Comparison of generative models

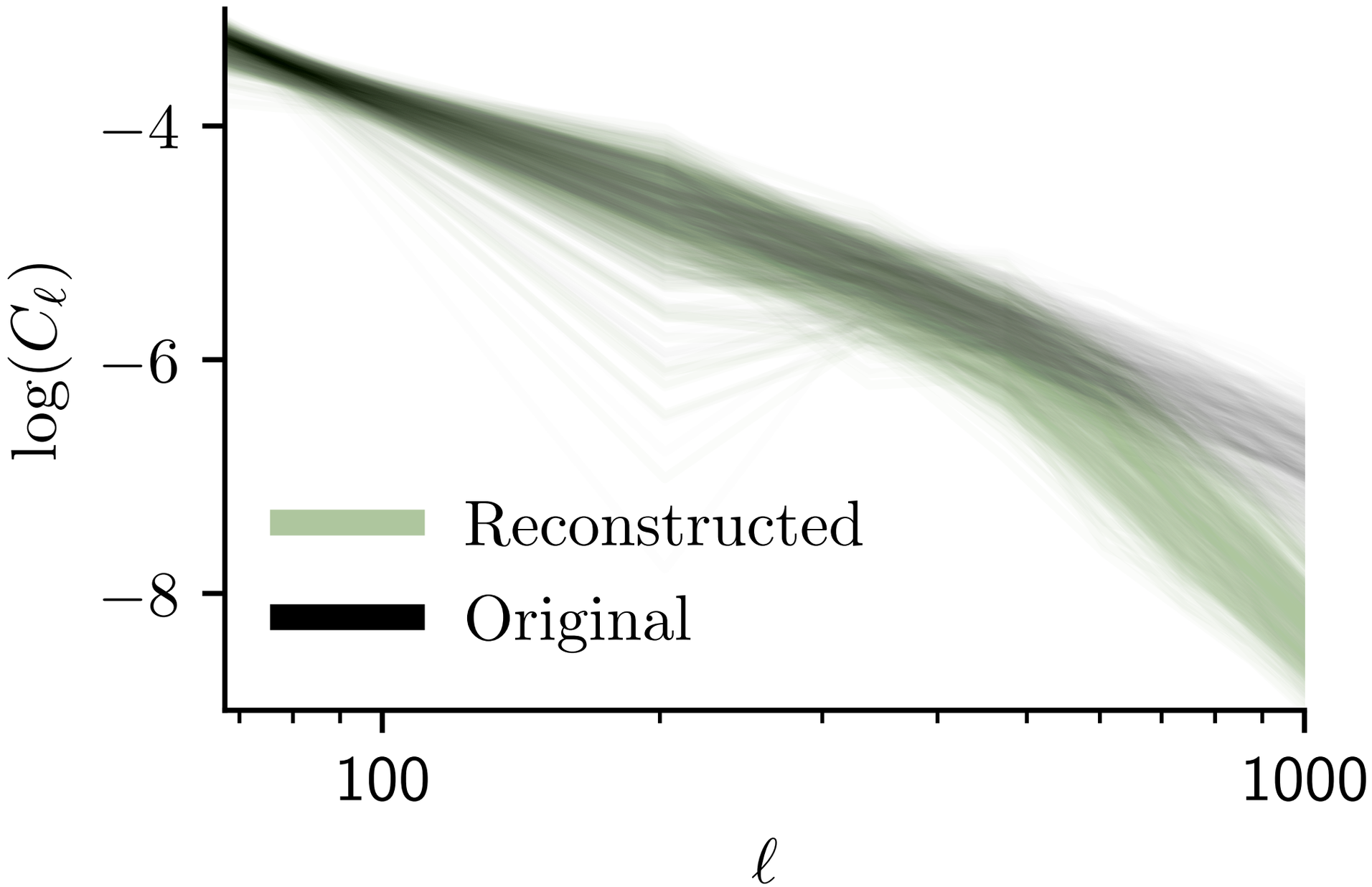
	Variational Autoencoders	GANs	Normalizing Flows
Bayesian Inference	✓	✗	✓
Stable Training	✓	✗	✓
Competitive Resolution	✗	✓	✓
Tractable in High Dimensions	✓	✓	✗

Reconstructions

Preliminary results using MHD Simulations

Summary Statistics

Computed on test set of 339 images.



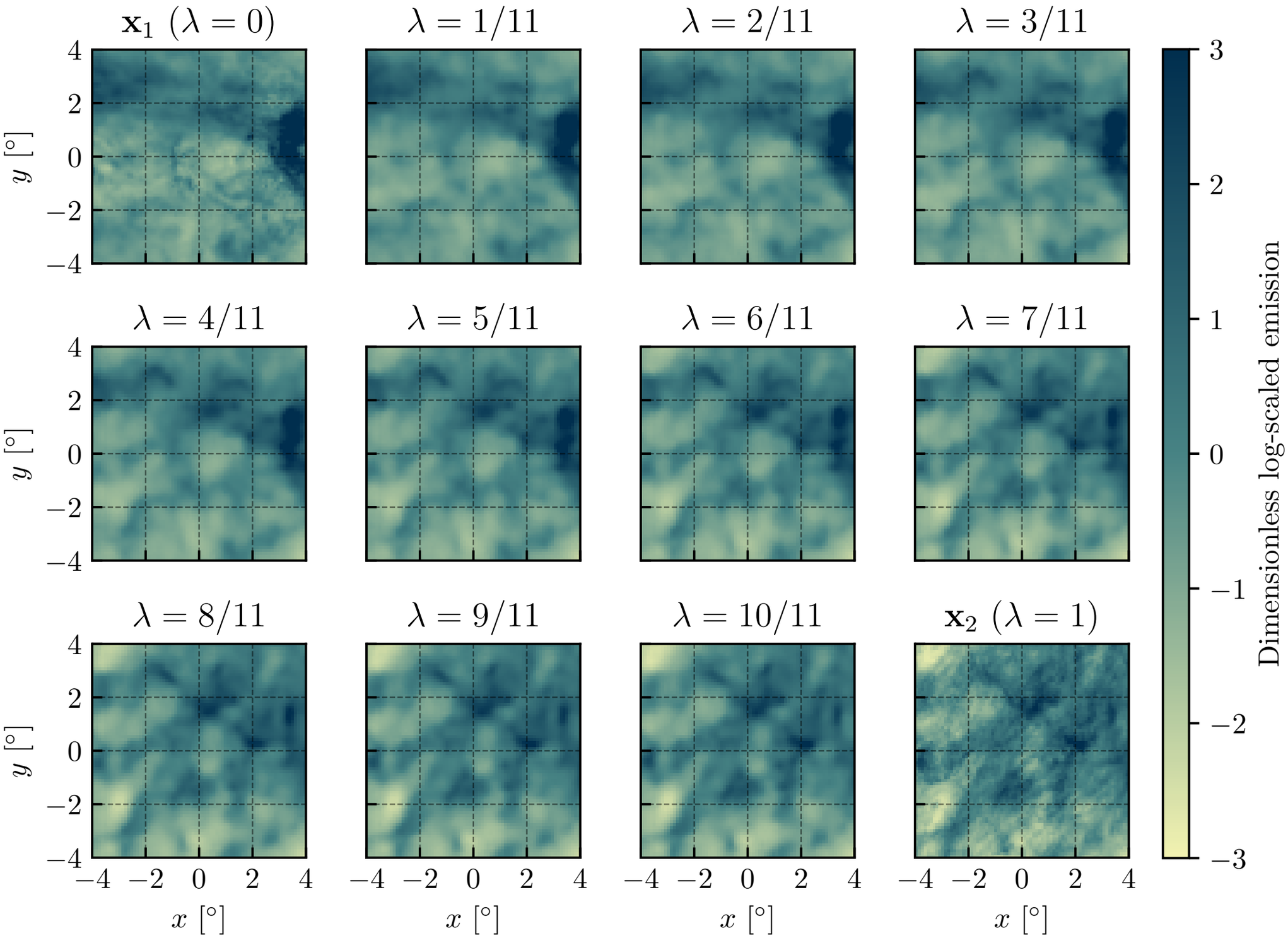
Reconstructed power spectra, compared to original image power spectra.

Semantic Interpolation

Testing the smoothness of the latent space

$$\mathbf{z}_{1,2}(\lambda) = \frac{\sin((1-\lambda)\theta)}{\sin\theta}\mathbf{z}_1 + \frac{\sin(\lambda\theta)}{\sin\theta}\mathbf{z}_2$$

Semantic interpolation



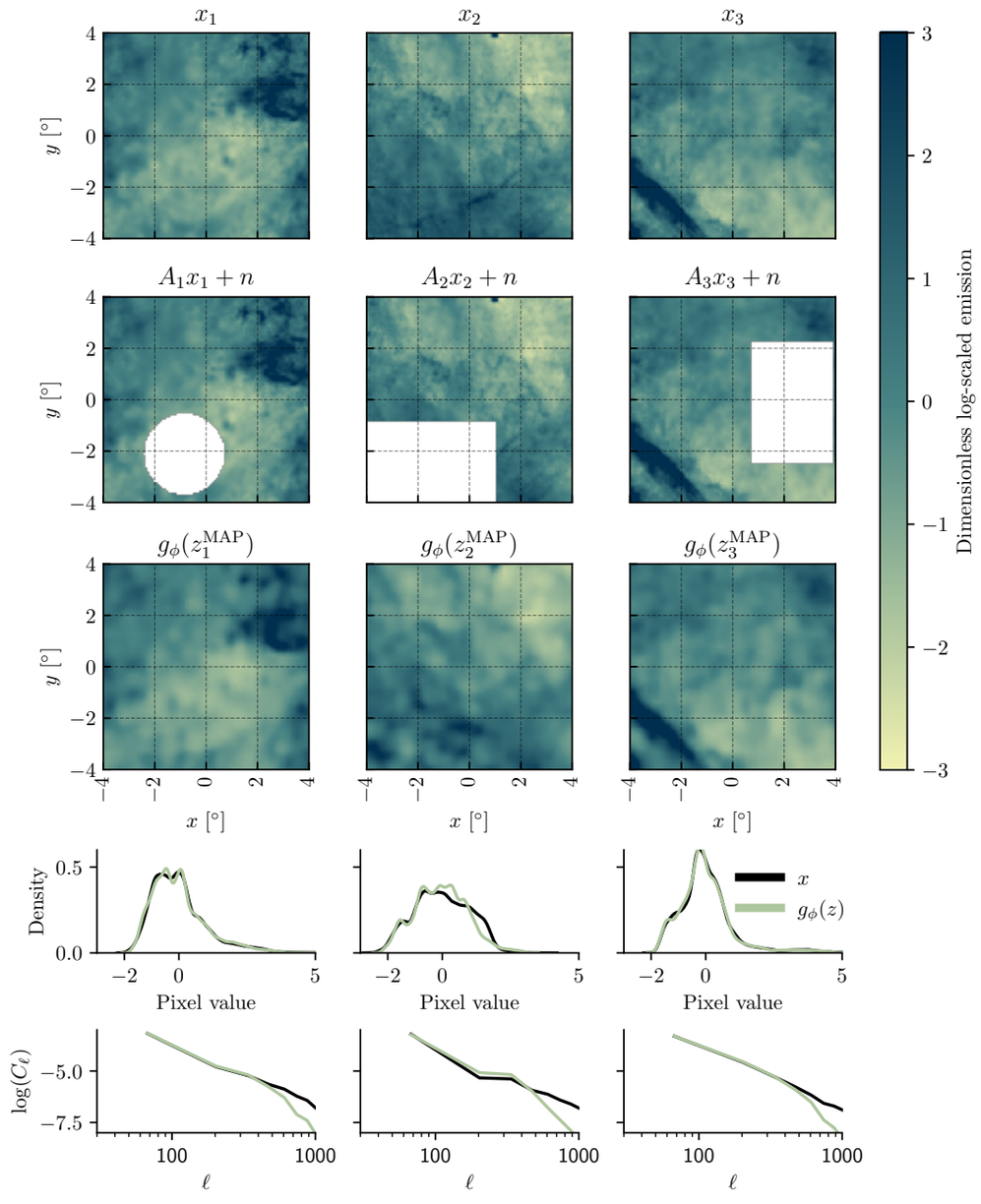
Data Imputation

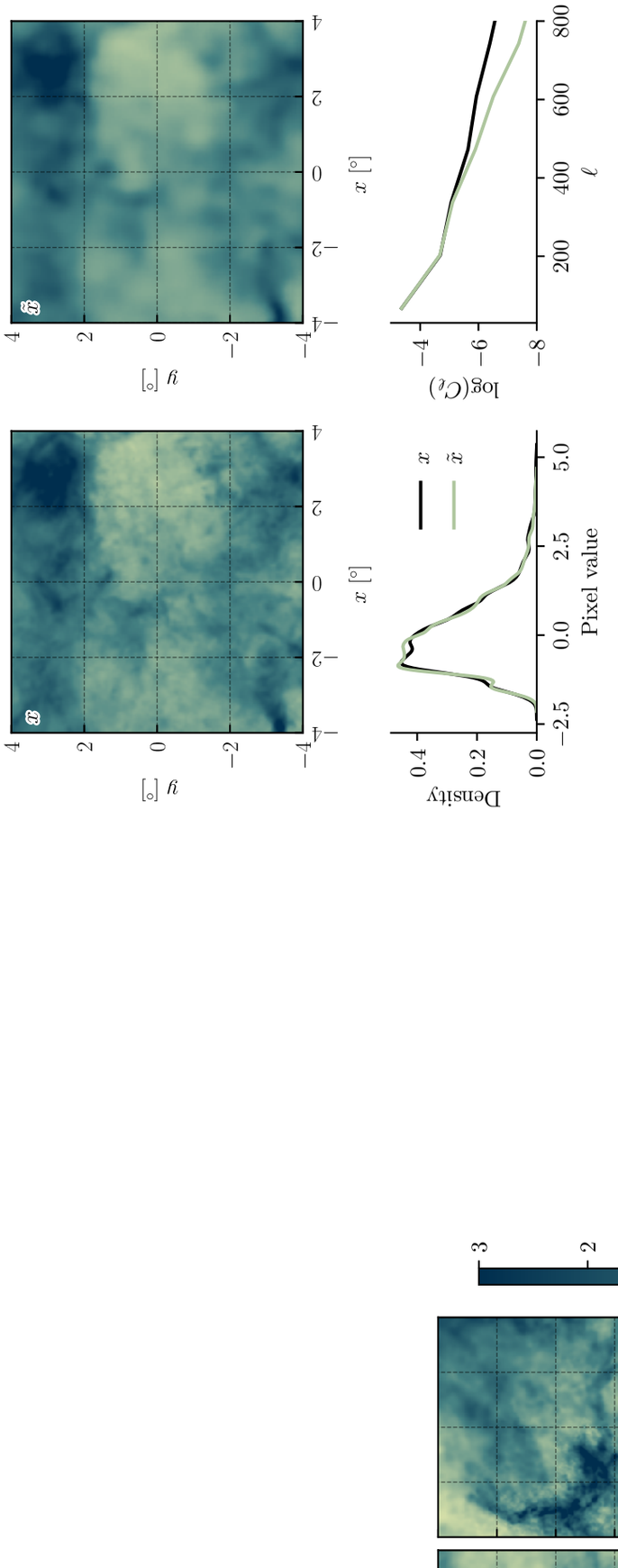
- The statistical model $q_\phi(z \mid x)$ allows us to perform Bayesian inference tasks. A toy model is:

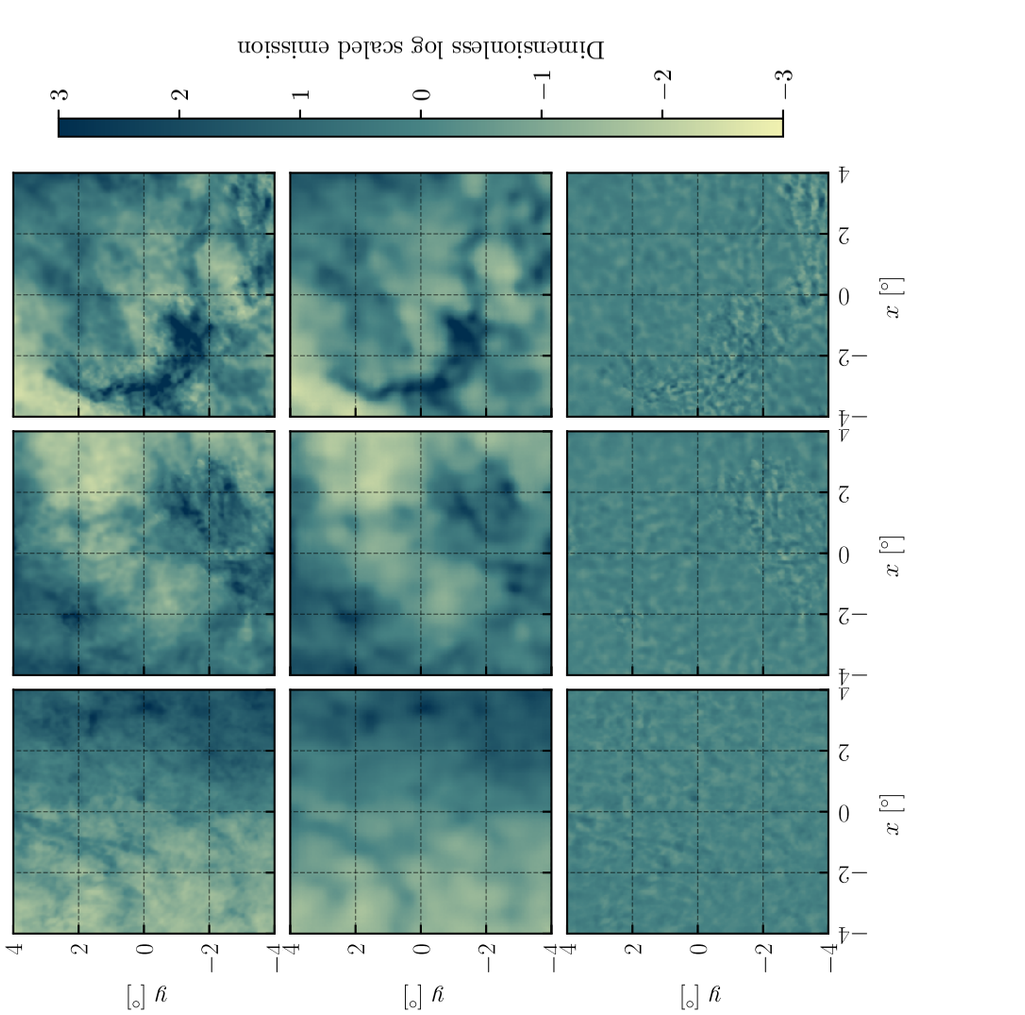
$$\log p(\mathbf{z} \mid \mathbf{d}) = \log p(\mathbf{z}) + \log p_\theta(\mathbf{d} \mid \mathbf{z}) - \log p(\mathbf{d})$$

$$-2 \log p(\mathbf{z} \mid \mathbf{d}_{\text{test}}) \propto \mathbf{z}^T \mathbf{z} + \frac{\mu_\theta(\mathbf{z})^T \mu_\theta(\mathbf{z})}{\sigma^2}$$

Data Imputation




a
b
y [°]
x [°]
Density
Pixel value
x
$\tilde{x}$
$\log(C_\ell)$
ℓ


y [°]
x [°]
Dimensionless log scaled emission