

# Superresolution and Generation of Ocean Sea-Surface Temperature

## Introduction

Our project has two goals. One is to generate high-resolution images of sea surface temperature (SST) that recover the unresolved structures from the low-resolution images. The motivation arises from the huge cost of obtaining and computing high-resolution sea surface temperature images. The second part involves the interpretability of a pure generative model (from white noise), namely, we want to investigate the correspondence between the latent features and the ocean's physical properties.

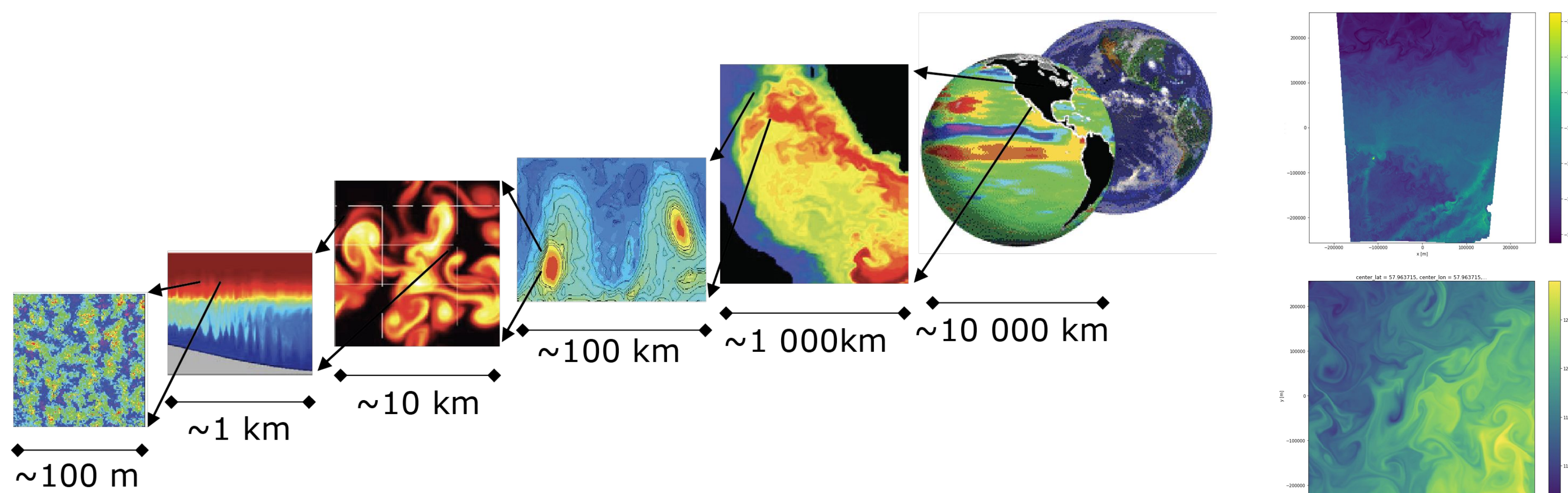


Figure 1. Ocean Sea-Surface Temperature Images

## Approaches

System Design: Data Cleaning - Model Selection - Training - Testing and Evaluation

Methods: For the first goal, we implement SRGAN to recover low-resolution images to high-resolution through generator network. For the second goal, we deploy DCGAN to generate random ocean images from white noise through deep convolutional layers.

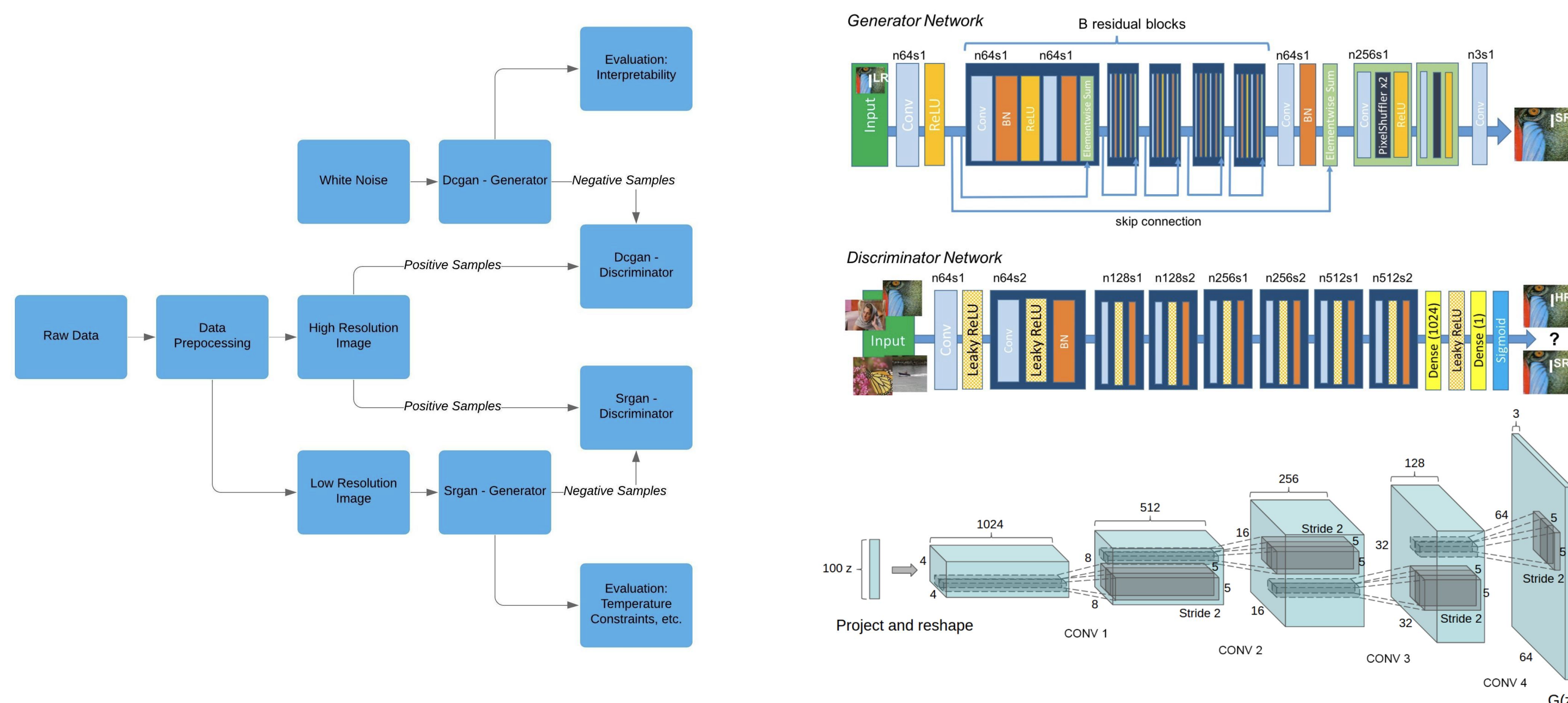
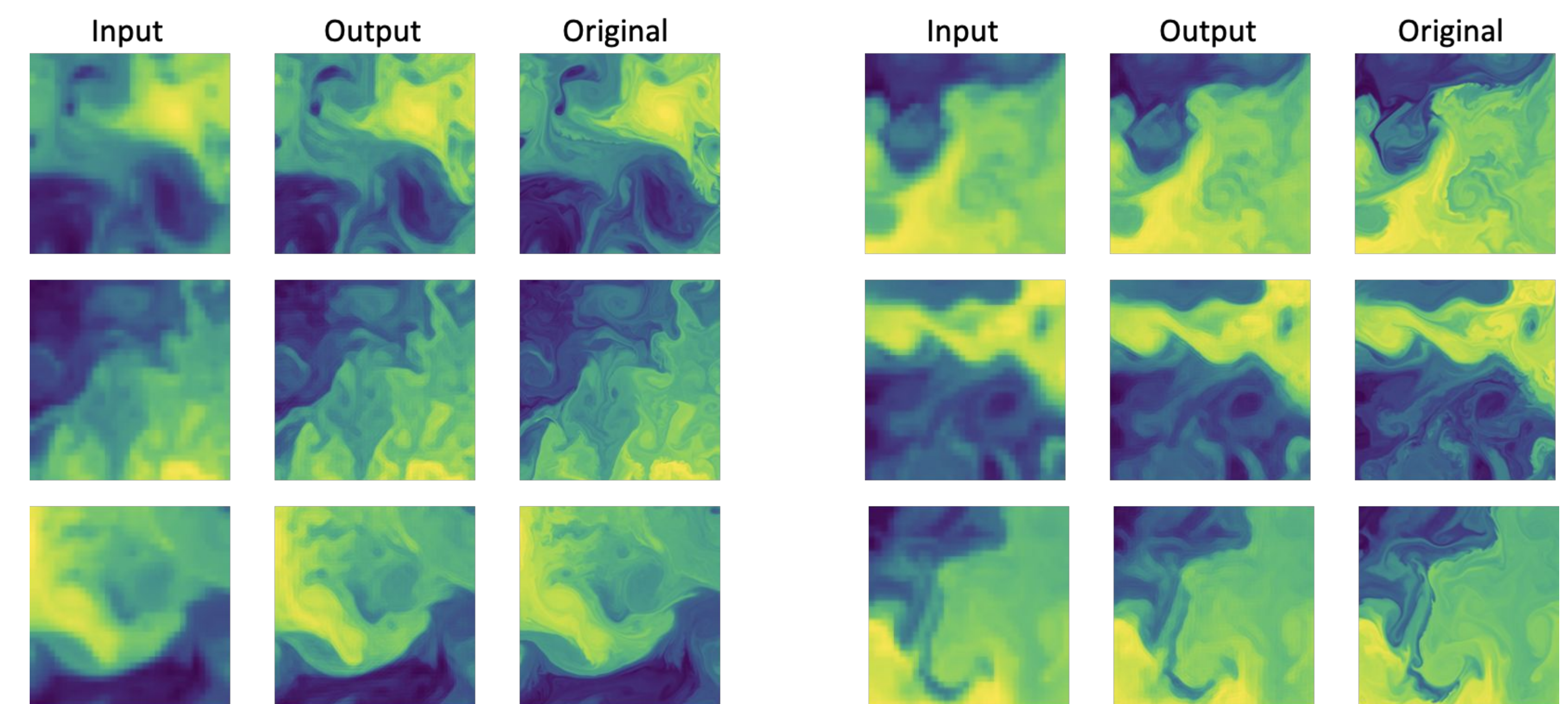


Figure 2. Flow Chart of System Design (left) and Model Architecture: SRGAN (upper right) and DCGAN (lower right)

## Experiments

Since the images across the whole ocean regions have too many modes for GAN to train, we selected 5 regions with similar modes for training. For the two goals, our group trained the proposed two models, SRGAN and DCGAN, on the selected 5 regions. To address the physical constraints in image generation, we add a special regularization term, and we call this Energy-Regularized SRGAN. We tuned hyperparameters and tested our models on testing dataset.



Without Regularization

With Regularization

Figure 3. SRGAN Experiment Results

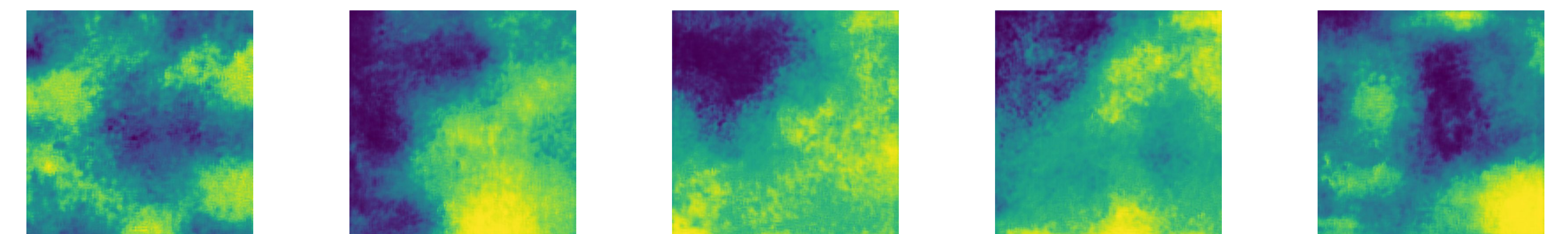


Figure 4. DCGAN Experiment Results

## Future Work

The current work points to two future directions. One is to ensure the time continuity in sequential prediction. The other one is to generate the global prediction given the local information, while respecting the border continuity.

## References

- Photo-Realistic Single Image Super-Resolution Using a Generative Adversarial Network (Ledig et al., 2017)
- Unsupervised Representation Learning With Deep Convolutional Generative Adversarial Networks (Alec Radford & Luke Metz et al., 2016)