An Agrometeorological Prediction System on Various Time Scales for Smart Weather Risk Management of Agricultural Sector in Korea

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Introduction

Sun-burn | Frost | Bud-freezing | Physical damages



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RDA Research Projects

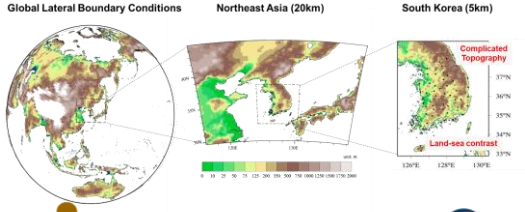
Short-term Prediction (~9days)

A Farm-specific Early Warning System at Field Level (30×30m)


https://agmet.kr Mobile service

Long-term Prediction (~6months)

Subseasonal-to-Seasonal Climate Forecast System at Regional Level (5×5km)



HKUST RDA Cooperative project

APEC Climate Center -MME project

✓ However, the existing systems have limitation in obtaining the various future weather data of a place at a given time.

Short-term (~9 days) Prediction

A Farm–specific Early Warning System

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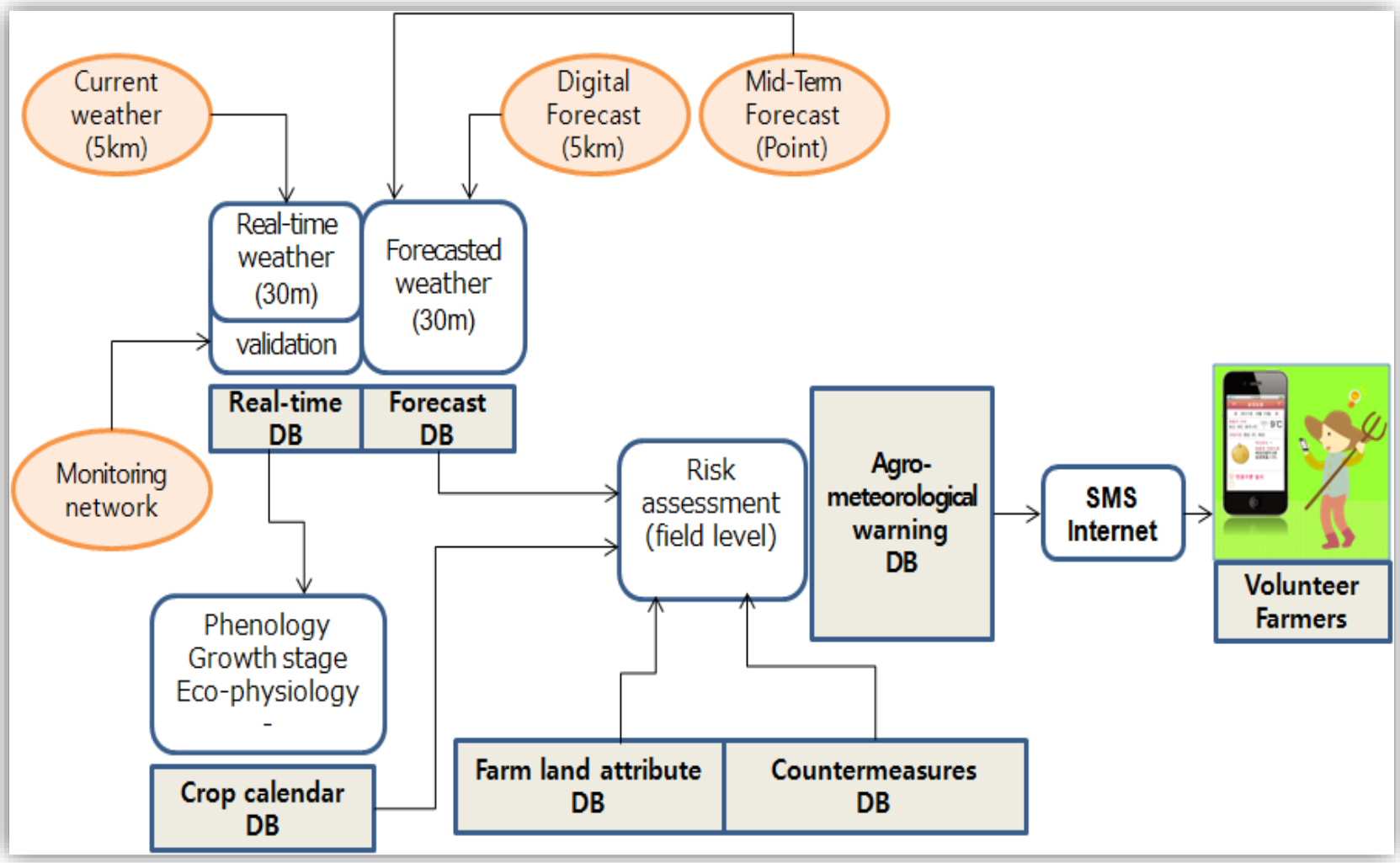

- ✓ The system forecasts real time weather conditions at the individual farm level and simultaneously assesses weather risk of specific crops.
- ✓ When the risk reaches the condition that can cause any damage to the crops, the Early Warning System is activated and the warning messages are delivered to the farmer's mobile phone.
- ✓ The messages are sent with proper recommendations that farmers can utilize to protect their crops against potential damage.

Short-term (~9 days) Prediction

A Farm-specific Early Warning System

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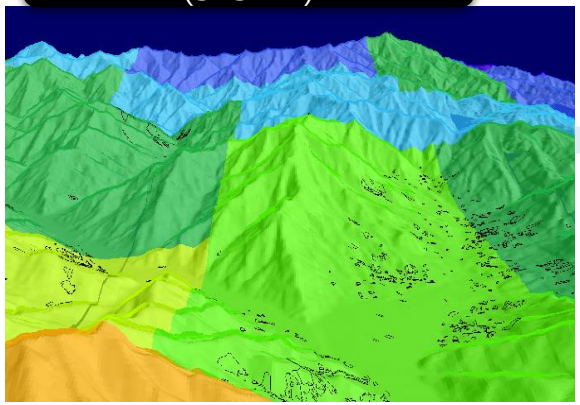
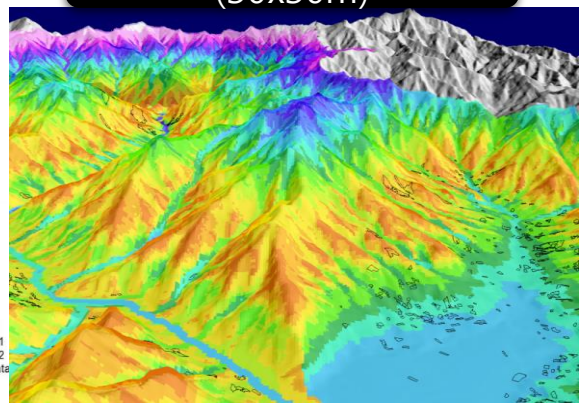
1. Downscaling to the farm level (30~270m)

Parameters (11 types) : Minimum/Maximum temperature, Solar irradiance, Sunshine duration, Precipitation, etc

KMA weather data (5x5km)



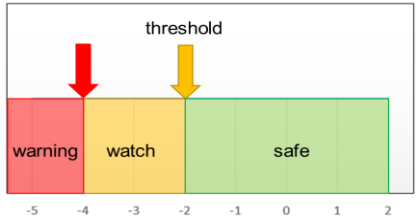
RDA weather data (30x30m)



2. Weather Risk Assessments of specific crop

Risks (15 types) : Freezing, Frost, Chilling, Sunburn, High temp etc.
Crops (38 types) : Apple, Pear, Rice, Bean, Grape, etc

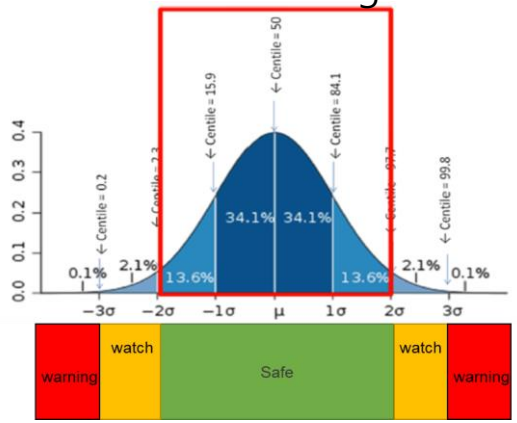
Acute damage



Critical minimum temp. for frost injury depending on growth stages of Apple tree

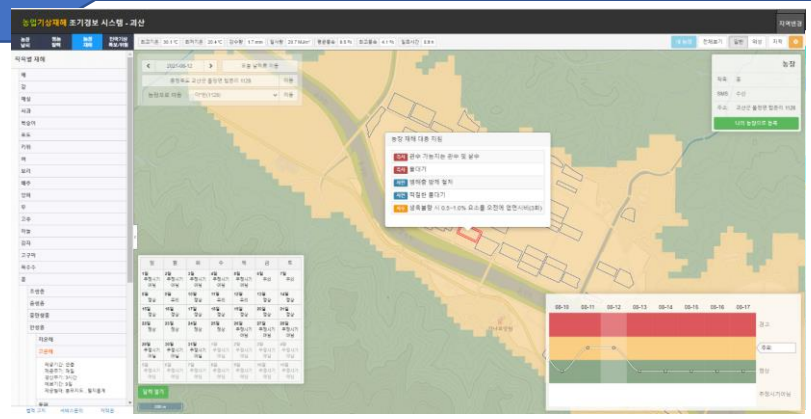
	Bud burst	Bloom	Full bloom	End of bloom	Fruit development
Watch	≤-2.8℃	≤-1.1℃	≤0.0℃	≤0.0℃	≤0.5℃
Warning	≤-5.0℃	≤-2.2℃	≤-1.7℃	≤-1.7℃	≤-1.1℃

Chronic damage



3. Service through Web GIS and Mobile

Web GIS service (https://agmet.kr)



Mobile service (App: m2.agmet.kr)

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Long-term (~6 months) Prediction

Subseasonal–to–Seasonal Prediction System

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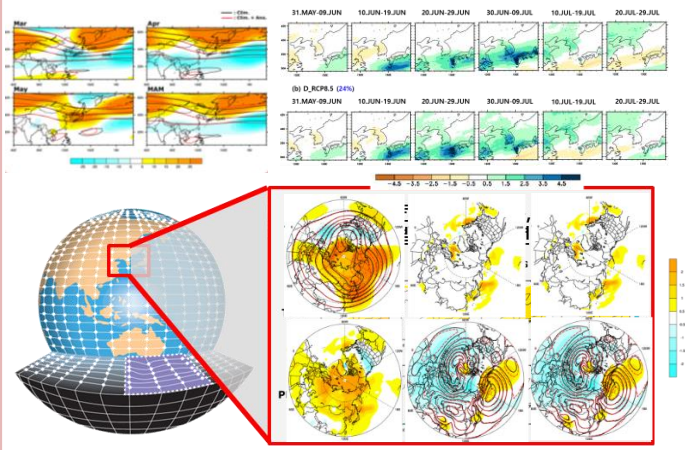
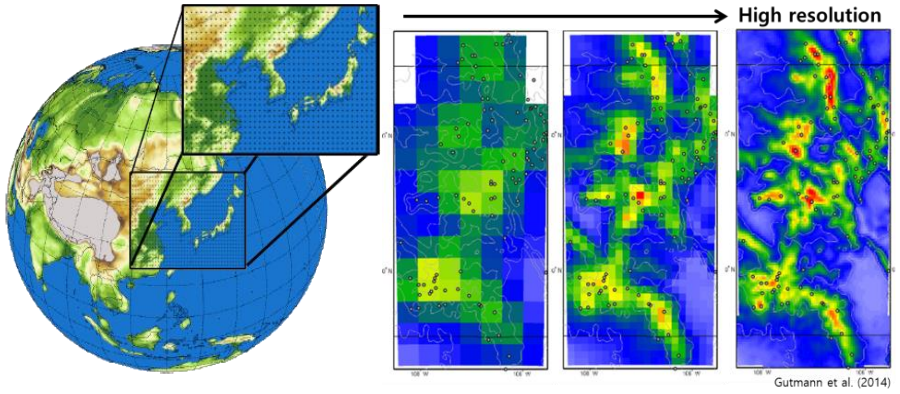
Long-range forecast(~6month) of CGCM



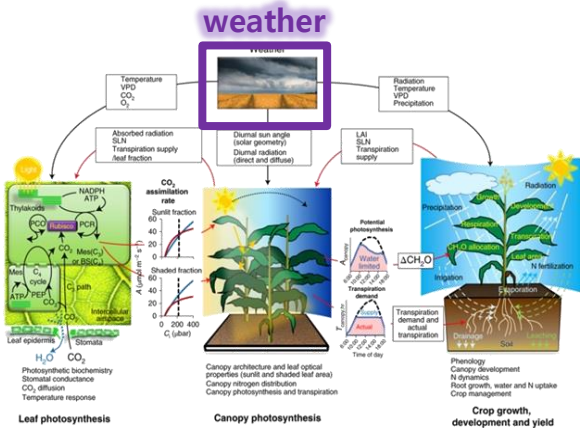
Dynamical downscaling with RCM

(horizontal resolution : 5km)

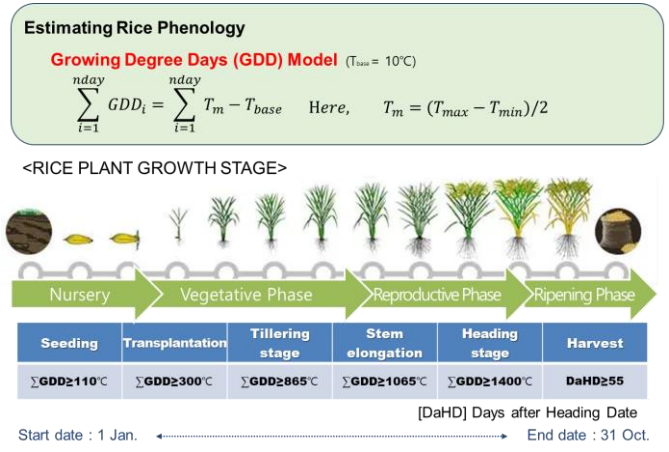


I.C./B.C. : PNU/RDA CGCM with in-direct land initialization run (4 members)

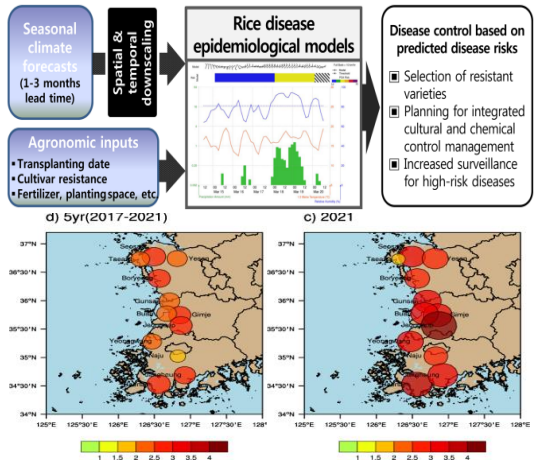
Crop Yield prediction models



Crop phenology model



Crop disease model



- ✓ The system projects the magnitude and direction of climate parameters at regional levels 1~6 months ahead.
- ✓ To obtain high-resolution long-term prediction, the system adopts a chain of a global climate model and a regional climate model.
- ✓ Seasonal forecast coupled with agricultural models can potentially enhance decision-making for different stakeholders.

Long-term (~6 months) Prediction

Subseasonal–to–Seasonal Prediction System

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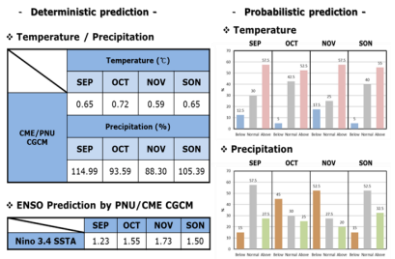
Seasonal Forecast Data



Parameters (11 types) :
Minimum/Maximum temperature, Solar irradiance, Sunshine duration, Precipitation, etc

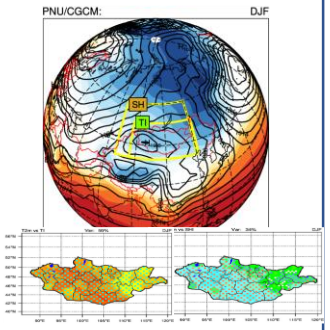
KMA
(Korea Meteorological Administration)

Providing seasonal outlook for S. Korea every season

Rural Development Administration
National Institute of Agricultural Sciences

NAMEM
(National Agency for Meteorology and Environmental Monitoring in Mongolia)

Initial Condition and forecast result every month

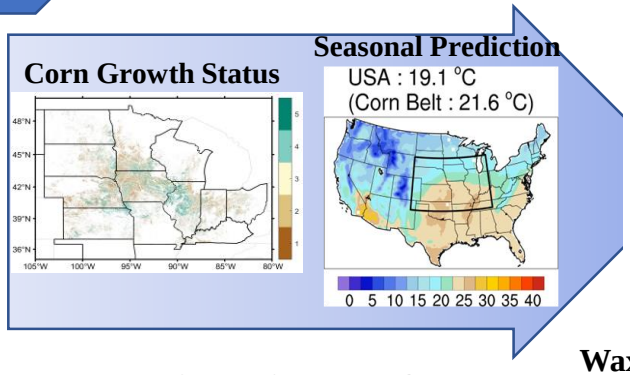


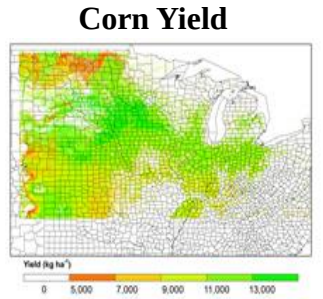
APCC APEC CLIMATE CENTER
(APEC Climate Center)

6-month forecast for every month

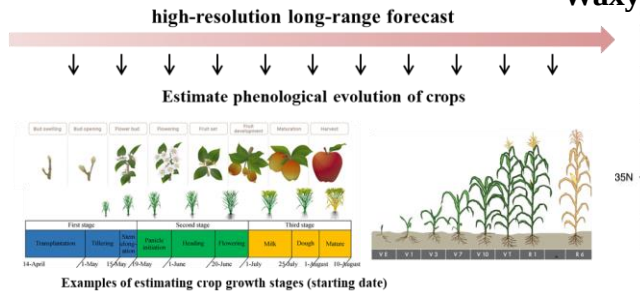
Application on Agricultural Field

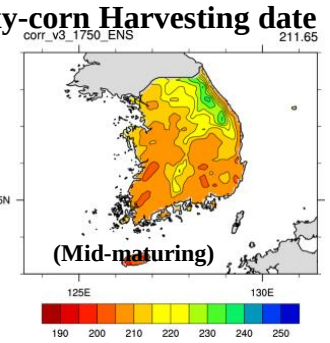
Crop yield prediction model



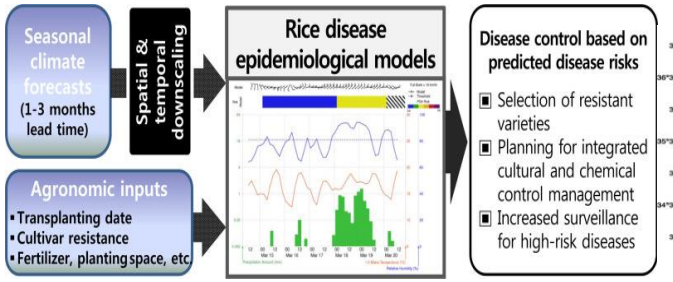


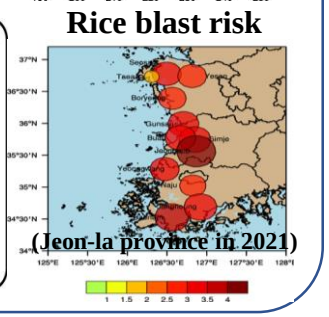
Crop phenology model





Crop disease model





Future Collaboration

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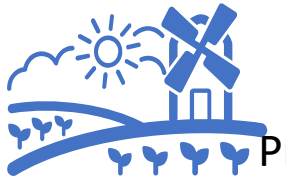

Provide tailored day-to-day information and data-driven solution

Supports all countries in their sustainable Agrifood system

Climatology	Agriculture is significantly influenced by the local climate in the farming region.	The information is critical for the farmers to choose the right crop according to the season.	It is a method of agricultural technology to adapt climate change.
Real-time Forecast	Accurate real-time weather information at farm levels is an important element for smart farming.	This information could aid the farmers in making easy decisions and help prevent multiple weather-related risks.	It could help farmers save their efforts, time, and resources from harsh weather, with proactive steps to prevent any weather-caused loss.
Seasonal Forecast	Subseasonal to seasonal forecast data contains potential valuable information for farmers and agriculture in general.	The information could predict Inter-annual variations of crop yield and agricultural planning in a few months advance.	It plays a critical role in decision making for different stakeholders- from farmers to policy makers to governments for food security.

Conclusion

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- ✓ RDA has been building and operating two prediction systems for Smart Weather Risk Management in Korea.
- ✓ For short-term response to hazardous weather events, the Early Warning System is developed to assess farm-specific weather risks and to deliver custom-made risk management recommendations.
- ✓ For long-term preparedness to climate variability, the Subseasonal-to-Seasonal Prediction System is developed to predict a range of possible climate changes at specific temporal and spatial scales in 1~6 months ahead.
- ✓ These weather/climate prediction systems on various time scales help to inform added value for decision making in agricultural sector, which in turn can support sustainable Agrifood system.

WORLD BANK GROUP | KOREA GREEN GROWTH TRUST FUND | Ministry of Economy and Finance

KOREA GREEN INNOVATION DAYS

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