Spontaneous ELLIS Hackathon

Exploring

Identifiability – Explainability – Extrapolation – Causality

How much solar energy is converted into chemical energy?

(1) $F_{GPP} = \epsilon_{max} \times PAR$ → Photosynthetic Active Radiation

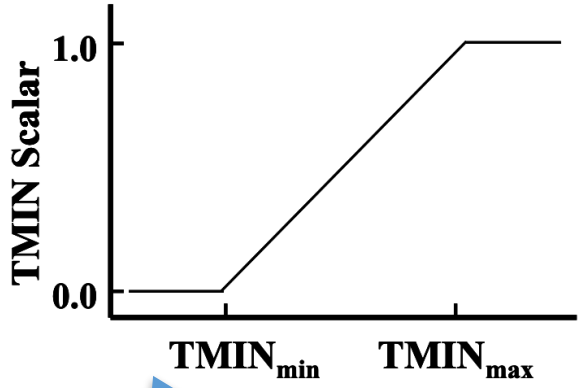
↘ Maximum Radiation-Use Efficiency

(2) $F_{GPP} = \epsilon_{max} \times PAR \times fPAR$ → Fraction of Absorbed Photosynthetic Active Radiation

Add temperature dependency

(3) $F_{GPP} = \epsilon_{max} \times PAR \times fPAR \times f_1(T_{min})$

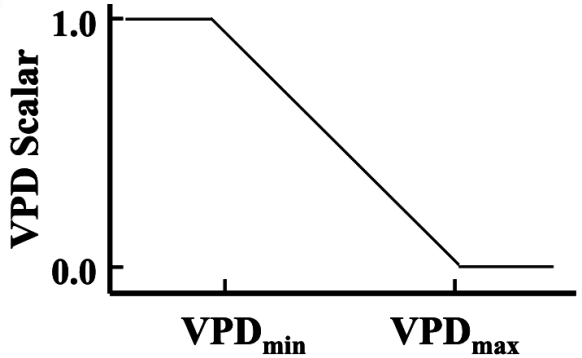
↙ Daily Minimum Temperature



Add water stress dependency

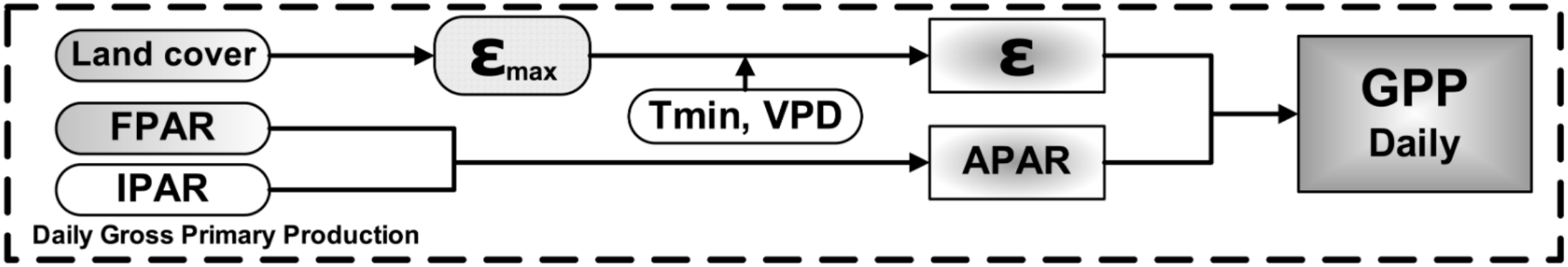
(4) $F_{GPP} = \epsilon_{max} \times PAR \times fPAR \times f_1(T_{min}) \times f_2(VPD)$

↙ Vapor Pressure Deficit



MODIS GPP Model (MOD17)

The MOD17 GPP Model at one glance



More details: https://www.ntsg.umt.edu/project/modis/user-guides/mod17c61usersguidev11mar112021.pdf

How?

Join the mattermost group

https://minervamessenger.mpdl.mpg.de/signup_user_complete/?id=5yc6iq67tigduxko8yd9snaine

pinplex/**Hackathon-Attribution**

This repository contains code (toy models) and data for the attribution and hybrid modeling hackathon.

1 Contributor 0 Issues 0 Stars 0 Forks

Get the GitHub repo

https://github.com/pinplex/Hackathon-Attribution

FOUR TASKS:

1. Hybrid Modeling
2. Extrapolation
3. Explainable AI
4. Causal Inference

Can we fit parts of the MODIS model using hybrid modeling?

$$\text{GPP} = \epsilon_{\text{max}} \times \underbrace{\text{Temperature Scalar}}_{f_{TS}(t_{min})} \times \underbrace{\text{Water Stress Scalar}}_{f_{WSS}(\text{vpd})} \times \underbrace{\text{Radiation Scalar}}_{f_{RS}(\text{rad},\text{FAPAR})}$$

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Pure ML Model

Model GPP as a function:

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- **Bonus Task 2:** Can we identify f_{WSS} and f_{RS} simultaneously?

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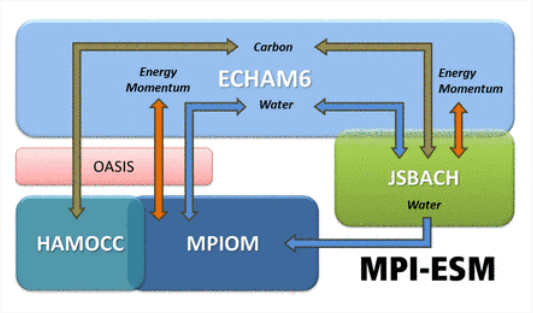
Today

Variables from ERA5 in Jena, Germany

Transient

Output of a transient run of an ESM at Jena, Germany



- **Task 1:** Does the model generalize to the different regimes if we only use one in training?

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- **Task 2:** Does the hybrid model generalize better than the pure ML model?

Did the pure ML model identify the correct function f_{WSS}?

- **Task 1:** Use your favorite explanation method for interpreting neural networks to determine whether the pure ML model identified the correct function f_{WSS}.

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- **Task 2:** Use your second favorite explanation method and compare the results.

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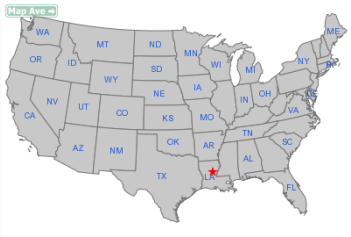
Jena, Louisiana



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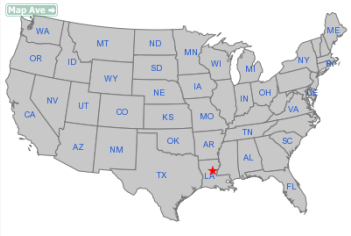
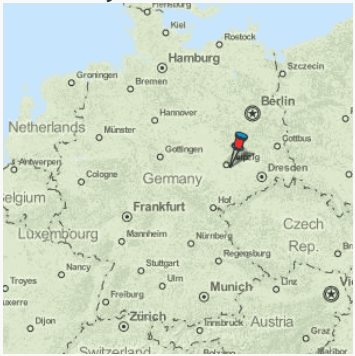


The pixel next to Jena, Germany



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- **Bonus Task:** Do the results change if we change the sampling frequency of GPP?