Typhoon Sensei

NVIDIA TEAM

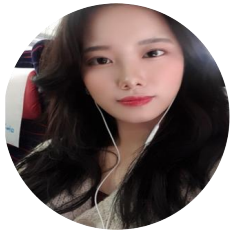
Our Members

Jiho Ko

Graduate student at Pohang University of Science and Technology (POSTECH)'s Climate System Lab.

Changi Lee

Graduate student at Chonnam National University's Climate Science Lab. My major is education, but I interested in climate and atmospheric science.



Jinwan Joo

Student at Kyungpook National University's Mesoscale Weather Extremes Lab.

Yelim Kim

Research Assistant at Seoul National University's Weather and Climate Dynamics Lab,

Gunwoo Do

Graduate student at Korea Maritime & Ocean University's Climate Science Lab.

Dasom Ryu

Graduate student at Korea Maritime & Ocean University's Climate Science Lab.

Haedo Baek

Graduate student at Chungnam National University`s Ocean Climate Dynamics LAB.

Our Mentors

Hyungon Ryu

NVIDIA

Daewon Kim

Machine learning engineer, works in HanwhaSystems/ICT

Song chi-oh

Machine Learning Engineer
現 Chart studio CEO
前 Linewalks(現 Kakao healthcare)

Aswinkumar

NVIDIA

Jeff Adie

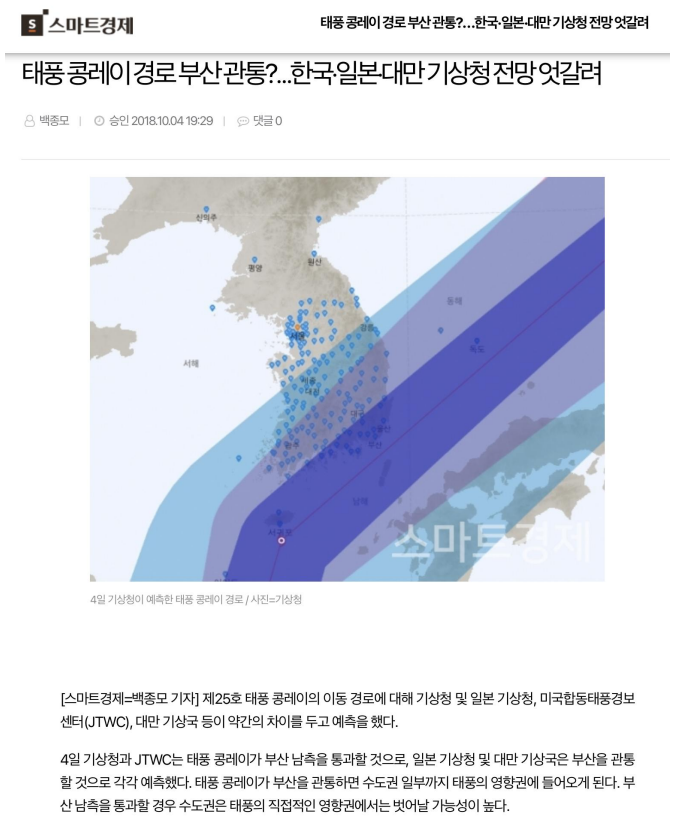
NVIDIA

Juntao Yang

NVIDIA

Socially Arisen Issue

Prediction from **ECMWF** about the projected path of Typhoon Kongrei was inaccurate



스마트경제

태풍 콩레이 경로 부산 관통?...한국·일본·대만 기상청 전망 엇갈려

태풍 콩레이 경로 부산 관통?...한국·일본·대만 기상청 전망 엇갈려

백종모 | 승인 2018.10.04 19:29 | 댓글 0

4일 기상청이 예측한 태풍 콩레이 경로 / 사진=기상청

[스마트경제=백종모 기자] 제25호 태풍 콩레이의 이동 경로에 대해 기상청 및 일본 기상청, 미국합동태풍경보센터(JTWC), 대만 기상국 등이 약간의 차이를 두고 예측을 했다.

4일 기상청과 JTWC는 태풍 콩레이가 부산 남측을 통과할 것으로, 일본 기상청 및 대만 기상국은 부산을 관통할 것으로 각각 예측했다. 태풍 콩레이가 부산을 관통하면 수도권 일부까지 태풍의 영향권에 들어오게 된다. 부산 남측을 통과할 경우 수도권은 태풍의 직접적인 영향권에서는 벗어날 가능성이 높다.

아주경제 | 태풍 콩레이 예상경로, 한국·미국·유럽 기상청 달라…美 기상청 "우리나라 관통할 것"

태풍 콩레이 예상경로, 한국·미국·유럽 기상청 달라…美 기상청 "우리나라 관통할 것"

정세희 기자 | 입력 2018-10-01 09:54

가 가

| 유럽 기상청 "대만 관통할 것"

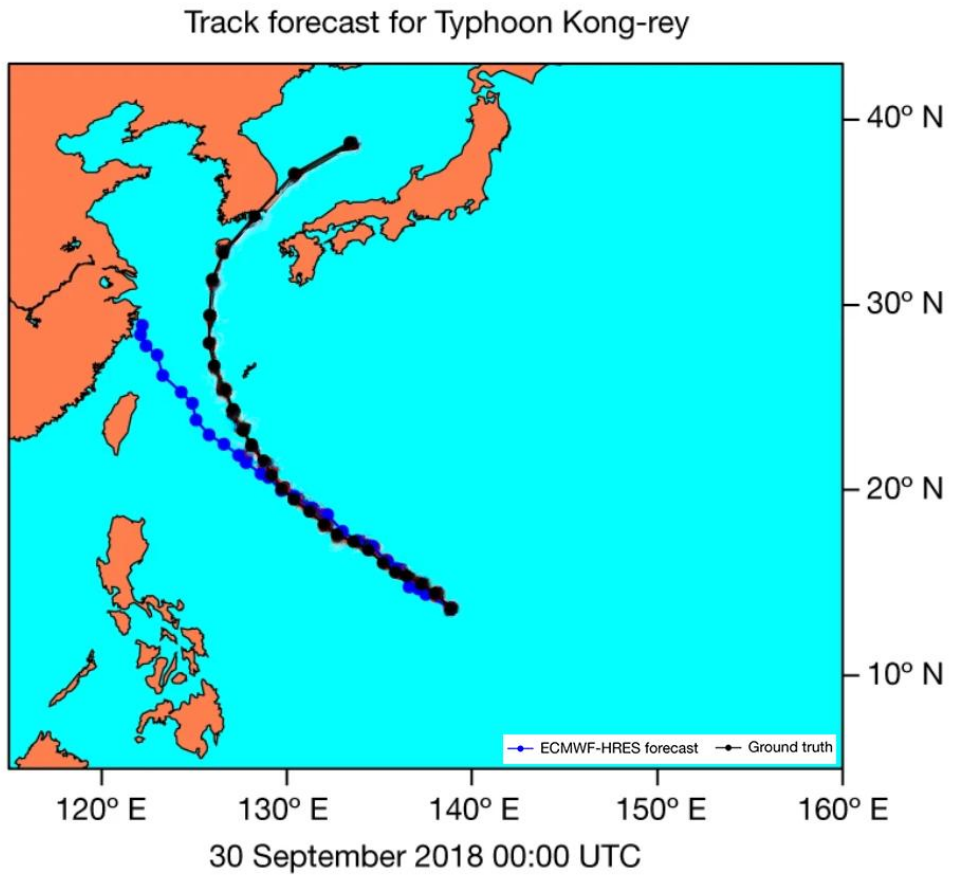
[사진=네이버 날씨 캡쳐]

ECMWF is the European Centre for Medium-Range Weather Forecasts.

This model is considered the best-performing numerical model.

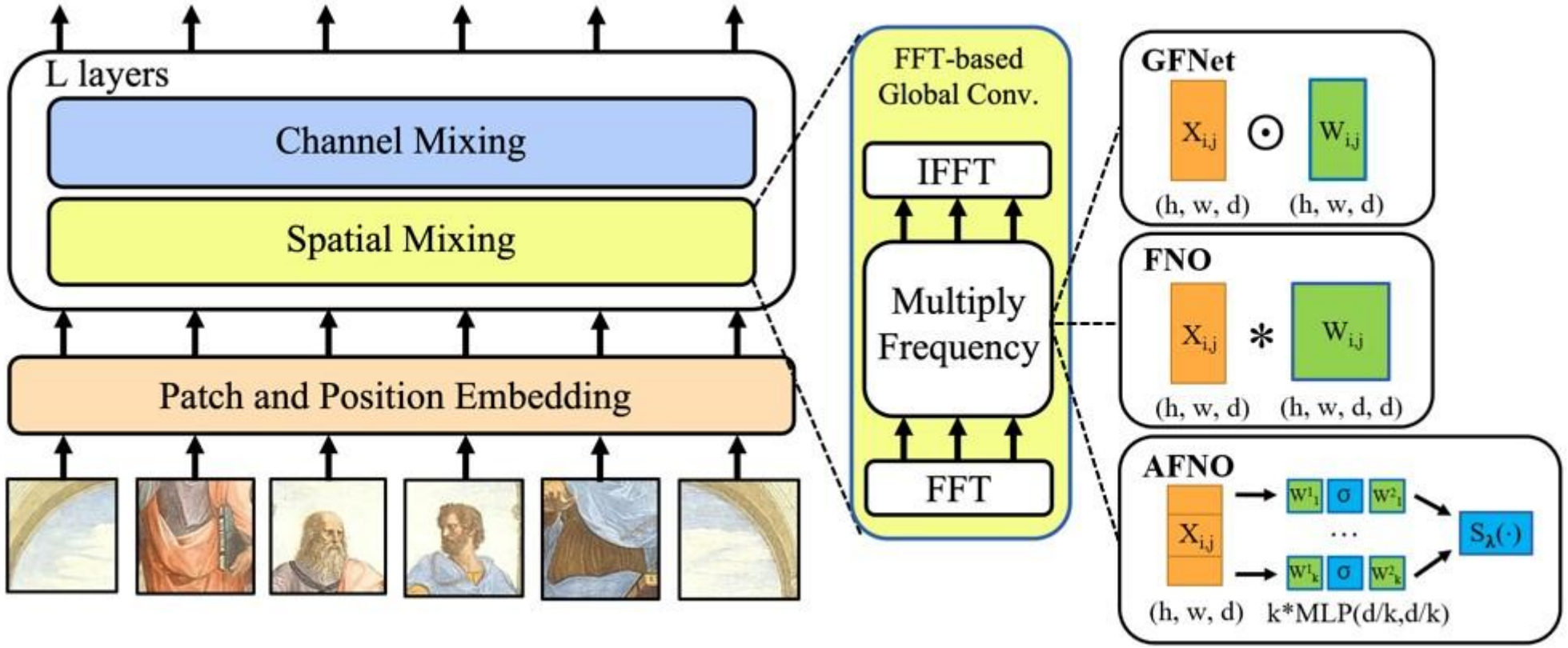
Our Hackathon Topic

- Predict Typhoon Kongrei and potentially other typhoons using FCN



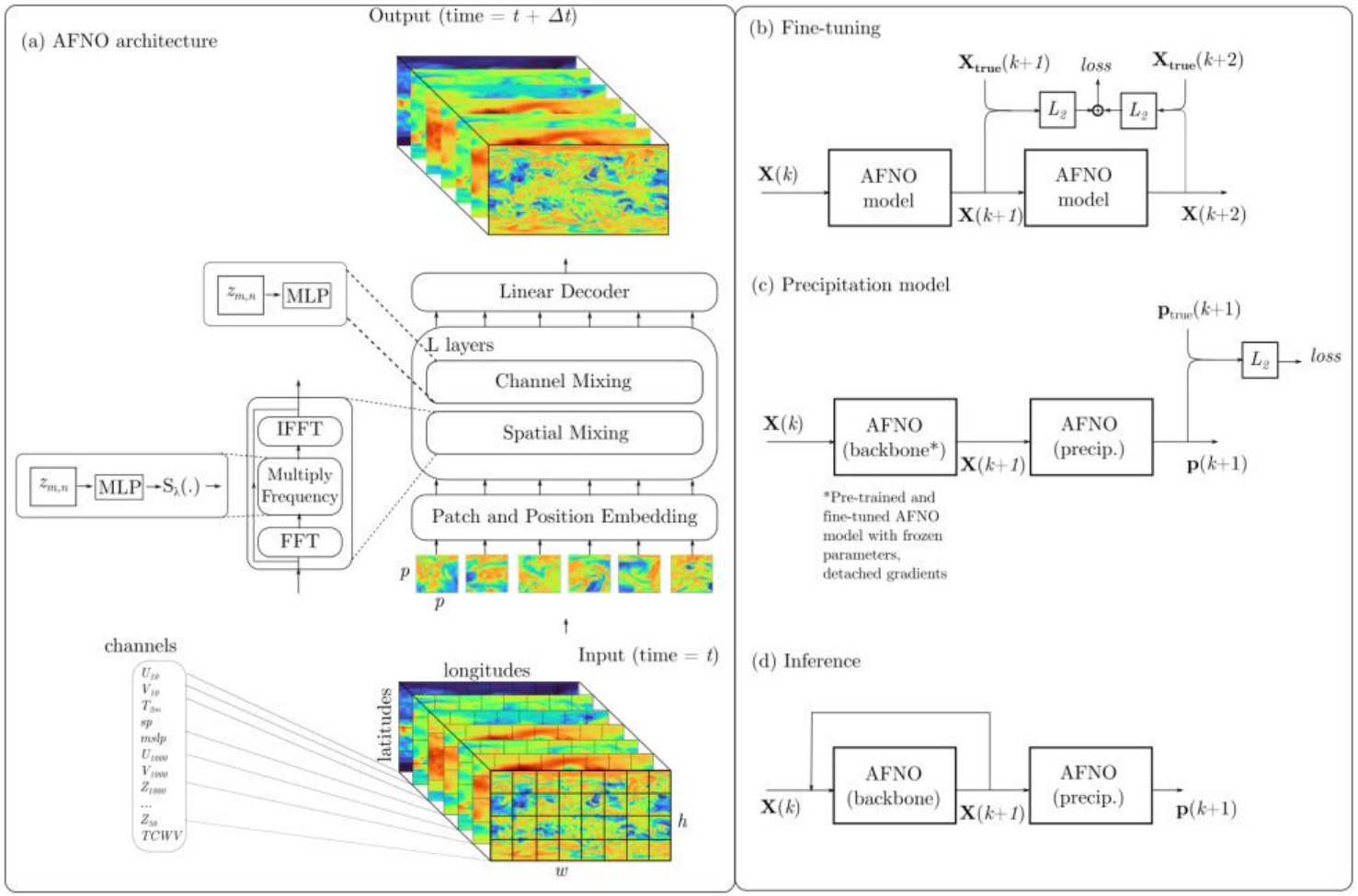
Our Hackathon Topic

- FCN model structure——AFNO



Our Hackathon Topic

- FCN model structure



What is Our Goal?

- Exploring how we can leverage our background knowledge effectively.
  - Meteorological research, front-end, deep-learning training

The model is already developed, but training it within the limited time is unfeasible. How can we improve this situation?

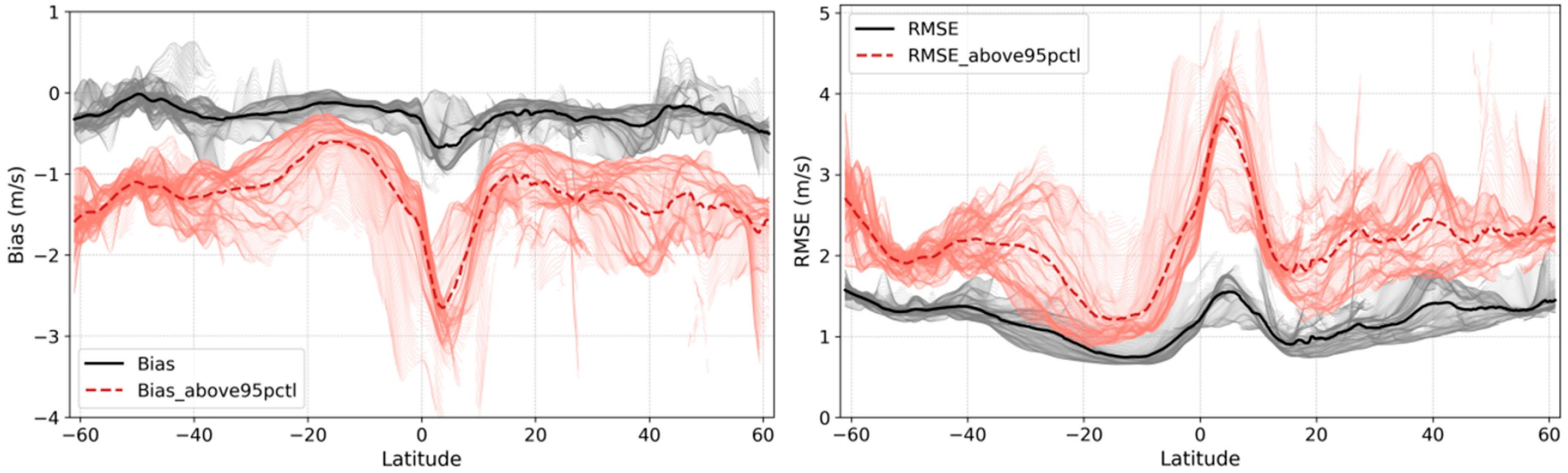
Is there any possibility of applying the model for typhoon forecasts?

The model is already developed, but training it within the limited time is unfeasible.
How can we improve this situation?

- The problems we encountered & proposed solutions

1. Insufficient Data for forecasting

   - underestimated for the wind speed values

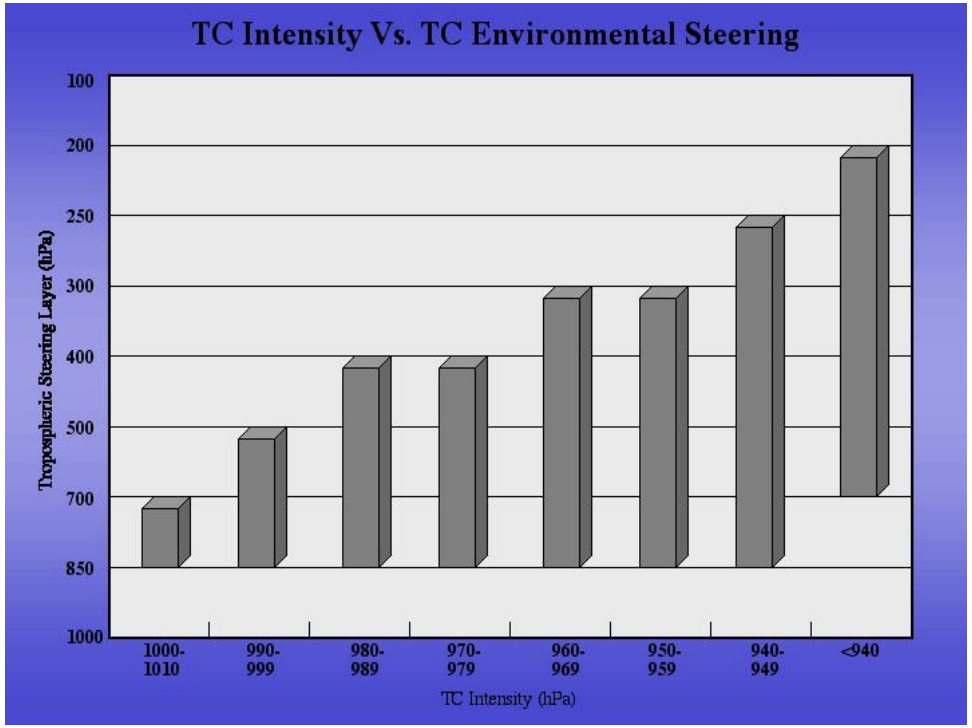


Campos, R.M.; Gramcianinov, C.B.; de Camargo, R.; da Silva Dias, P.L. Assessment and Calibration of ERA5 Severe Winds in the Atlantic Ocean Using Satellite Data. Remote Sens. 2022, 14, 4918.

The model is already developed, but training it within the limited time is unfeasible.
How can we improve this situation?

2. limitations of FCN in typhoon forecasting

"FCN is a global data-driven weather forecasting model that provides accurate short to medium range global predictions at 0.25◦ resolution."



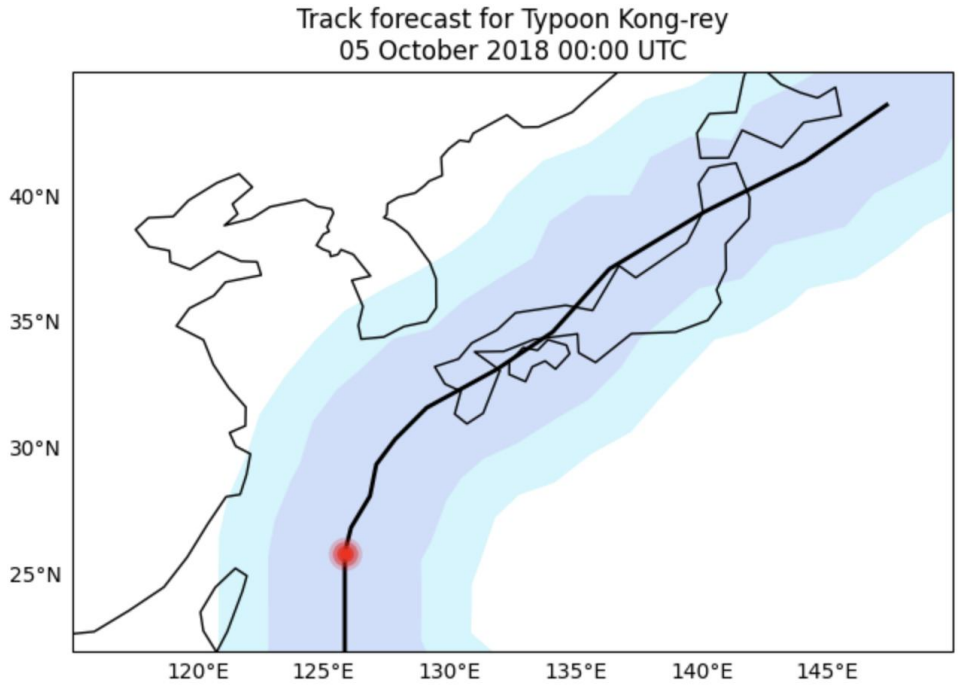
Vertical Level	Variables
Surface	$U_{10}, V_{10}, T_{2m}, sp, mslp$
~~$1000hPa$~~	~~U, V, Z~~
$850hPa$	T, U, V, Z, RH
$500hPa$	T, U, V, Z, RH
~~$50hPa$~~	~~Z~~
Integrated	$TCWV$

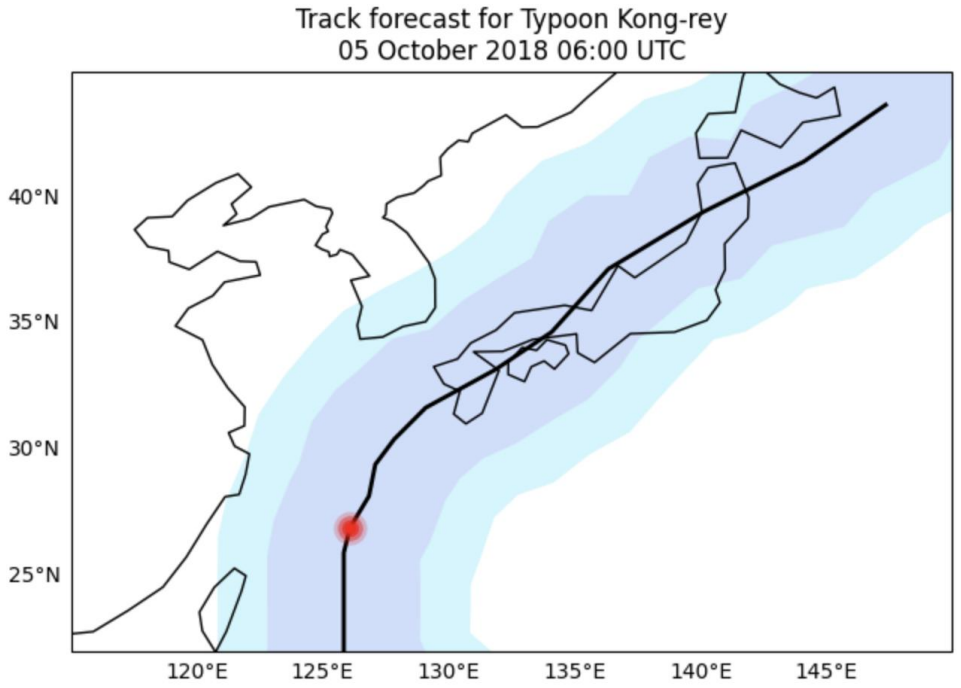
+ 250hPa **T, U, V, Z, RH**

The model is already developed, but training it within the limited time is unfeasible.
How can we improve this situation?

3. Reduce the forecast intervals & increase frequency

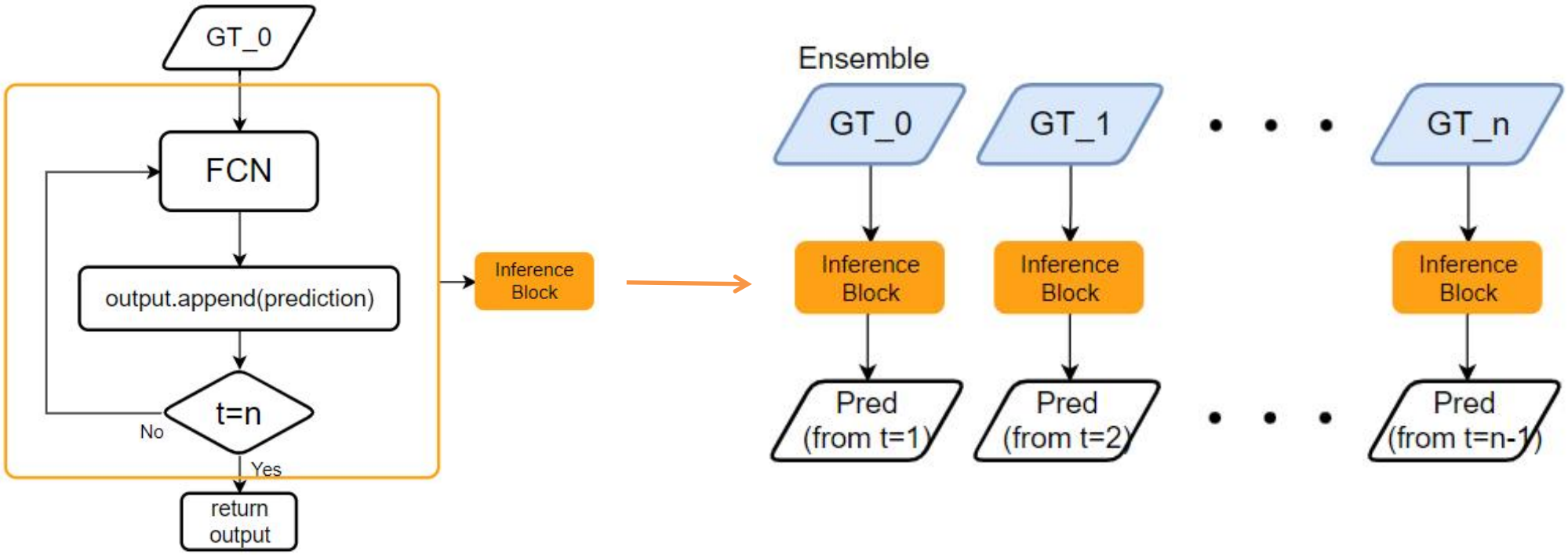
"These variables, listed in the table below are sampled from the ERA5 dataset at a temporal resolution of 6 hours."





The model is already developed, but training it within the limited time is unfeasible.
How can we improve this situation?

4. Autoregressive Predictions with Ground Truth (GT) Data:

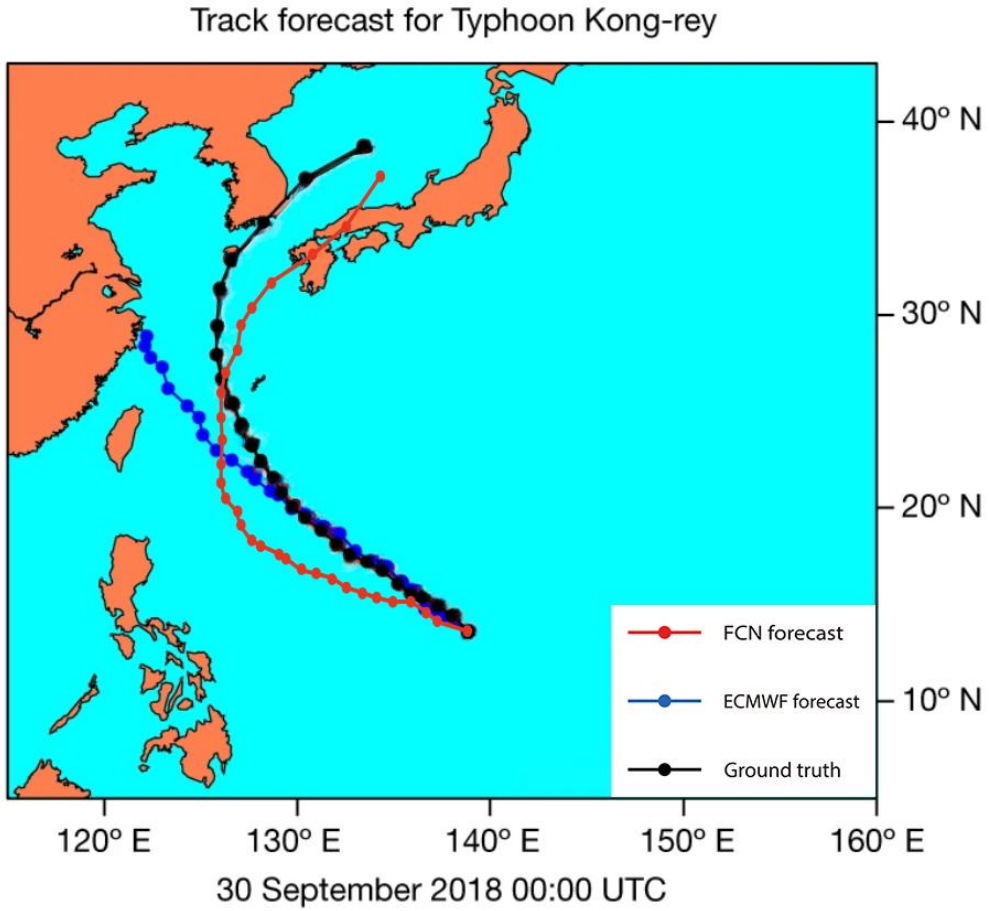


Original

New Structure

The model is already developed, but training it within the limited time is unfeasible.
How can we improve this situation?

4. Autoregressive Predictions with Ground Truth (GT) Data:



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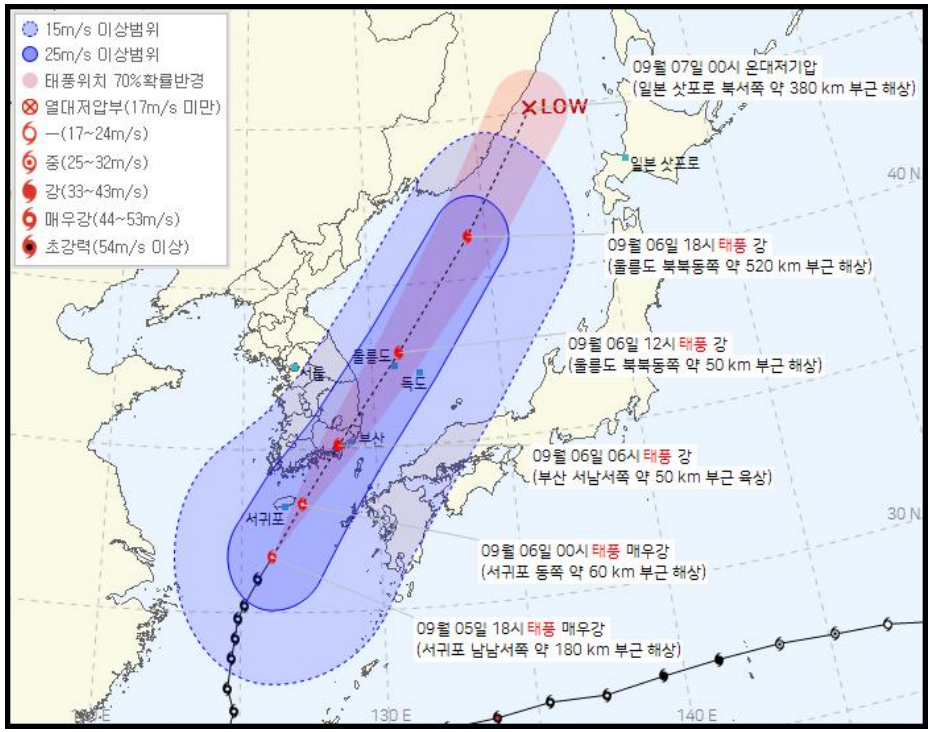
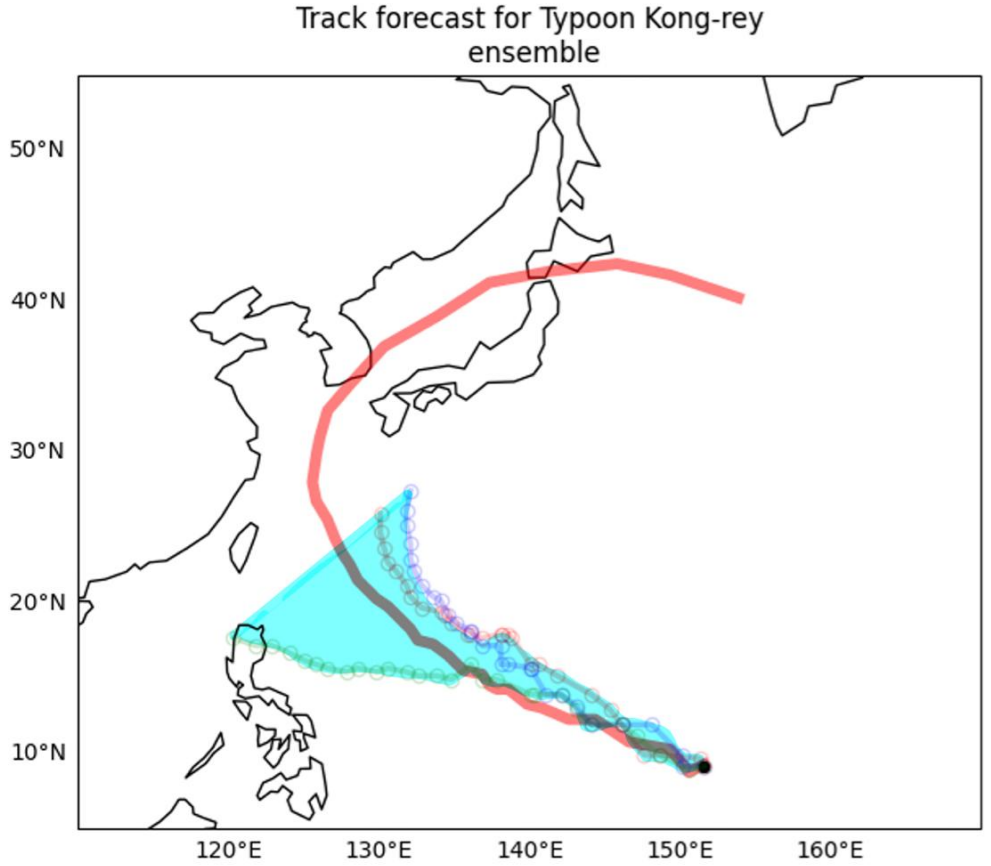




Considering the possibility of applying the model for typhoon forecasts.

- The problems we encountered & proposed solutions

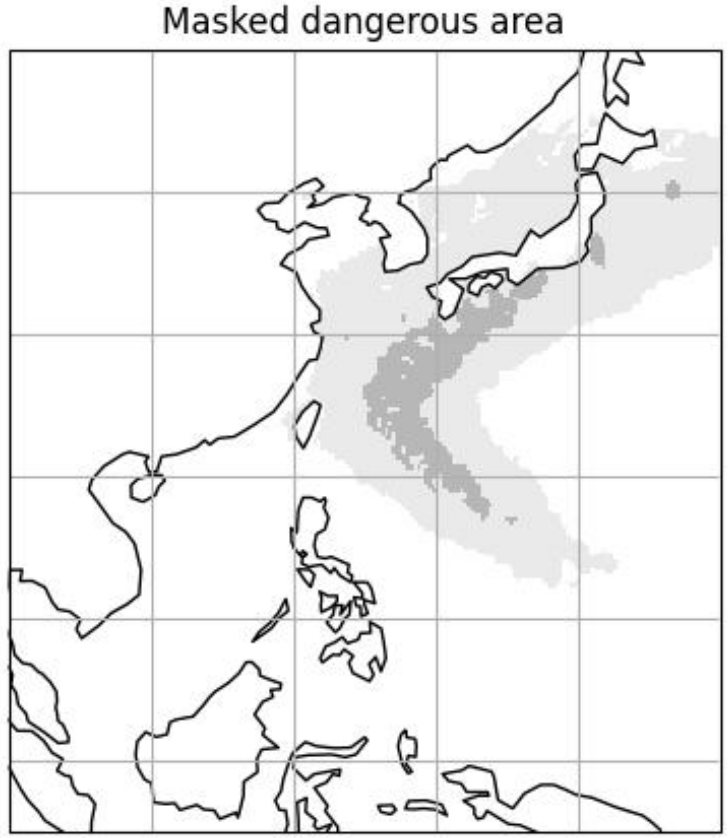
1. Selecting the typhoon influence radius

○ 태풍의 크기

– 태풍의 크기 구분 기준은 태풍 중심으로부터 초속 15m의 바람이 부는 반경(강풍반경)을 사용함

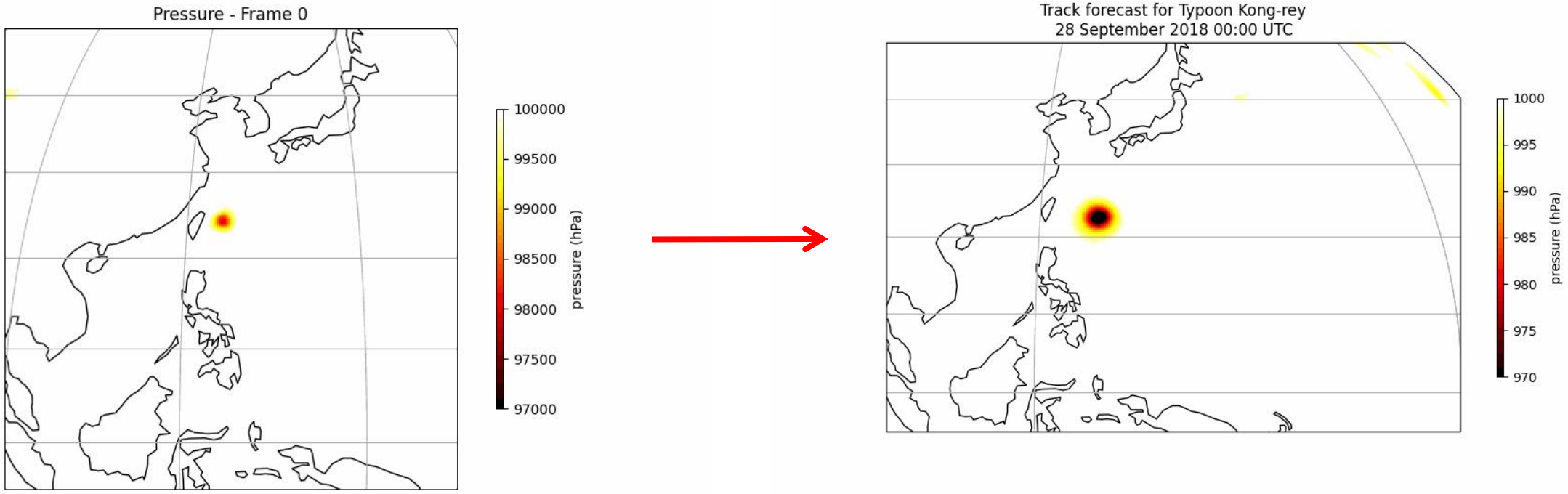
단계	풍속 15m/s 이상의 반경
소형	300km 미만
중형	300km 이상 ~ 500km 미만
대형	500km 이상 ~ 800km 미만
초대형	800km 이상

From Typhoon White Book



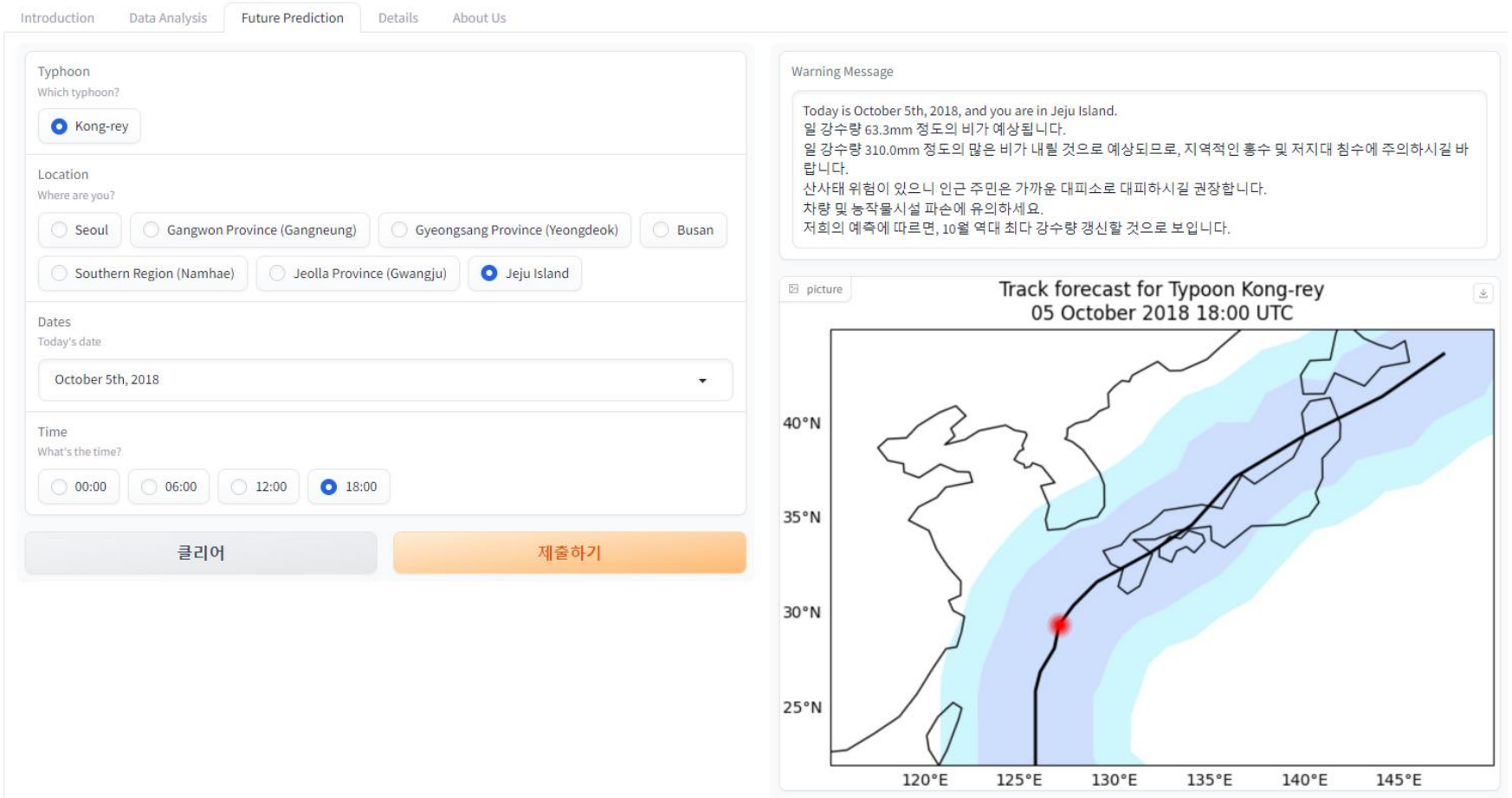
Considering the possibility of applying the model for typhoon forecasts.

2. Processing multiple typhoons



Considering the possibility of applying the model for typhoon forecasts.

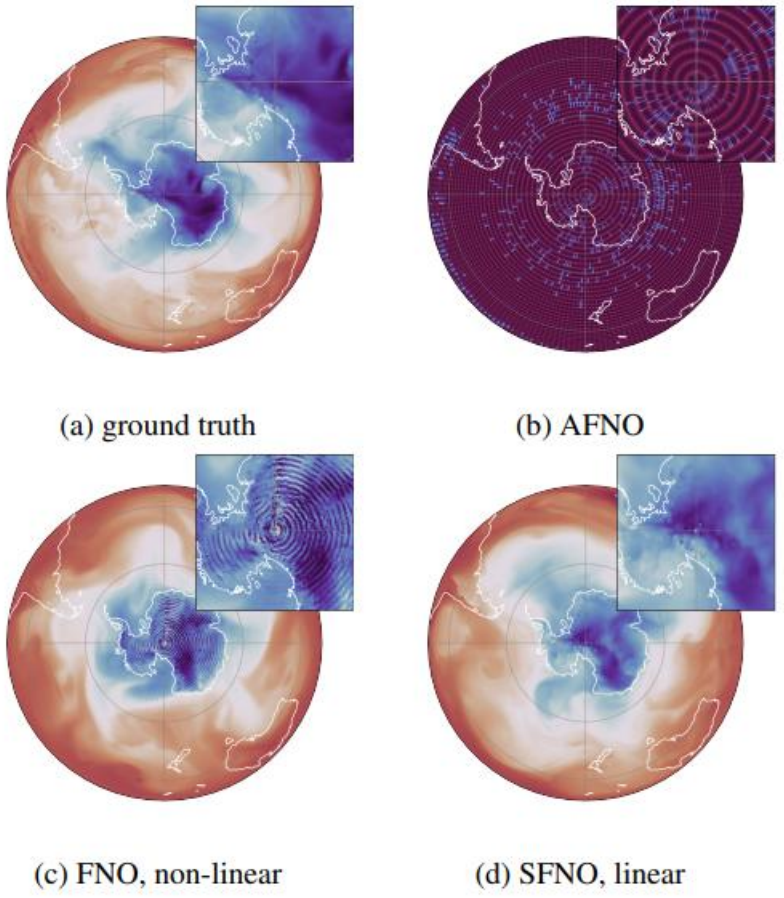
3. How to make users use it?



Insights from the Hackathon

- Potential research topics for future exploration.

  1. AFNO -> SFNO



(a) ground truth (b) AFNO

(c) FNO, non-linear (d) SFNO, linear

Bonev, Boris et al. “Spherical Fourier Neural Operators: Learning Stable Dynamics on the Sphere.” ArXiv abs/2306.03838 (2023): n. pag.

Insights from the Hackathon

- Potential research topics for future exploration.

  2. Change variables

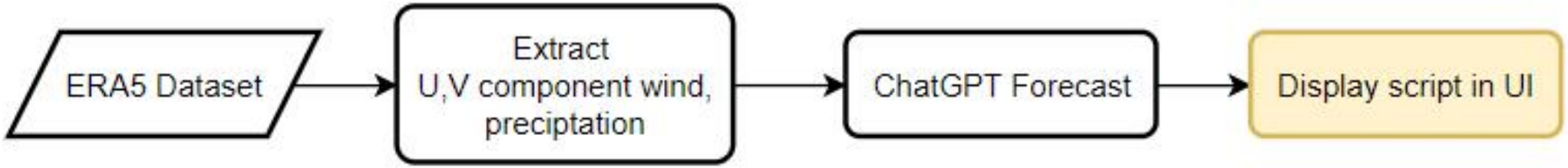
Vertical Level	Variables
Surface	$U_{10}, V_{10}, T_{2m}, sp, mslp$
~~$1000hPa$~~	~~U, V, Z~~
$850hPa$	T, U, V, Z, RH
$500hPa$	T, U, V, Z, RH
~~$50hPa$~~	~~Z~~
Integrated	$TCWV$

+ 250hPa **T, U, V, Z, RH**

Insights from the Hackathon

- Potential research topics for future exploration.

  3. enhance UI for real-case

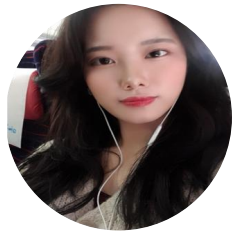


Insights from the Hackathon

- Ideas on how we can apply the knowledge gained in our respective labs.

한파 발생 예측에서는 태풍보다 더 나은 예측 성능을 보일 것으로 생각이 들고, 적용해보고 싶다

기후변화 시나리오를 이용한 미래 기후에서의 태풍 진로 및 강도 예측



자연 재해로 인해 발생하는 사회 경제적 피해 예측

현재 딥러닝 모델들의 성능향상을 위한 언급된 개선점

FCN의 inference 코드를 계속 수정하며 돌리면서 했던 경험을 바탕으로 딥러닝 모델을 활용할 때 어떤식으로 코드를 구성해서 작동시키면 될지에 로직에 대해 이해하게 된 것을 적용시켜 직접 모델을 구현하여 실행하여 현재 도메인에 적용 시키면 될 것이라 생각이 들었습니다.

UI for Real-case

Insights from the Hackathon

- “One Sentence”

조교님 목소리 좀 크게 해주세요
ㅎ.ㅎ

연구실을 나와서 좋았다..

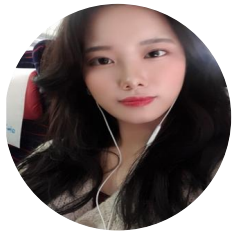
대전은 노잼도시가 아니다

“논문 용 코드”에 대해서 알고
싶지 않았지만 알게 되었다.

신경식 강사님 사진 같이 찍어도
되나요? 아니면 싸인이라도...

오프라인 해커톤 진행 기간 동안
랩미팅 준비하는 기분이었습니다...ㅠ

배고플 때가 없었다
너무 많이 먹었다



THANK YOU!

Typhoon Sensei

Our jobs in the project

논문 자료 찾기, 시각화

시각화 개선

태풍 영향 반경 시각화,
UI 첫페이지

UI 구성 및 개발,
PPT 및 전체 총괄

데이터 분석, 시각화

inference.py수정, 앙상블 개선

UI Detail 페이지,
스타팅 포인트 3D 시각화