Ahmed M.S. Kheir

Coupling machine learning-based cloud computing with multiple crop models for robust yield predictions in arid regions

Outlines:

➢ Why robust predictions of yield is a hot spot?

➢ What is the developed approach?

➢ Advantages of CMs and ML in yield prediction

➢ Our developed hybrid CMs-ML approach, why it is important?

➢ What is next?

Why accurate yield prediction is important?

➢ It plays an essential role in decision making at global, regional, and field levels

➢ Developing and updating the yield gap in a specific region

➢ If a farmer knows how much yield he can expect from his land, he can plan his crops accordingly and increase his profit margin

➢ Early crop yield prediction plays an important role in reducing famine by estimating the food availability for the growing world population

➢ Building up accurate adaptation options for climate change scenarios

➢ Minimizing trade-offs between yield and resource efficiency for farming cropping systems
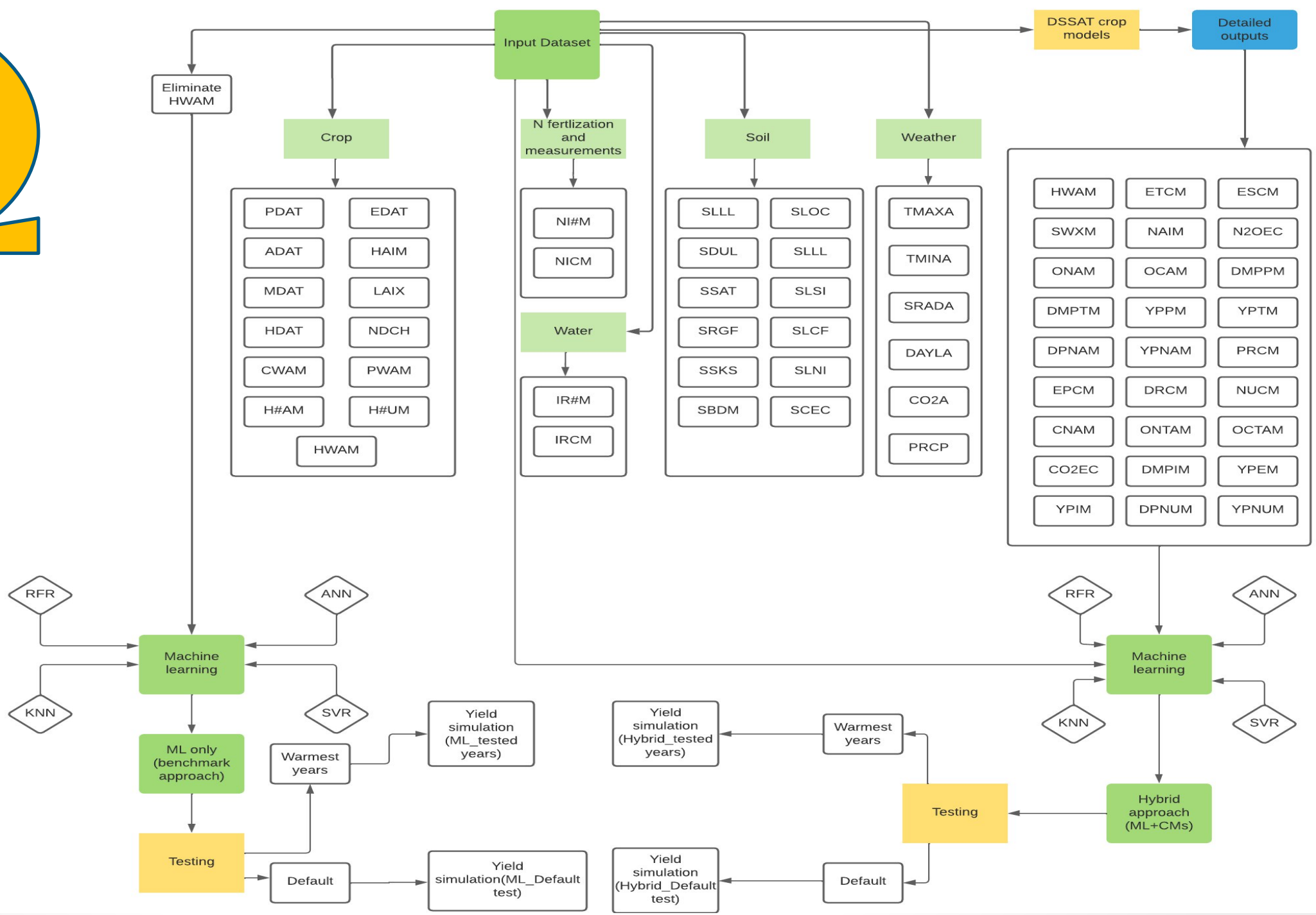
Importance of dynamic crop models

- Diagnose problems (Yield Gap Analysis)
- Precision agriculture
  - Diagnose factors causing yield variations
  - Prescribe spatially variable management
- Water and irrigation management
- Soil fertility management
- Plant breeding and Genotype * Environment interactions ("virtual" crop models)
- Gene-based modeling
- Yield prediction for crop management

- Climate variability & risk management
- Climate change impacts & adaptation
- Soil carbon sequestration
- Land use change analysis
- Targeting aid (Early Warning)
- Yield forecasting
- Biofuel production
- Risk insurance (rainfall)

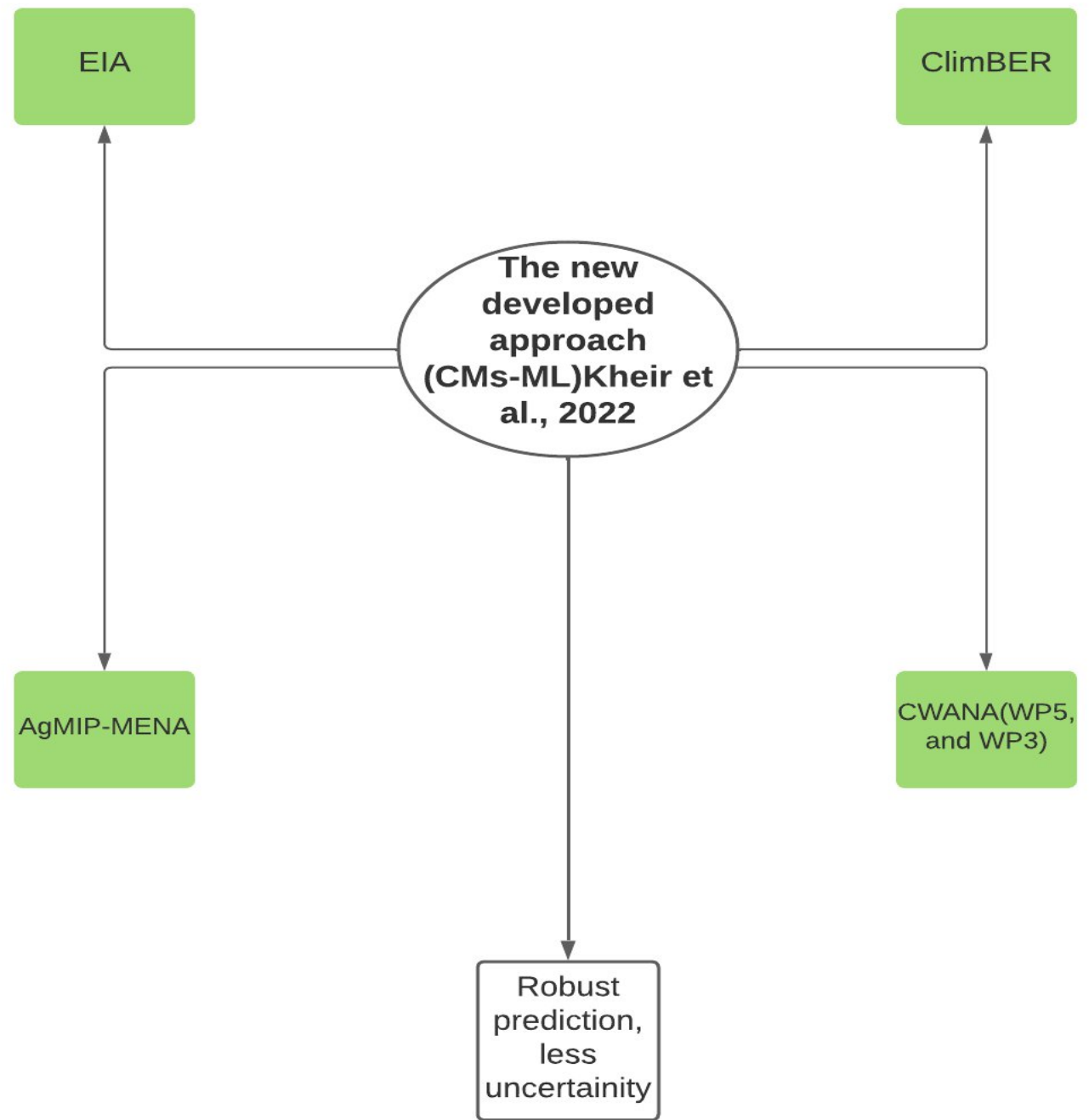Uncertainty associated with CM simulations

Xiong et al., 2019, Nature Food.
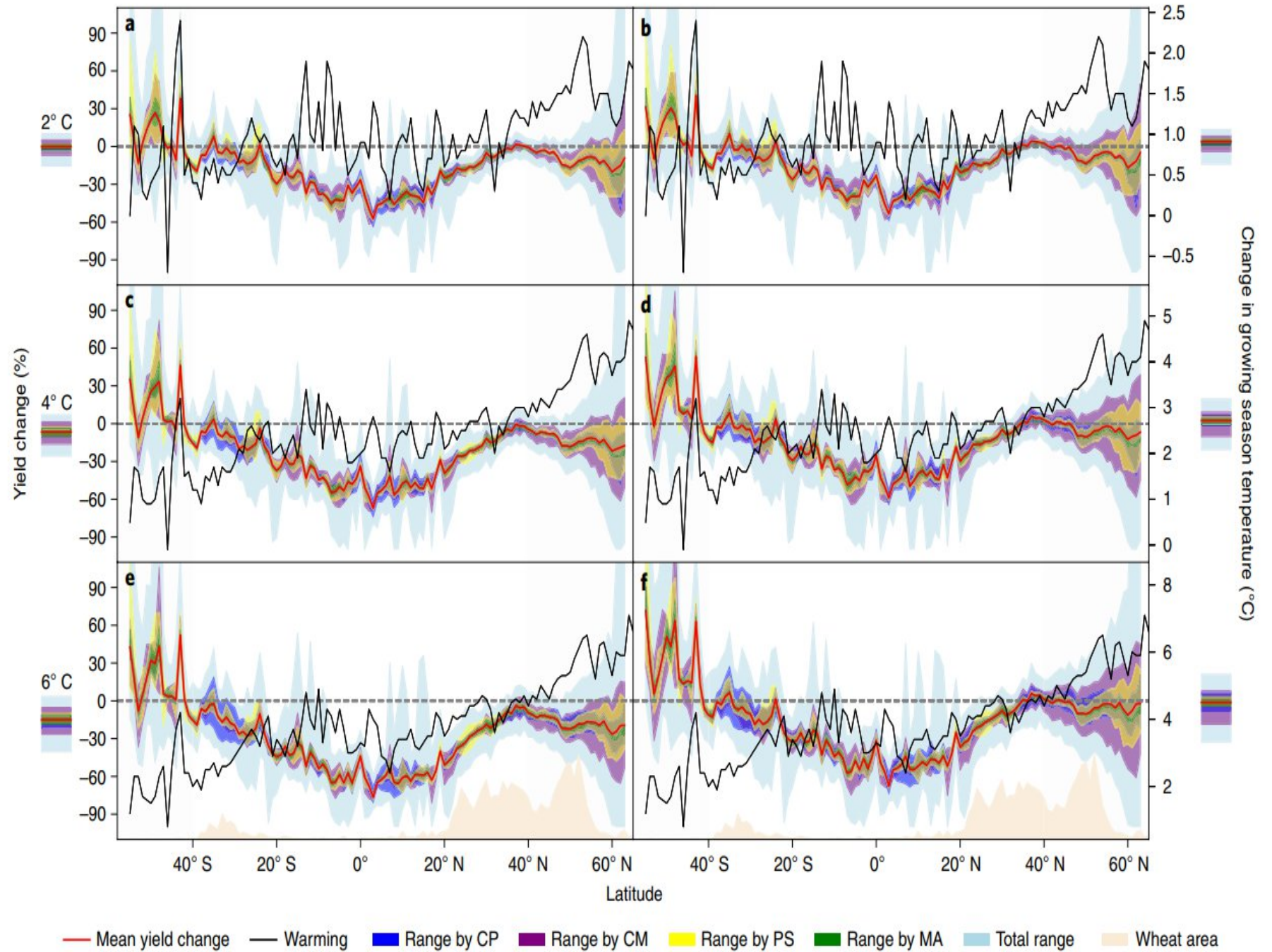
Importance of machine learning algorithms

➢ Today, machine learning in agriculture is one of the fastest-growing areas. Its applications in farming range from simple analytics systems to complex robotics hardware. Therefore, a growing number of stakeholders are raising awareness of the potential advantages of using ML agriculture and collaborating with [Data Science and AI companies](#) to get reliable input data for the data analyses.

➢ A machine learning model can be descriptive or predictive, depending on the research problem and research questions

➢ Machine Learning has found more utility with the arrival **of big data technology**

➢ ML can avoid CMs limitations (biotic stress, salinity, P, K, Micronutrients) if used as hybrid-approach

➢ Identify the most important features affecting the dependent variable

➢ ML could be used in cloud for elastic, flexible, cost-effective storage (give

Why is Hybrid CMs-ML needed?

➢ Tackling the limitations of both CMs and ML in an integrated approach

➢ Working easily and efficiently with big dataset

➢ The potential of using cloud computing for fast, robust and cost-effective computation

➢ The potential of integrating extensive analysis such as NLP, Sentiment analysis, ,…

➢ Ensure robust prediction and lower uncertainty

EIA

ClimBER

The new developed approach (CMs-ML)Kheir et al., 2022

AgMIP-MENA

CWANA(WP5, and WP3)

Robust prediction, less uncertainity

Minimizing trade-offs between wheat yield and resource-use efficiency in the Nile Delta – A multi-model analysis

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Machine learning-based cloud computing improved wheat yield simulation in arid regions

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ARTICLE INFO   ABSTRACT