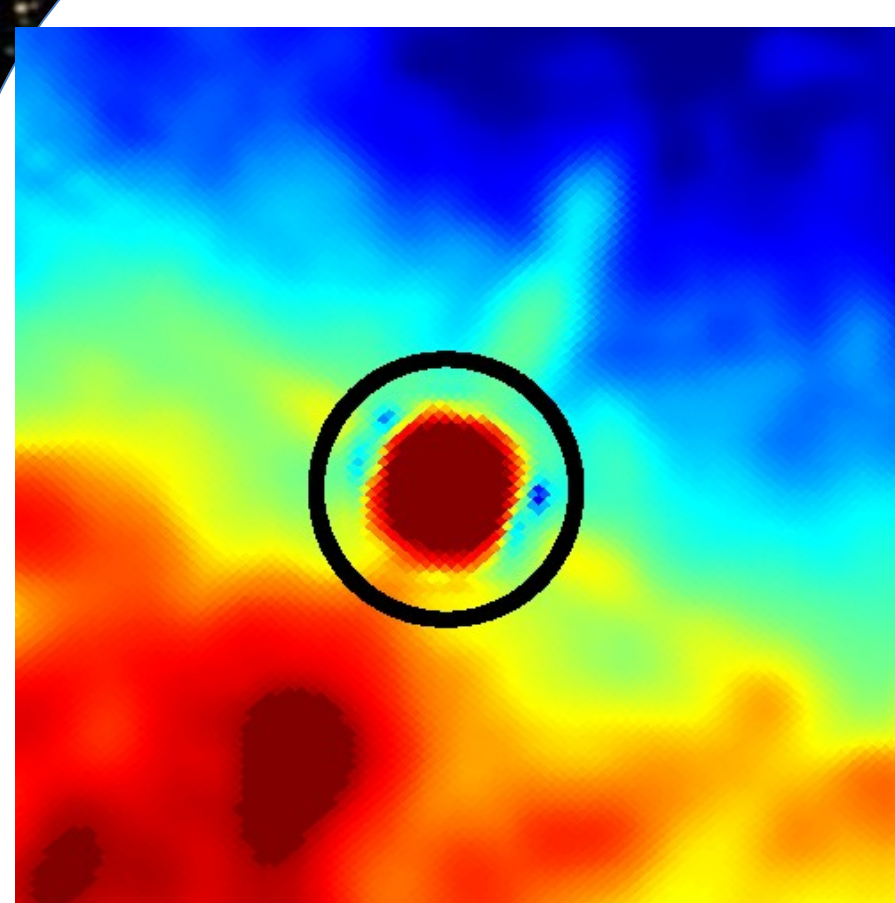


# An improved source-subtracted and destriped 408 MHz all-sky map<sup>1</sup>

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

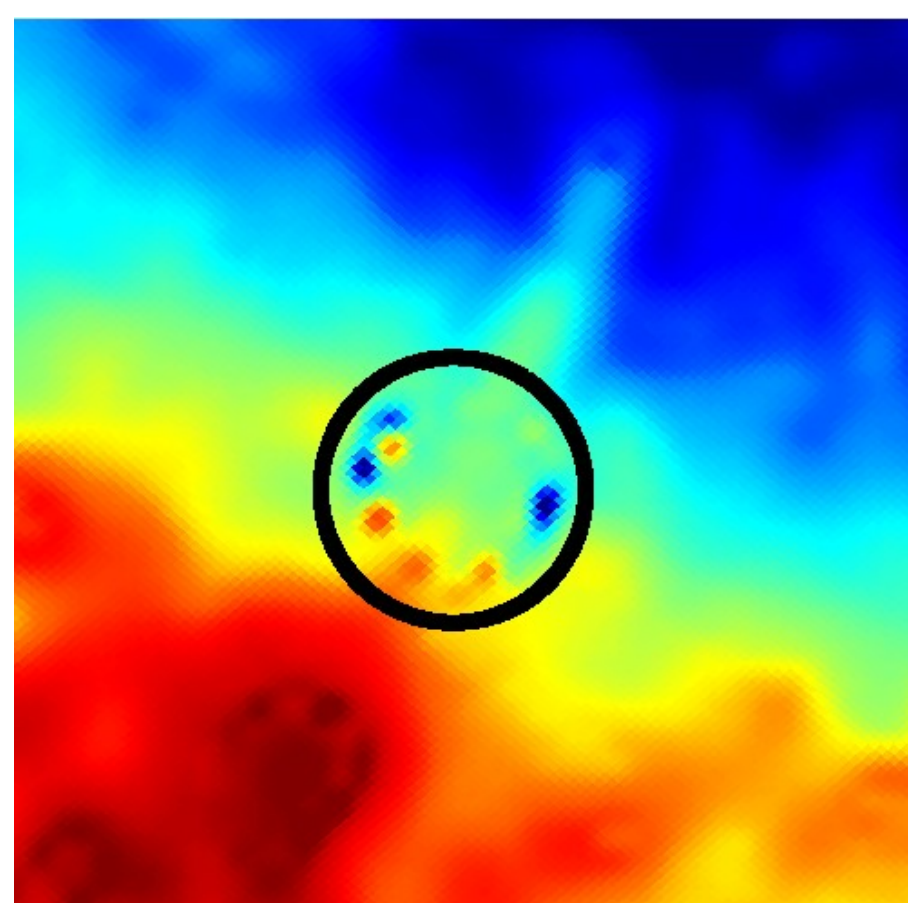
The all-sky 408 MHz map of Haslam et al.<sup>2</sup> is one the most important total-power radio surveys. It has been widely used to study **diffuse synchrotron radiation** from our Galaxy and as a template to remove **foregrounds in cosmic microwave background data**.<sup>3</sup> Synchrotron radiation is also expected to be the **major foreground for upcoming 21 cm intensity mapping experiments**.<sup>4</sup> 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.<sup>1</sup>

Haslam 1982



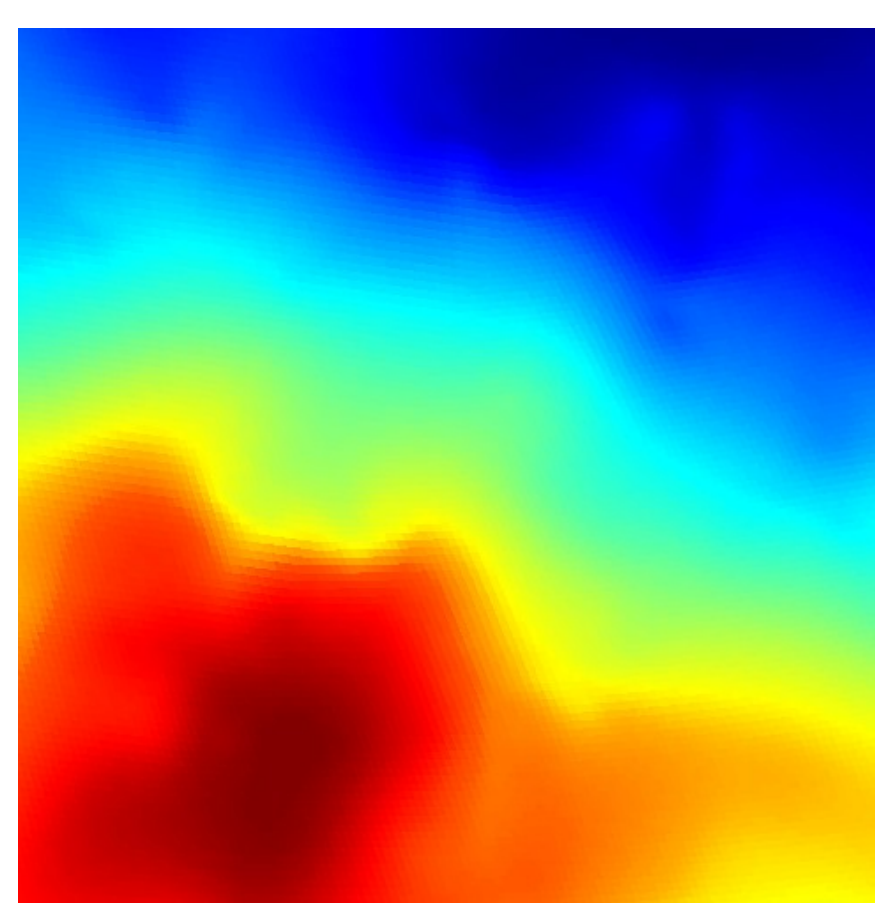
*Haslam et al., 1982*  
Strong extragalactic radio sources in the raw data.

Haslam 2003



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

Haslam 2014



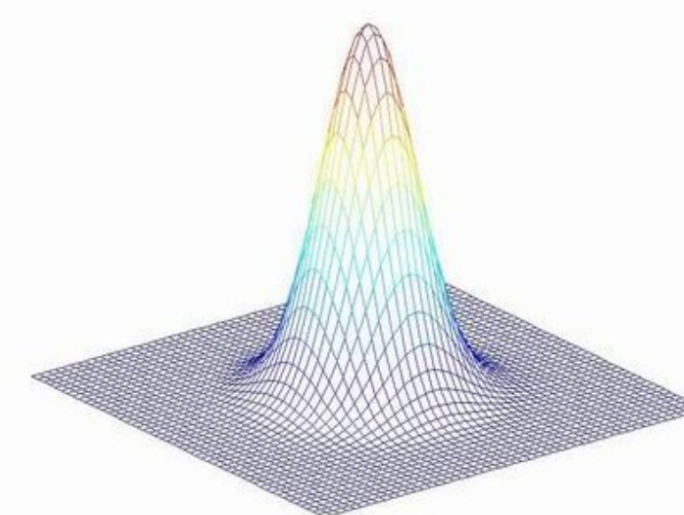
*Remazeilles et al., 2014*  
New synchrotron template at 408 MHz.

2014 re-processed Haslam map<sup>1</sup>

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

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

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

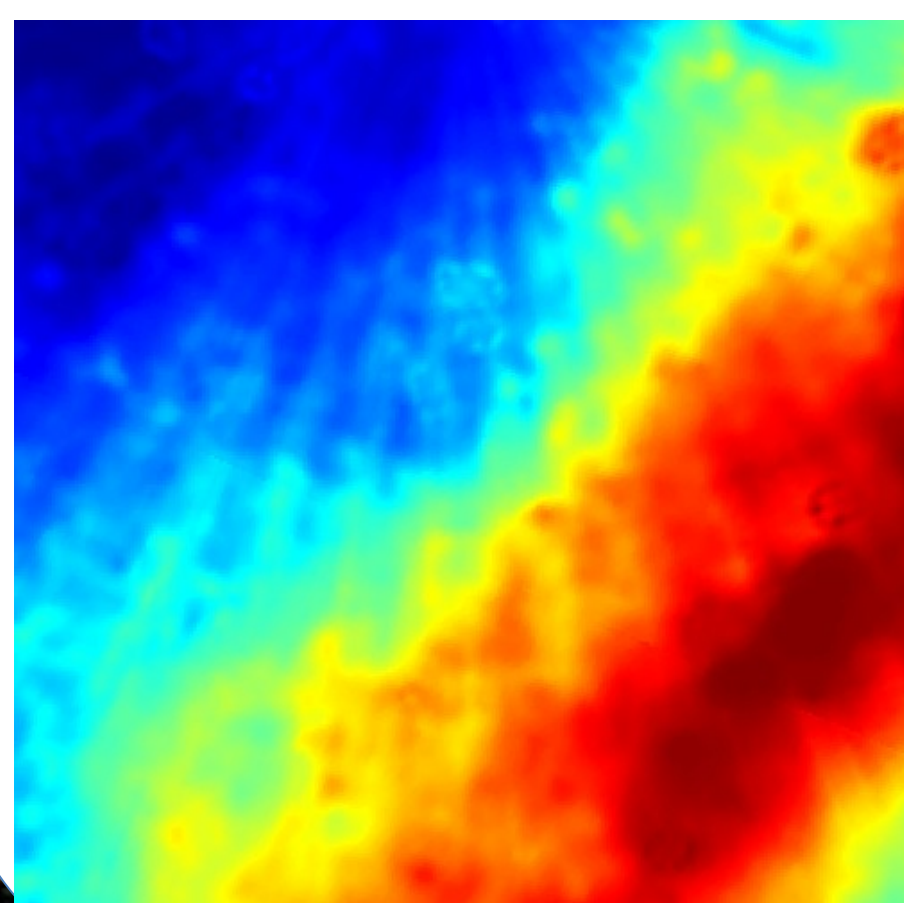
minimizes

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

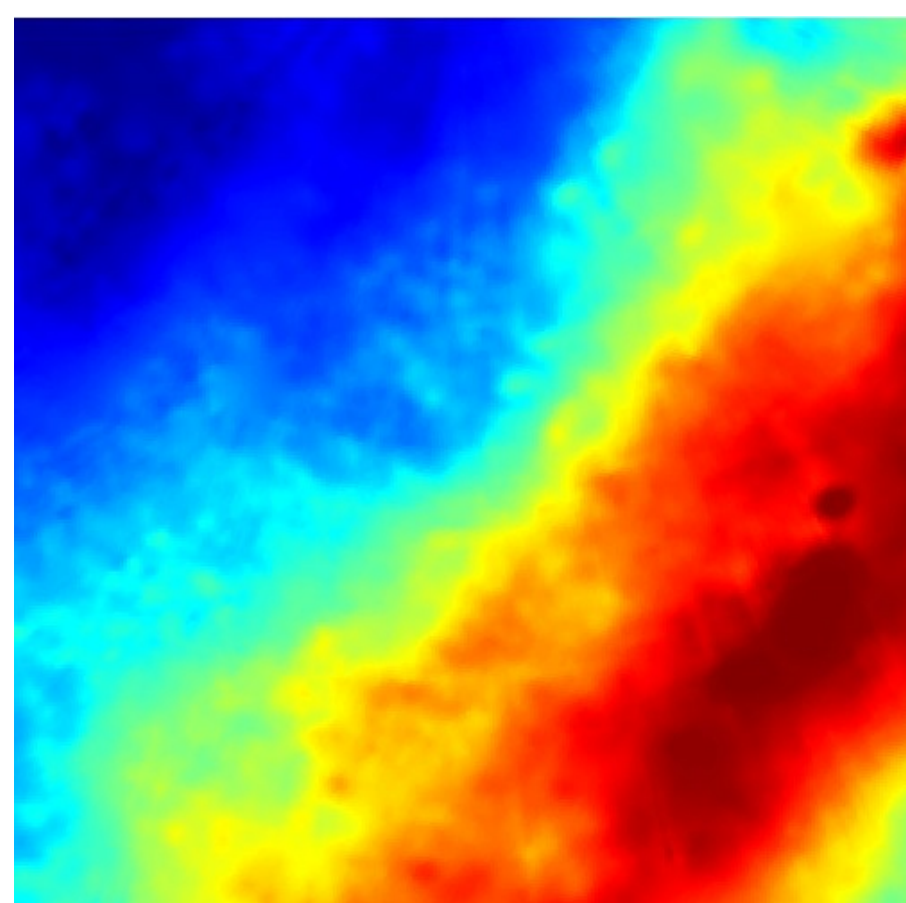
**desourcing**

## 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](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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