

Deep Learning surrogate models to accelerate on the fly Radiative Transfer in simulation

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In collaboration with Rune Rost and Tobias Buck.**

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Radiative transfer in astrophysical simulations

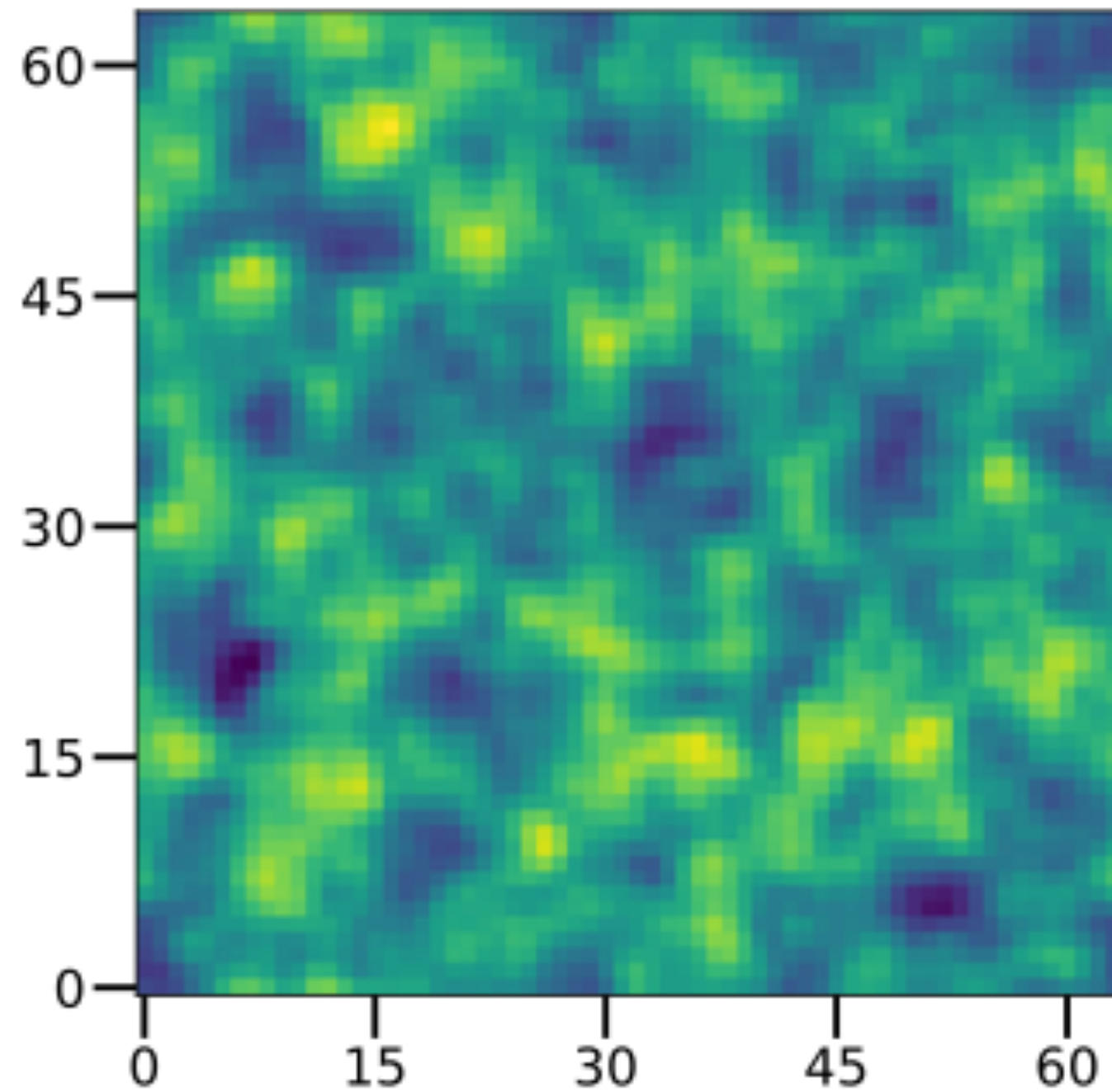
$$\frac{1}{c} \frac{\partial I_\nu}{\partial t} + \omega \nabla I_\nu + (k_{s,\nu} + k_{a,\nu}) \rho I_\nu = j_\nu \rho + \frac{k_{s,\nu} \rho}{4\pi} \int_{\mathcal{S}} I_\nu d\omega,$$

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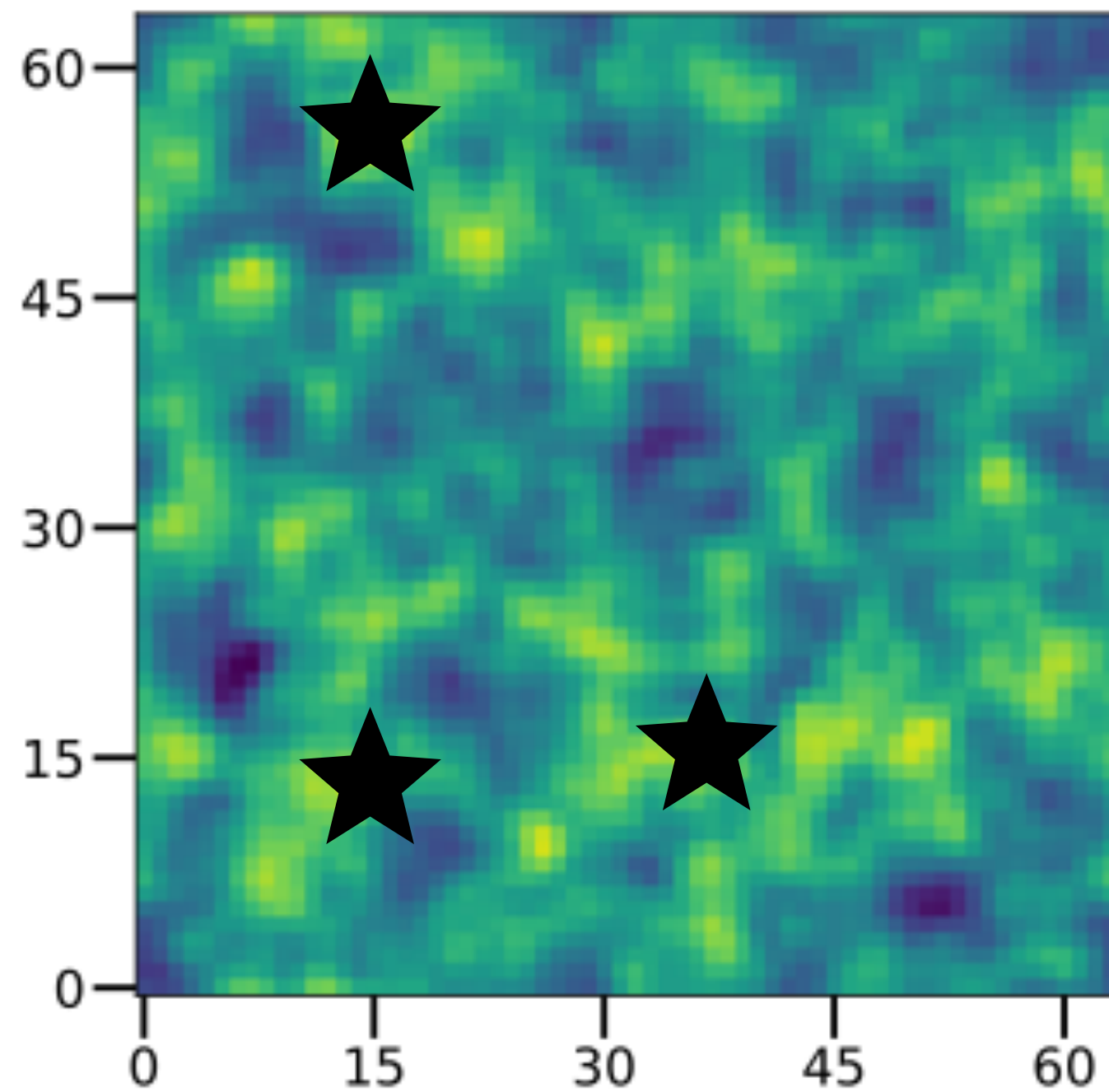
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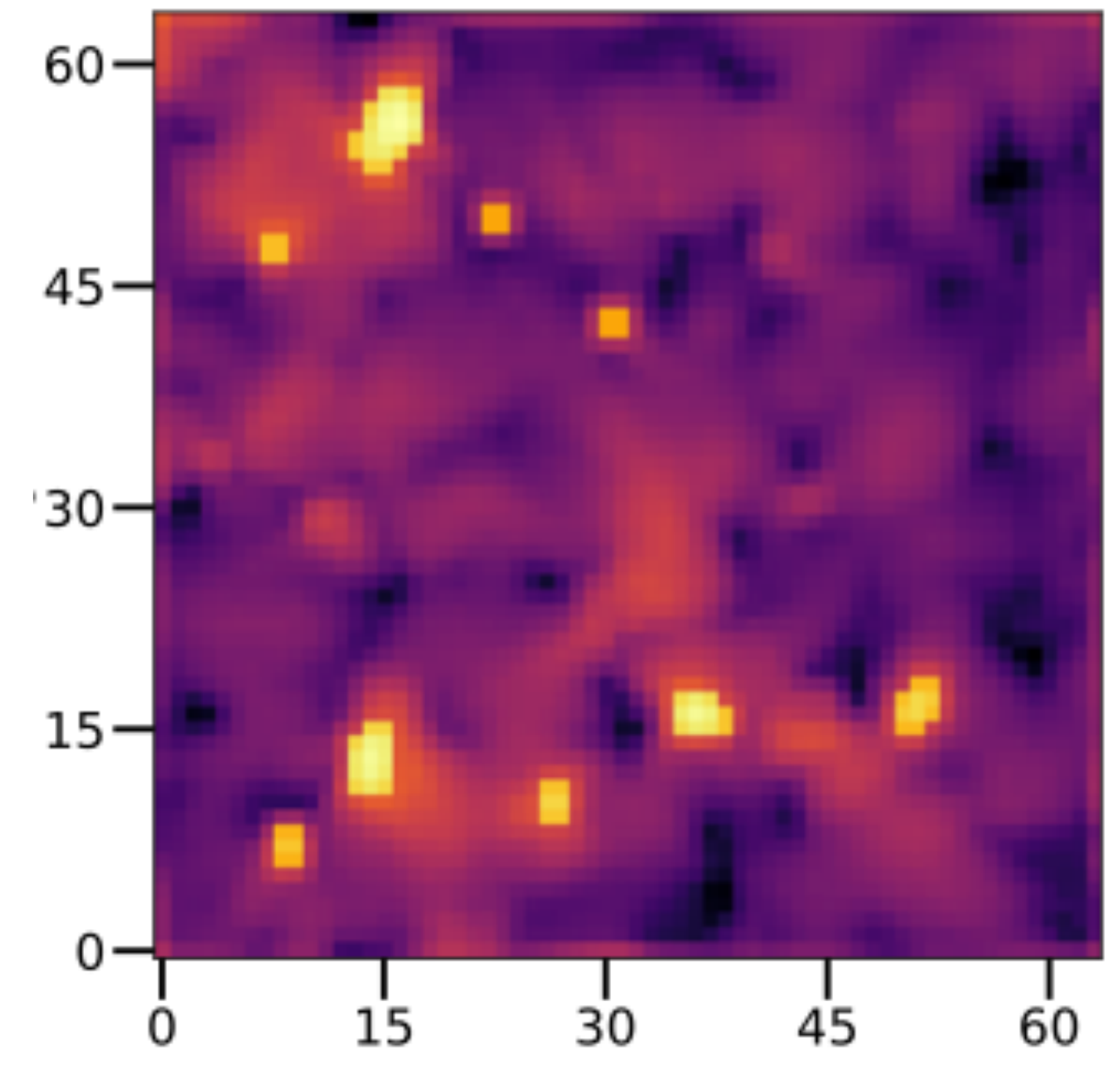
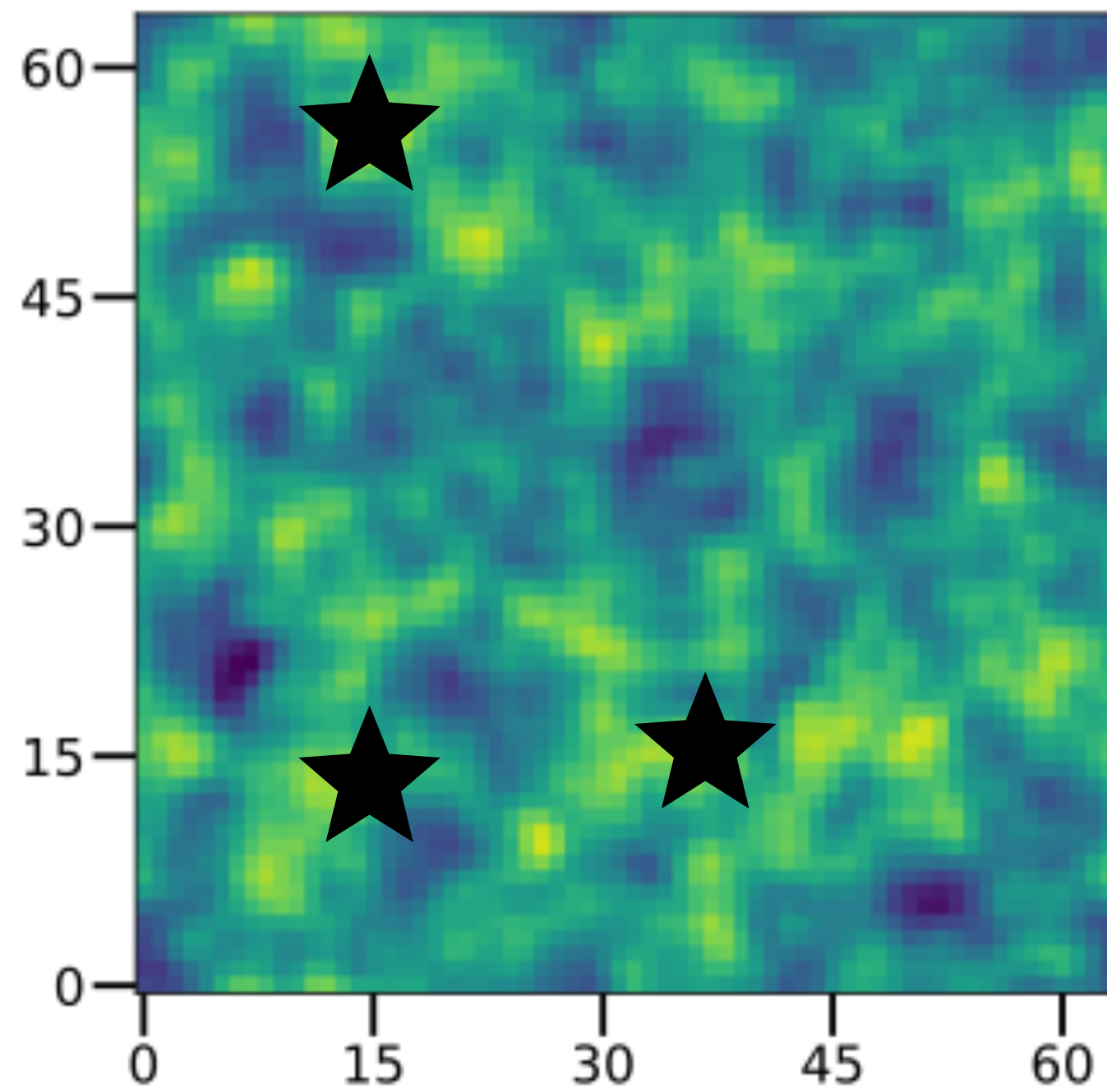
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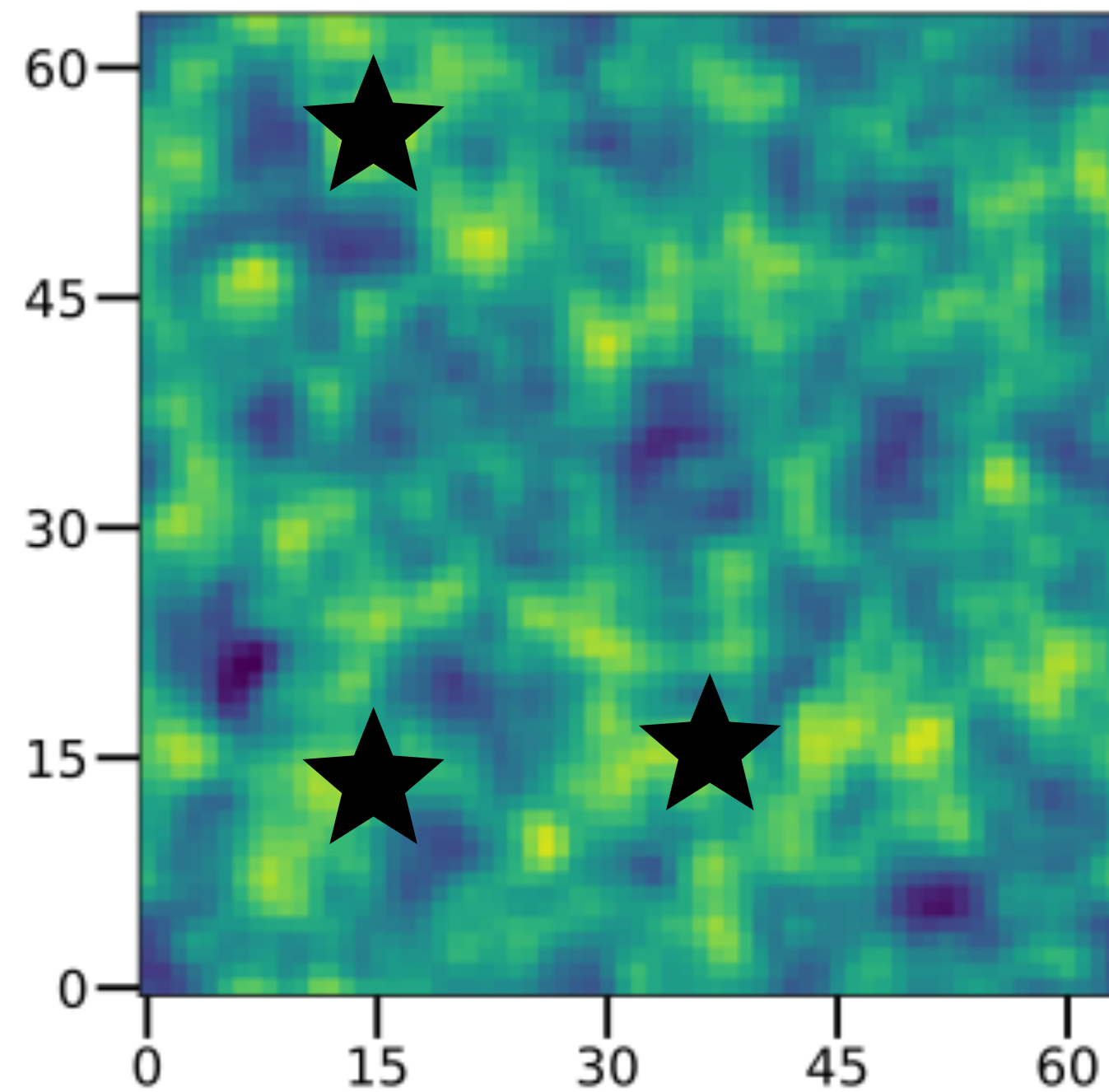
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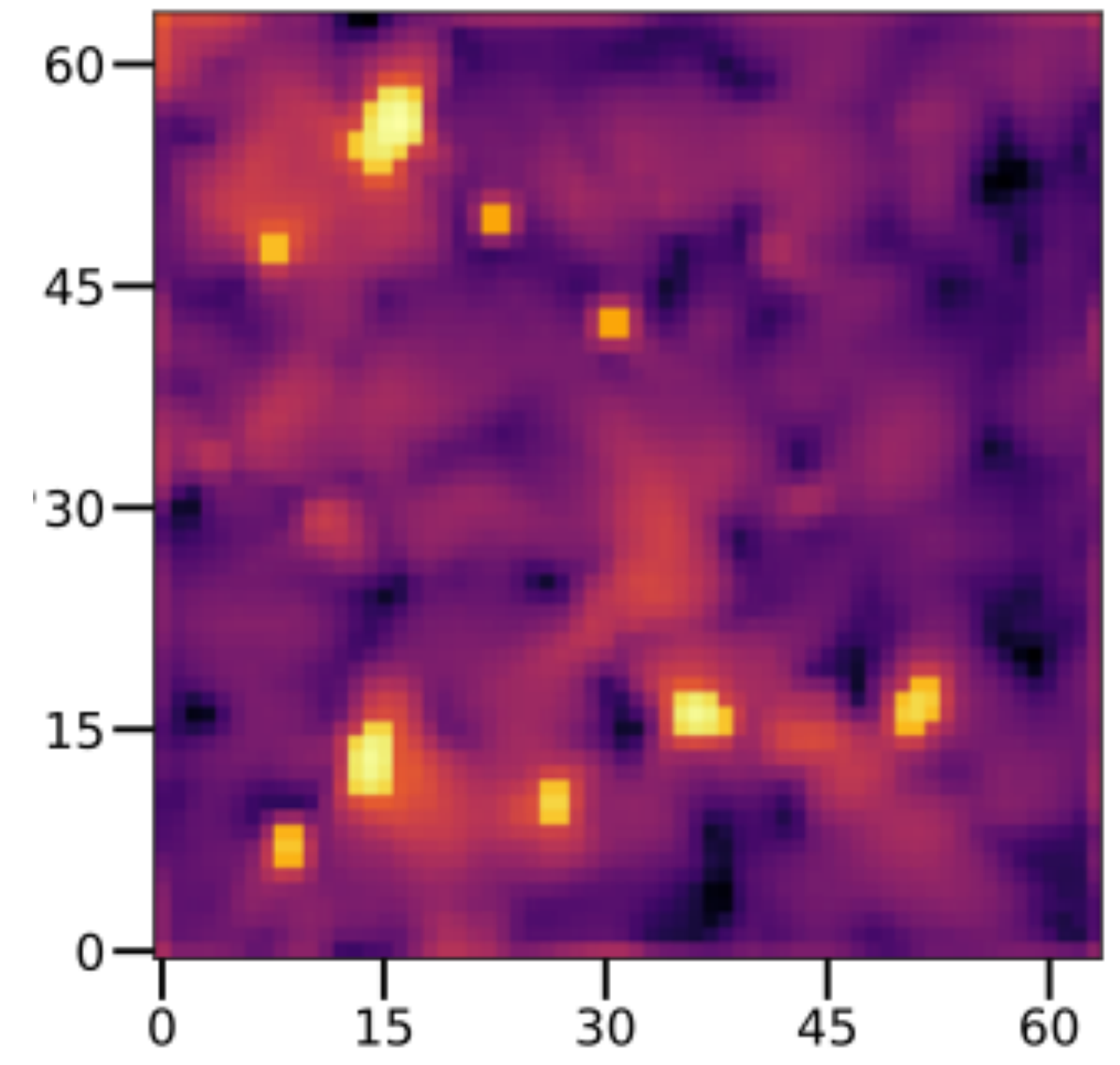
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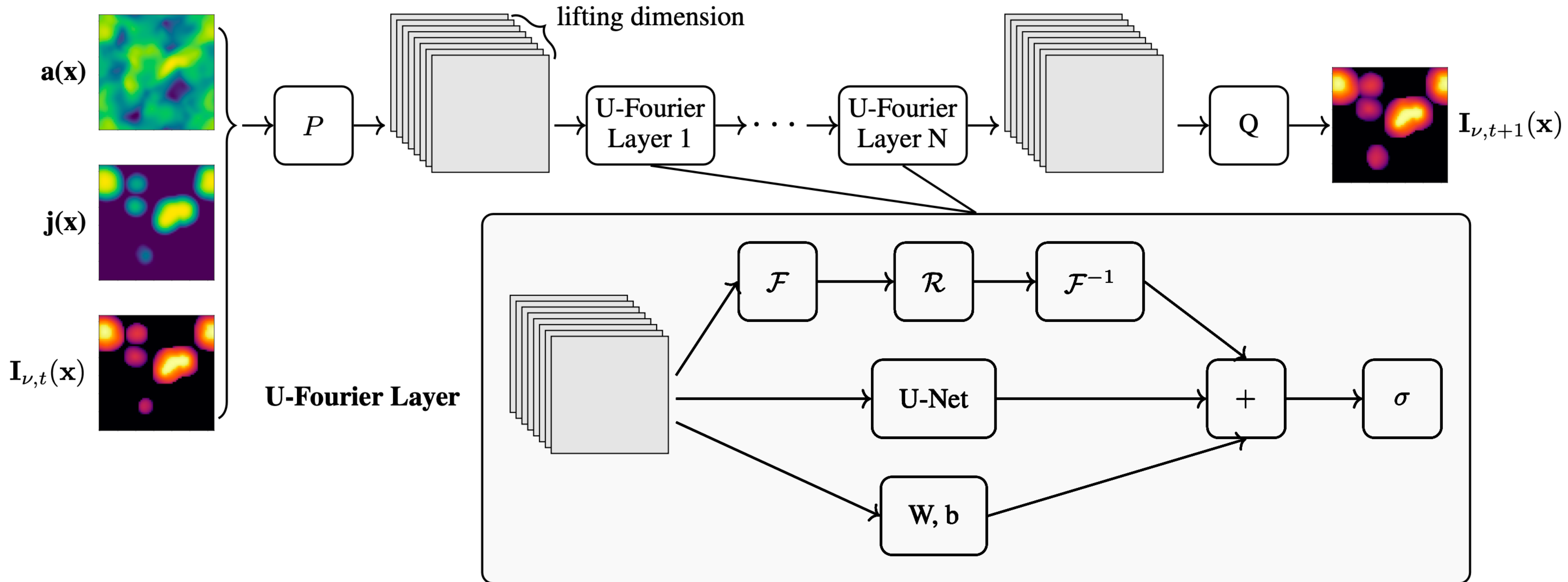
Problem:

Very slow wrt Hydro

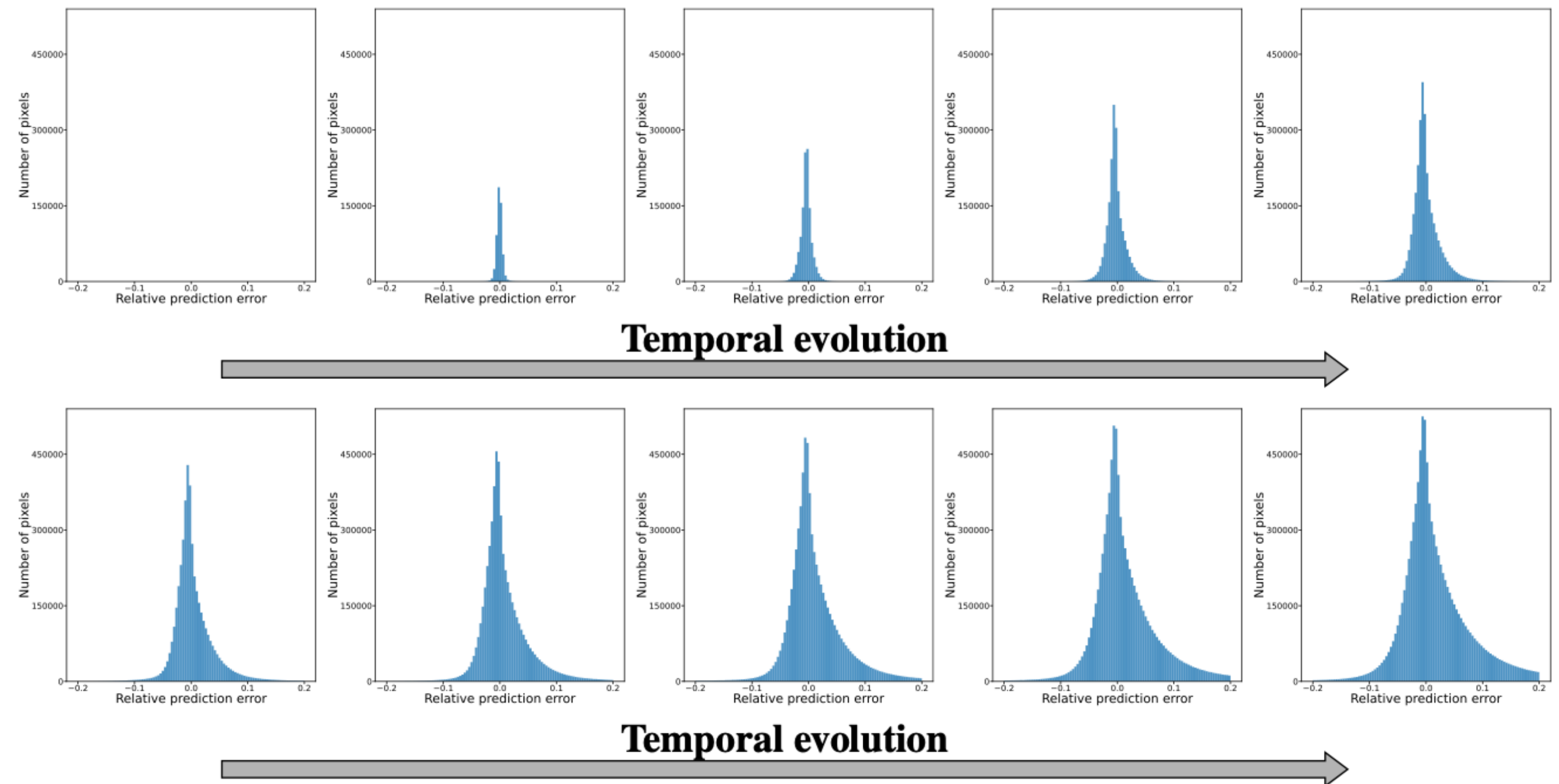
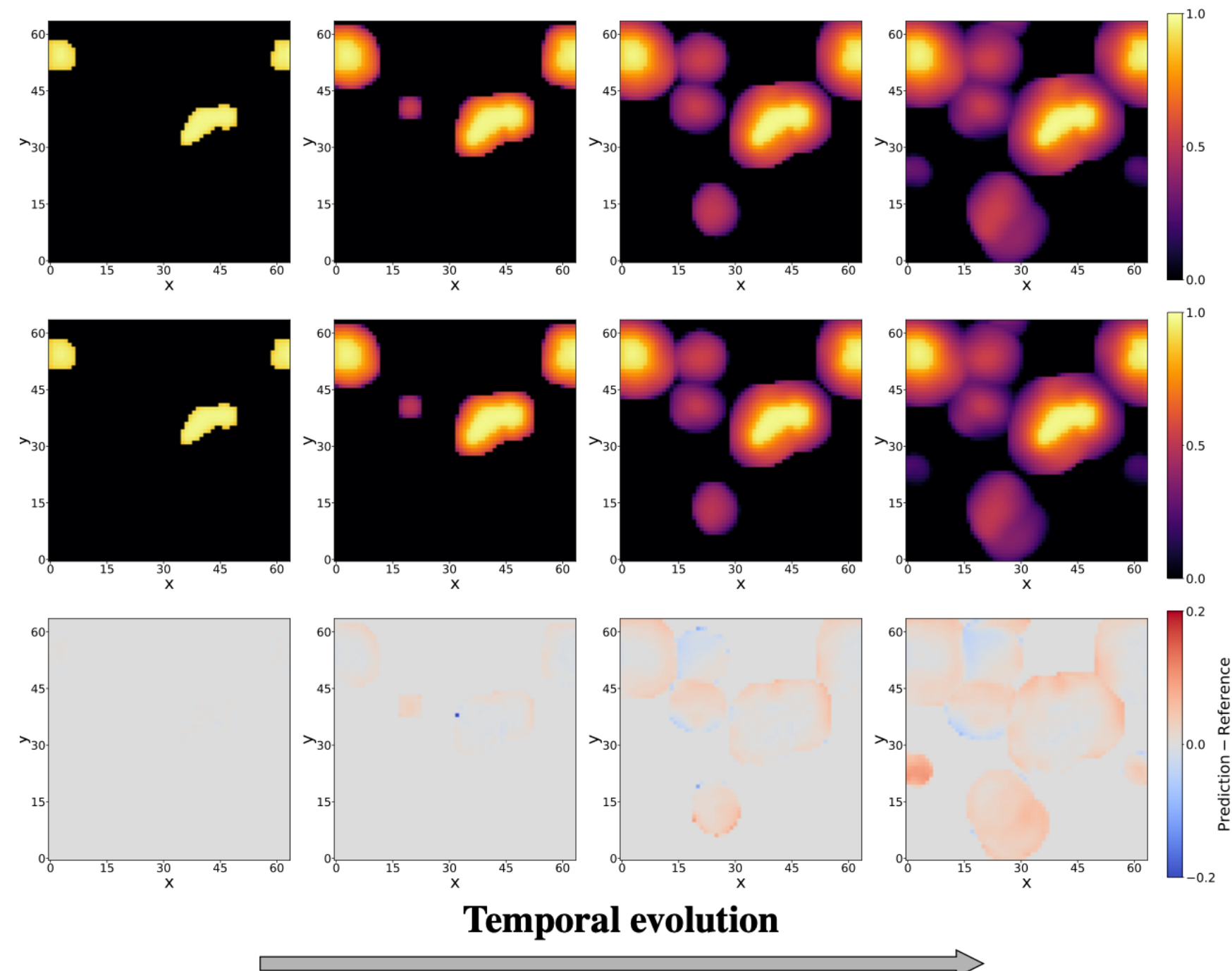


Surrogate Model

Roost, Branca, Buck; 2025



Results



Steady-State Model	~6,750x	2.6%
Recurrent Model	~600x	2.9%

<https://github.com/RuneRost/Astro-RT/tree/main>