Universität Stuttgart
Germany

eawag
aquatic research

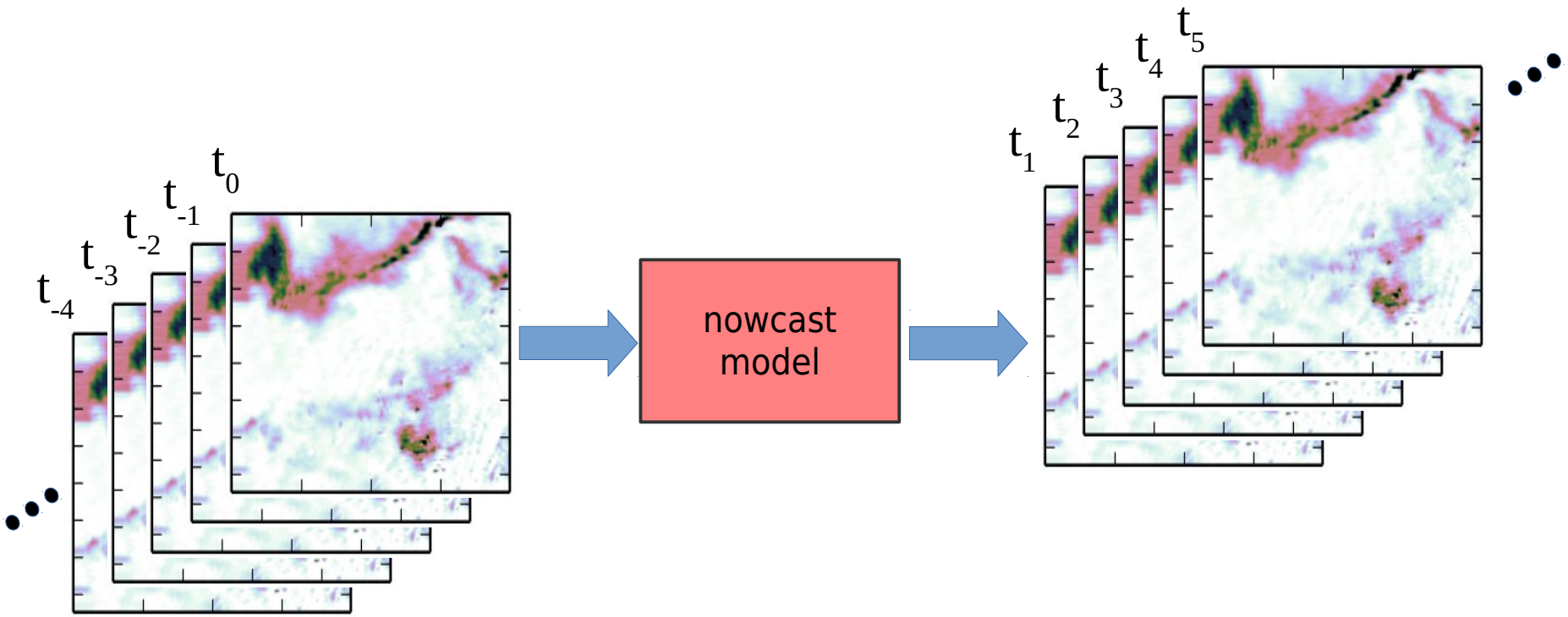
Recurrent Neuronal Network tailored for Weather Radar Nowcasting

Andreas Scheidegger

June 23, 2016

Eawag: Swiss Federal Institute of Aquatic Science and Technology

Weather Radar Nowcasting

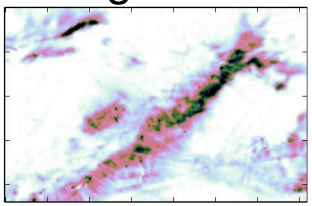


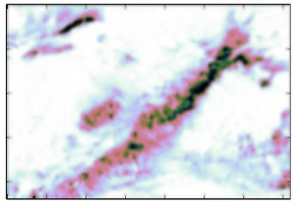
available inputs:
every pixel of the previous images

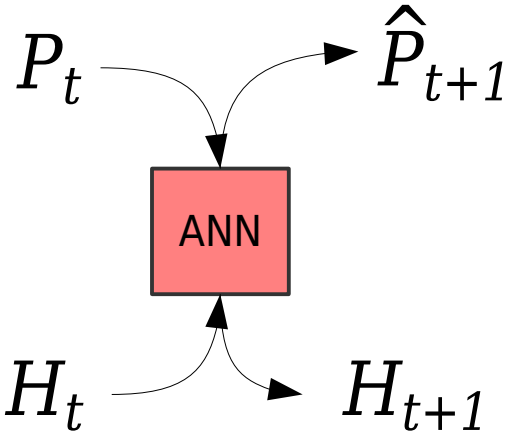
desired outputs:
every pixel of the next *n* images

Recurrent ANN

last observed image

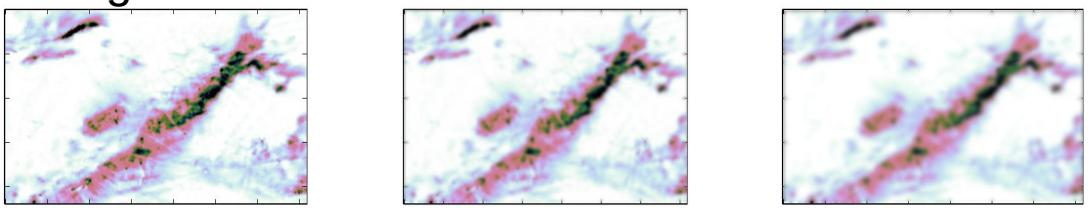


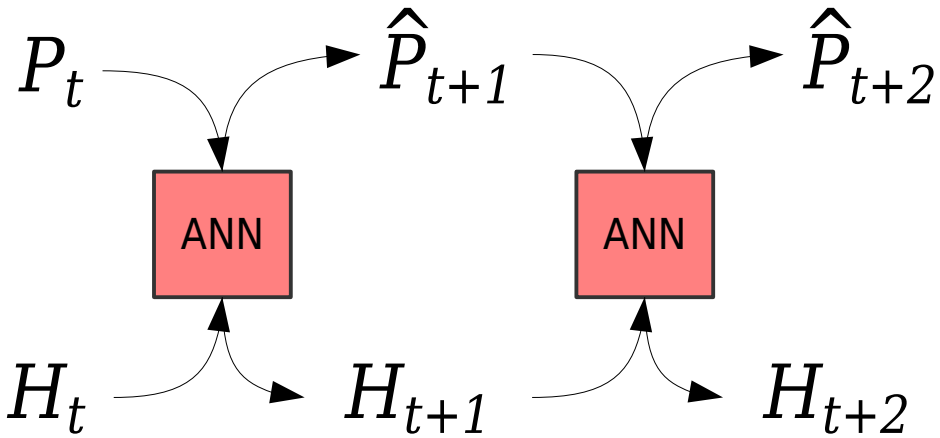




Recurrent ANN

last observed image





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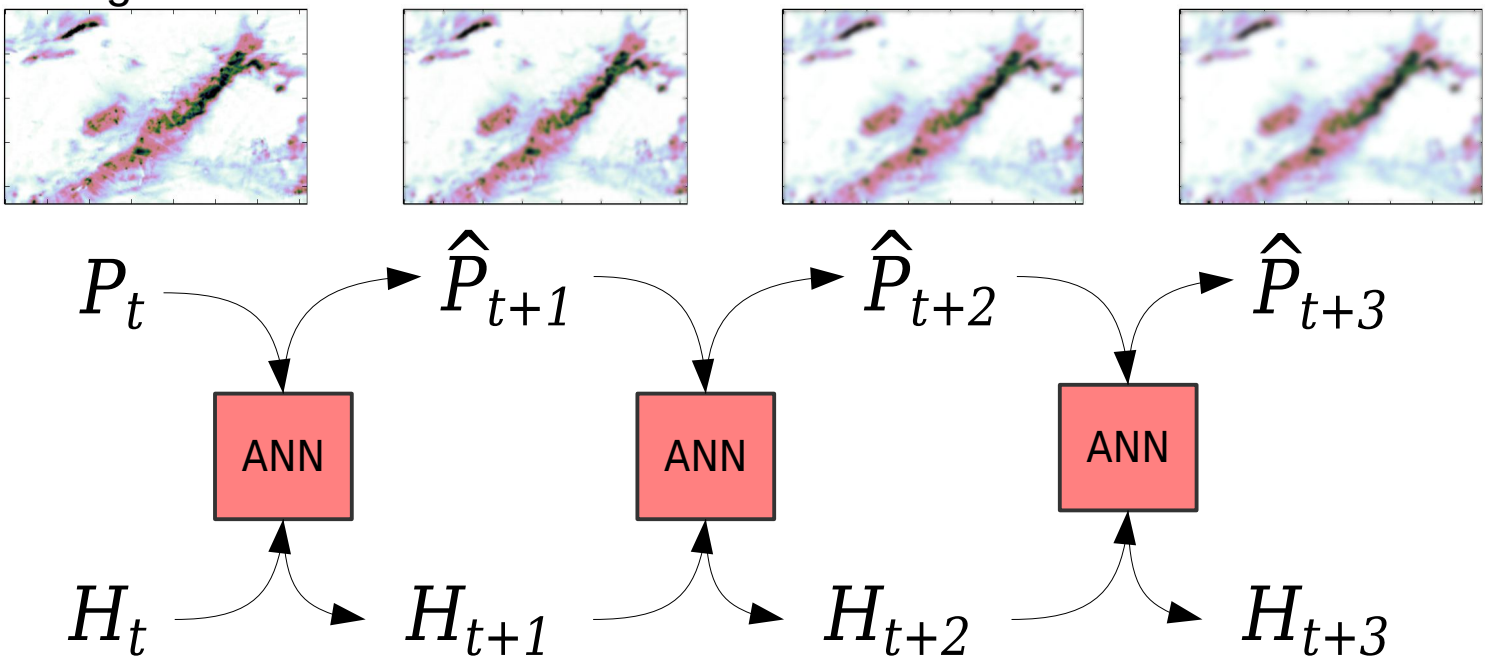

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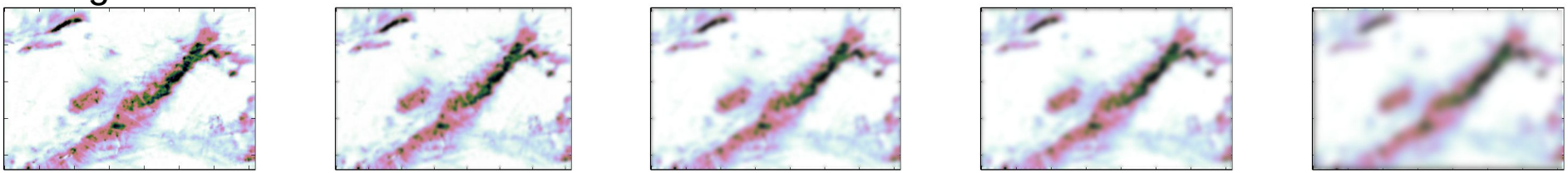
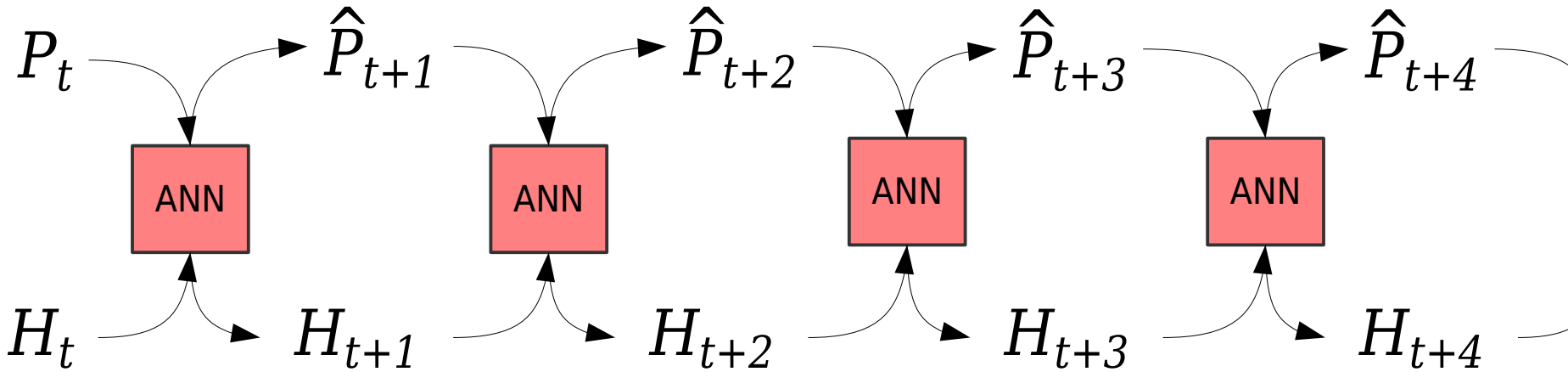
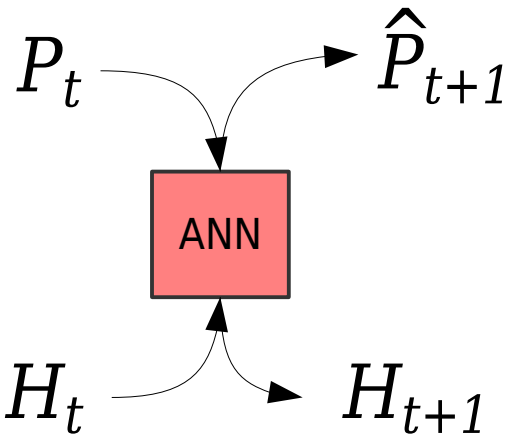




Model structure

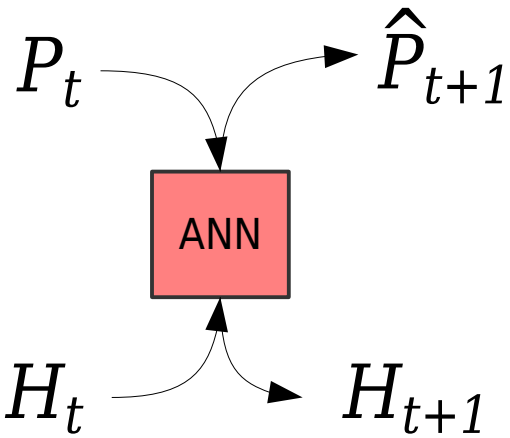


Traditional Artificial Neuronal Networks (ANN) are (nested) non-linear regressions:

$$v_j = \sigma\left(\sum_k w_{jk} u_k + b_j\right)$$

How can we do better?

Model structure



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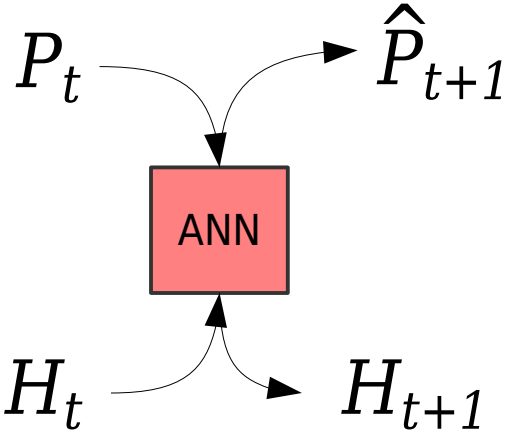
How can we do better?

→ **tailor model structure to problem**

Model structure



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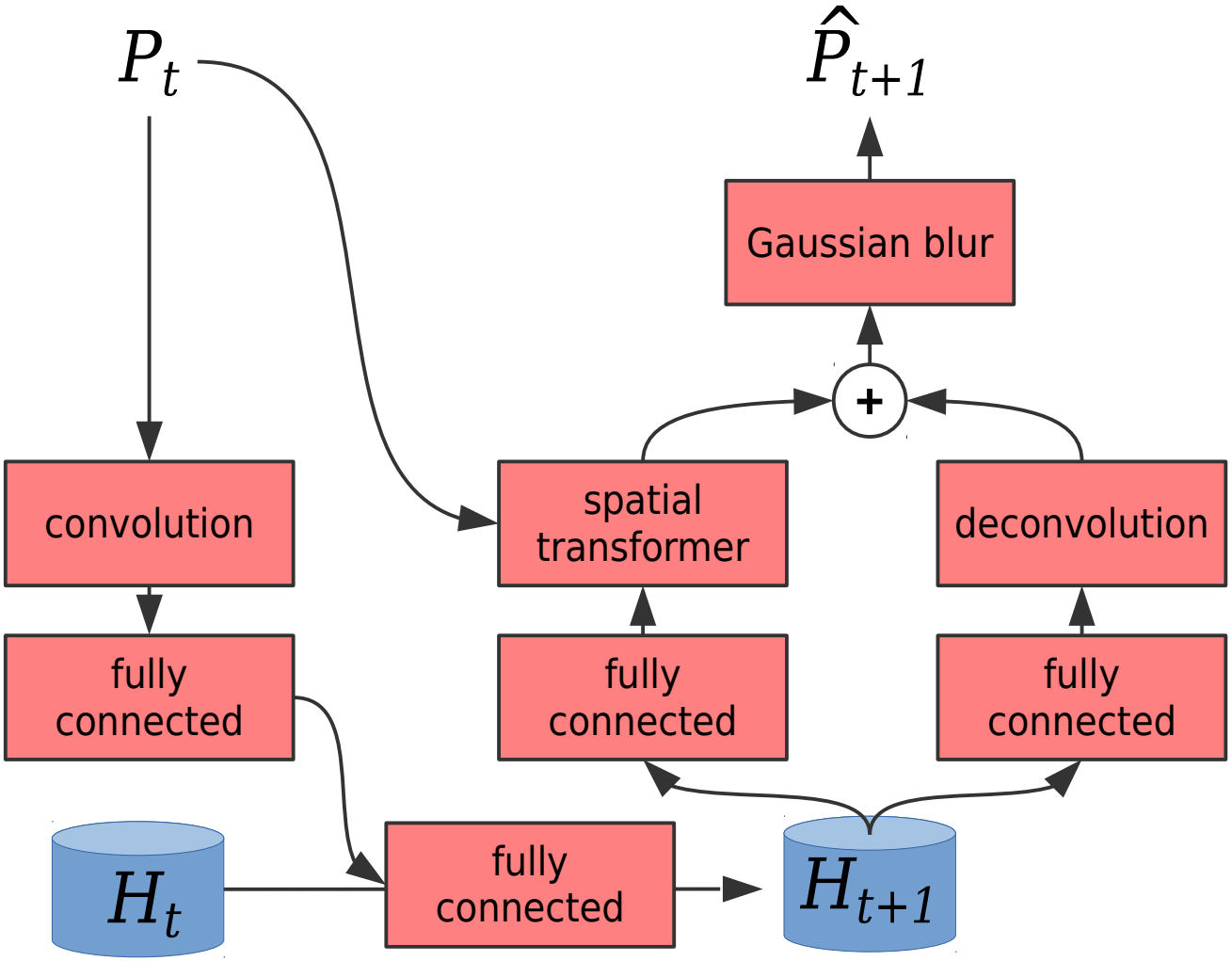
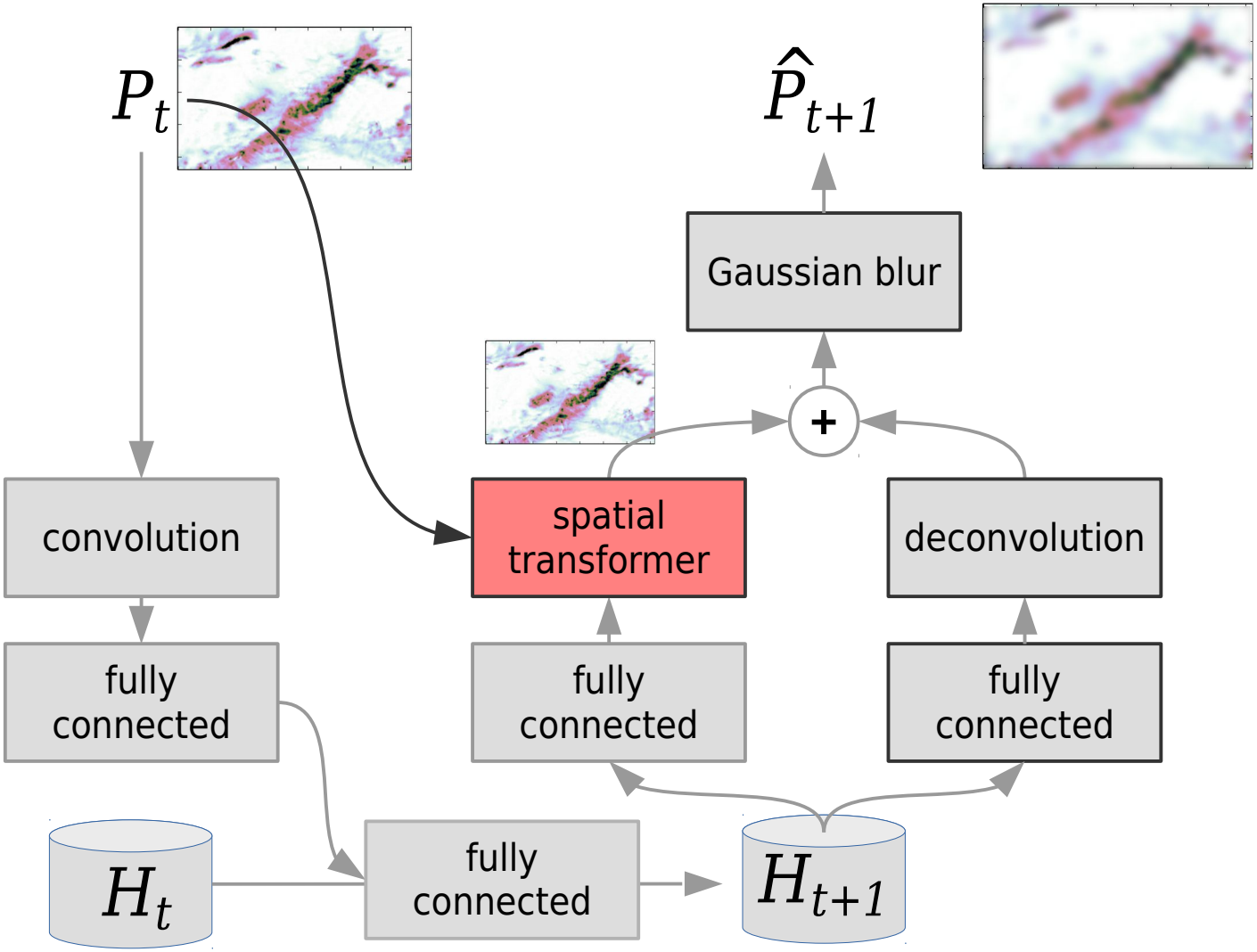
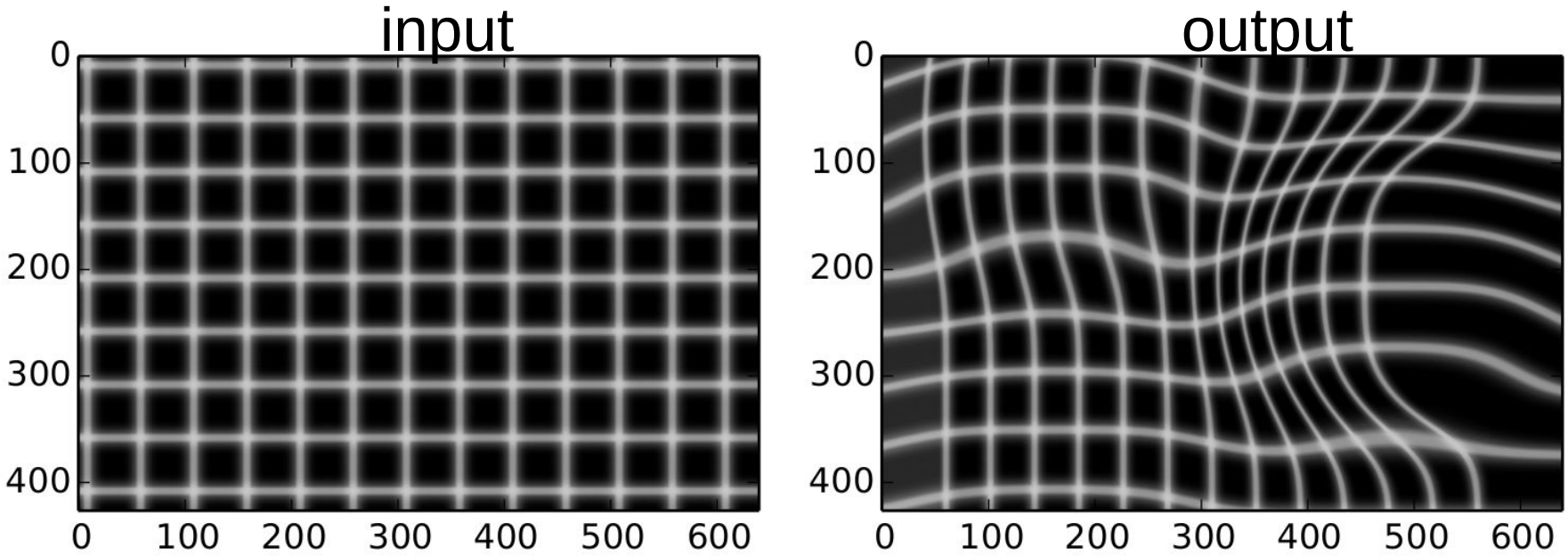


Spatial transformer



Jaderberg, M., Simonyan, K., Zisserman, A., and Kavukcuoglu, K. (2015) Spatial Transformer Networks. arXiv:1506.02025 [cs].

Spatial Transformer



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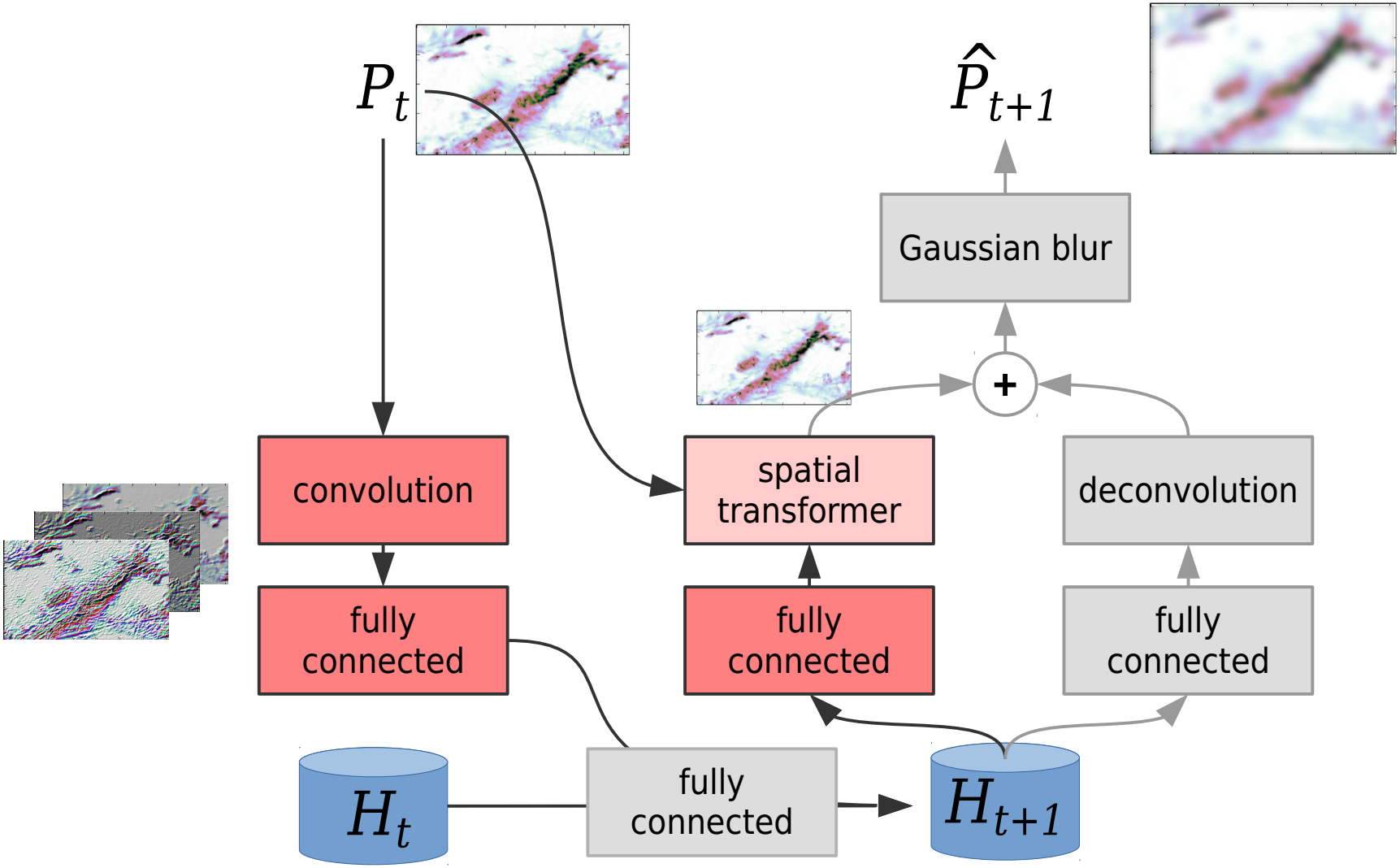
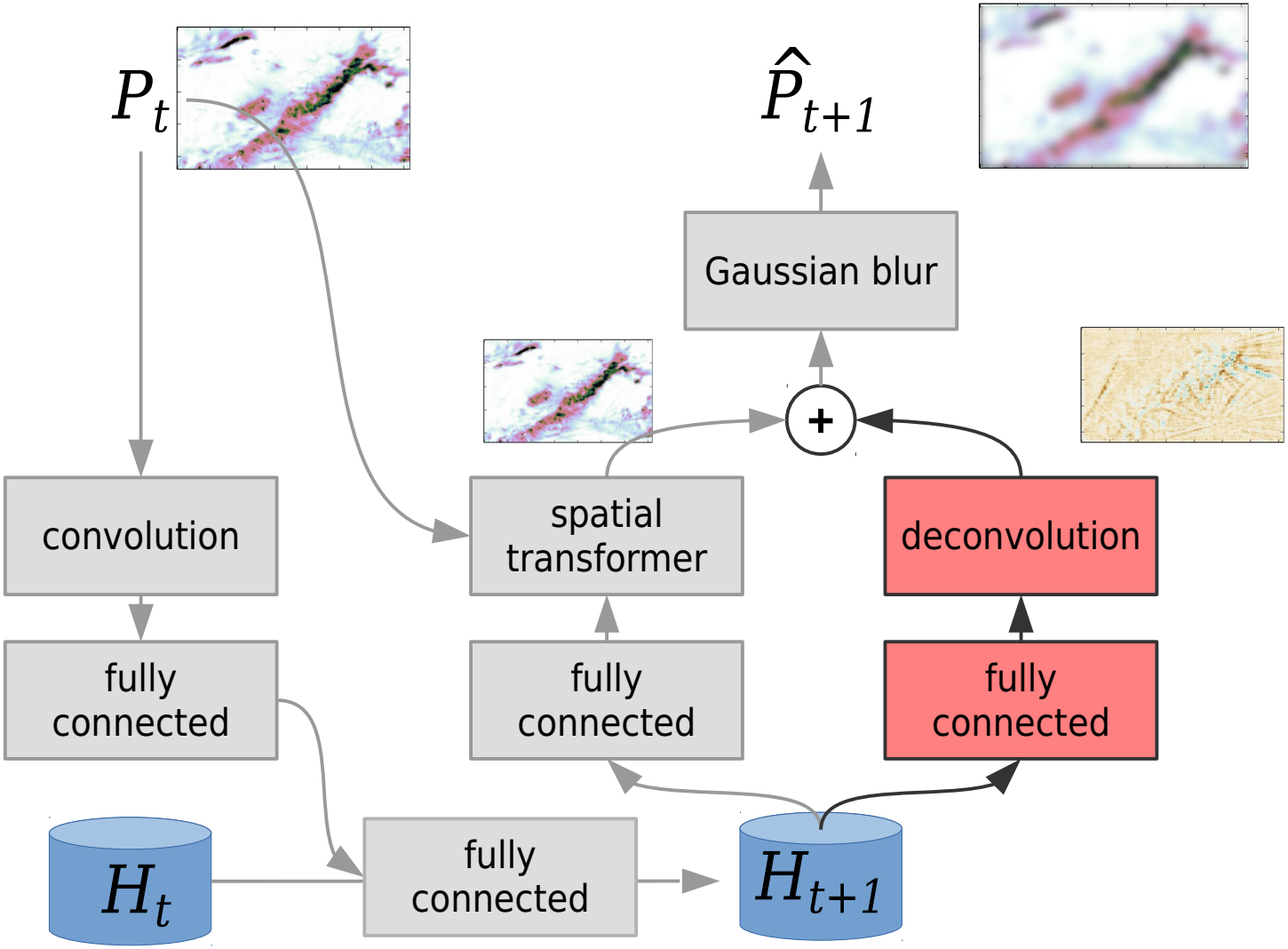


Local correction



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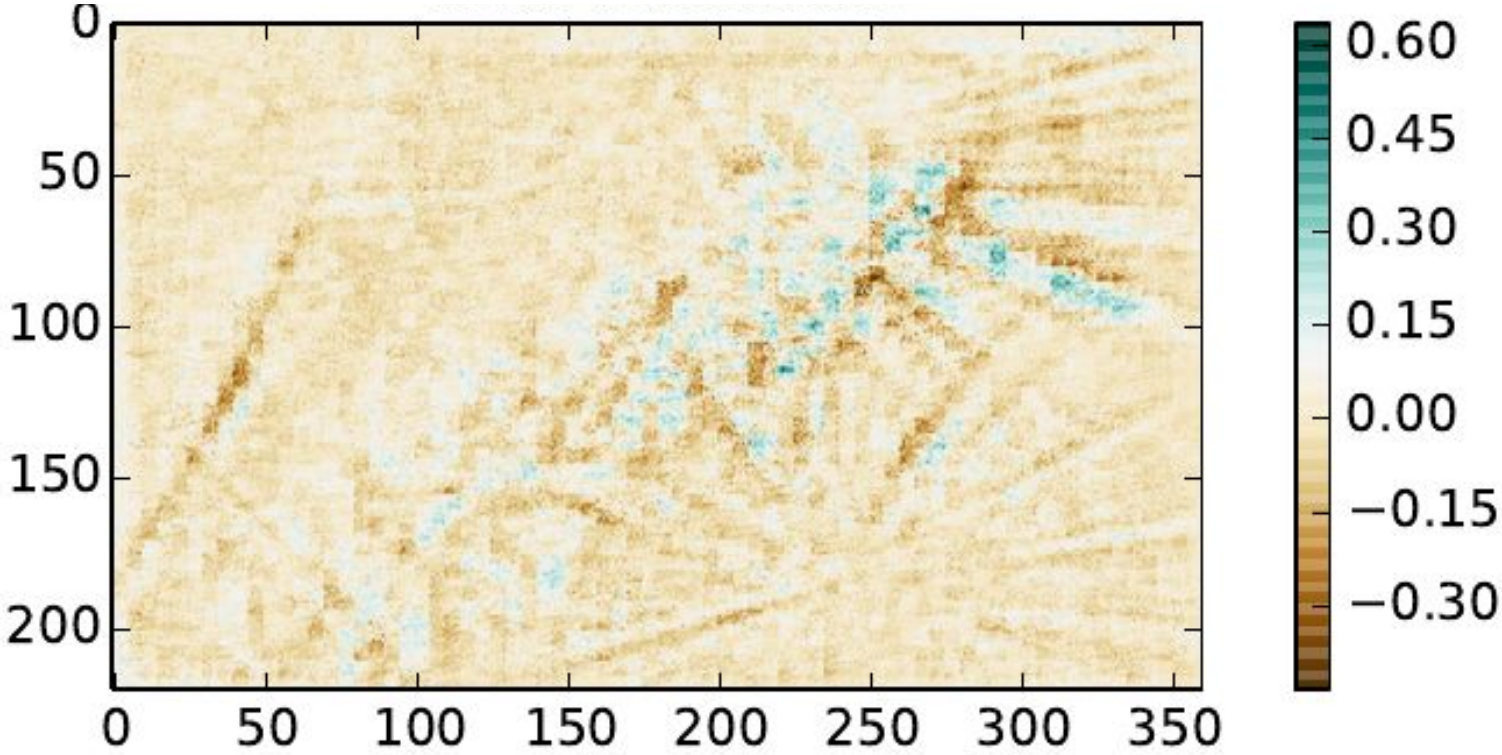
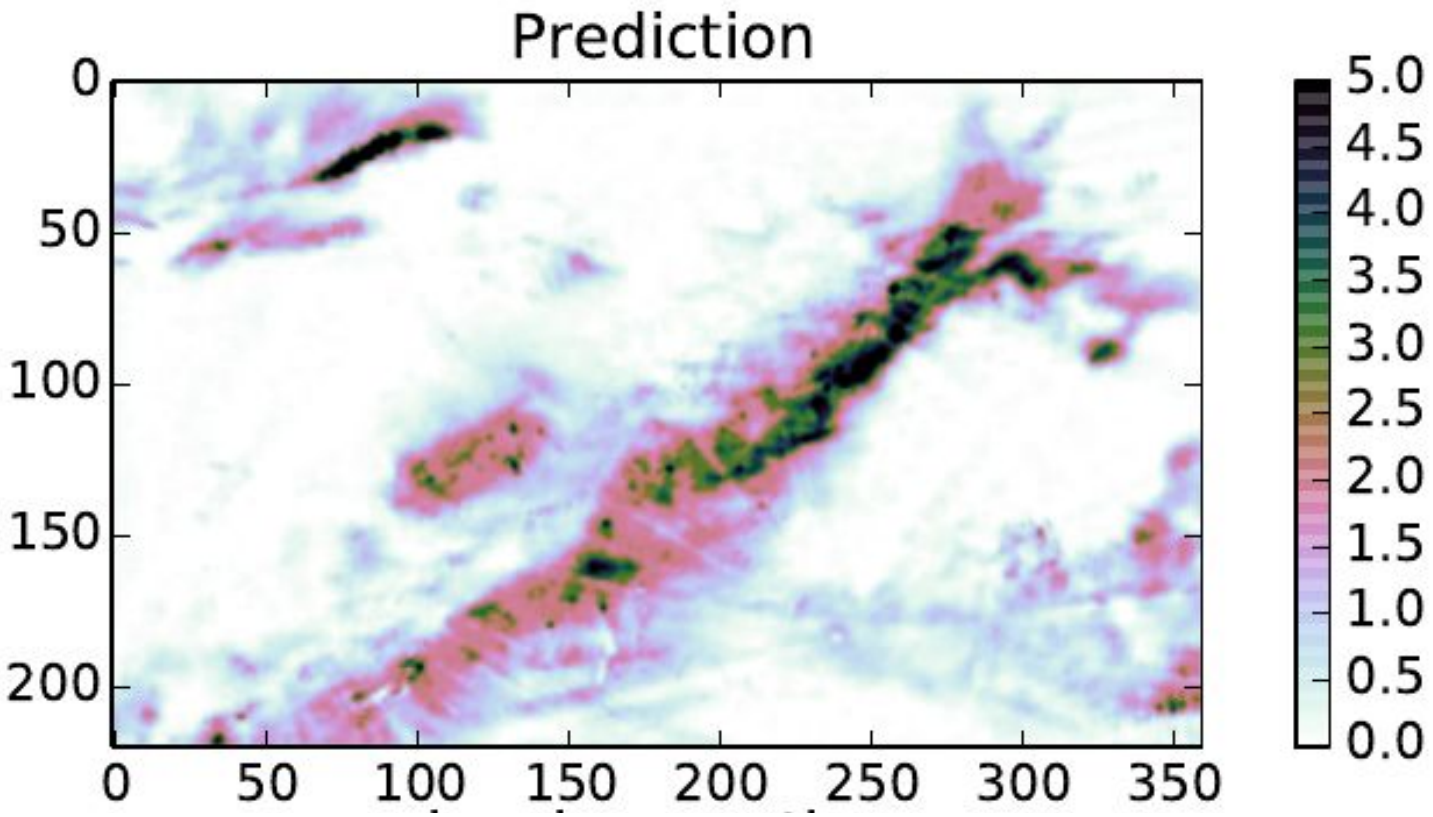
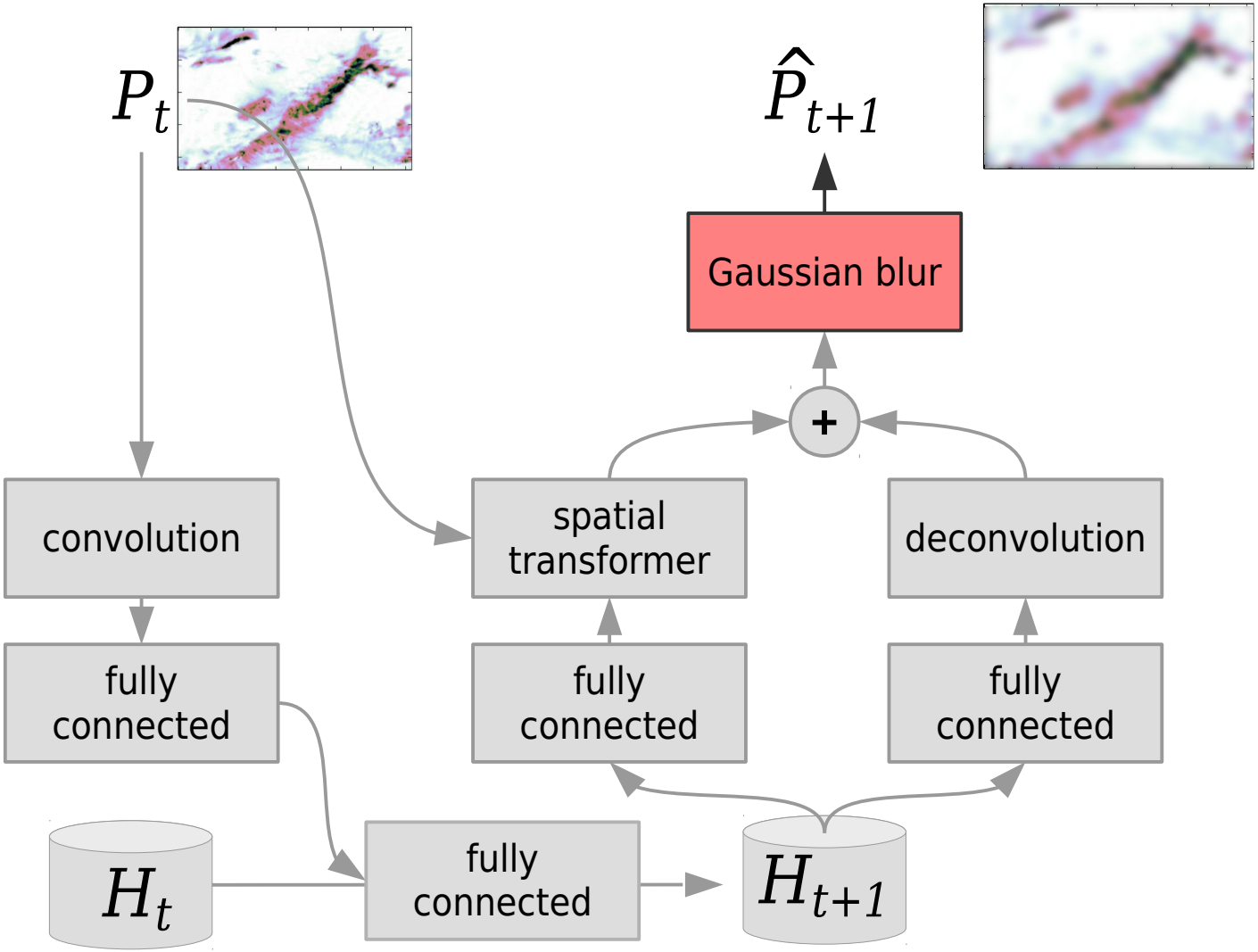


Local correction

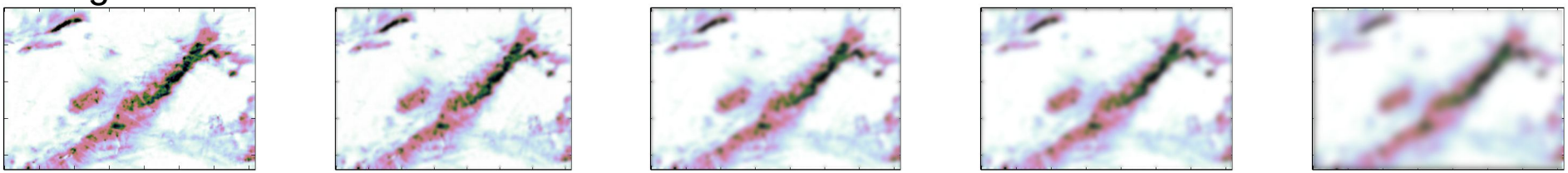


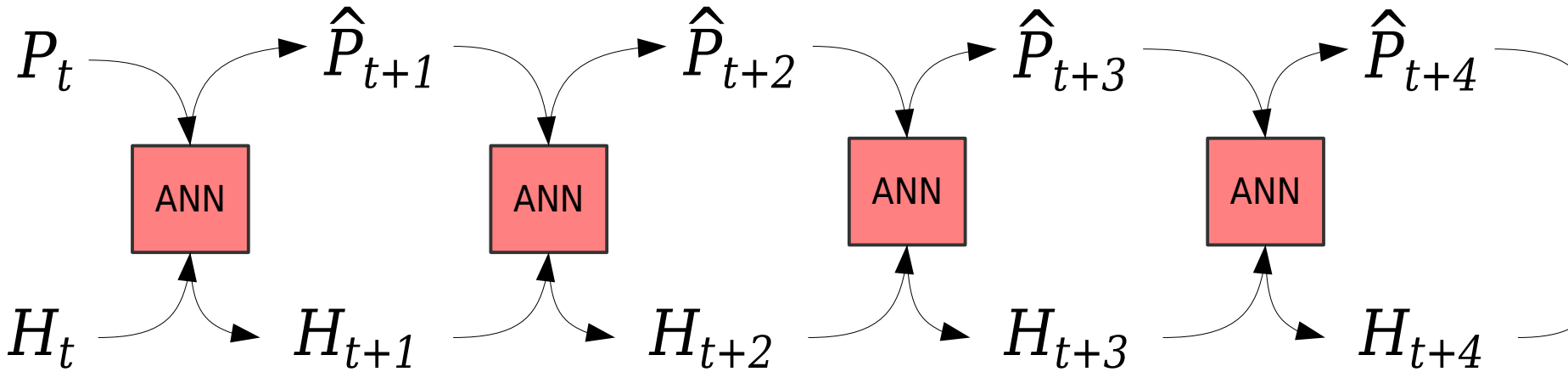
Gaussian blur



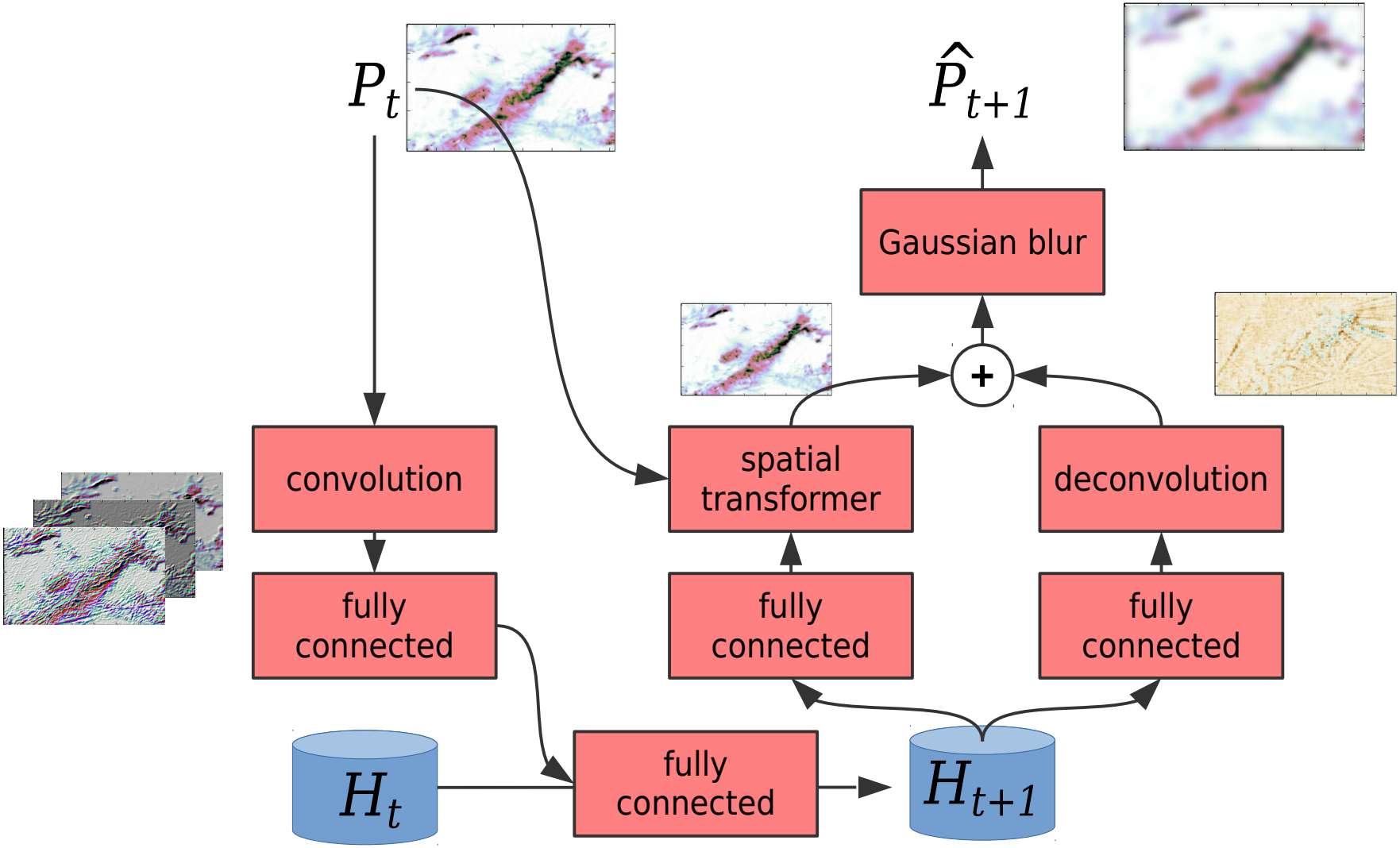
Recurrent ANN

last observed image



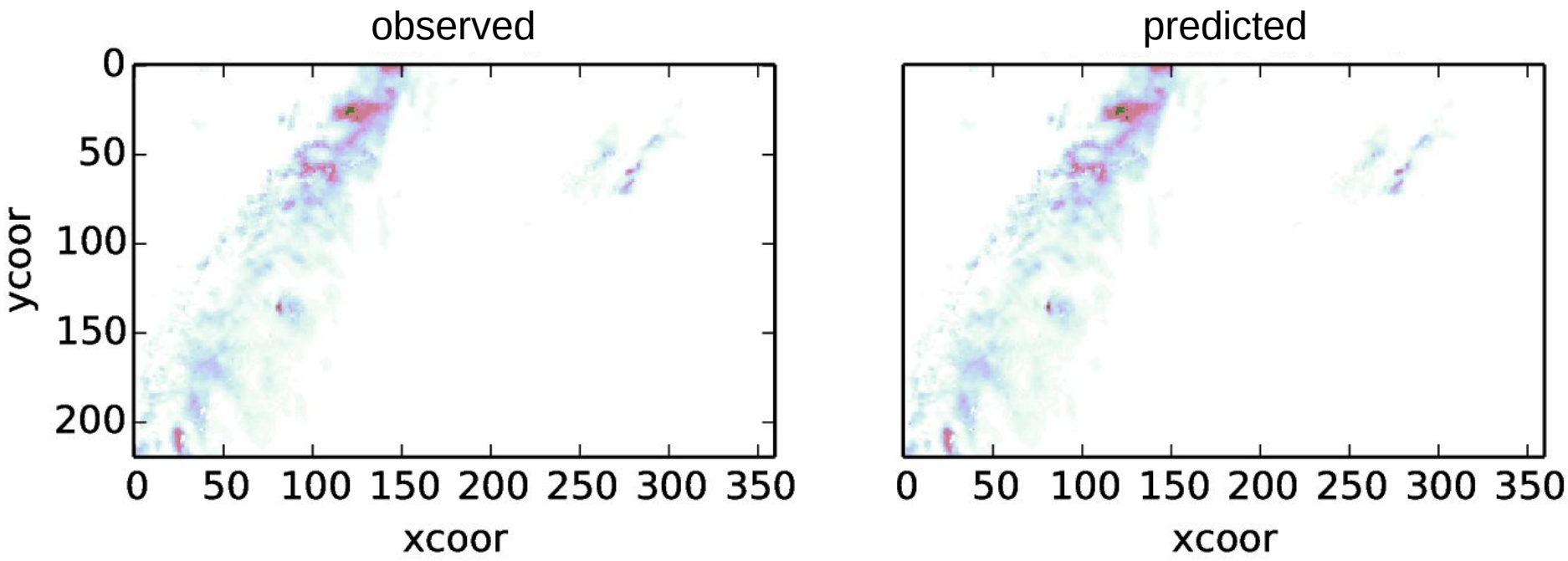


Model structure



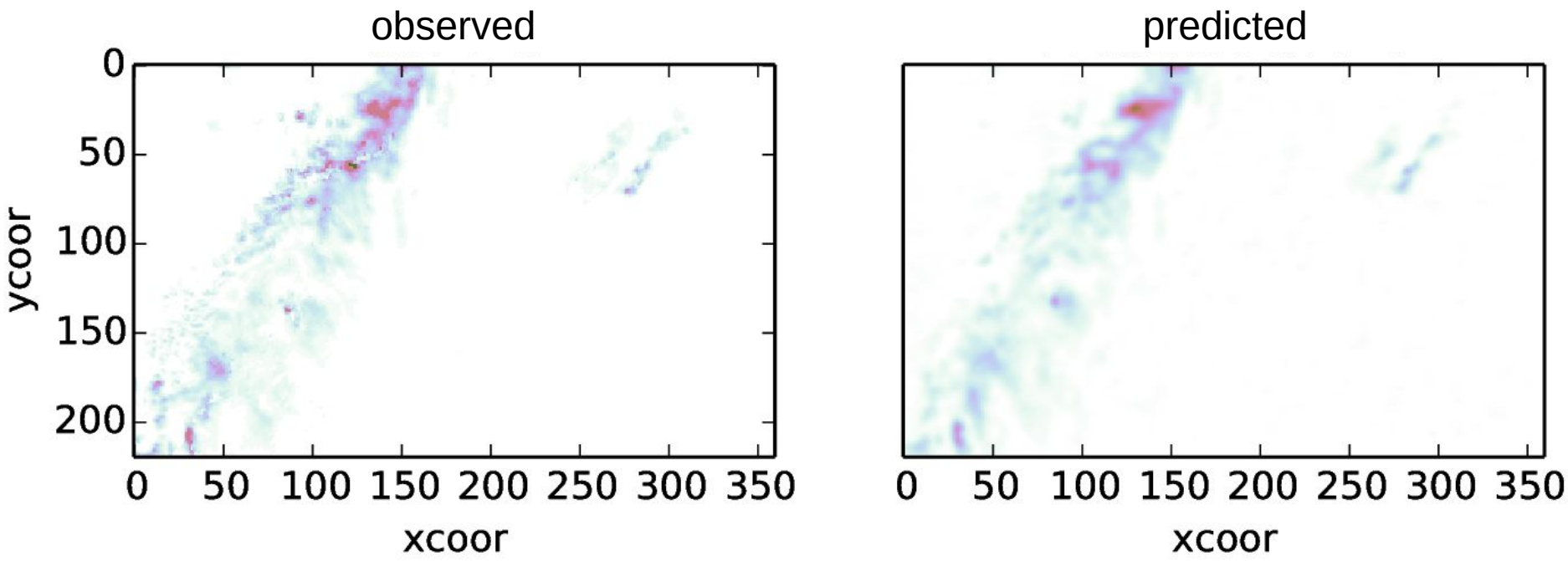
Prediction

Forecast horizon: 2.5 minutes



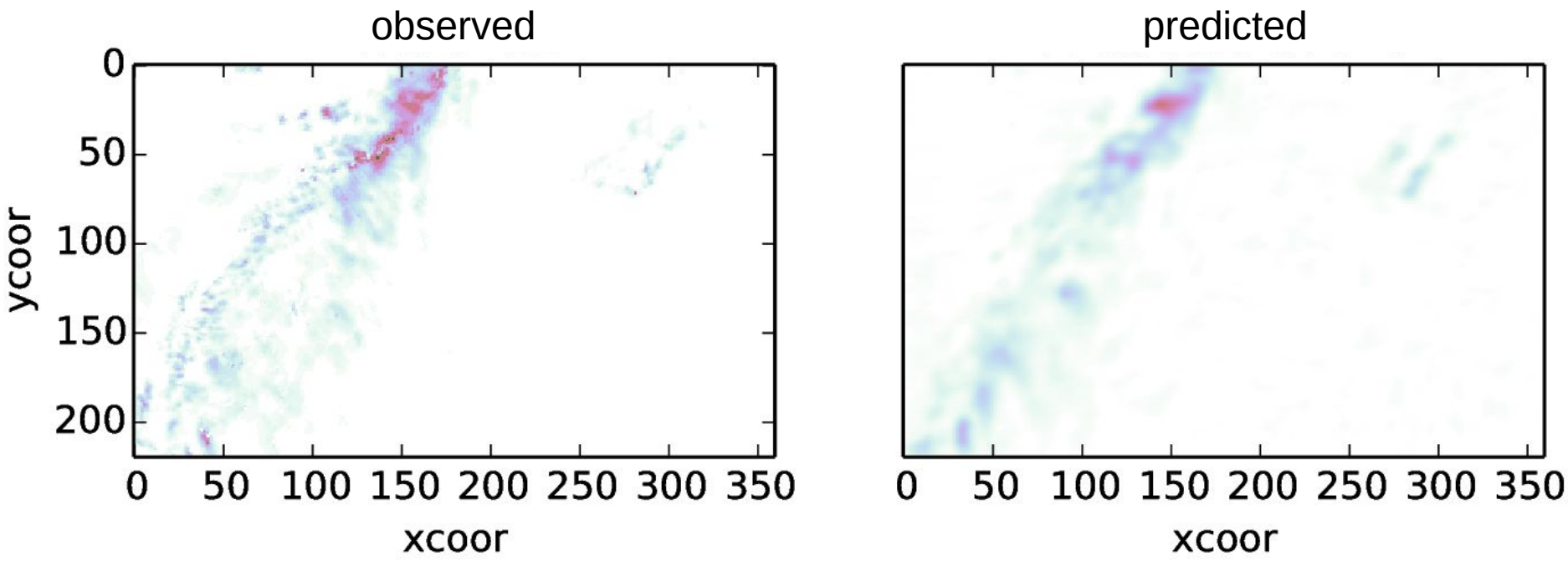
Prediction

Forecast horizon: 15 minutes



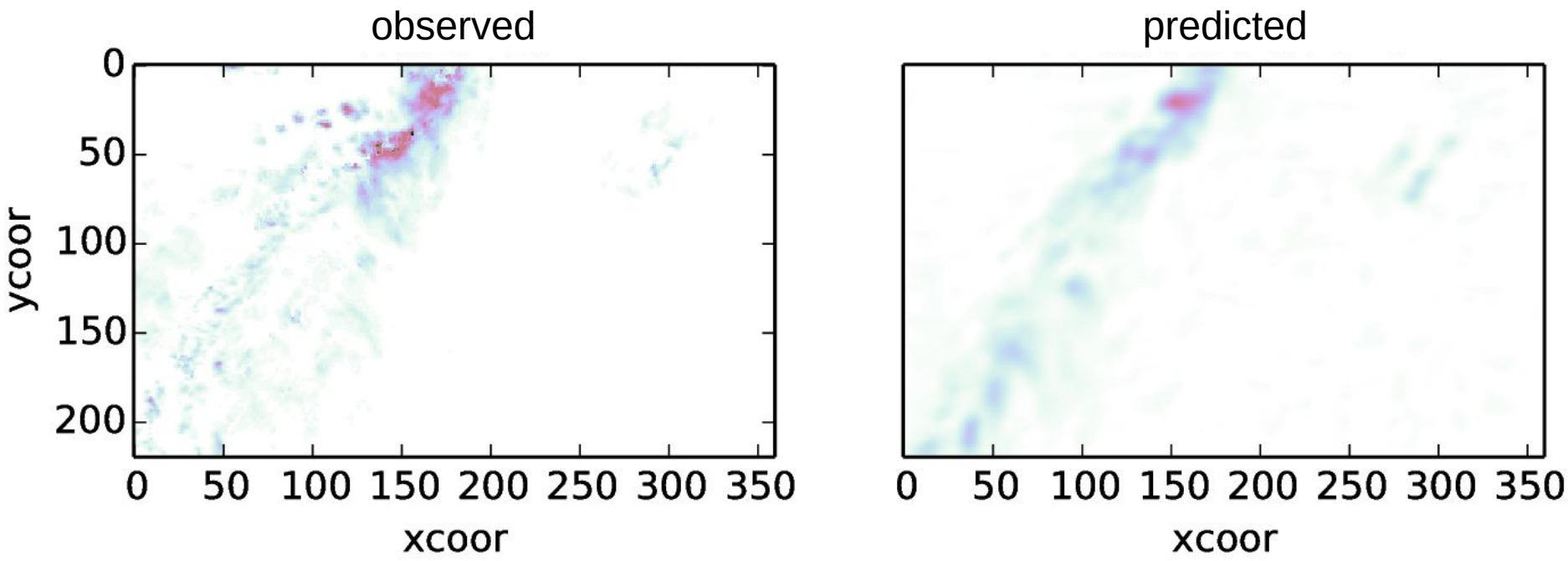
Prediction

Forecast horizon: 30 minutes



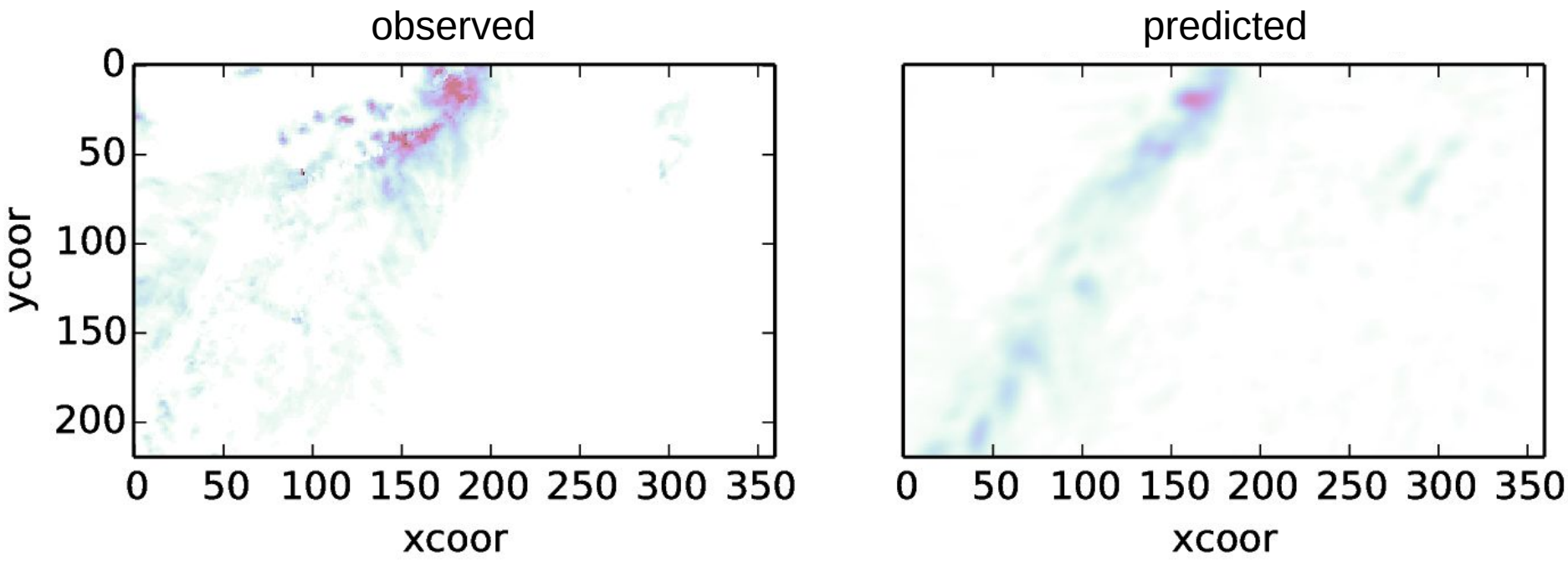
Prediction

Forecast horizon: 45 minutes

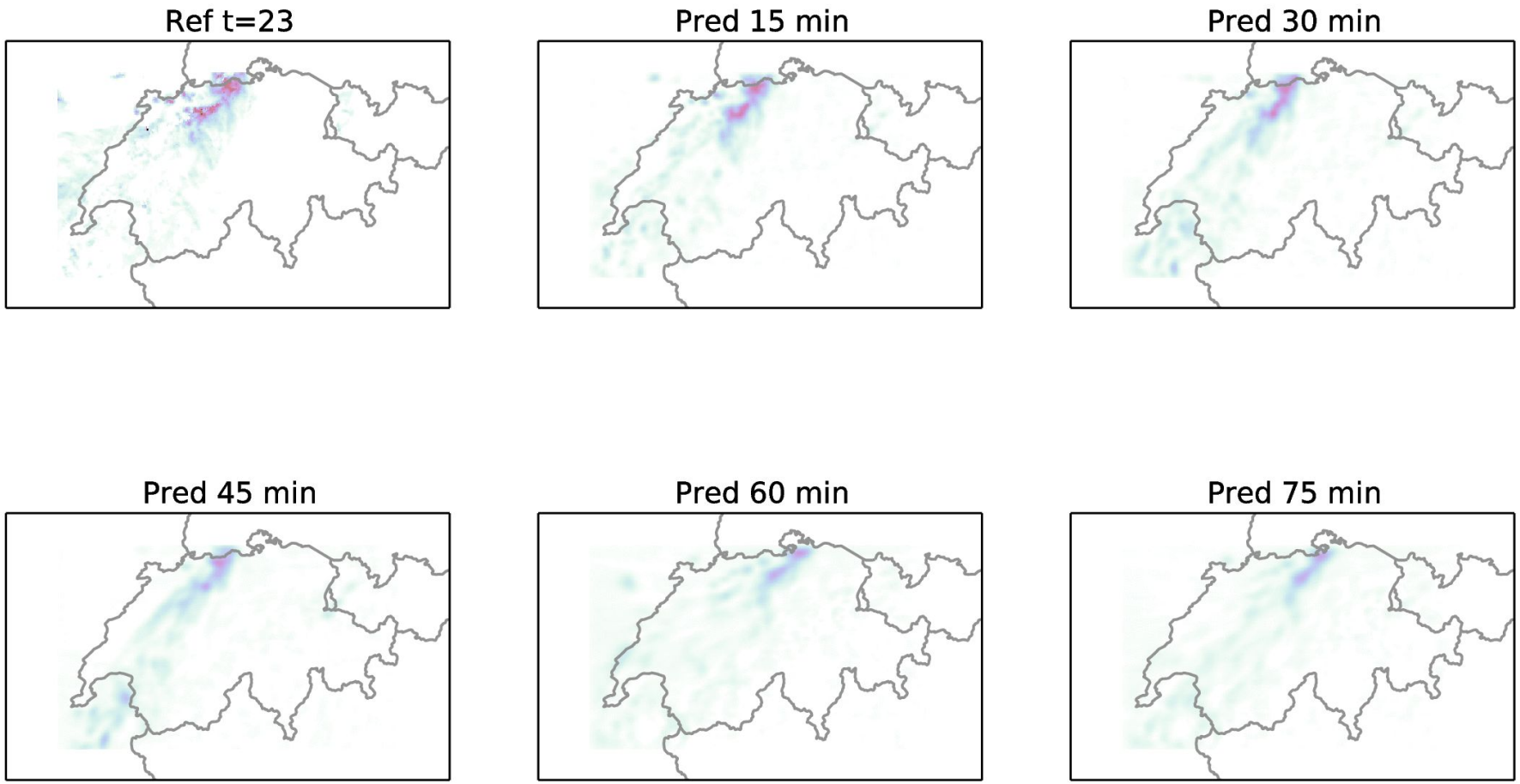


Prediction

Forecast horizon: 60 minutes



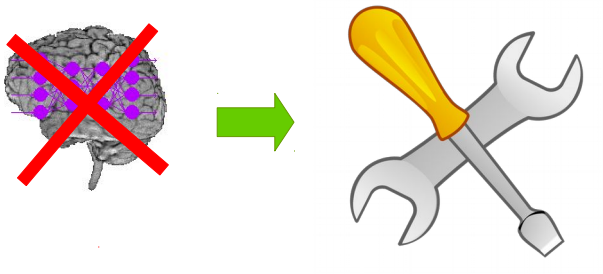
Prediction


Ref t=23
Pred 15 min
Pred 30 min
Pred 45 min
Pred 60 min
Pred 75 min

Conclusions

Conclusions

Deep learning may be a hype – but it's a **useful tool** nevertheless!



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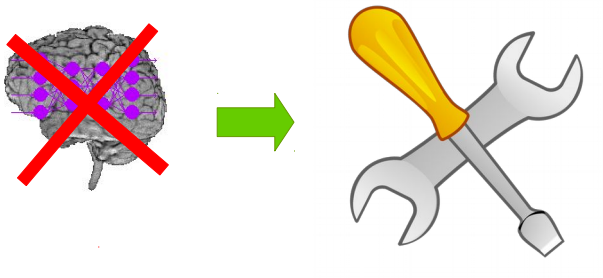
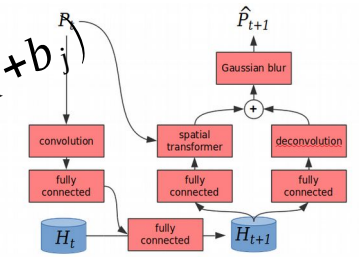


Combine **domain knowledge** with **data** driven modeling

$$v_j = \sigma\left(\sum_k w_{jk} u_k + b_j\right)$$



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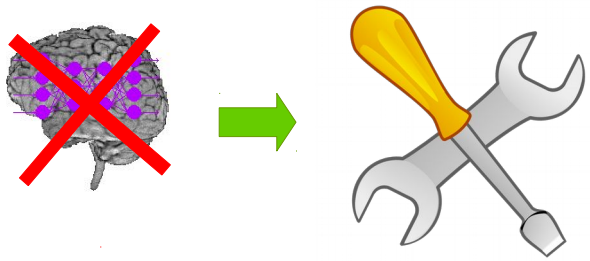

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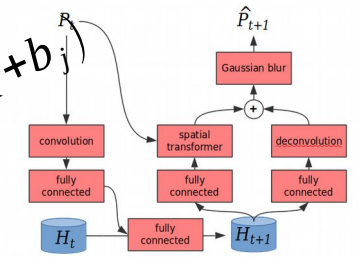

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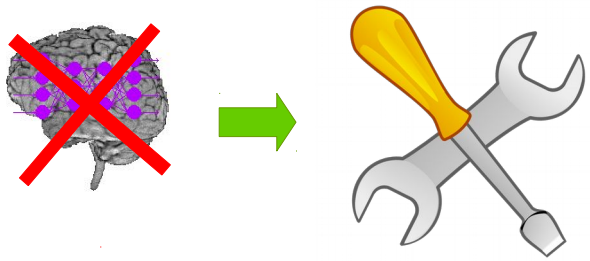

Online parameter adaption

$$\theta_{t+1} = \theta_t - \lambda \nabla L(\theta_t)$$

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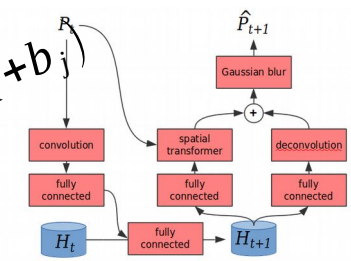

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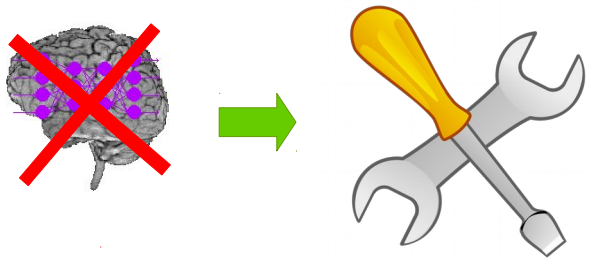

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Other **objective function**? $L(\theta)$

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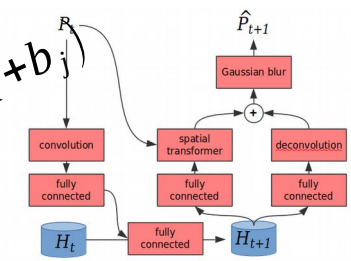

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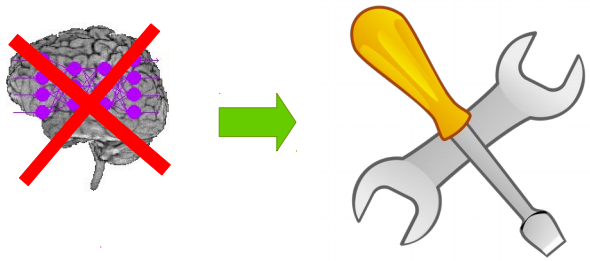

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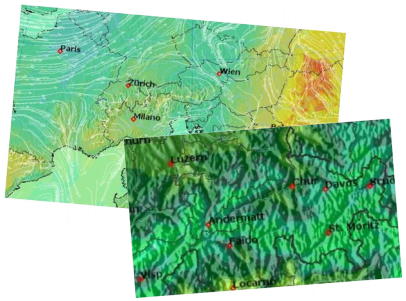
Include other **inputs**



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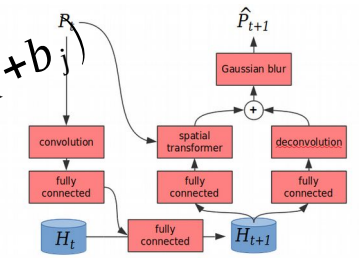

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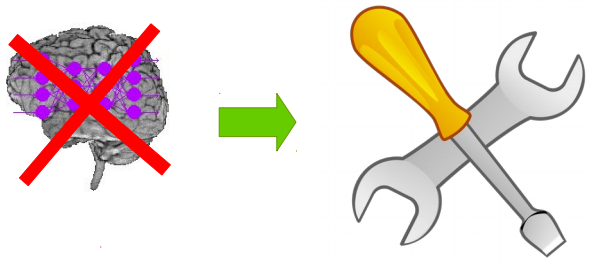

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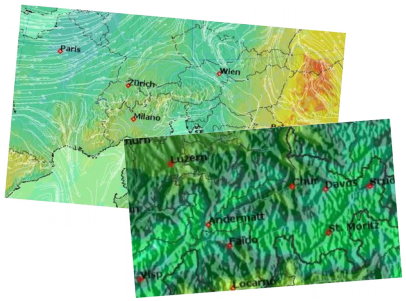

Predict prediction **uncertainty**

Combine **domain knowledge** with **data** driven modeling

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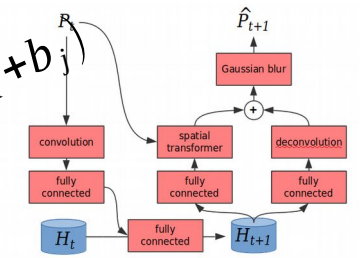

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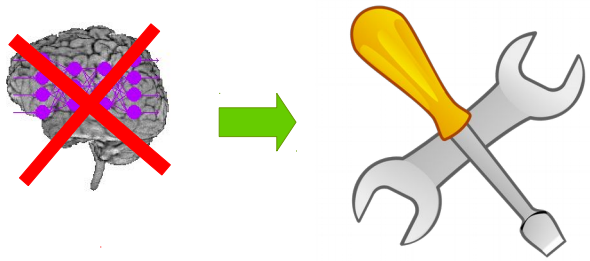

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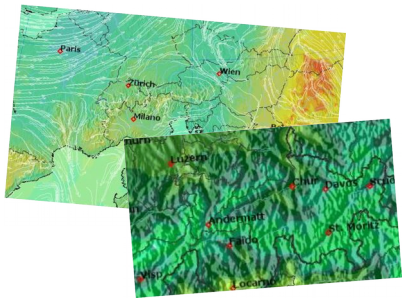

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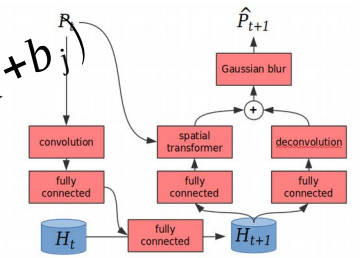

Predict prediction **uncertainty**

Interested in collaboration?
→ andreas.scheidegger@eawag.ch