

Perceptually Constrained Precipitation Nowcasting Model

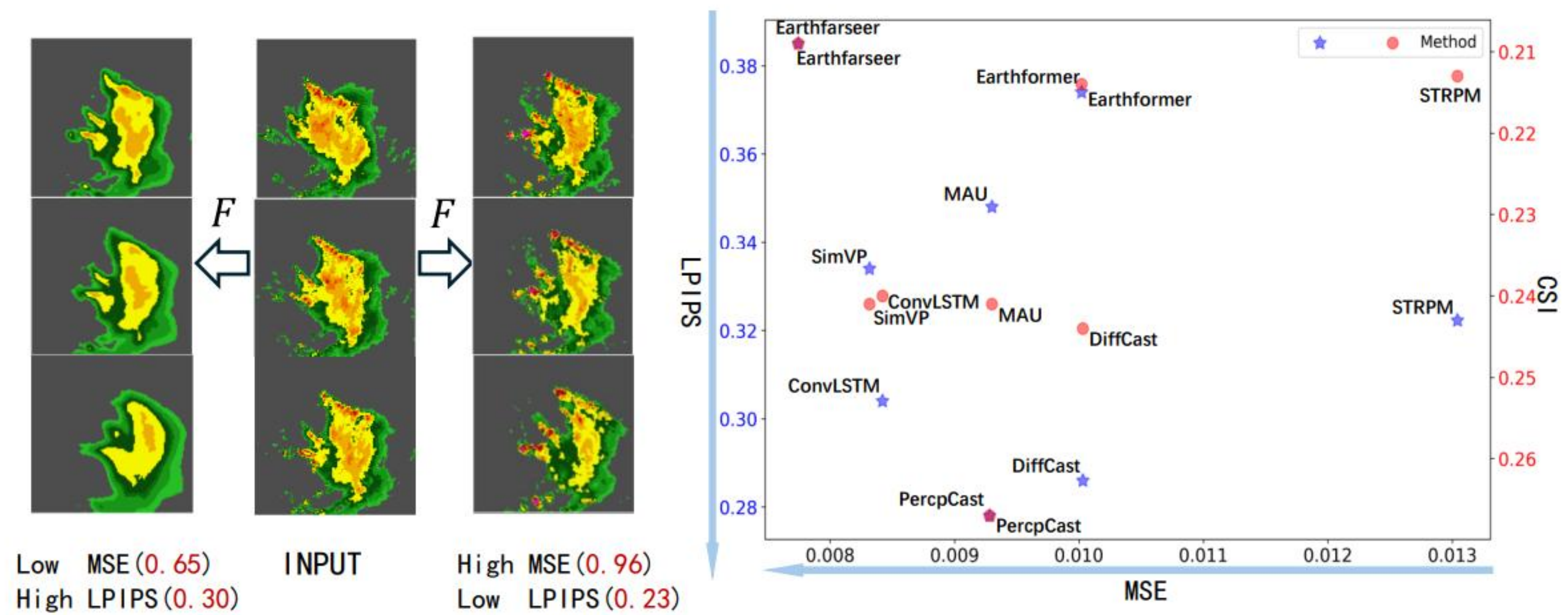
ICML 2025

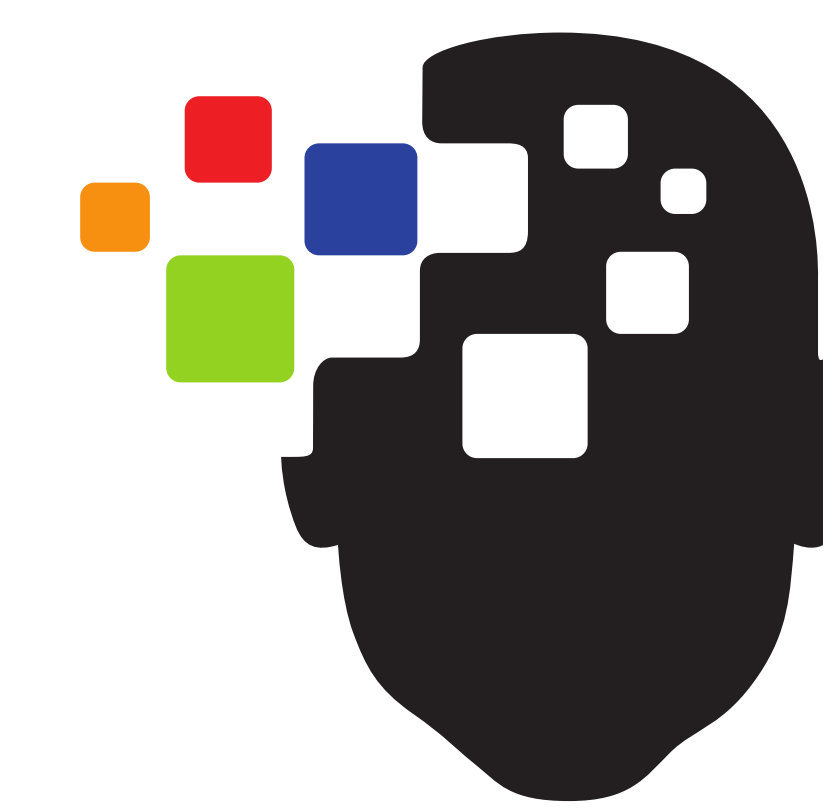
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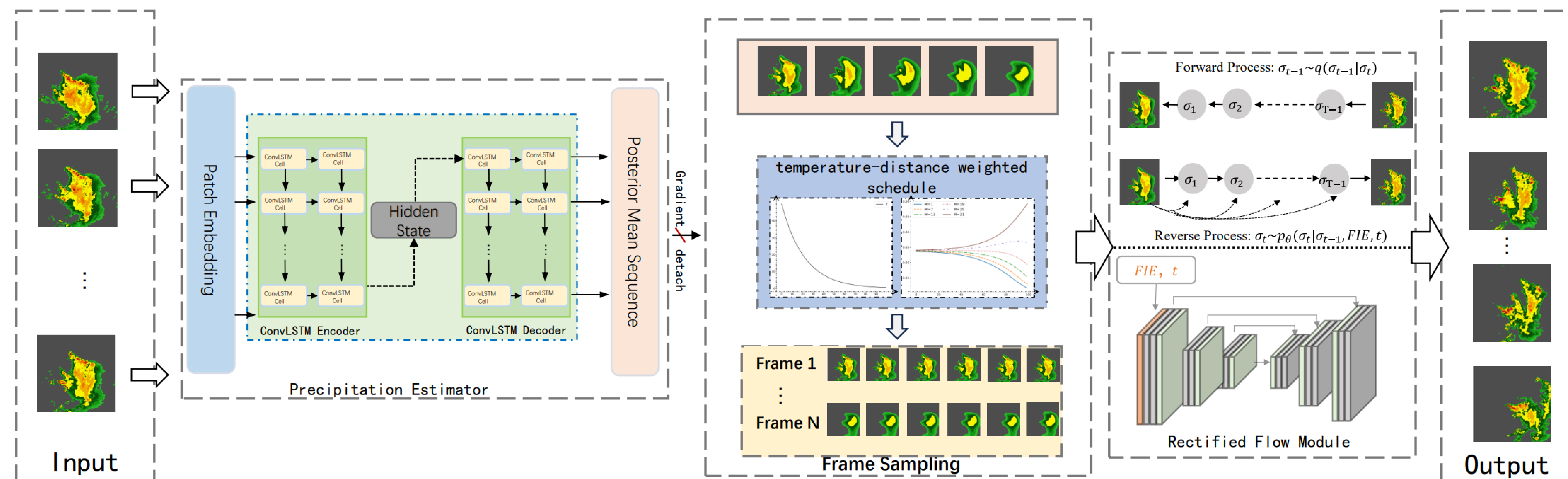


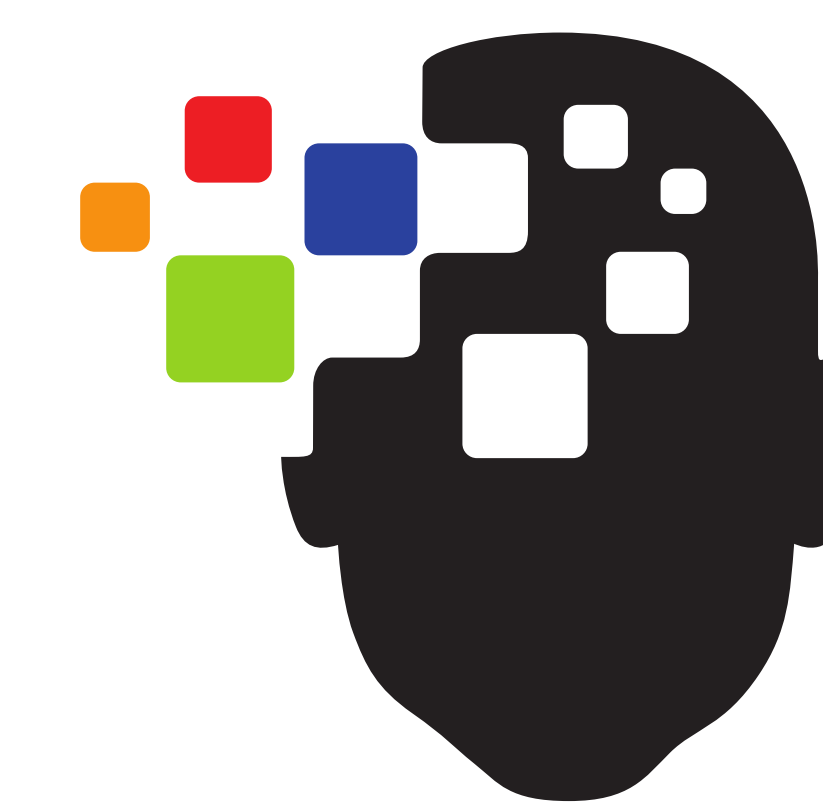
Motivation





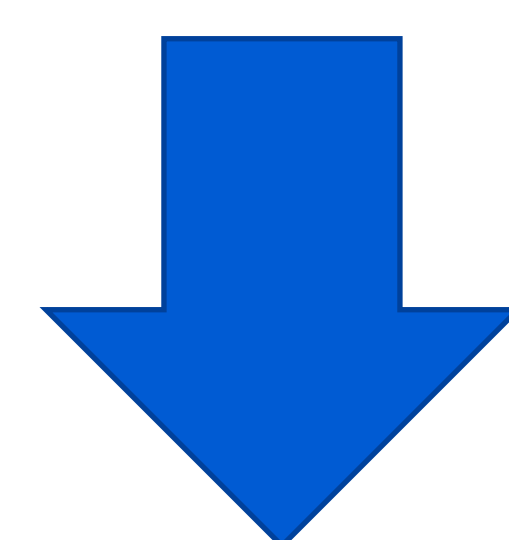
Method





Method

$$\min_{p_{\hat{Y}|X}} \mathbb{E}[\|Y - \hat{Y}\|^2] \quad \text{s.t.} \quad p_{\hat{Y}} = p_Y \quad \text{Eq: 1}$$



$$\mathbb{E}[\|Y - \hat{Y}^*\|^2] + \mathbb{E}\left[\int_0^1 \|(Y - Z_0) - v_\theta(Z_t, t)\|^2 dt\right] \quad \text{Eq: 2}$$

Experiments

Table1:Quantitative evaluation of state-of-the-art spatiotemporal prediction algorithms on Sevir and MeteoNet benchmarks

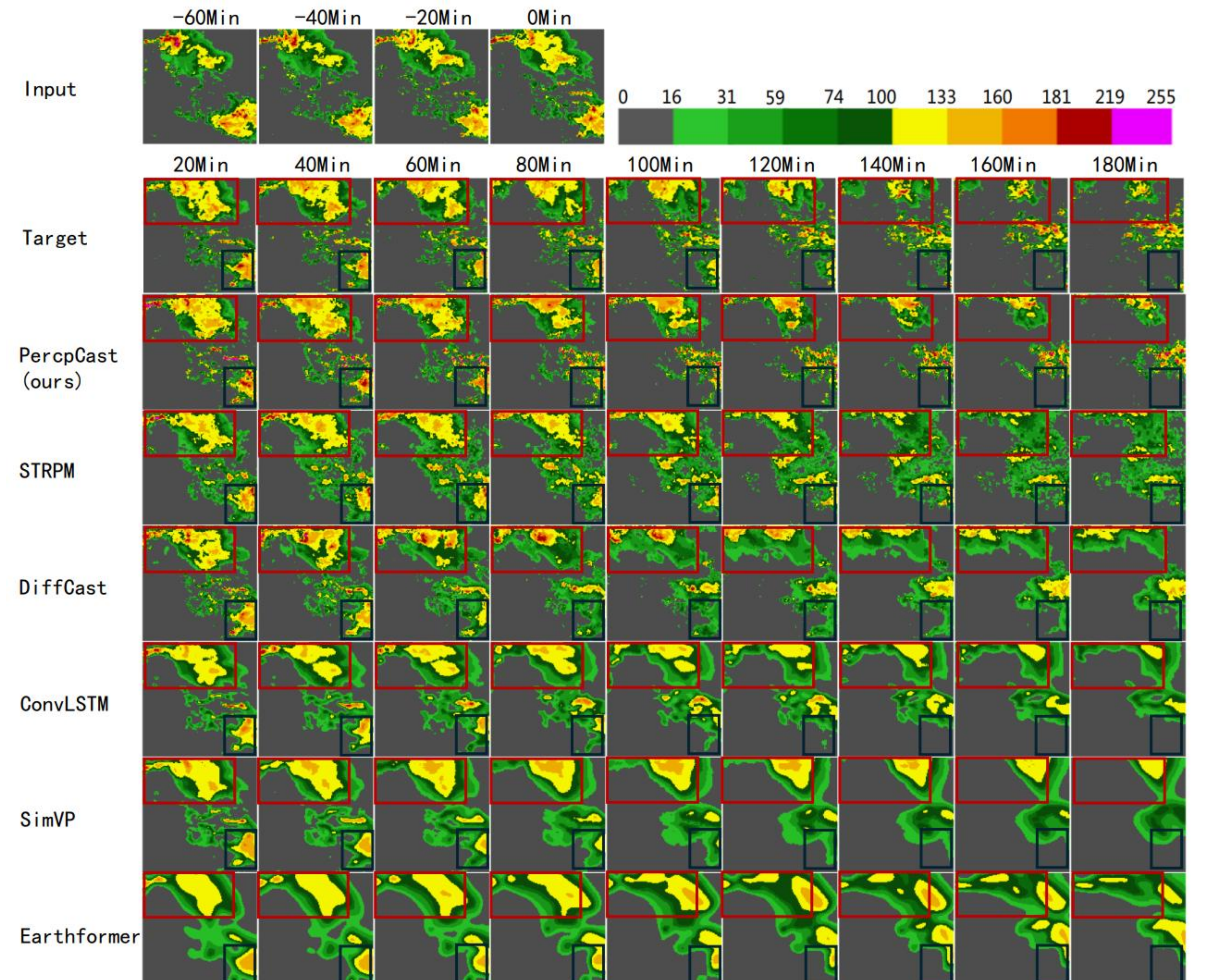
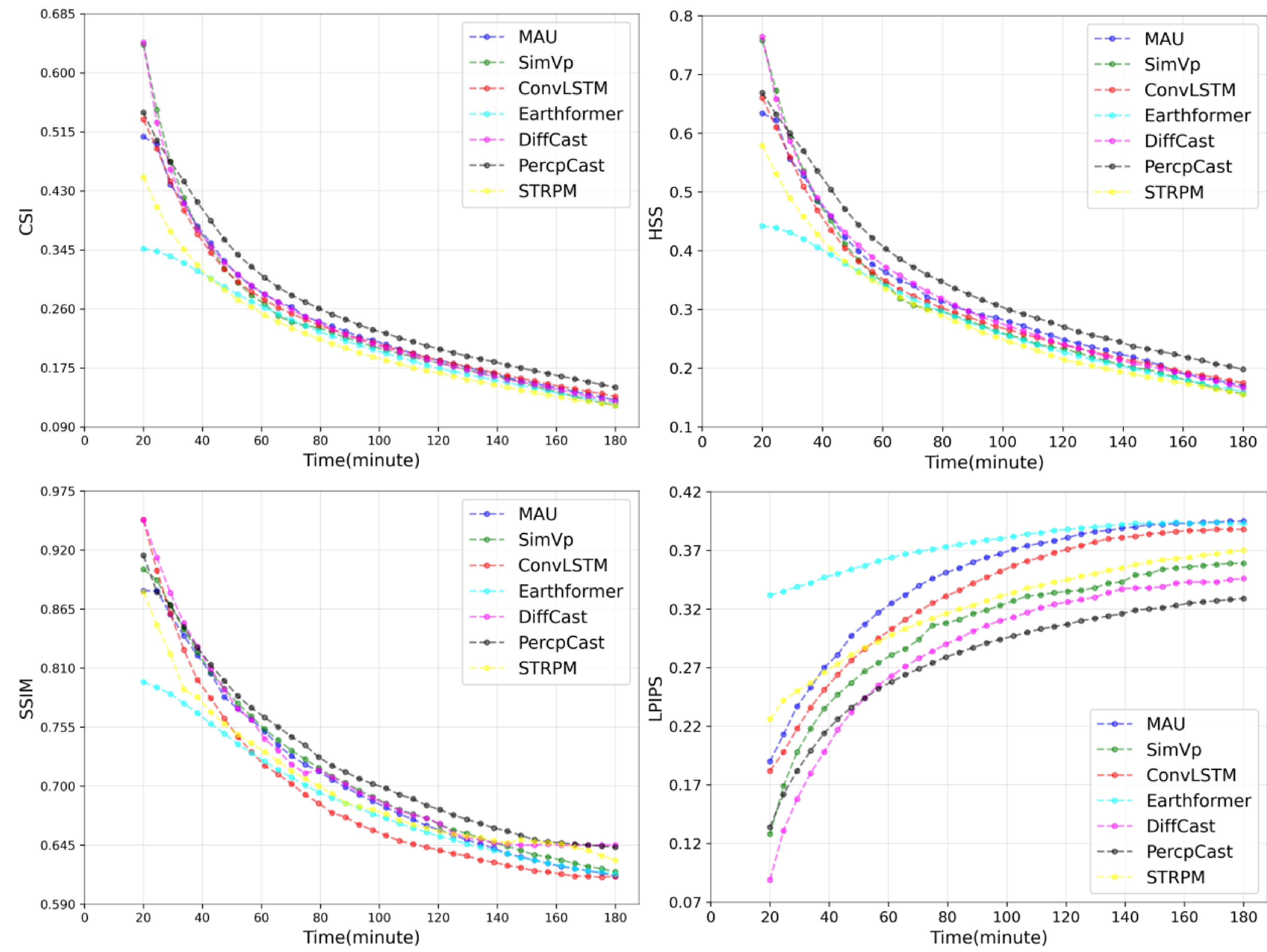
Method	SEVIR					MeteoNet				
	CSI	HSS	SSIM	MSE	LPIPS	CSI	HSS	SSIM	MSE	LPIPS
MAU	0.241	0.312	0.705	0.0093	0.348	0.197	0.281	<u>0.819</u>	0.0029	0.250
ConvLSTM	0.240	0.306	0.711	0.0084	0.304	0.192	0.272	0.811	0.0031	0.256
SimVP	0.241	0.306	<u>0.717</u>	<u>0.0083</u>	0.334	0.165	0.239	0.774	0.0037	0.294
Earthformer	0.214	0.277	0.685	0.0100	0.374	0.158	0.224	0.765	0.0035	0.303
Earthfarseer	0.209	0.262	0.675	0.0077	0.385	0.161	0.232	0.789	<u>0.0030</u>	0.306
STRPM	0.213	0.281	0.621	0.0130	0.322	0.154	0.223	0.701	0.0064	0.322
CasCast	0.238	0.301	0.709	0.0120	0.285	0.183	0.274	0.810	0.0062	0.252
DiffCast	<u>0.244</u>	<u>0.318</u>	0.692	0.0100	<u>0.286</u>	<u>0.199</u>	<u>0.287</u>	0.816	0.0054	<u>0.241</u>
PercpCast	0.267	0.360	0.722	0.0092	0.268	0.209	0.305	0.820	0.0049	0.237

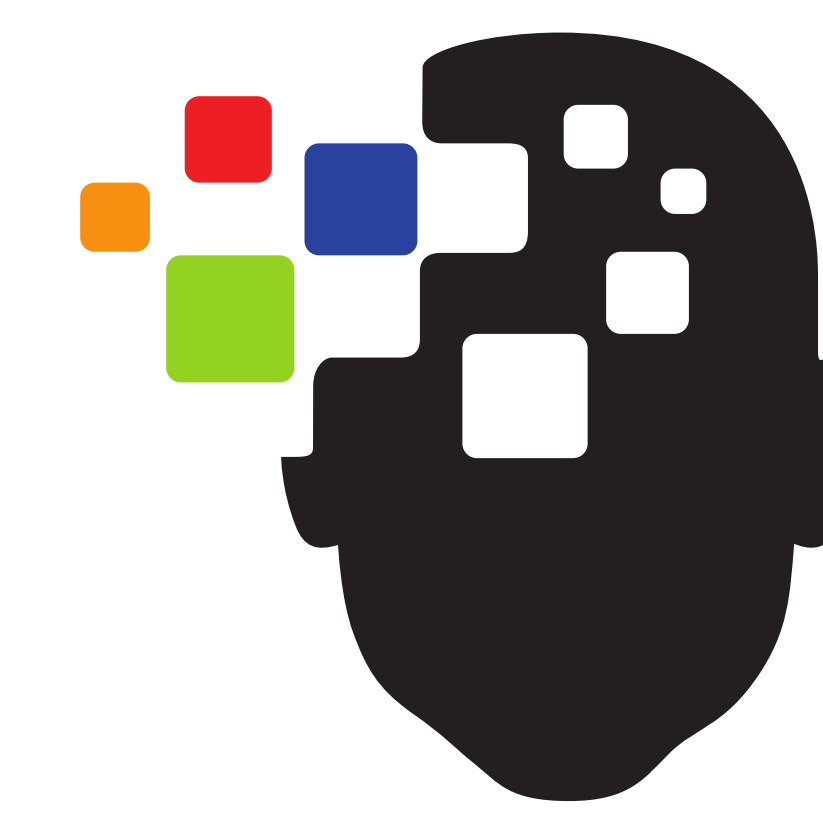
Table 2. Quantitative evaluation of state-of-the-art spatiotemporal prediction algorithms on Sevir and MeteoNet benchmarks with different thresholds for CSI.

Method	SEVIR					MeteoNet				
	CSI74	CSI133	CSI160	CSI181	CSI219	CSI16	CSI24	CSI32	CSI36	CSI40
MAU	0.484	<u>0.206</u>	0.096	0.064	0.020	0.348	0.236	0.092	0.039	0.023
ConvLSTM	0.497	0.203	0.085	0.052	0.013	<u>0.349</u>	0.218	0.079	0.031	0.021
SimVP	0.490	0.177	0.090	0.064	0.026	0.307	0.181	0.053	0.022	0.011
Earthformer	0.453	0.165	0.066	0.040	0.003	0.308	0.173	0.031	0.010	0.002
Earthfarseer	0.469	0.110	0.048	0.029	0.012	0.300	0.176	0.041	0.018	0.009
STRPM	0.424	0.164	0.084	0.059	0.025	0.289	0.183	0.084	0.049	0.022
CasCast	0.440	0.193	0.105	0.067	0.023	0.315	0.228	0.108	0.043	0.020
DiffCast	0.449	0.203	<u>0.113</u>	<u>0.084</u>	<u>0.032</u>	0.323	<u>0.242</u>	<u>0.127</u>	<u>0.053</u>	<u>0.024</u>
PercpCast	<u>0.496</u>	0.251	0.134	0.099	0.037	0.354	0.276	0.132	0.068	0.027



Experiments





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Thank You

