Learning the physics of cyclone evolution using deep learning:
application to synthetic cyclone track generation

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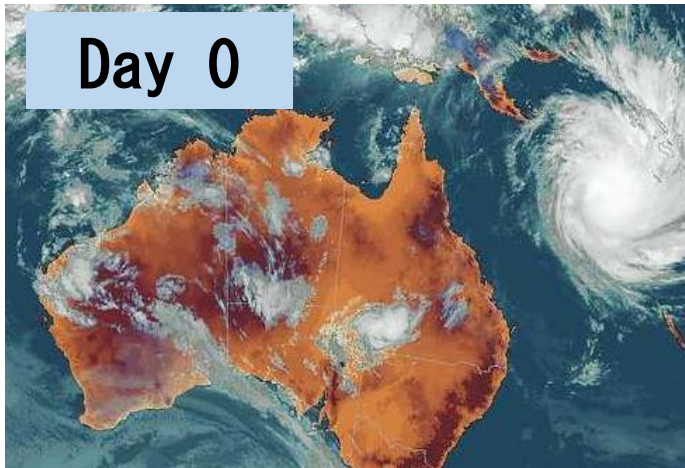Omri Anzecot
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(Photo courtesy of JCU)

Predicting cyclone's trajectory

How do we build an AI model?
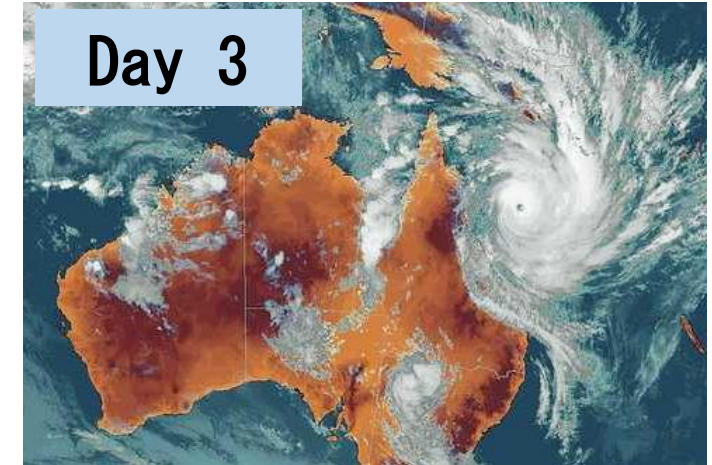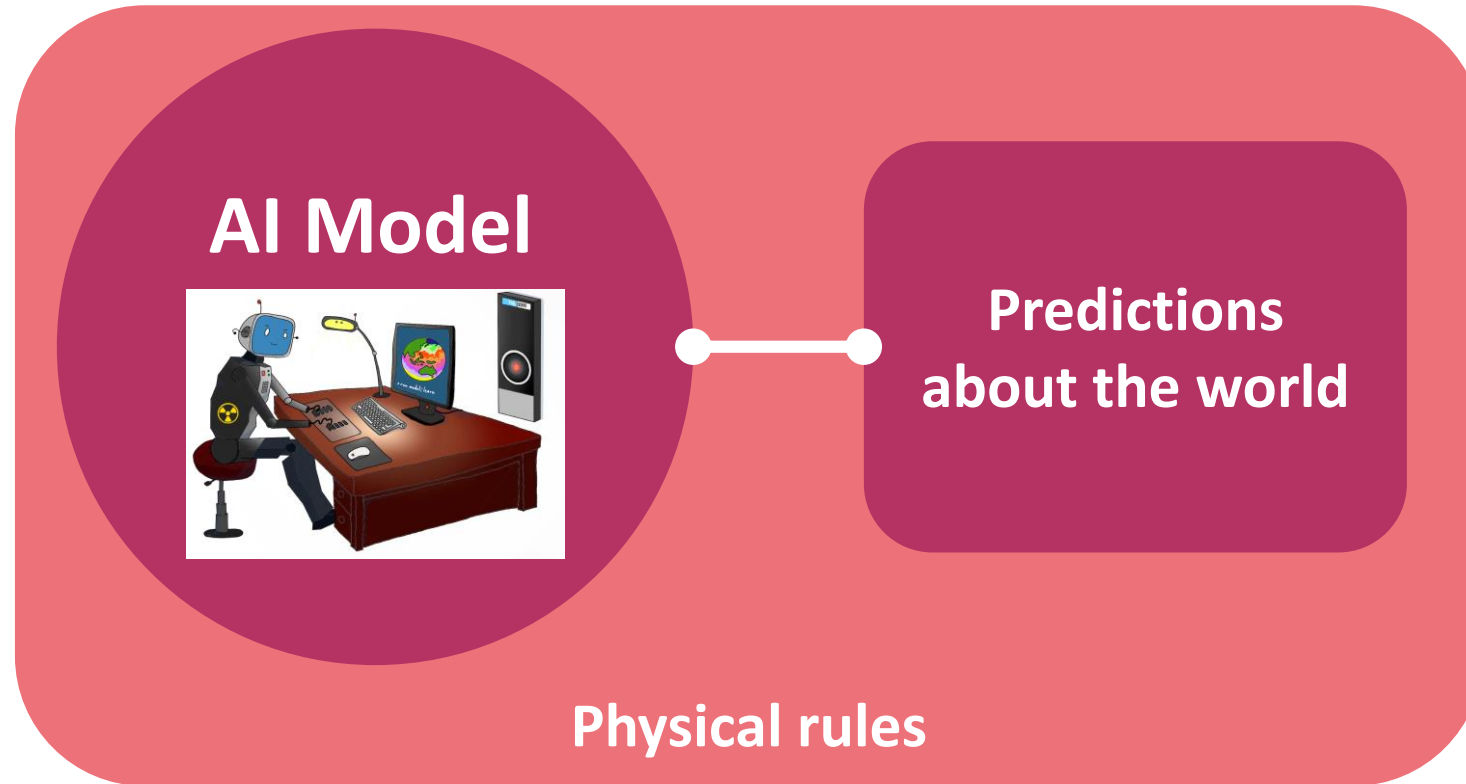
AI models learn about the world via **data**.

Unfortunately, we have very little data.

(The largest cyclone database only contains **4000** examples [IBTrACS and ERA5, 1970-2021].)

We used a novel deep learning model (Koopman Autoencoders) that combines physics + AI methods

Results

We found teaching the AI model about the physics
improved accuracy for cyclone predictions
(and also other scenarios!).

Physics-informed AI model

improved cyclone windspeed prediction by
40% after 24 hours and sea surface
temperature prediction by up to **200%**
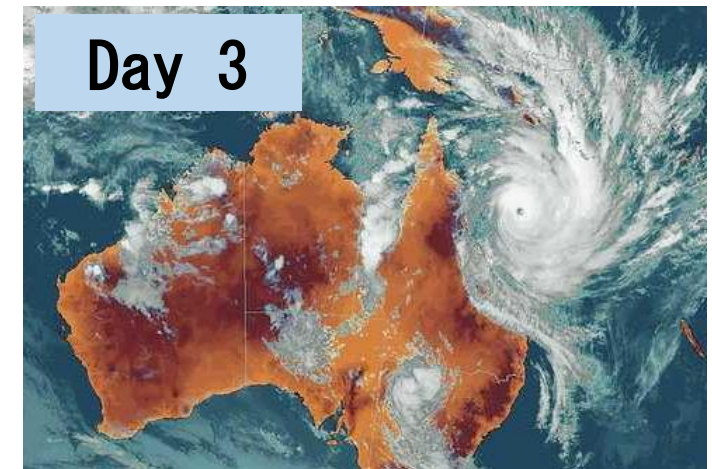
Predicting cyclone's trajectory

We can more accurately predict the movement of cyclones in new regimes.
How will a category 3 storm evolve south of Cairns?
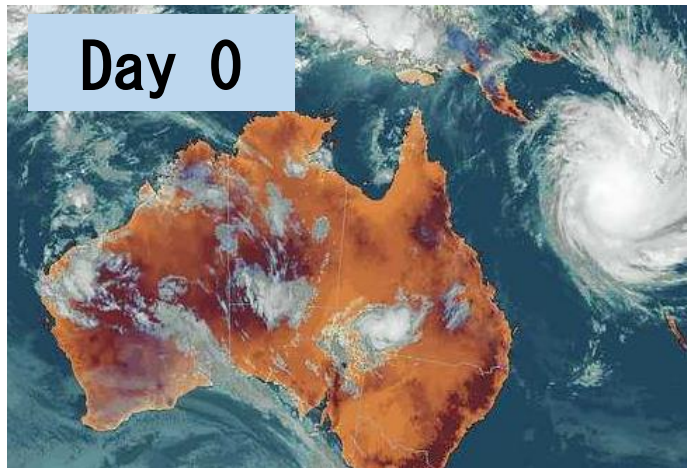
Statistical Physics-informed
Deep Learning AI Model

Accurate 😁

Cheap 😊

Using physical constraints + AI models

- Generate cheaply synthetic *but realistic* new cyclone trajectories
- Create large cyclone datasets that can be used to train novel/better models
- Leading to better preparation for future events

Thanks