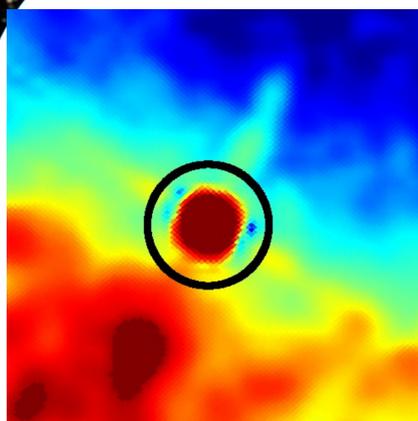


An improved source-subtracted and destriped 408 MHz all-sky map¹

Remazeilles, M., Dickinson, C., Banday, A. J., Bigot-Sazy, M.-A., Ghosh, T.
arXiv:1411.3628

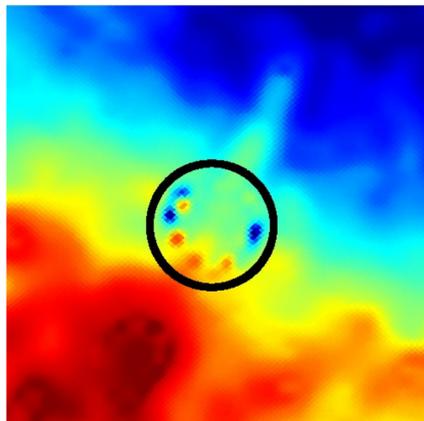
The all-sky 408 MHz map of Haslam et al.² is one of the most important total-power radio surveys. It has been widely used to study **diffuse synchrotron radiation** from our Galaxy and as a template to remove **foregrounds in cosmic microwave background data**.³ Synchrotron radiation is also expected to be the **major foreground for upcoming 21 cm intensity mapping experiments**.⁴ However, there are a number of issues associated with it that must be dealt with, including **large-scale striations** and contamination from **extragalactic radio sources**, and the 2003 destriped and desourced version of the Haslam map still suffers from significant source residuals and artefacts. We have re-processed the rawest data available to produce a new and improved 408 MHz all-sky map.¹

Haslam 1982



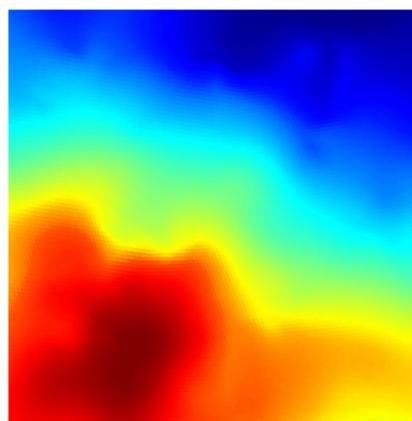
Haslam et al., 1982
Strong extragalactic radio sources in the raw data.

Haslam 2003



WMAP, 2003
Desourced destriped version used so far by astronomers. Residual source artefacts are evident.

Haslam 2014



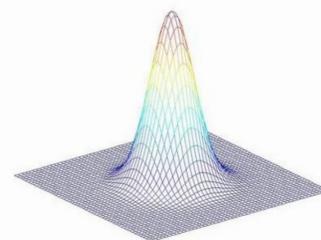
Remazeilles et al., 2014
New synchrotron template at 408 MHz.

2014 re-processed Haslam map¹

Iterative combination of two techniques, depending on the local SNR & on the background geometry surrounding the source:

- 9-parameter Gaussian fit subtraction

$$F(X, Y; \{A_i\}) = A_0 + A_1 X + A_2 Y + A_3 e^{-\frac{1}{2} \left(\frac{\cos(A_6 \frac{\pi}{180})(X-A_4) - \sin(A_6 \frac{\pi}{180})(Y-A_5)}{A_7} \right)^2 - \frac{1}{2} \left(\frac{\sin(A_6 \frac{\pi}{180})(X-A_4) + \cos(A_6 \frac{\pi}{180})(Y-A_5)}{A_8} \right)^2}$$



- Minimum curvature spline surface inpainting

$$F(X, Y) = \sum A_i d_i^2 \log d_i + a + bX + cY$$

$$\text{where } d_i^2 = (X - X_i)^2 + (Y - Y_i)^2$$

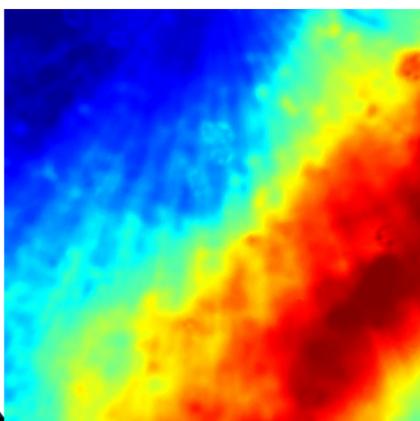
minimizes

$$\sum_{i=1}^N \|Z_i - F(X_i, Y_i)\|^2 + \lambda \iint \left[\left(\frac{\partial^2 F}{\partial X^2} \right)^2 + \left(\frac{\partial^2 F}{\partial Y^2} \right)^2 + 2 \left(\frac{\partial^2 F}{\partial X \partial Y} \right)^2 \right] dX dY$$

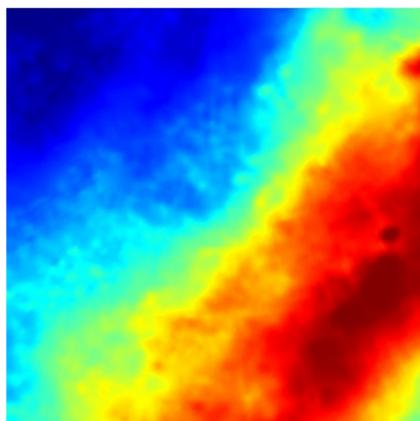
desourcing

Destriping

Haslam 2003



Haslam 2014



2014 re-processed Haslam maps
publicly available on LAMBDA

http://lambda.gsfc.nasa.gov/product/foreground/2014_haslam_408_get.cfm

References

1. Remazeilles et al. (2014) arXiv:1411.3628
2. Haslam et al. (1982) A&AS, 47, 1
3. Planck Collaboration, "Planck 2014 Results. XXXI. Diffuse low-frequency Galactic foregrounds", in preparation.
4. Ansari et al. (2012) A&A 540, A129

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