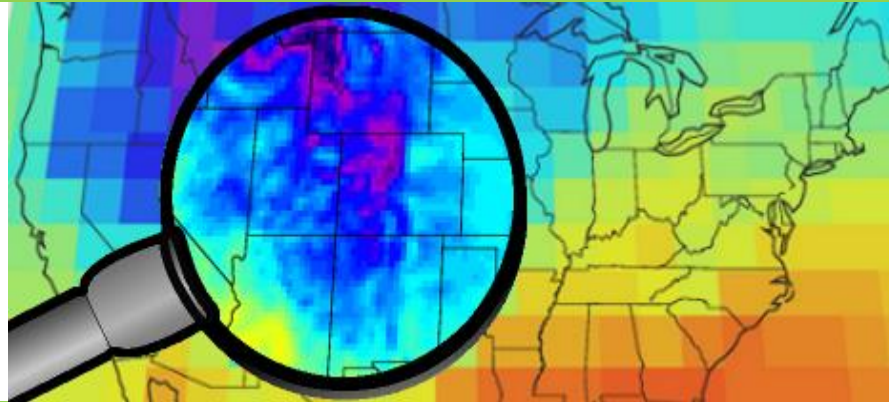


**APCC**  
APEC CLIMATE CENTER

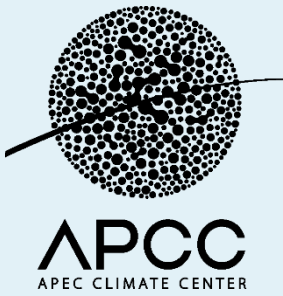
# Hands-on Statistical Downscaling Training (IV)

The screenshot shows the APCC AIMS sign-in interface. On the left, there is a blue header with the APCC logo and the text "Welcome to AIMS (APCC Integrated Modeling Solution). This software requires Internet access and user authentication." On the right, there is a white "Sign In" form with fields for "Email address" and "Password", a "Sign in" button, and links for "Sign up" and "Forgot your password?".



**Jaepil Cho**

**2017/10/18**



# 9. Impact Assessment Modeling: Drought

## Objective Quantification of Drought Severity and Duration

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(Manuscript received 17 March 1998, in final form 12 August 1998)

### ABSTRACT

Common weaknesses of current drought indexes were analyzed. First, most of the current indexes are not precise enough in detecting the onset, end, and accumulated stress of drought. Second, they do not effectively take into account the aggravating effects of runoff and evapotranspiration, which build up with time. Third, they have a limited usefulness in monitoring ongoing drought because they are based on a monthly time step. Fourth, most of them fail to differentiate the effects of drought on surface and subsurface water supply.

A new series of indexes are proposed to solve these weaknesses and to improve drought monitoring. In the new indexes, daily, rather than monthly, time steps are used. A new concept, effective precipitation (EP), the summed value of daily precipitation with a time-dependent reduction function, is proposed as a basic tool.

Three additional indexes complement EP. The first index is each day's mean of EP (MEP). This index shows climatological characteristics of precipitation as a water resource for a station or area. The second index is the deviation of EP (DEP) from the MEP. The third index is the standardized value of DEP (SEP). By using these three indexes, consecutive days of negative SEP, which can show the onset, the ending date, and the duration of a water deficit period is categorized.

With the duration categorized, four additional indexes that can show drought severity are calculated: 1) accumulation of consecutive negative SEP, which shows the duration and severity of precipitation deficit together; 2) accumulated precipitation deficit, which shows precipitation departure from the normal during a defined period; 3) precipitation for the return to normal; and 4) effective drought index, a standardized index that can be used to assess drought severity worldwide. The merits and weaknesses of each index are compared. New quantified definitions on drought and its onset, end, and duration are proposed.

These indexes were tested in the High Plains region of the United States from 1960 to 1996. The results were compared to historical reports of drought. From this analysis, it was concluded that the new indexes not only advanced objectivity, but also offered a number of advantages in practical use. These are 1) a more precise determination of drought duration, 2) the usefulness in monitoring an ongoing drought, and 3) the variety of ways a drought's characteristics can be described.

**EDI**(Effective Drought Index, Byun and Wilhite, 1999)

# Concept of EDI: Effective Precipitation

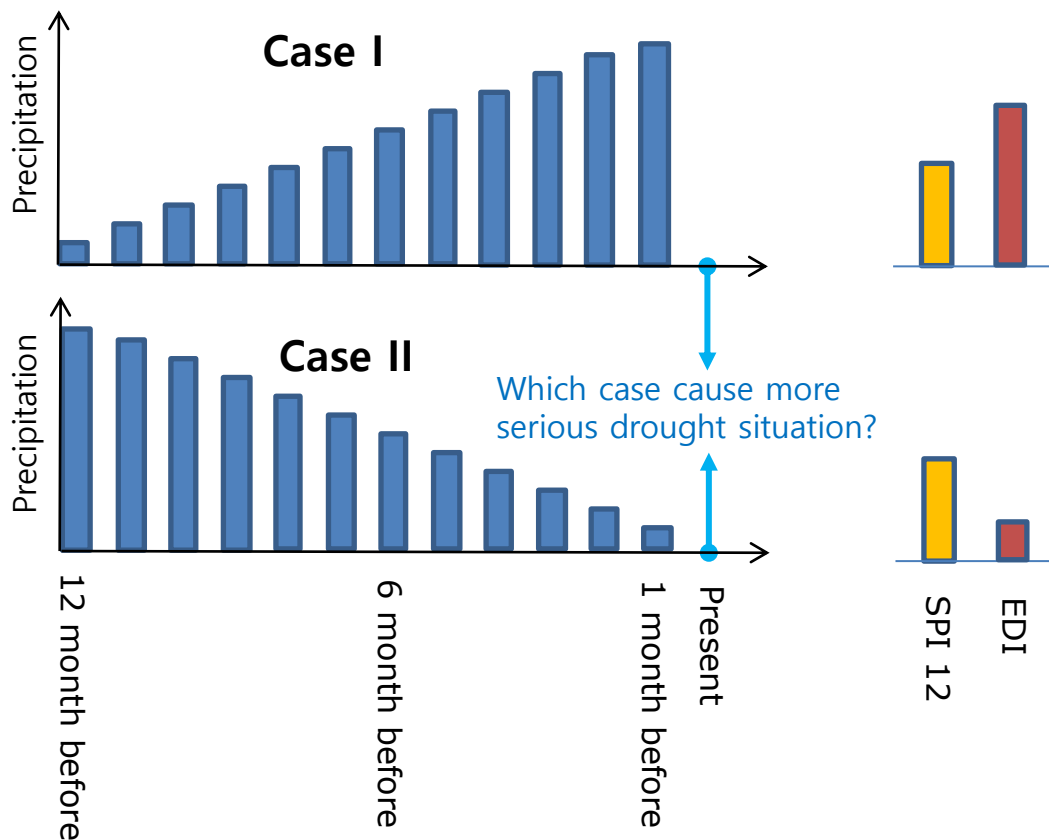
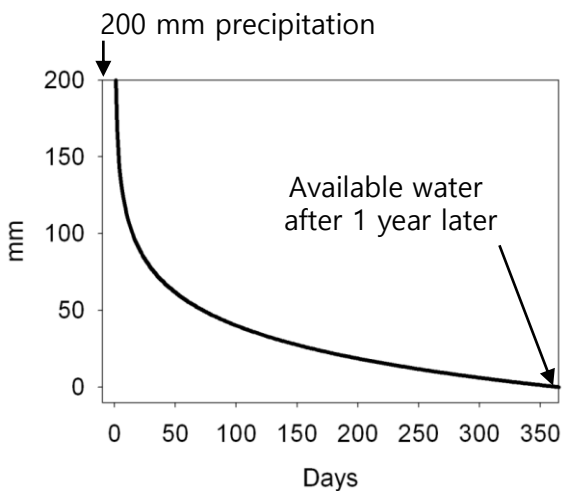
EP (Effective Precipitation)

$$EP_i = \sum_{n=1}^i \left[ \left( \frac{\sum_{m=1}^n P_m}{n} \right) \right]$$

$$DEP = EP - MEP$$

$$EDI = DEP / ST(DEP)$$

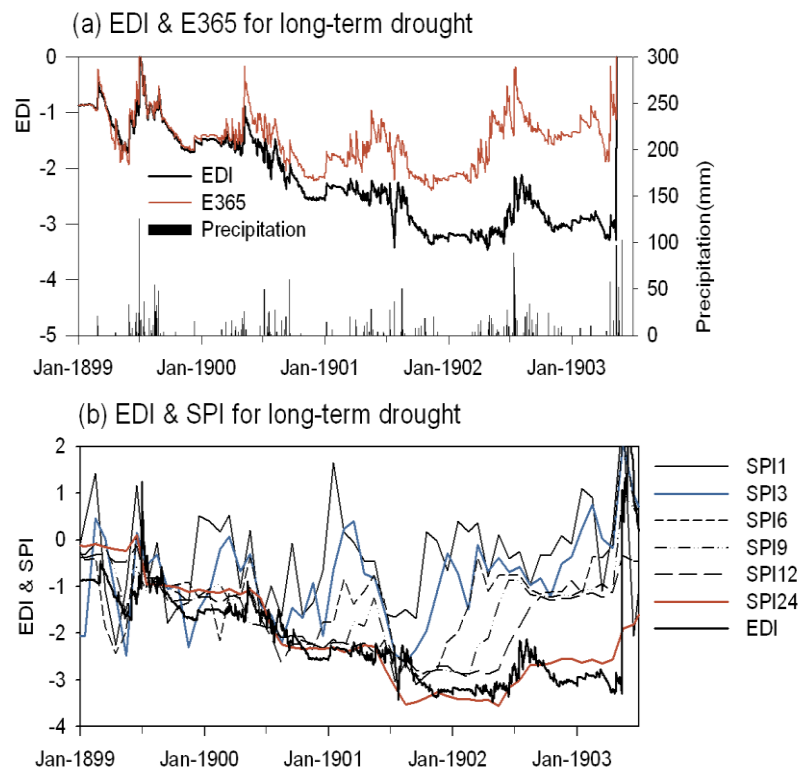
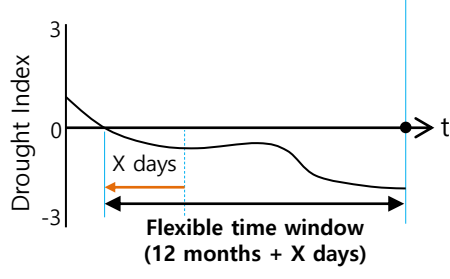
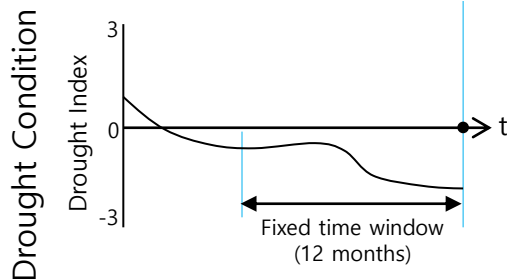
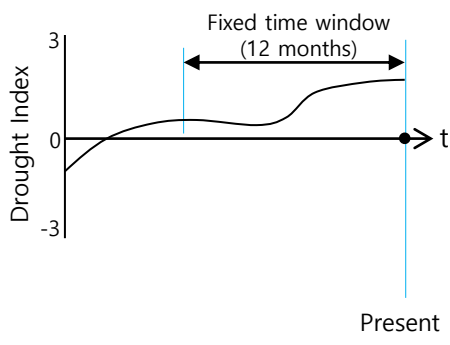
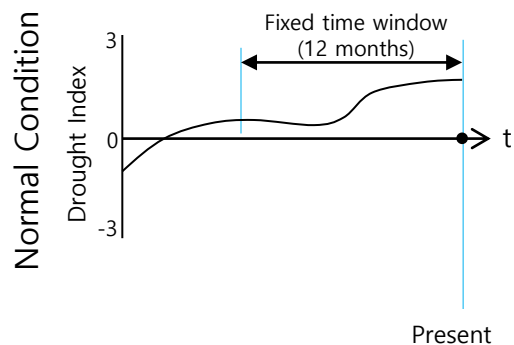
Available water decrease as time goes on



# Concept of EDI: Flexible Time Window

SPI 12

EDI

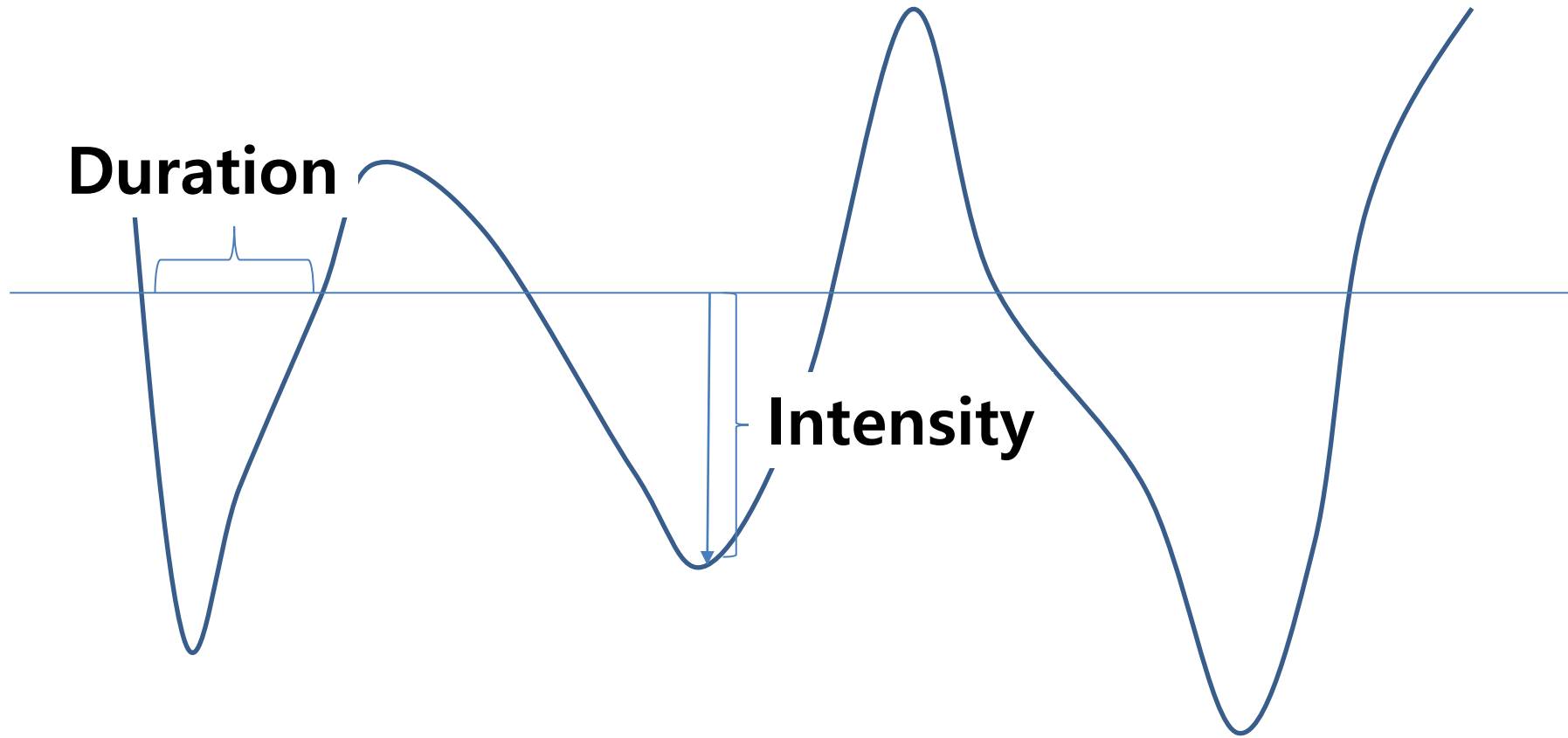


Long-term drought situation

Kim et al., 2009 (Evaluation, modification, and application of the Effective Drought Index to 200-Year drought climatology of Seoul, Korea)



# Climate Change Impacts on duration and intensity of Drought

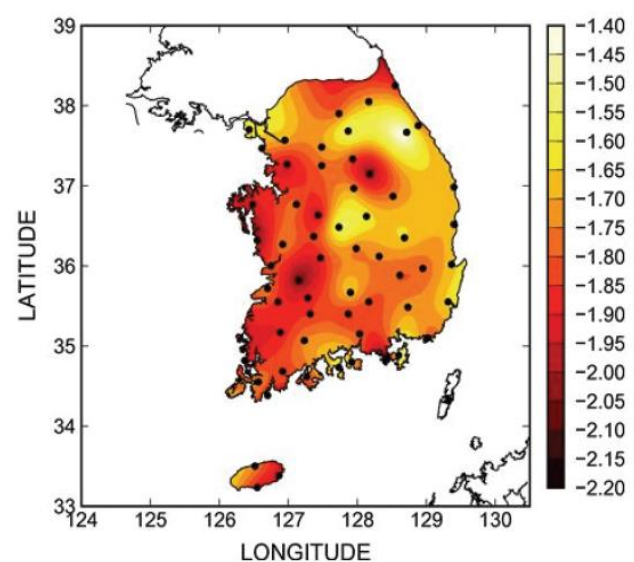
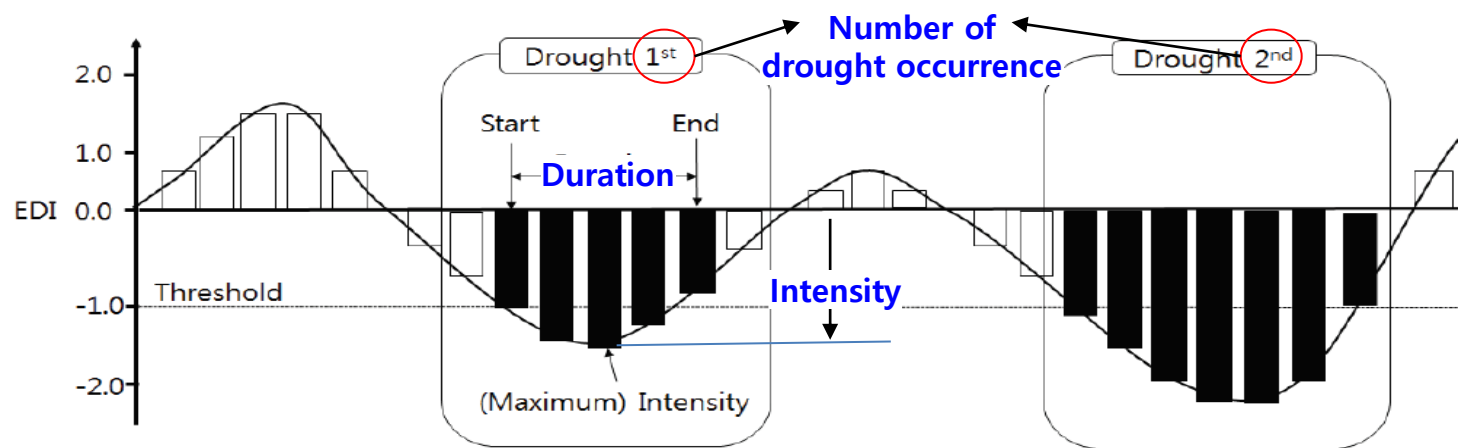


# Drought severity in EDI

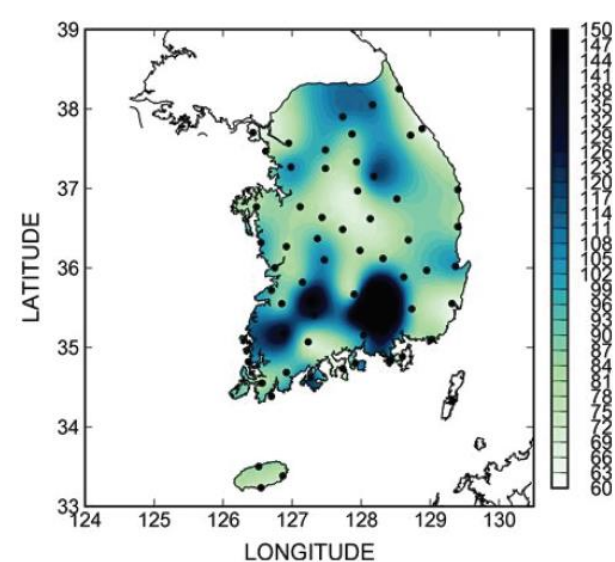
Table 1. The drought criterion of EDI with the drought severity (Kim, 2009)

<b>EDI Value</b>	<b>Category</b>
2.00 or more	Extremely wet
1.50 to 1.99	Severely wet
1.00 to 1.49	Moderately wet
0 to 0.99	Mildly wet
0 to -0.99	Mildly drought
-1.00 to -1.49	Moderately drought
-1.50 to -1.99	Severe drought
-2 or less	Extreme drought

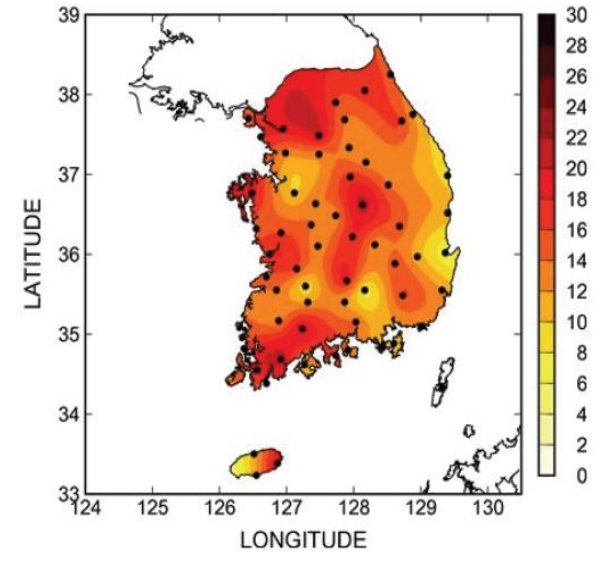
# Spatial distribution of drought characteristics (1976~2005)



**Drought Intensity**



**Duration**



**Number of drought occurrence**

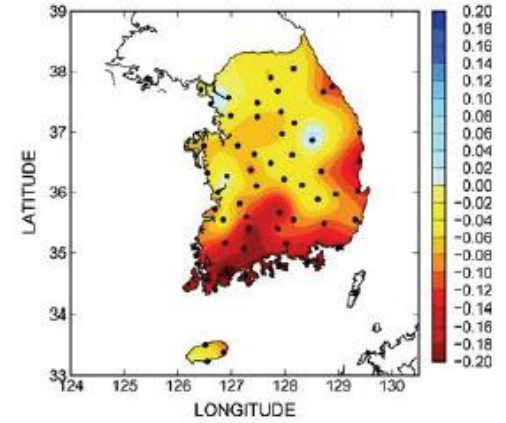
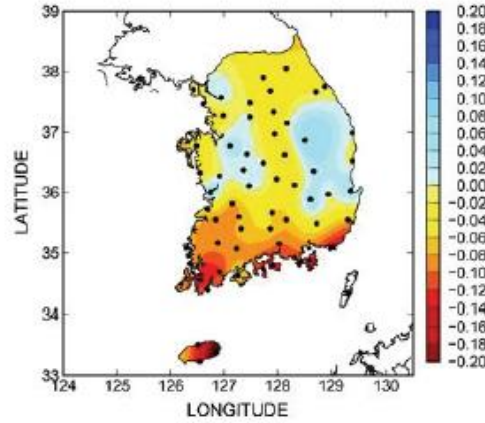
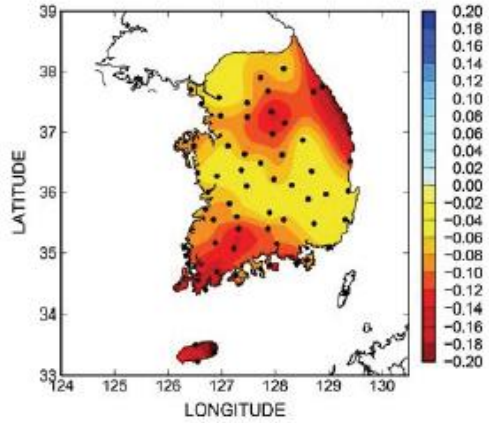
# Changes in drought intensity

2010~2039

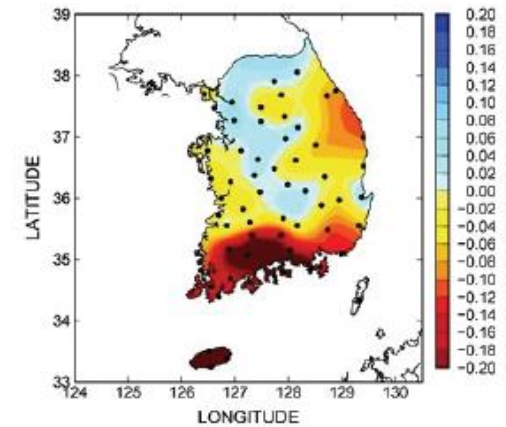
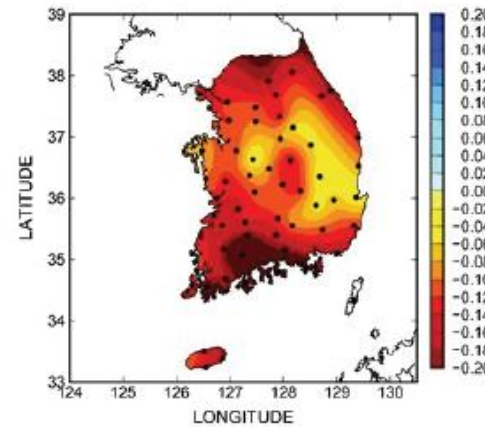
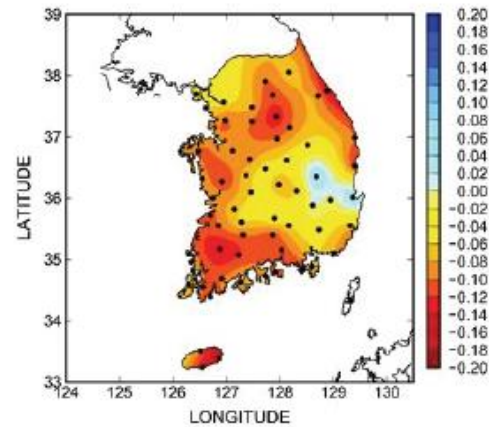
2040~2069

2070~2099

RCP 4.5



RCP 8.5



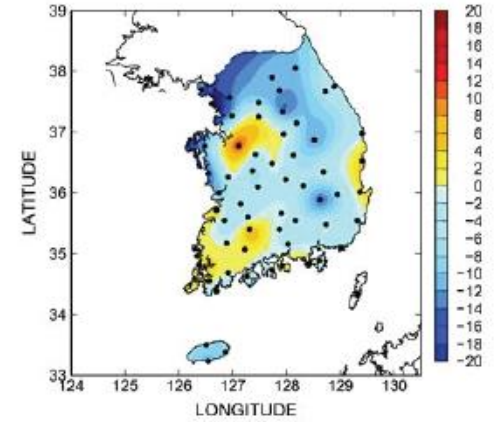
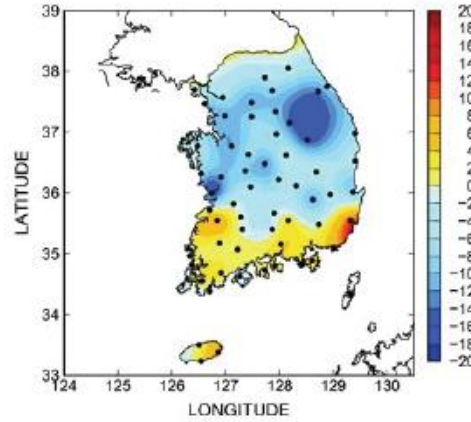
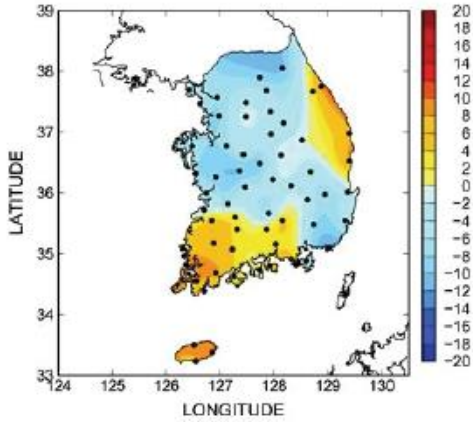
# Changes in drought duration

2010~2039

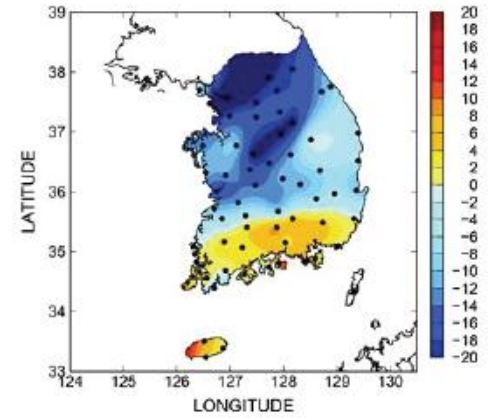
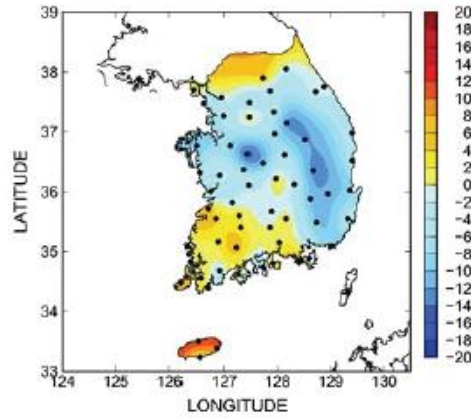
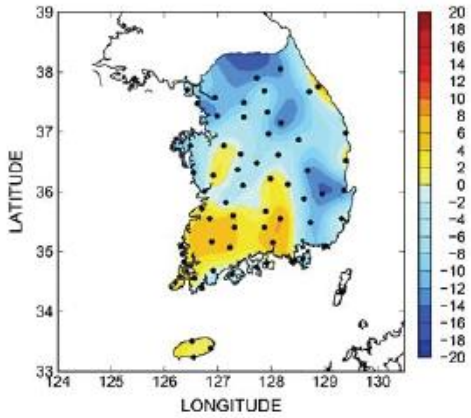
2040~2069

2070~2099

RCP 4.5



RCP 8.5



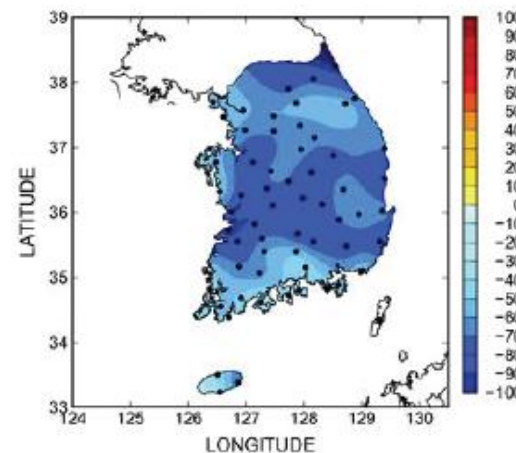
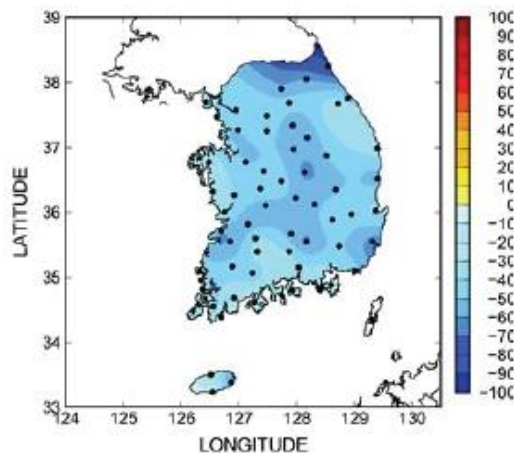
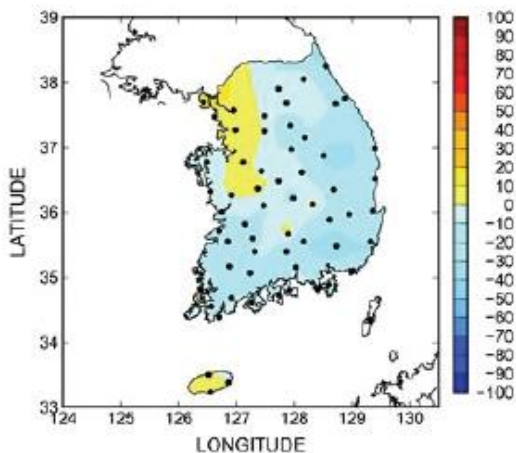
# Changes in number of drought occurrence

2010~2039

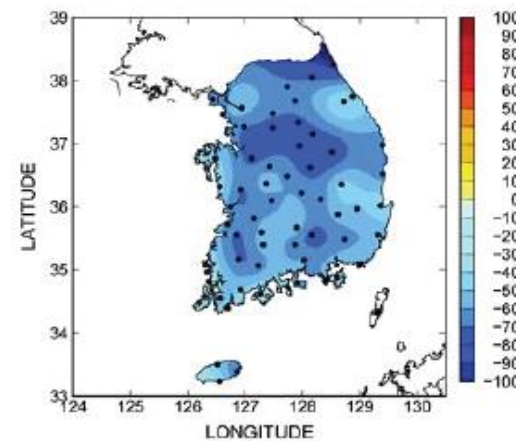
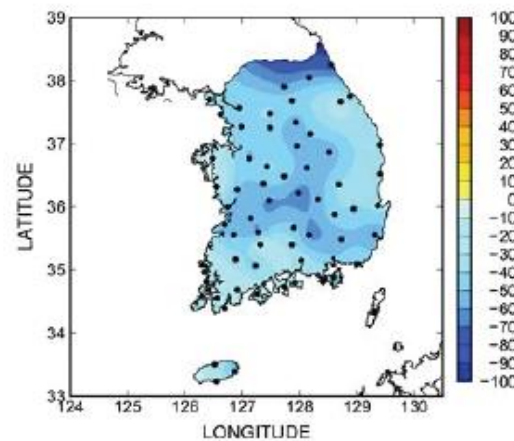
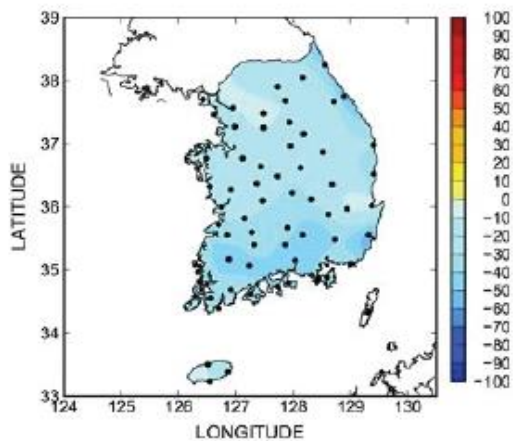
2040~2069

2070~2099

RCP 4.5



RCP 8.5





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# Thank You!