Comments on Cylinder simulation and map making paper

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***A**stronomy and*
***A**strophysics*

A simulation of calibration and map-making errors of the Tianlai cylinder pathfinder array

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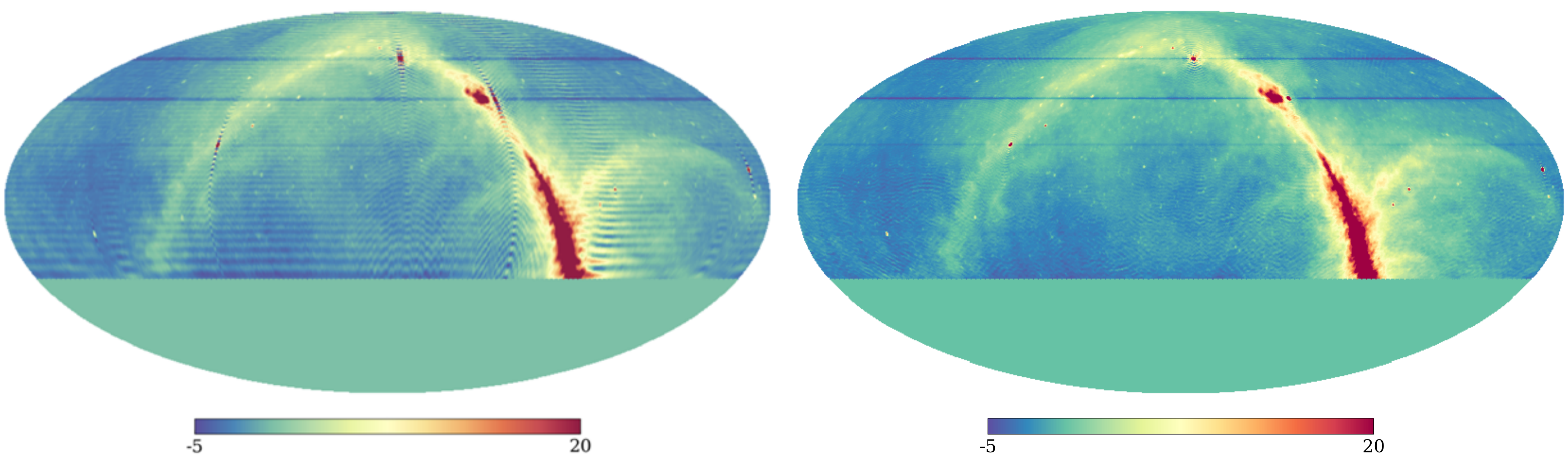


Fig. 11: The reconstructed map with threshold $\epsilon = 10^{-3}$ (Left) and 10^{-5} (Right).

- Use of Moore-Penrose pseudo-inverse generates striping (or wiggles) along the theta direction.

- This is due to sharp cuts along the ell direction in the (l,m) spherical harmonics coefficients plane, introduced by the threshold in eigenvalues when applying the Moore-Penrose

- To overcome (partially) this, additional filter in (l,m) plane where applied in J.Zhang et al. papers (2016)

- Another possible way to reduce this effect is to transform the sharp threshold into a smooth threshold

- It is useful to revisit the 2016 papers : (l,m) filter, R-response matrix and filtering using the error covariance matrix, and compute the corresponding quantities to get a better explanation and understanding of theses effects for this paper

- Note also that the noise covar. Matrix should be taken into account in the Moore-Penrose pseudo-inverse expression.

$$\left[\widehat{\mathcal{I}}(\ell)\right]_m = \mathbf{H}_m \left[\tilde{\mathcal{V}}\right]_m$$

$$\widehat{\mathcal{I}}_m = (\mathbf{L}_m^\dagger \mathbf{N}_m^{-1} \mathbf{L}_m)^{-1} \mathbf{L}_m^\dagger \mathbf{N}_m^{-1} \mathcal{V}_m \equiv \mathbf{H}_m \, \mathcal{V}_m$$
$$\mathbf{H}_m = (\mathbf{L}_m^\dagger \mathbf{N}_m^{-1} \mathbf{L}_m)^{-1} \mathbf{L}_m^\dagger \mathbf{N}_m^{-1}$$

Diagonal noise matrix

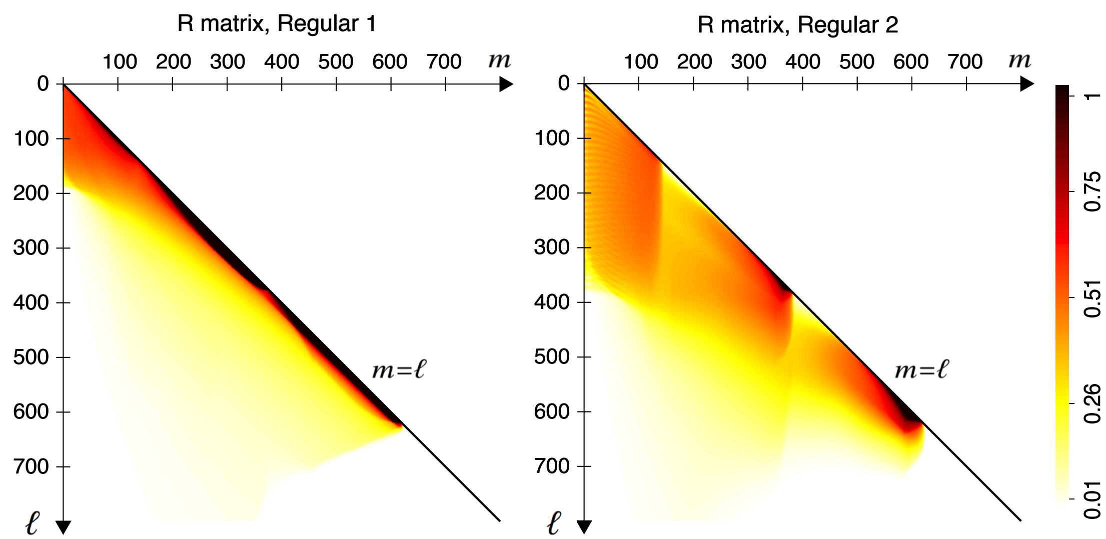
$$\mathbf{H}_m = \left(\mathbf{N}_m^{-\frac{1}{2}} \, \mathbf{L}_m \right)^{-1} \mathbf{N}_m^{-\frac{1}{2}}$$

Response matrix

$$\mathbf{R}_m \equiv (\mathbf{H}_m \mathbf{L}_m)$$

Compressed Response matrix

$$\mathbf{R}(\ell, m) = \mathbf{R}_m(\ell, \ell)$$



From J. Zhang PhD dissertation

Figure 4.4.3: Comparison of the R matrix for regular 1(left) and regular2 (right) configurations.

Notice the limited ell range at low m
This is where the pseudo-inverse threshold has the largest impact, hence the striping

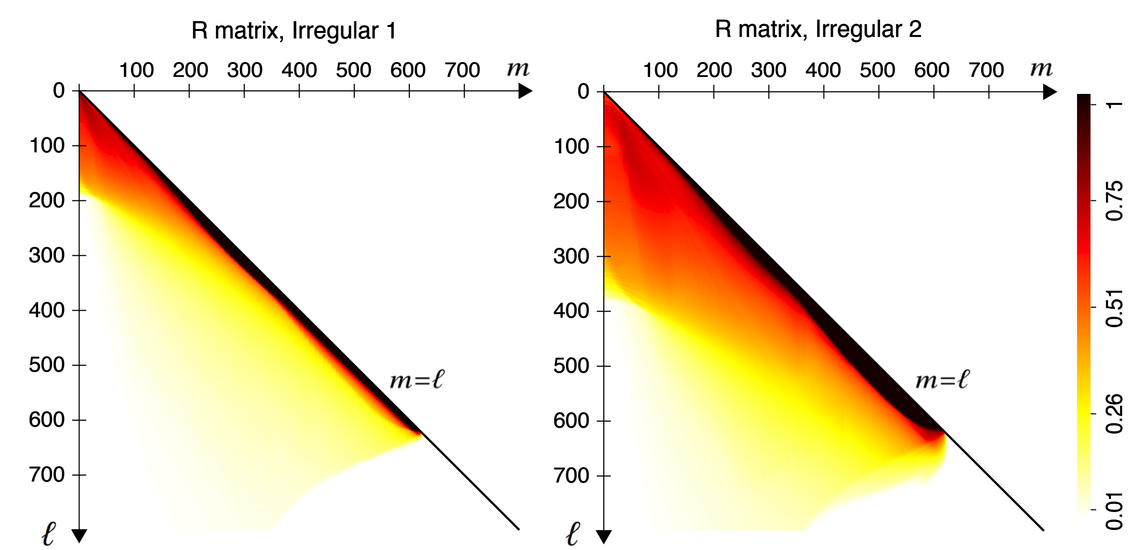


Figure 4.5.2: Comparison of the R matrix for the Irregular 1 (left) and Irregular2 (right) configurations.