



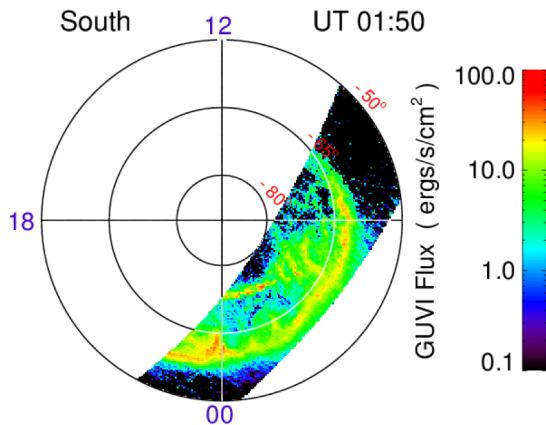
# An improved deep learning algorithm for TEC maps: image completion

Chen Zhou<sup>1,2</sup>, Yue Deng<sup>1</sup>

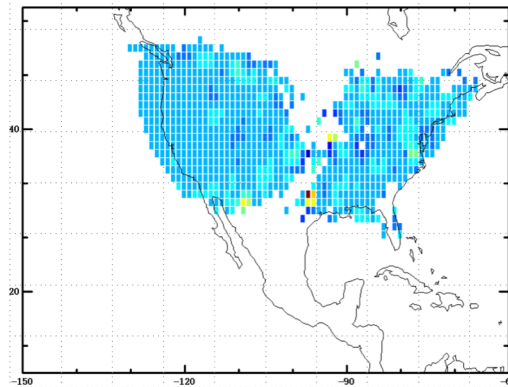
1. Texas University at Arlington

2. Nanchang University

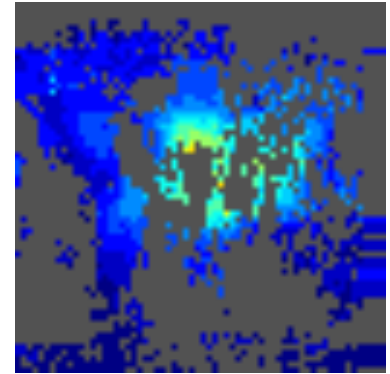
# Data missing is a **COMMON** issue!



Polar observation



Regional observation



Global observation

**Deep learning** can be also a good solution!

Similar problem to deep learning:  
**image completion**



**GAN**

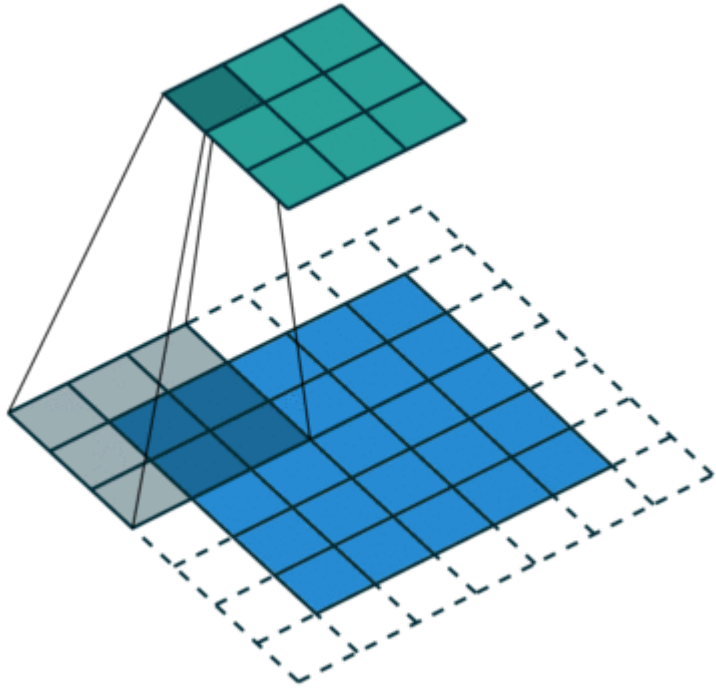
# Generative Adversarial Net (GAN)

**Min-Max game**

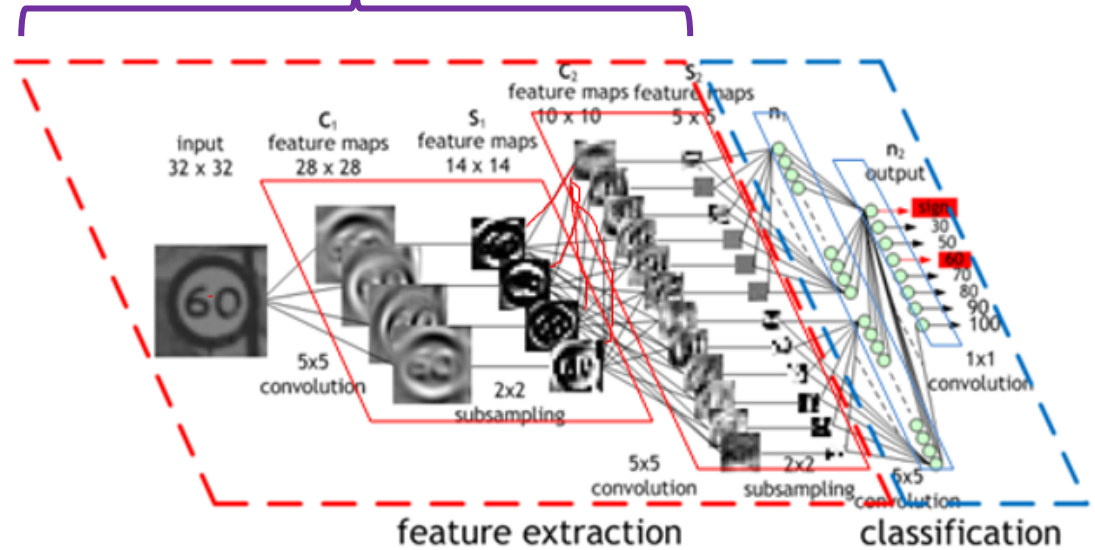


# DCGAN= deep convolutional GAN

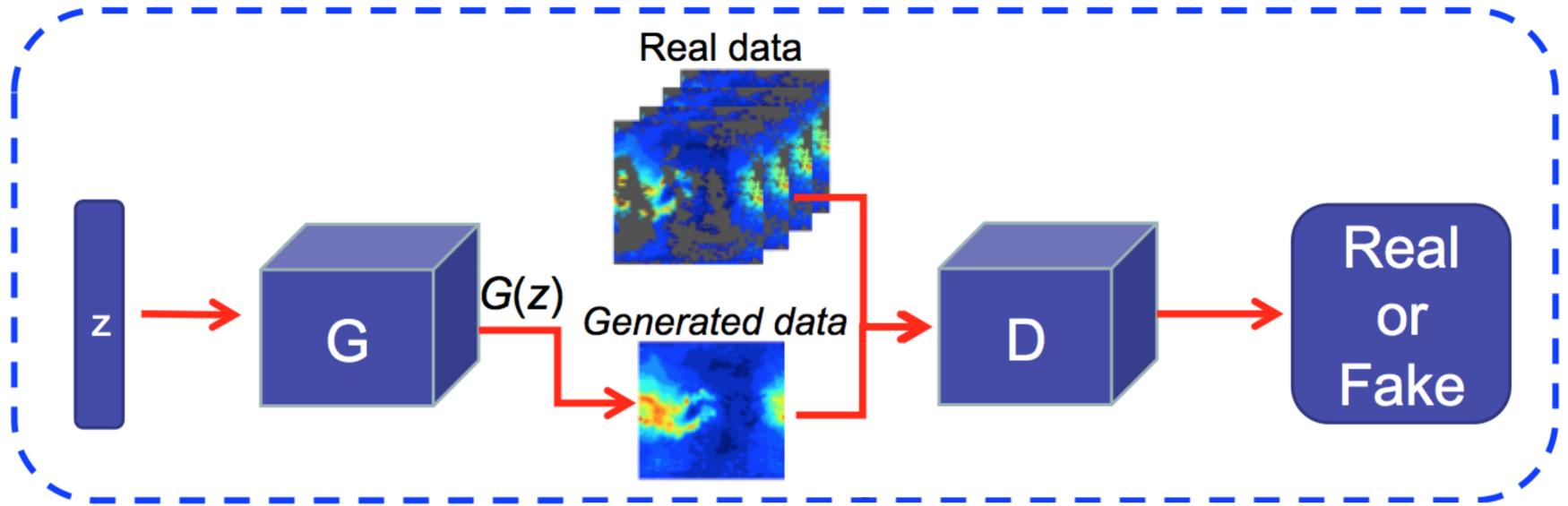
feature extraction



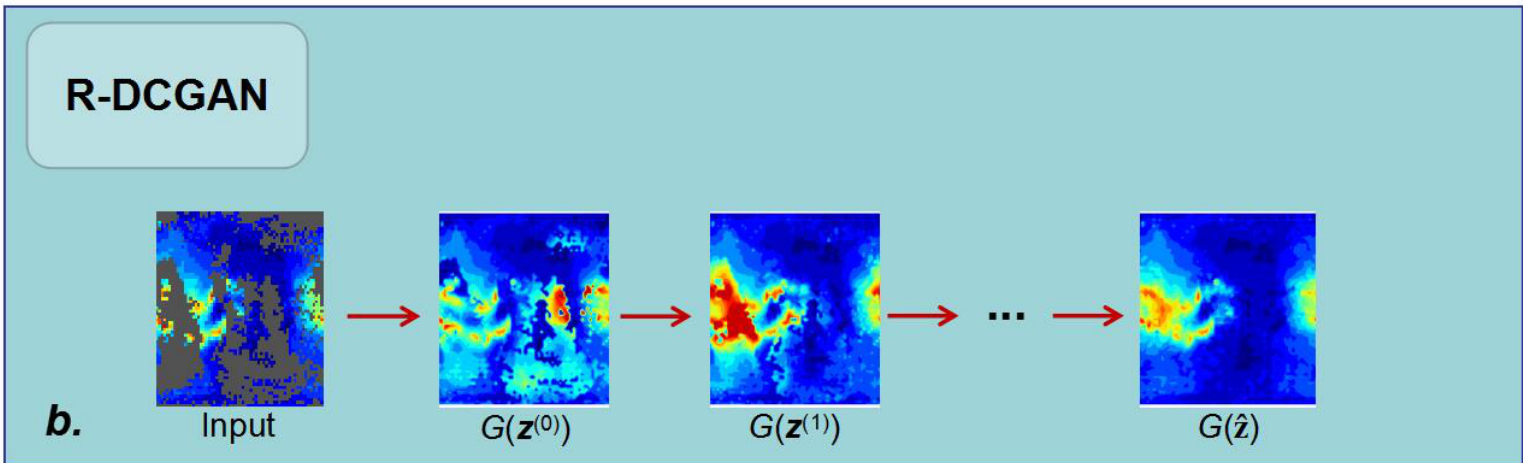
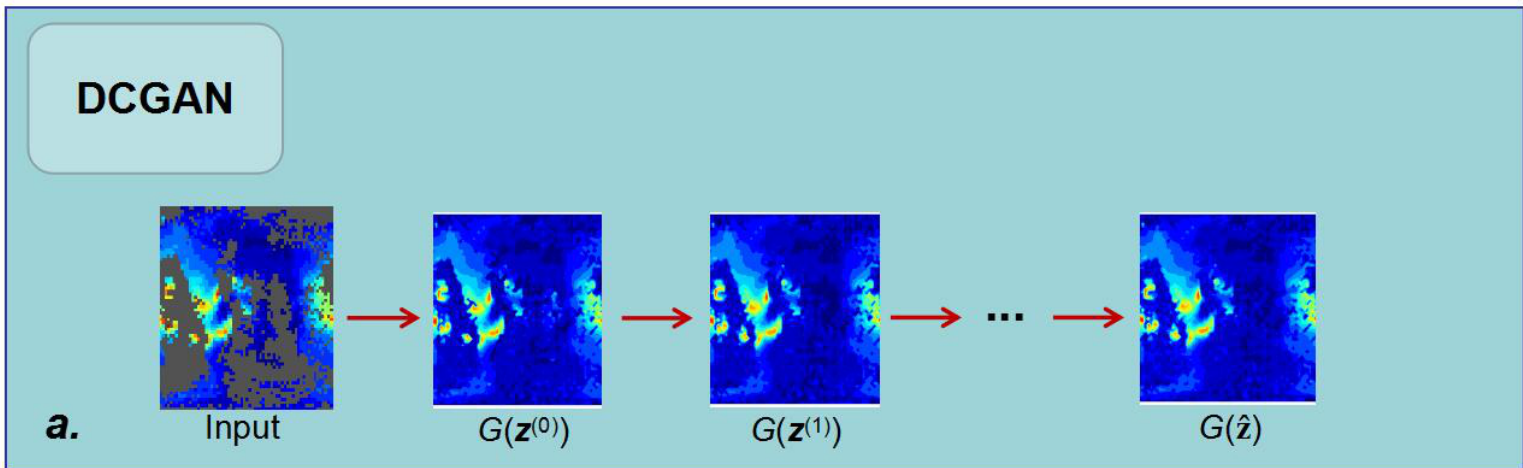
original images



# An improved DCGAN

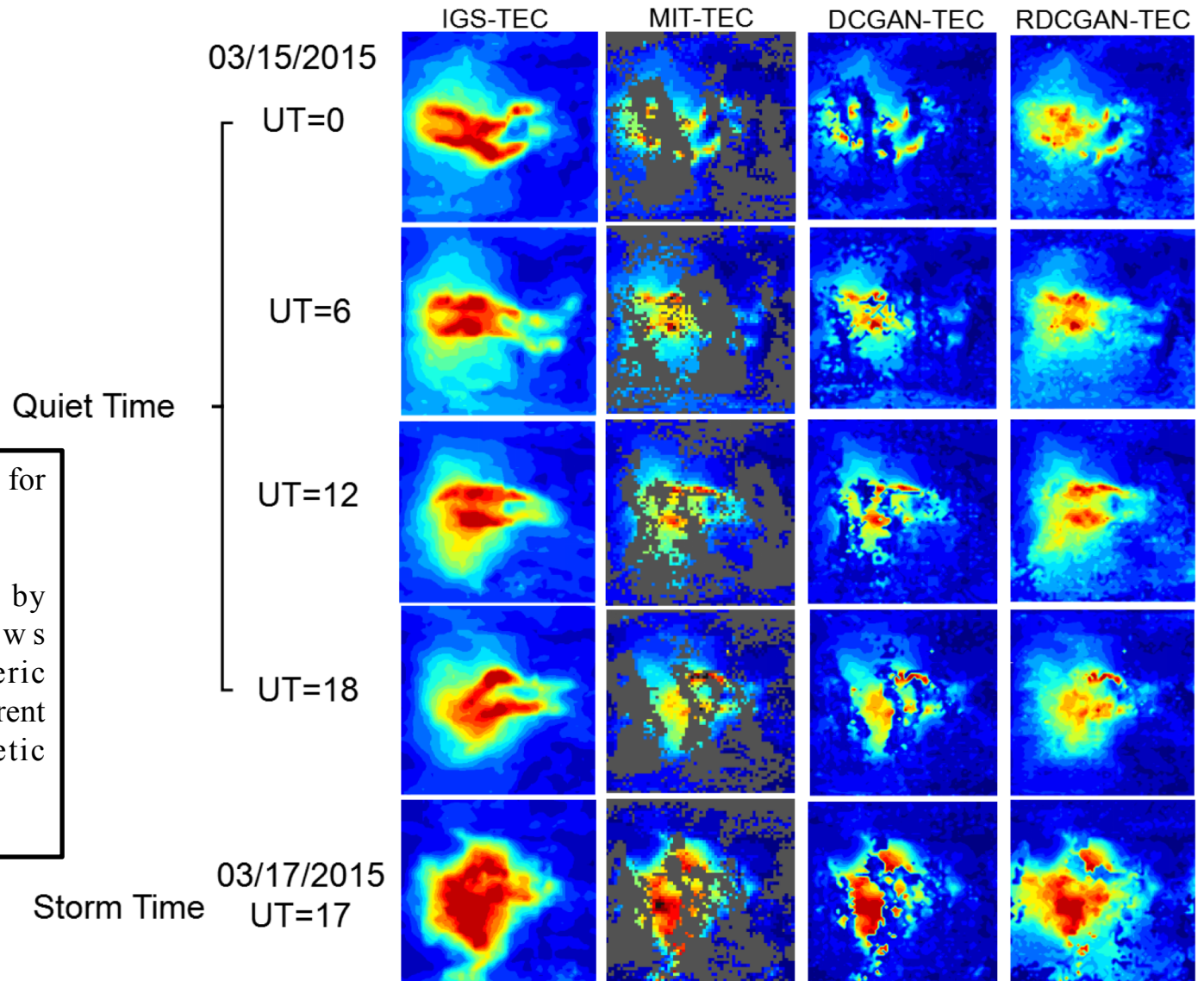


# comparing DCGAN and RDCGAN





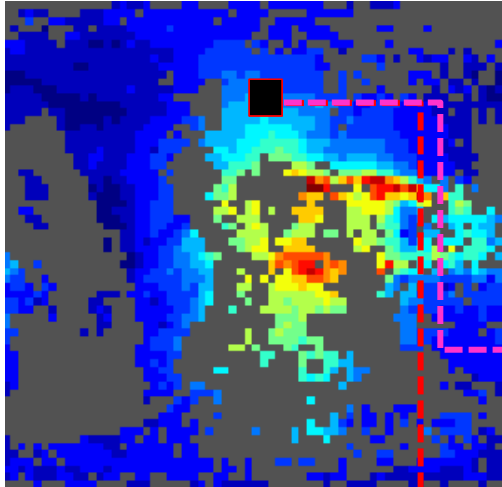
# Result: Time and Conditions



- DCGAN can not work for TEC map completion
- The result generated by RDCGAN can shows satisfactory ionospheric peak structures at different times and geomagnetic conditions.

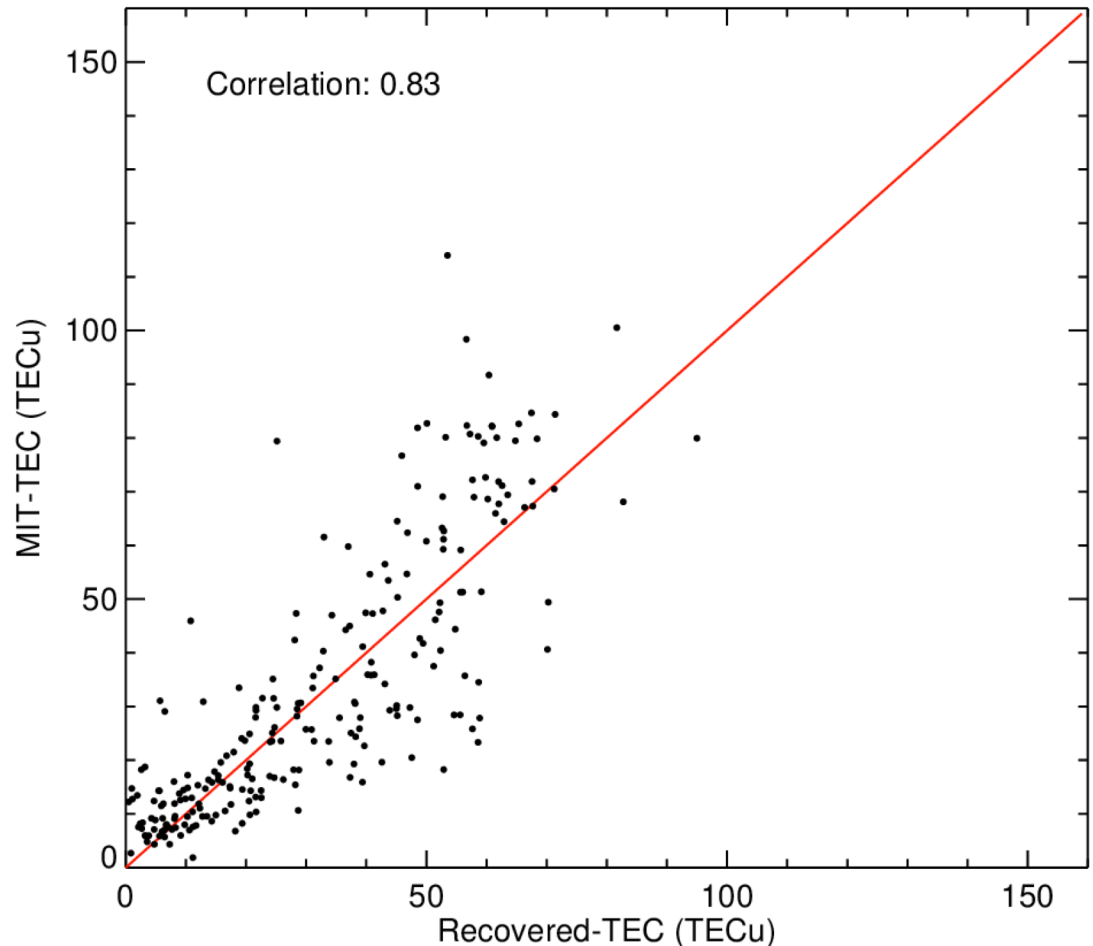


# How real the result generated by RDCGAN?



MIT-TEC map with data missing

- The recovered-TEC by RDCGAN is very similar to original observation
- The  $t$ -test also prove they have no statistically significant difference



Recoverd it by RDCGAN ↑

# Summary

**Deep learning love big data!**



*Thank you!*