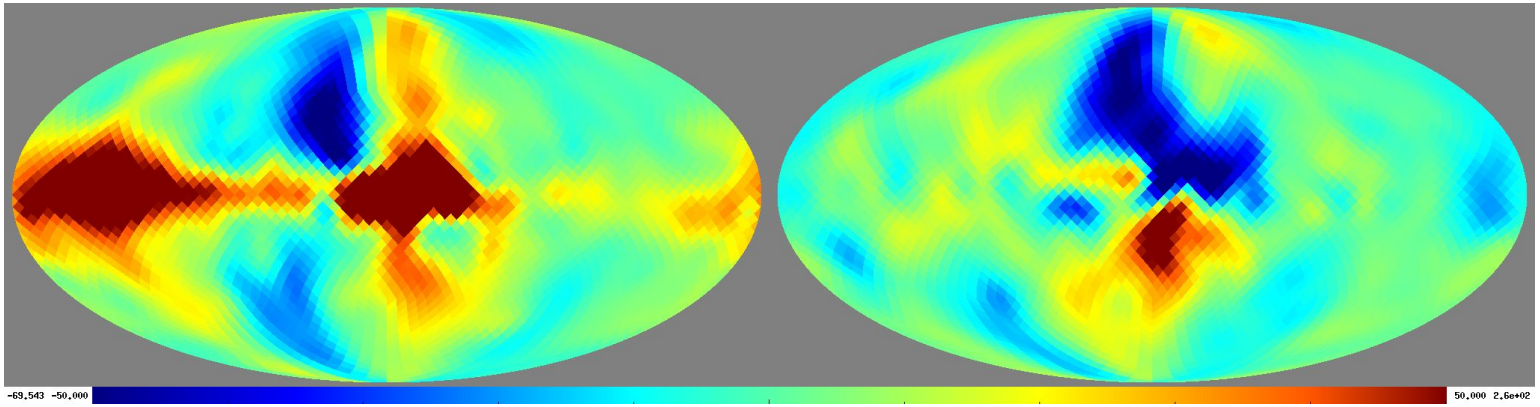


Td, color scale 14 - 25 K

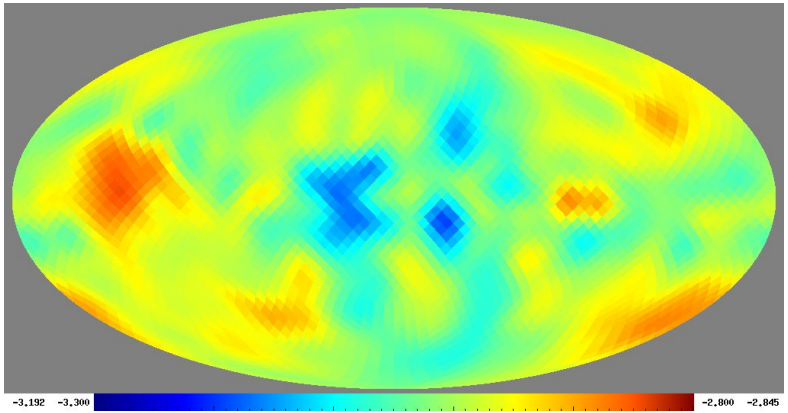


beta_d, color scale 1.4 - 1.7

Synch foreground model, from PySM

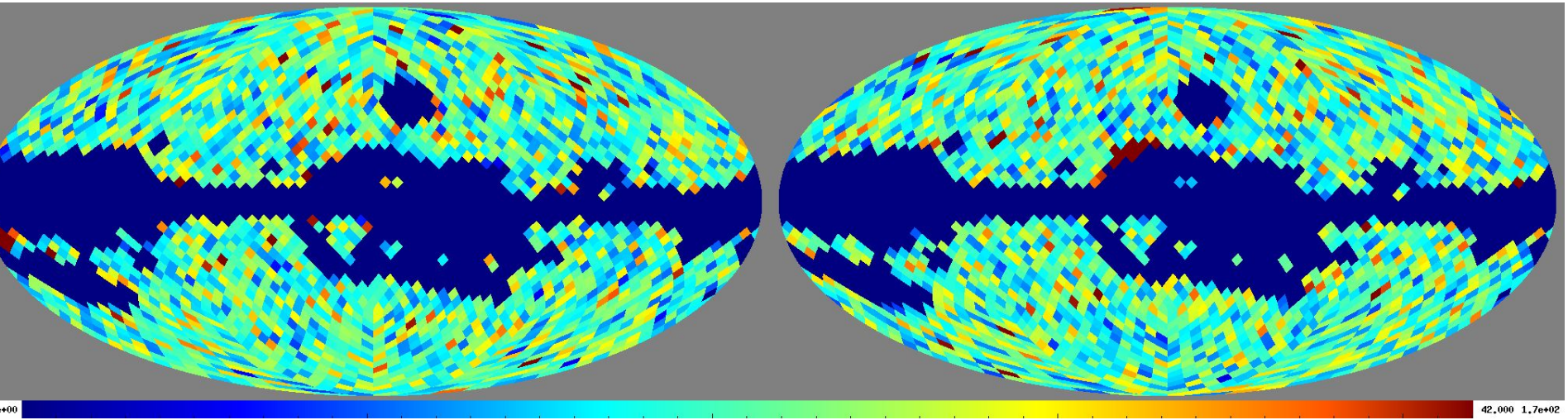


Amplitude, Q and U, color scale +-50μK



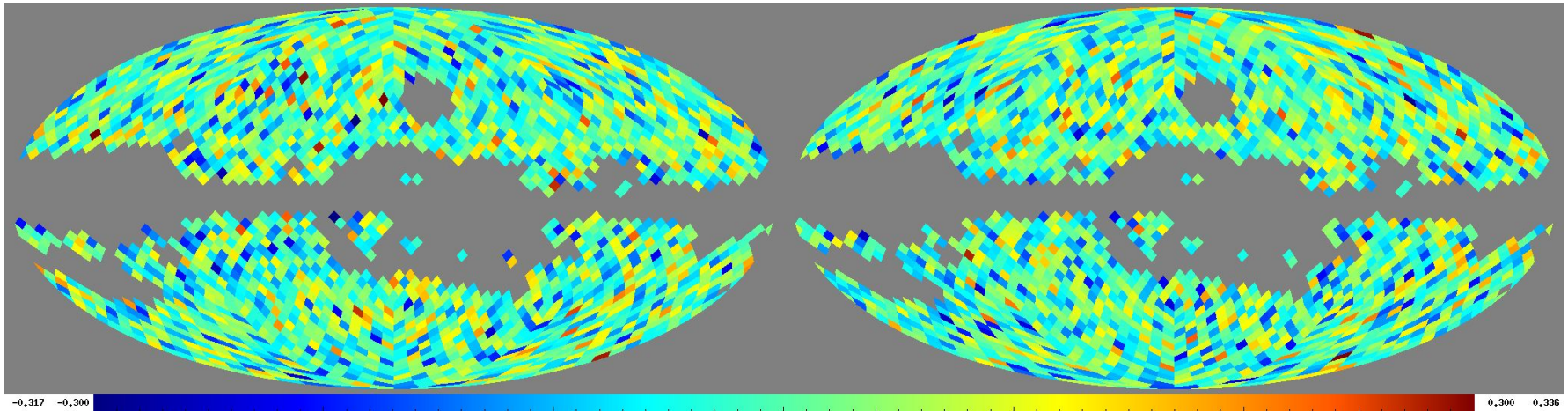
beta_d, color scale -3.3 - -2.8

Total chisquare map



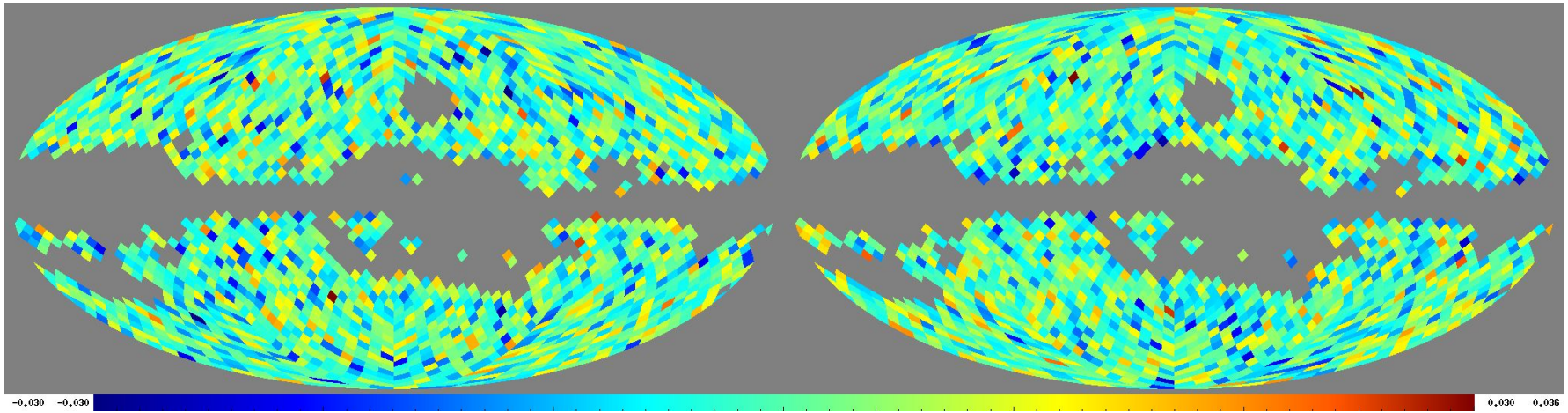
Color scale = 0 - 42

Residuals 21 GHz



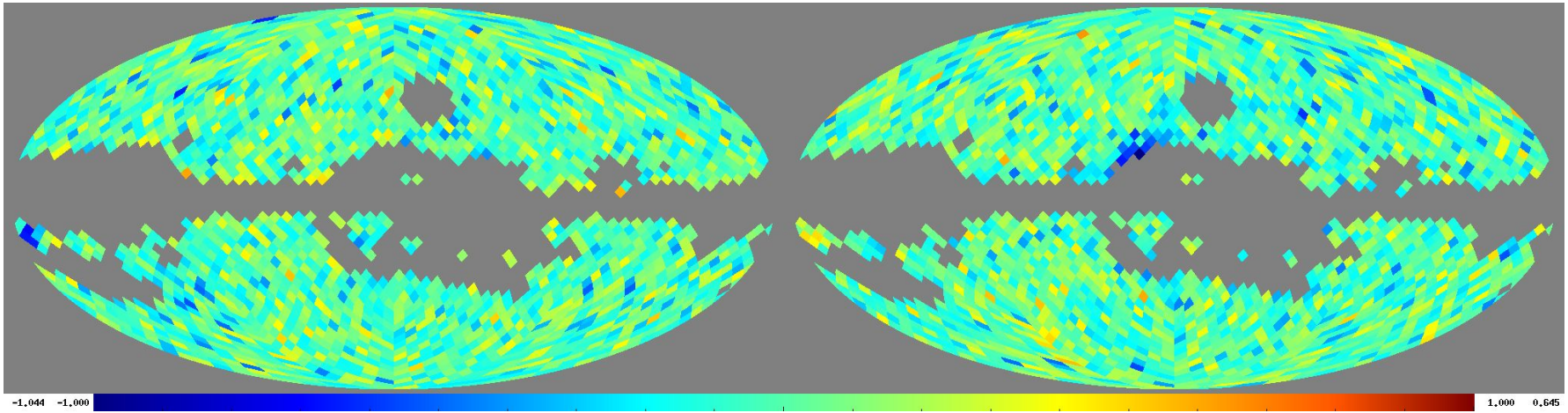
Color scale +- 0.3 μK

Residuals 108 GHz



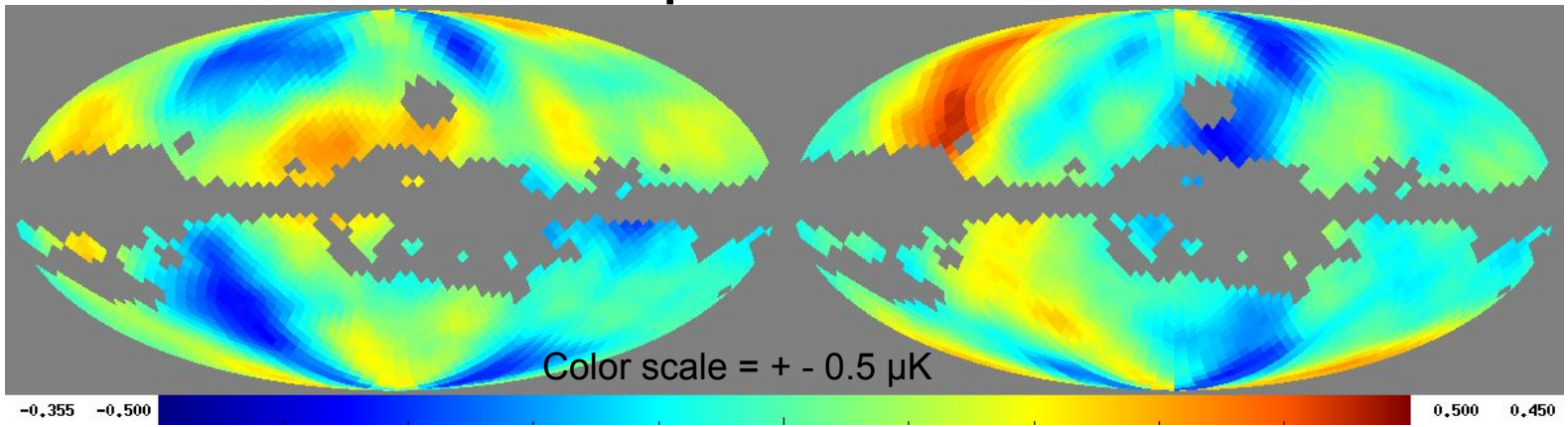
Color scale +- 0.03 μK

Residuals 555 GHz

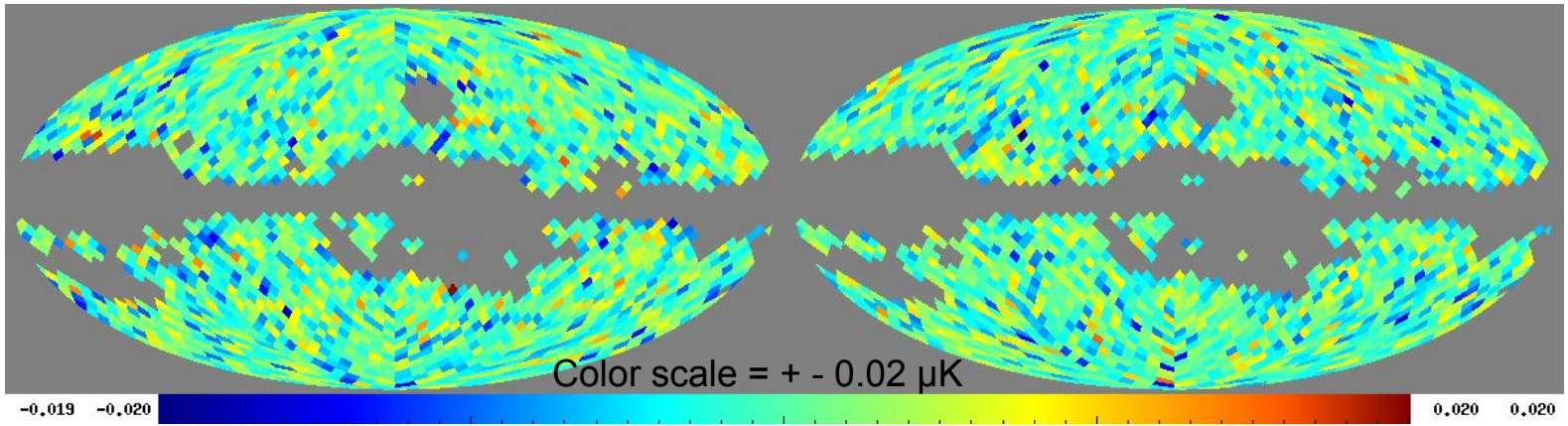


Color scale +- 1 μK

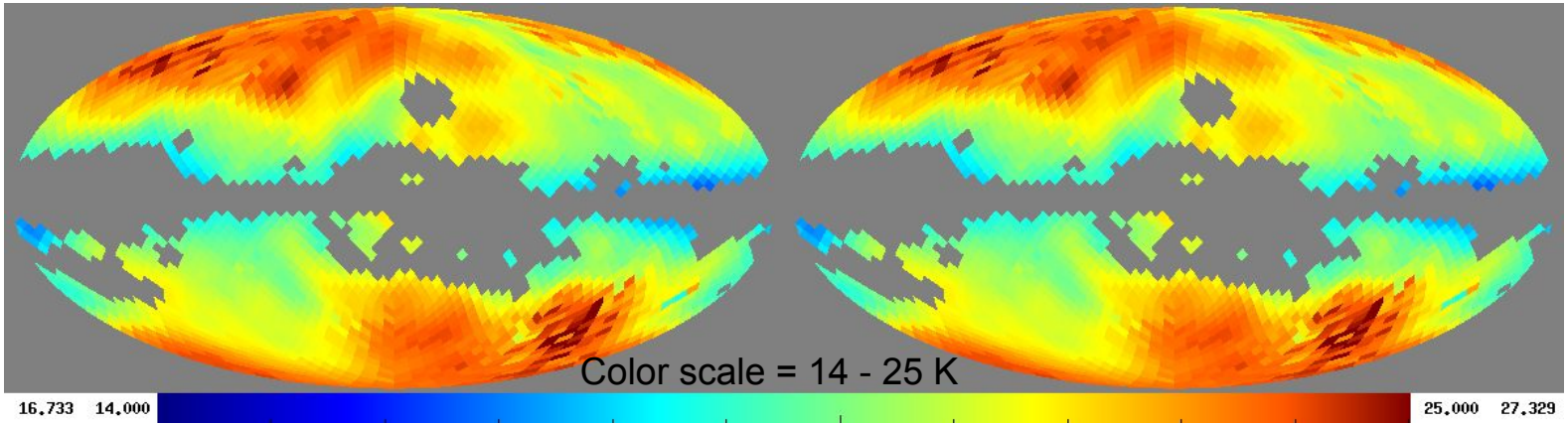
Output CMB



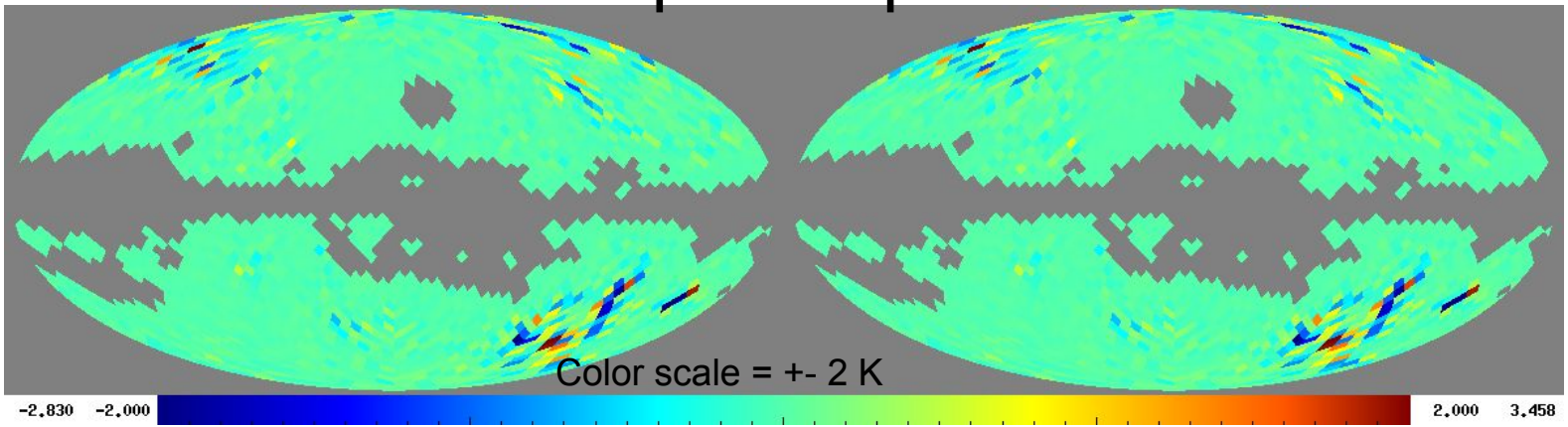
Difference input-output CMB



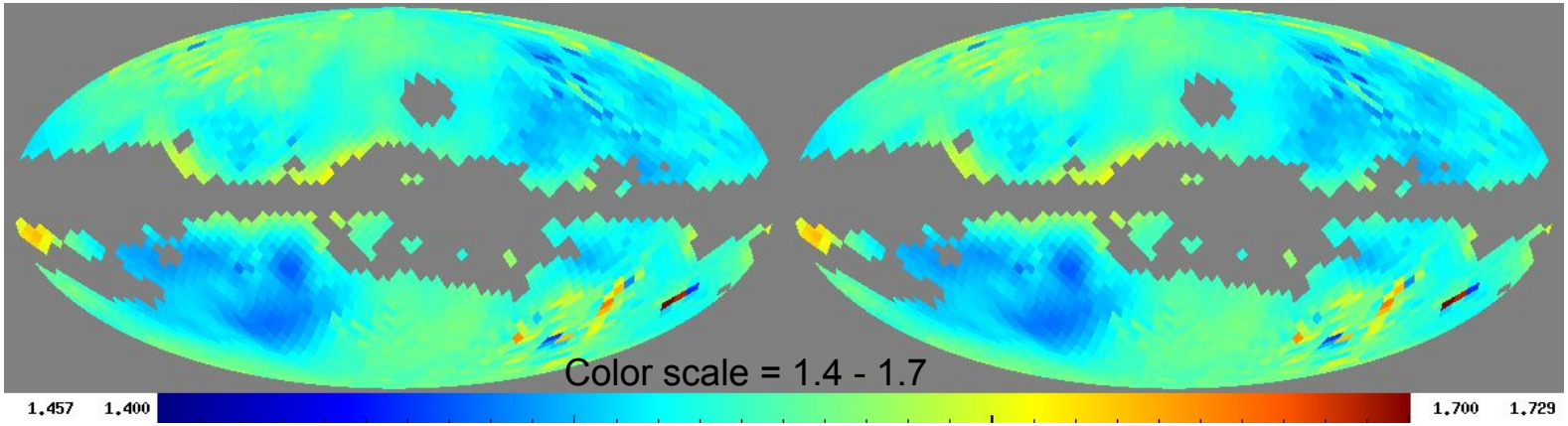
Output Td



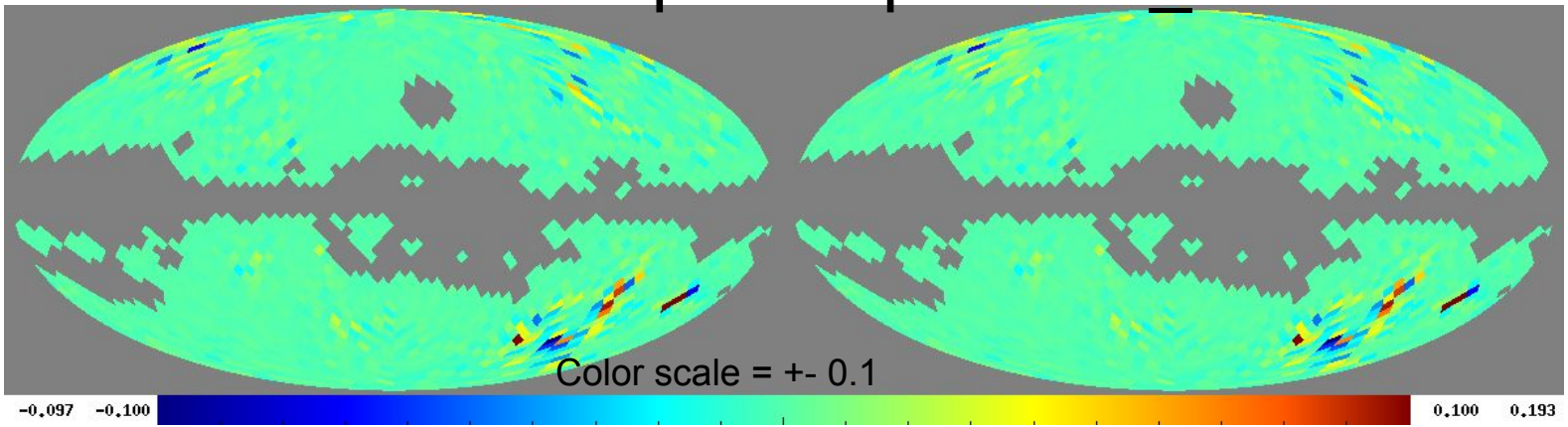
Difference input-output Td



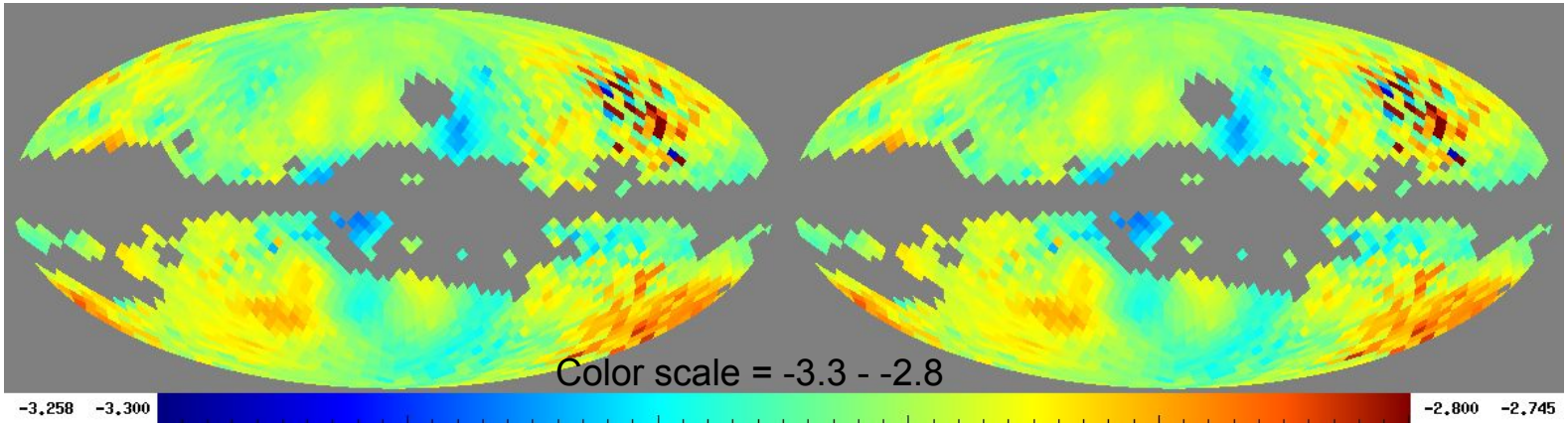
Output beta_d



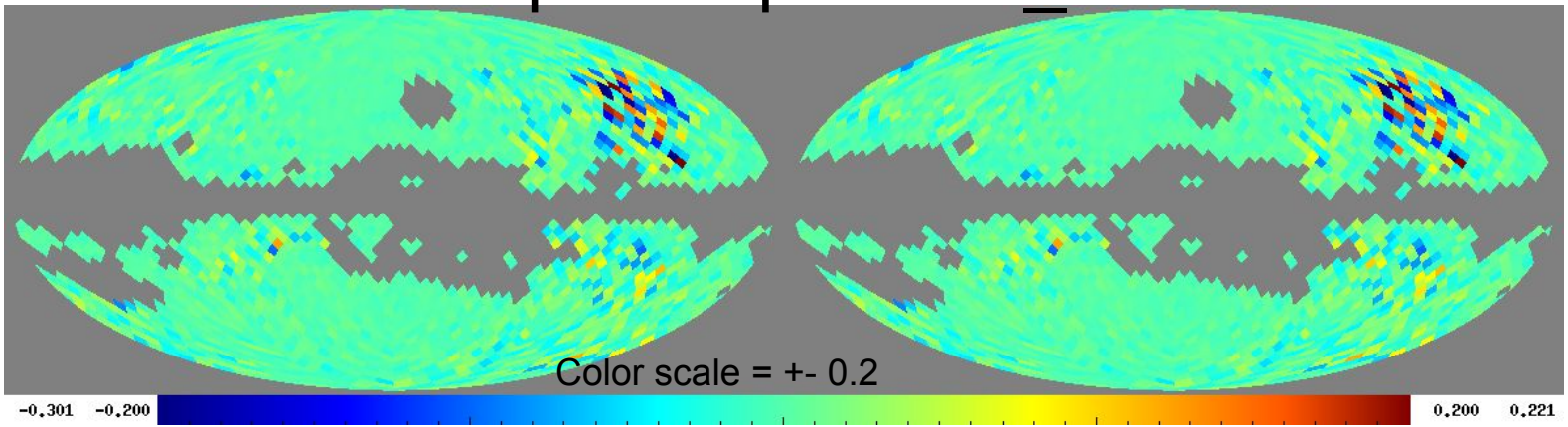
Difference input-output beta_d



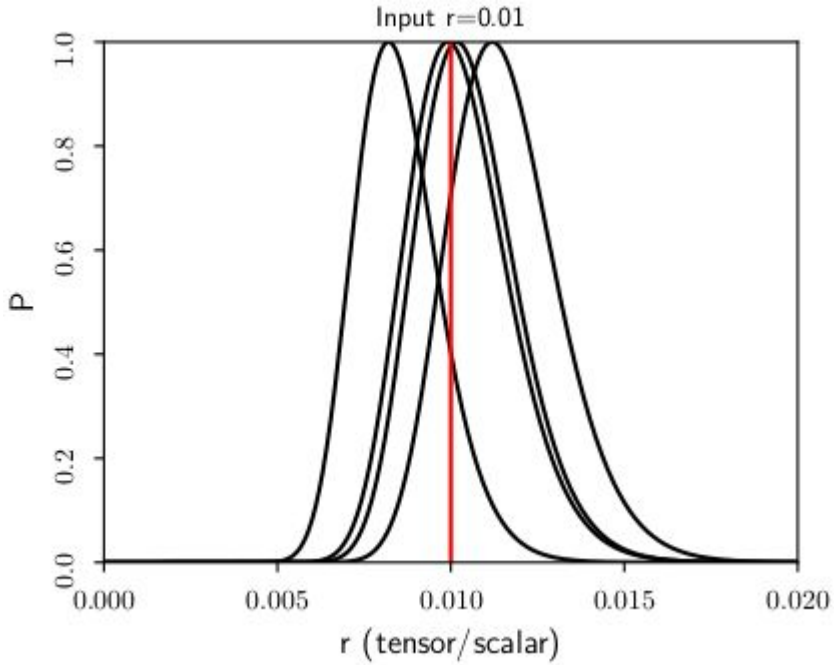
Output beta_s



Difference input-output beta_s



Estimation of r



r (average) = 0.00985

4 noise realisations

r1 = 0.0082 + 0.0013 - 0.0011

r2= 0.0101 + 0.0015 - 0.0013

r3= 0.0112 + 0.0017 - 0.0014

r4=0.0099 + 0.0016 - 0.0013