



Next Generation Drought Monitoring: Forecasting to Emotion-Focused Coping

Jonghun Kam

Division of Environmental Science and Engineering
Pohang University of Science and Technology

16 April 2024

EGU General Assembly 2024
Room 2.15

Outline

1. Introduction to Drought
2. Drought Predictability
3. Social Impact of Drought
4. Discussion: Importance of Big Data and AI

Impacts: Drought is Complex

<http://stateofthenation2012.com/?p=13541>



Meteorological

<http://www.prep-blog.com/2012/07/25/we-need-to-talk-about-the-drought/corn-drought-02/>



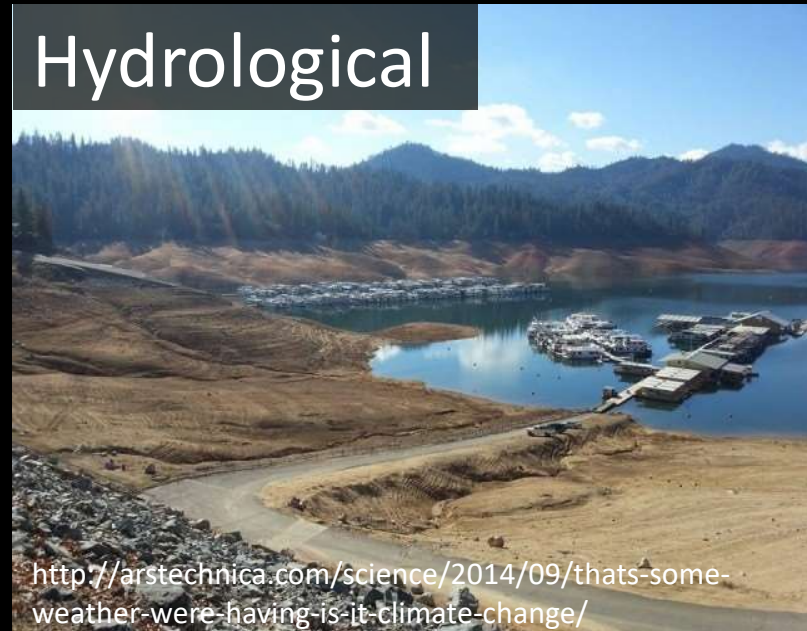
Agricultural

Socioeconomic



<http://www.billdamon.com/the-black-blizzards-of-the-1930s-dust-bowl/#sthash.Kcv6kAof.dpbs>

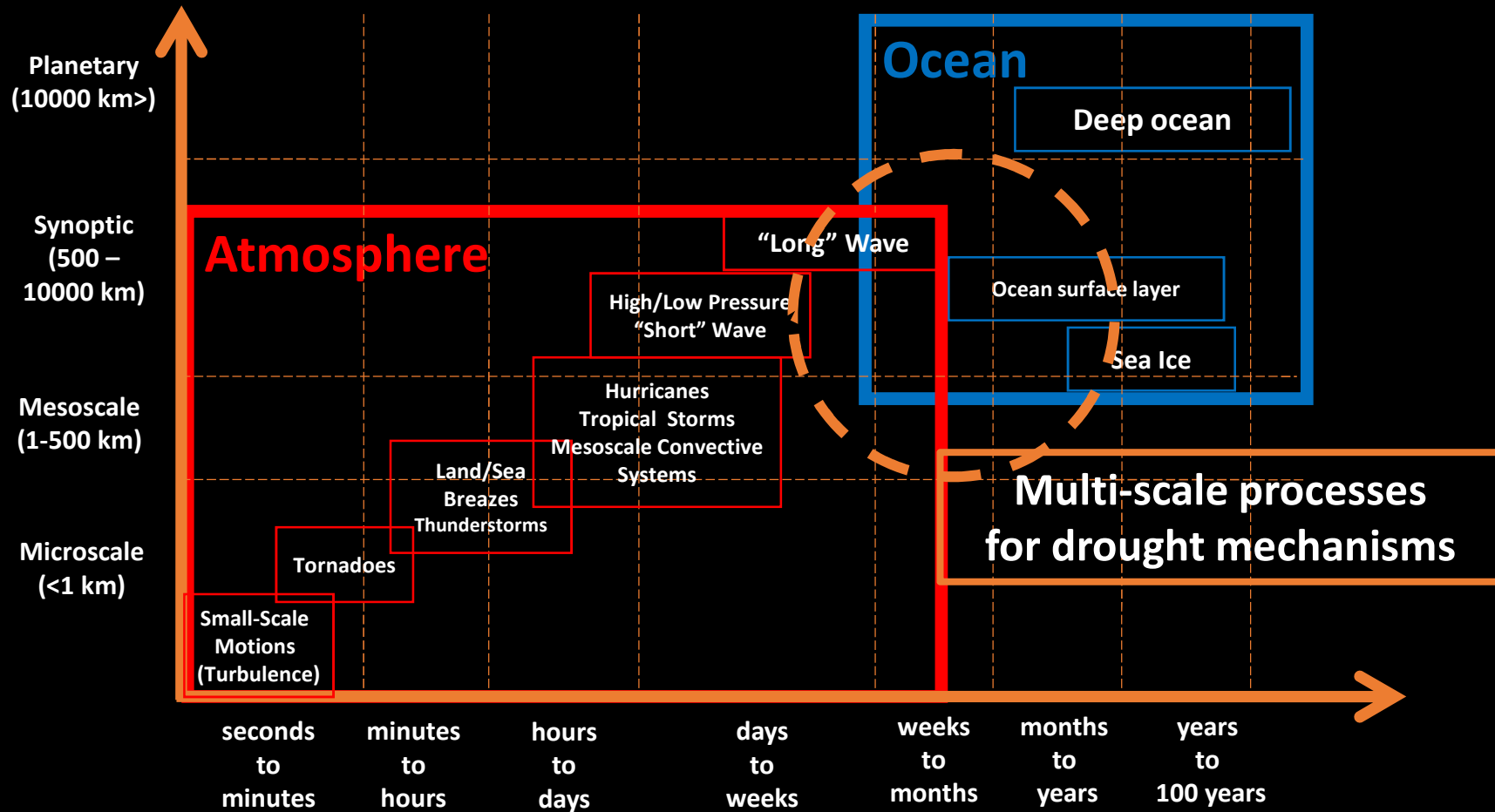
Hydrological



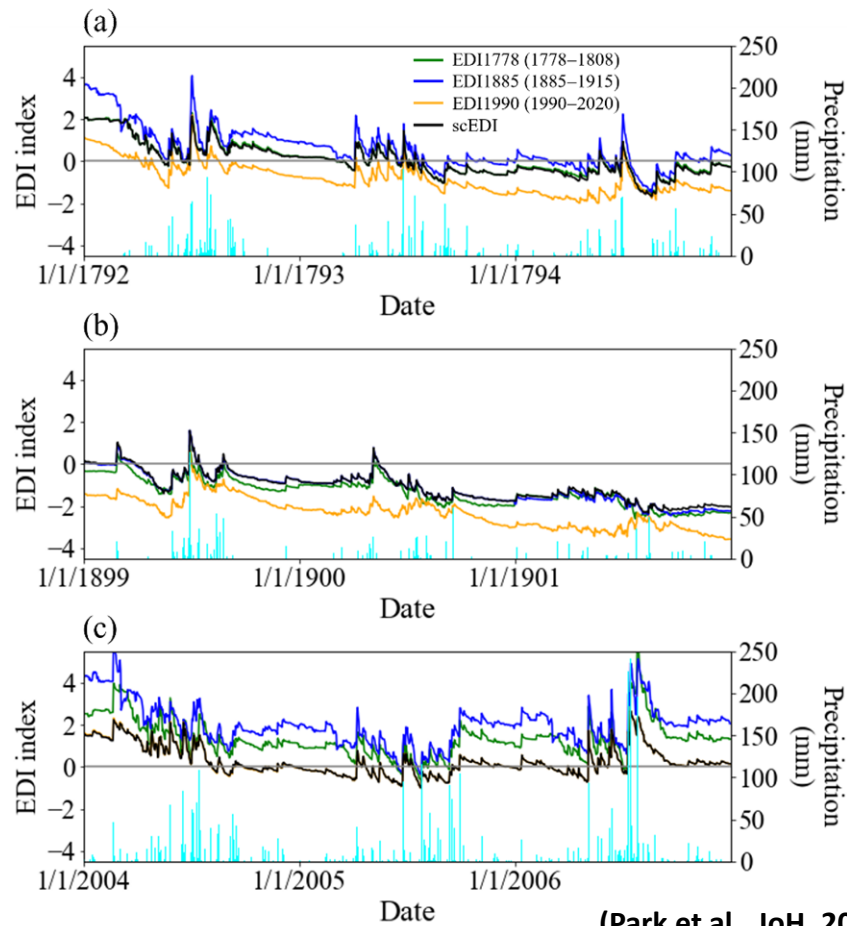
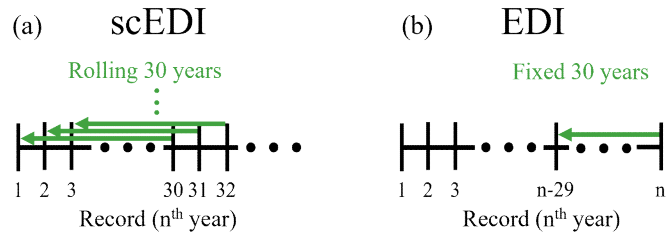
<http://arstechnica.com/science/2014/09/thats-some-weather-were-having-is-it-climate-change/>

Mechanisms: Drought is Complex

Drought is one of the **least understood** natural hazards due to complexity of the generating mechanisms.



Self-Calibrating Effective Drought Index (scEDI)



(Park et al., JoH, 2022)

Effective Drought Index can detect and characterize daily drought conditions.

Climatology of daily precipitation:

$$CP(k) = \frac{\sum_{y=1991}^{2020} P(k, y)}{30}$$

Mean of Effective Precipitation (MEP):

$$MEP(k) = \sum_{n=1}^{DS} \left[\frac{(\sum_{m=1}^n CP(k-m))}{n} \right]$$

The reference climatology is fixed in EDI.

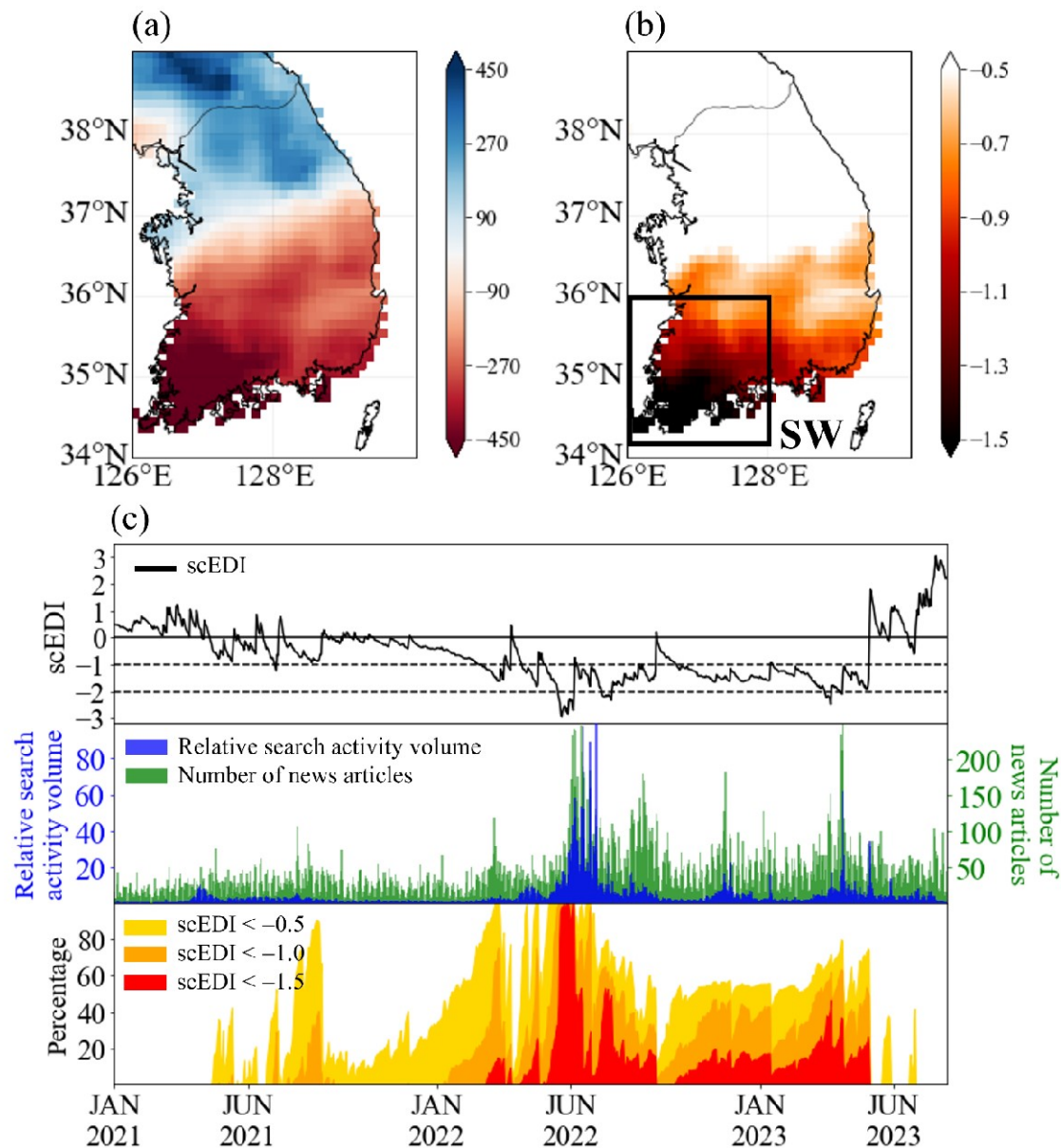
Rolling climatology of daily precipitation:

$$rCP(k, y) = \frac{\sum_{y=1-2}^1 P(k, y)}{30}$$

Rolling Mean of Effective Precipitation (rMEP):

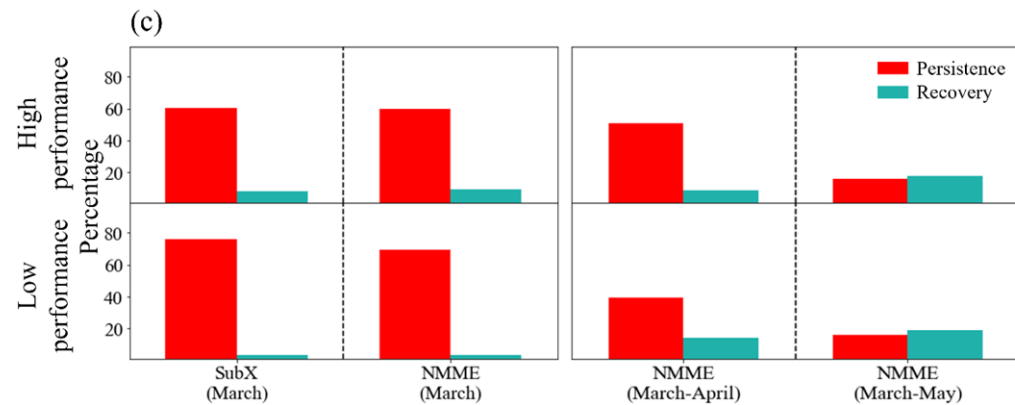
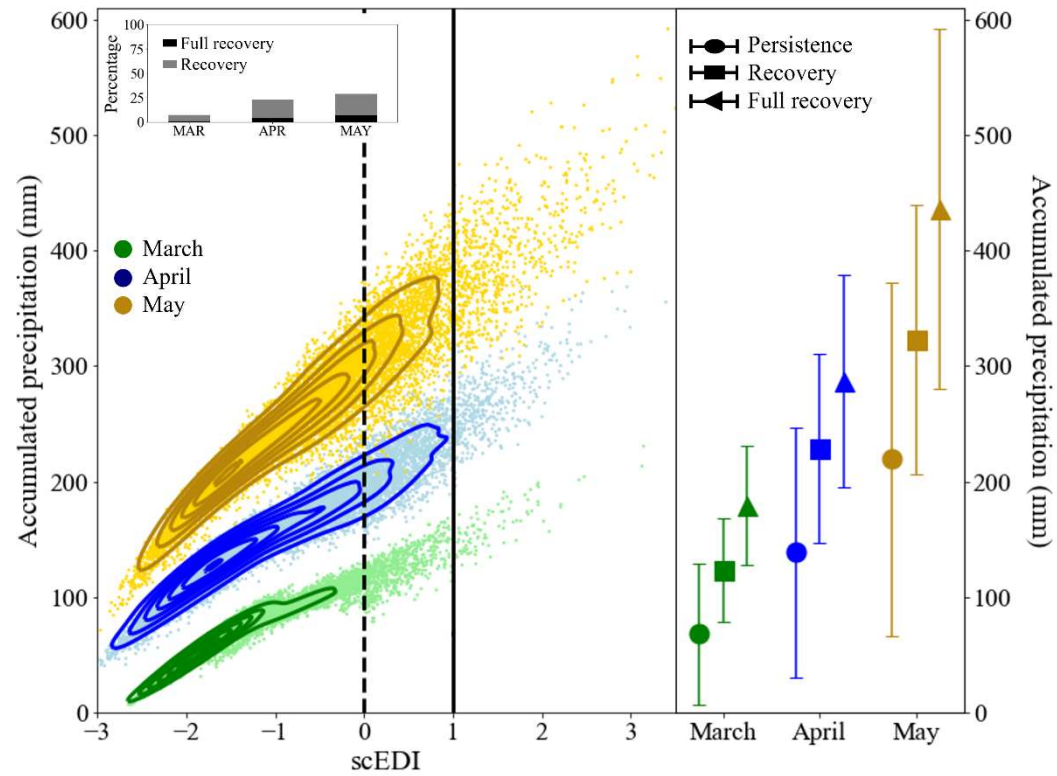
$$rMEP(k, y) = \sum_{n=1}^{DS} \left[\frac{(\sum_{m=1}^n rCP(k-m, y))}{n} \right]$$

2022-23 Southwestern Korea Drought



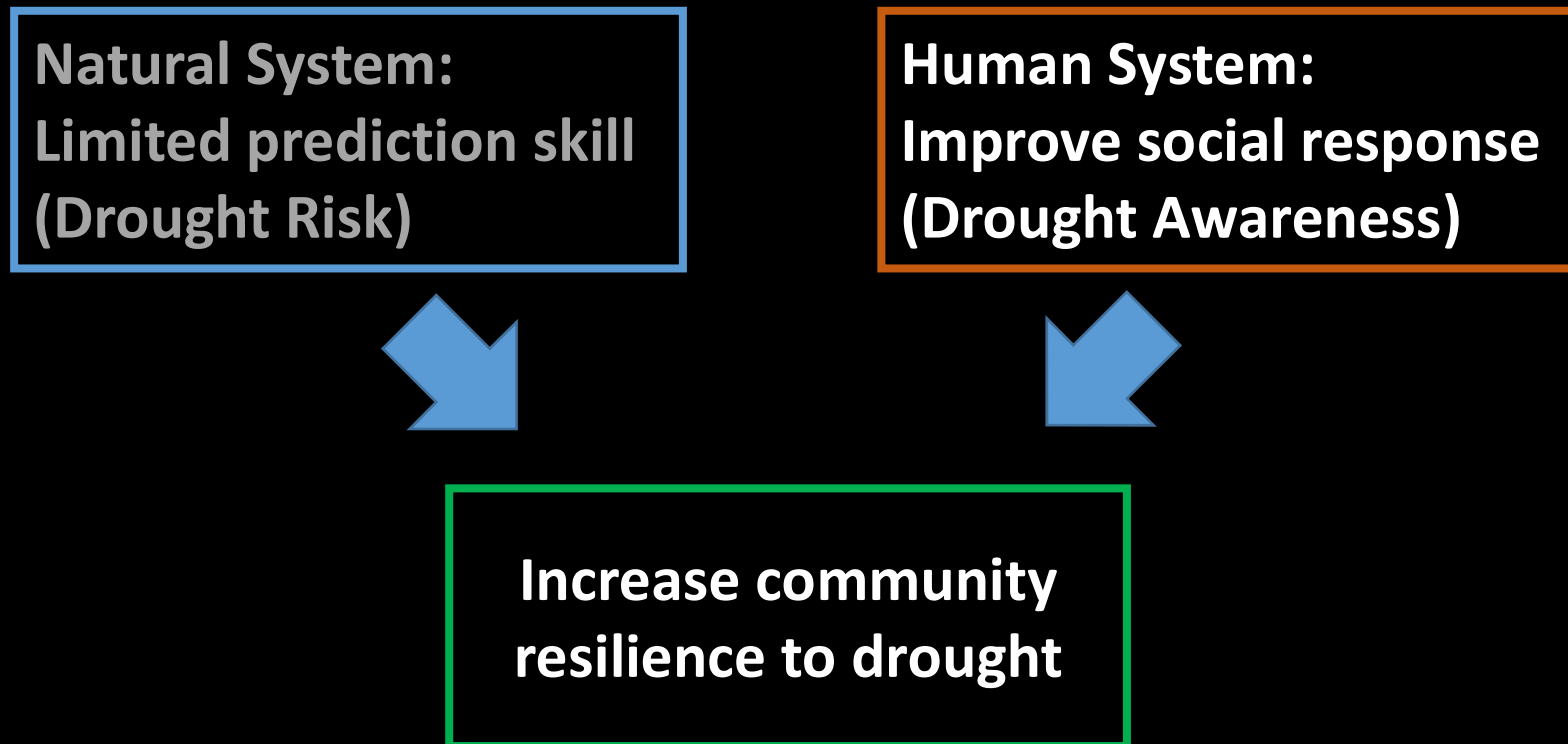
(Park et al., ERL, 2023)

Limited Skill of Climate Forecast Models



(Park et al., ERL, 2023)

How can we make our communities ready for drought?



Nowadays, more social monitoring data is available.

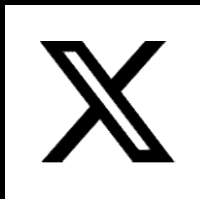
Twitter/X, NAVER News, and KOTE



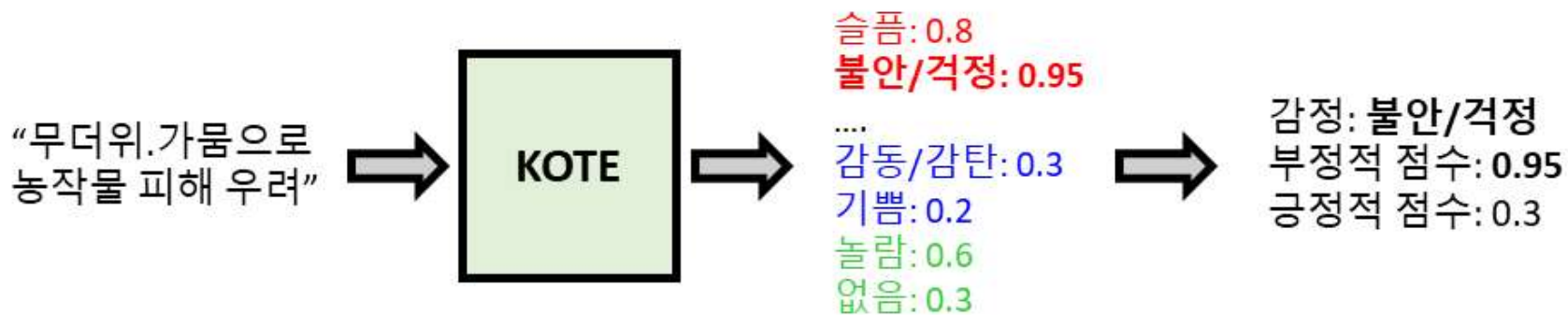
Data (2020-2023):

NAVER: 15,500 news articles

Twitter/X: 770,000 posts

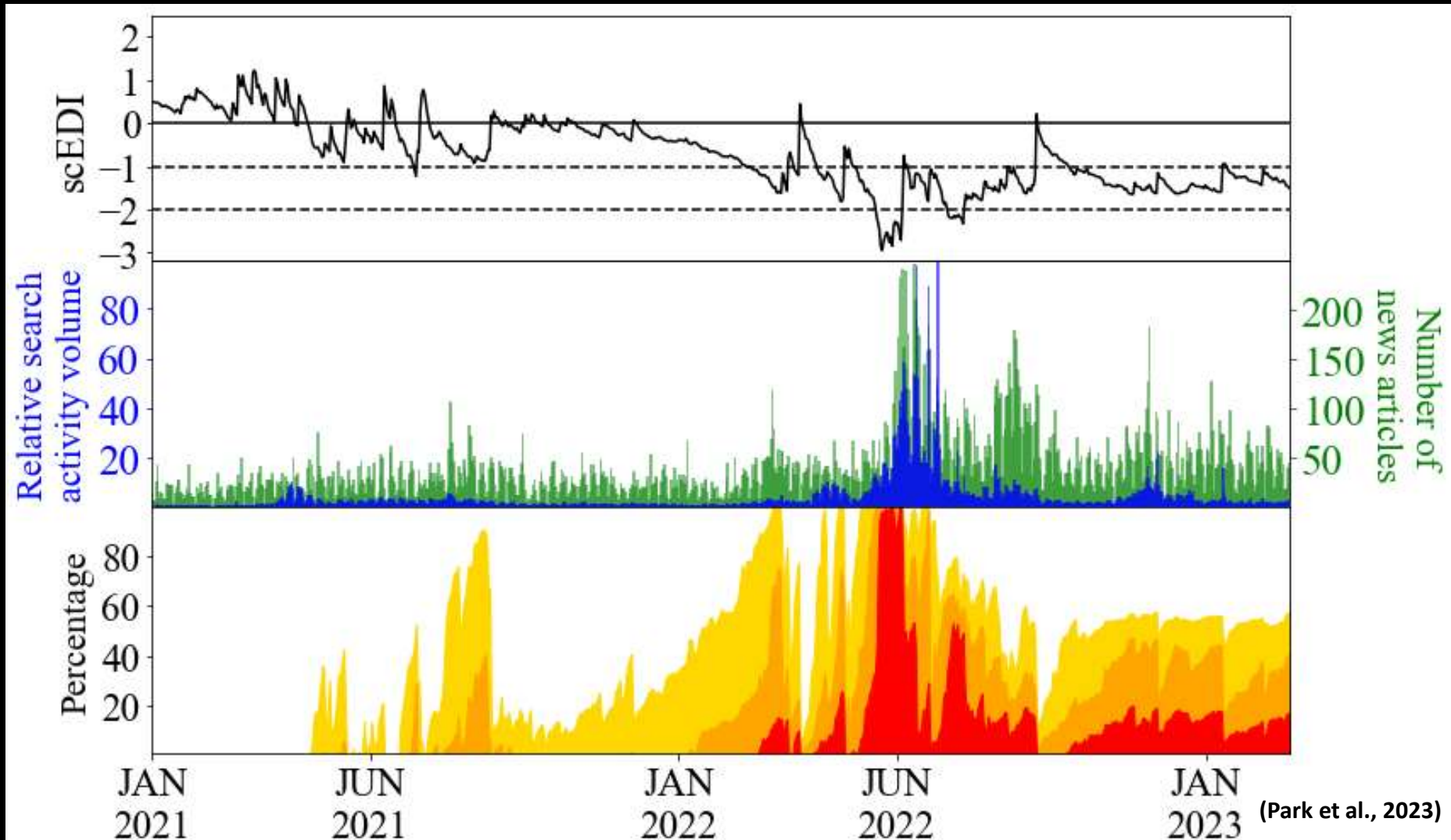


Method: Korean Online That-gul Emotions (KOTE)

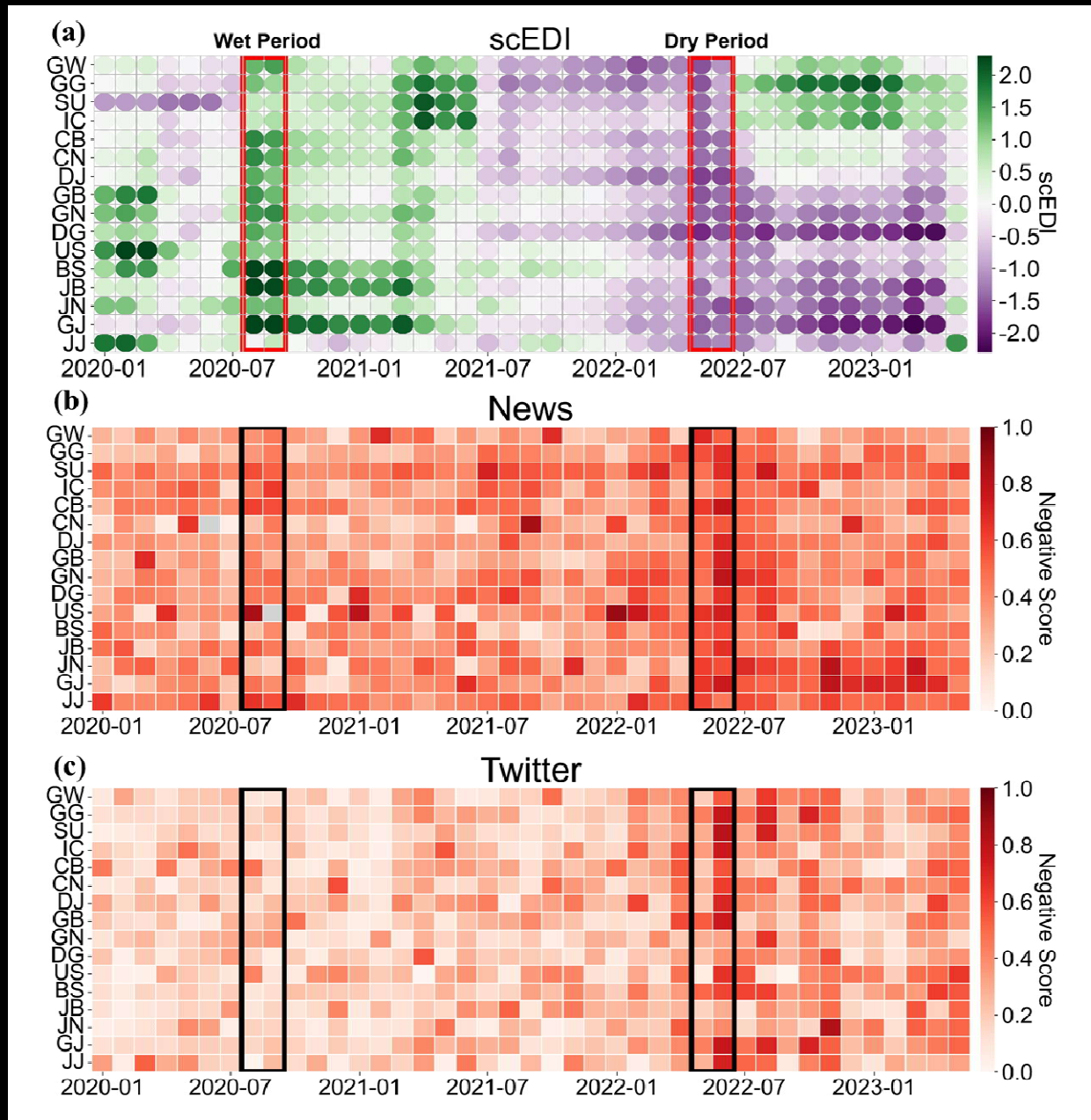


(Jeon et al., arXiv, 2022)

How is the emotion changing over time and space?

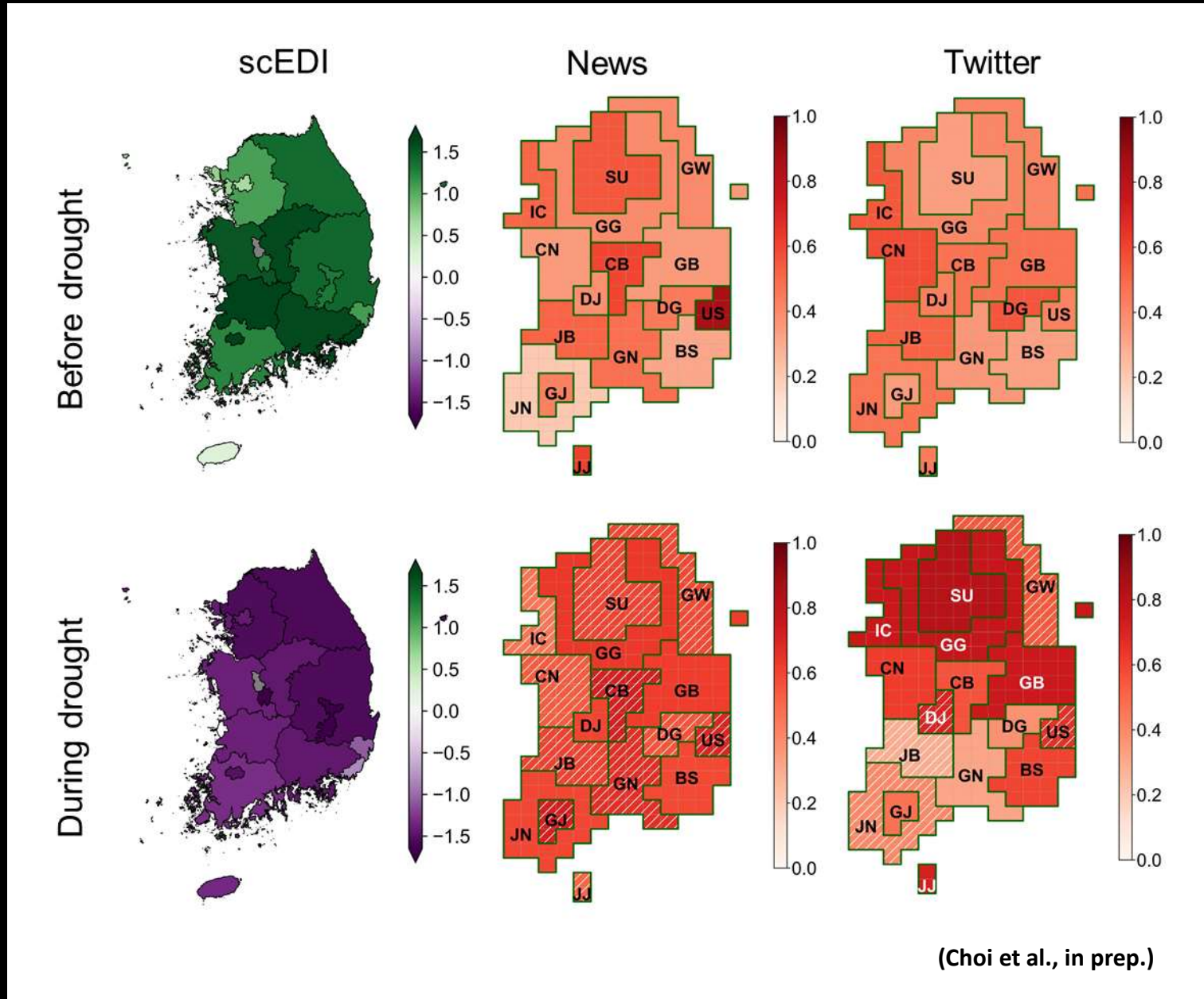


Different Social Response to Drought

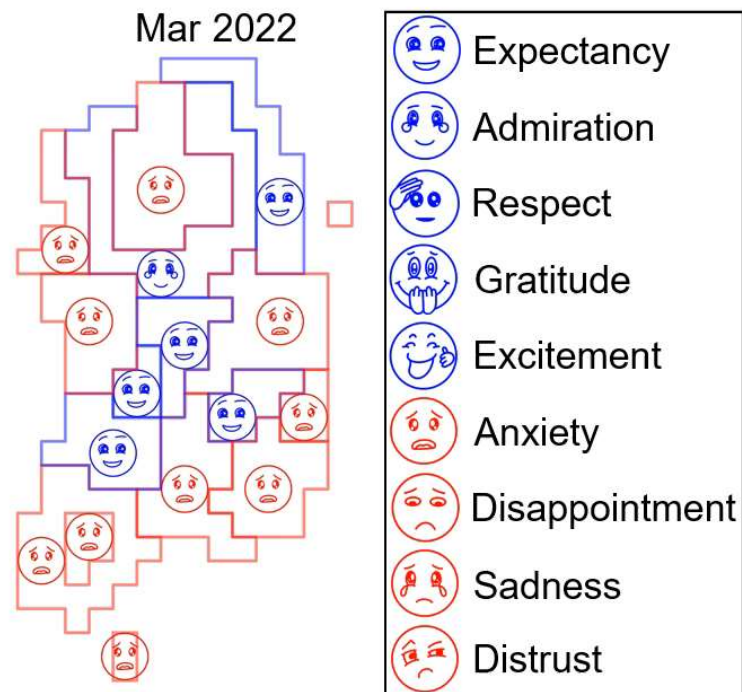
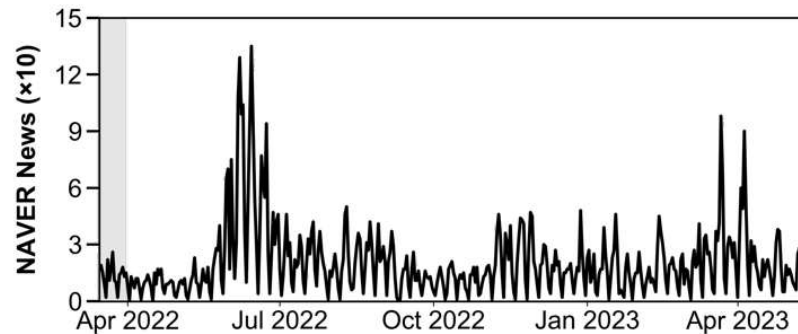


(Choi et al., in prep.)

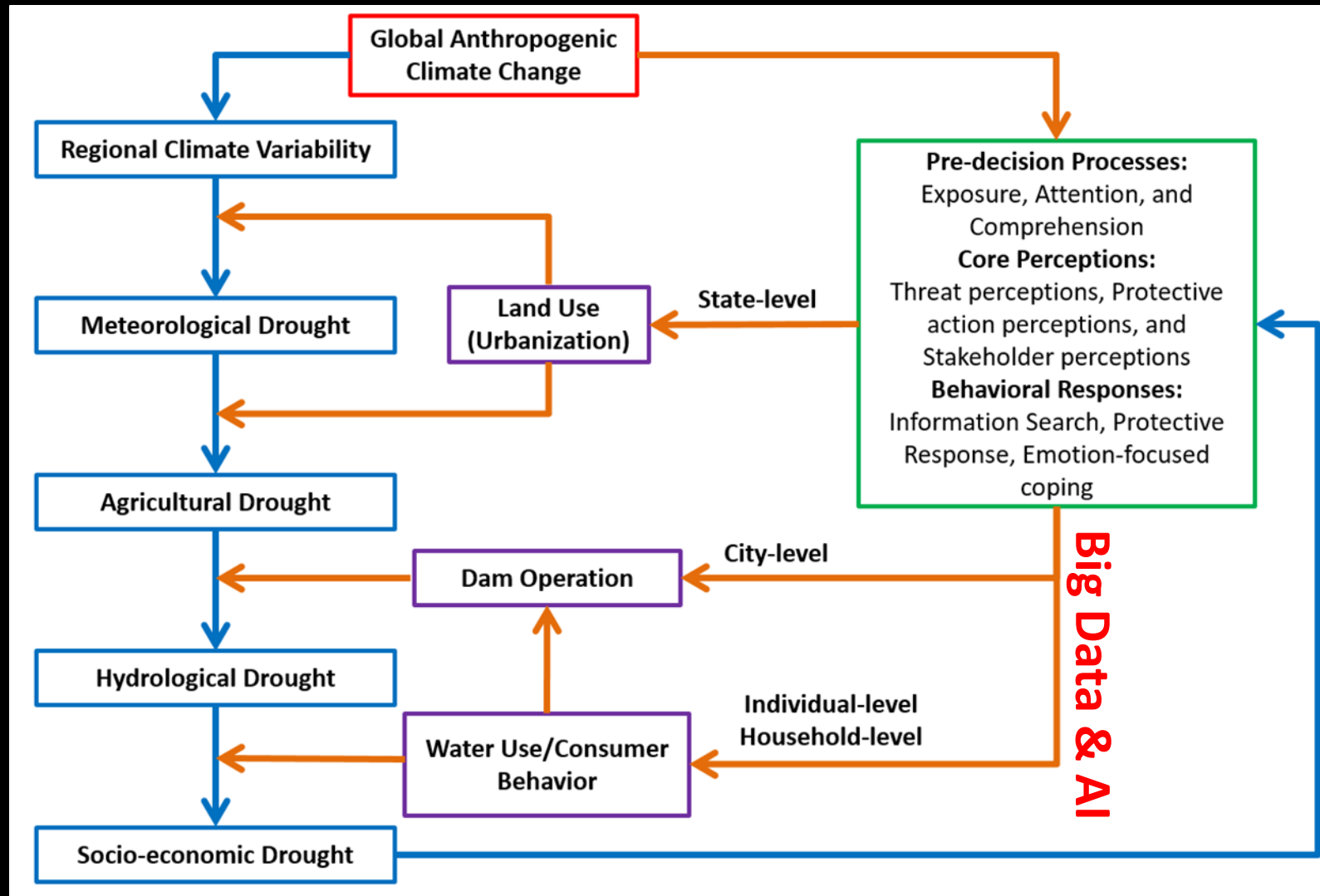
Different Spatial Social Response to Drought



Monitoring the emotion type in news headlines



We need the education program for Big Data and AI



References:

1. Choi, S., A. Liu, J. Kam, Toward Social Drought Monitoring System, *in prep.*
2. Park, C. K., S. Lee, H. Yoon, J. Kam, 2023, Sub-seasonal to Seasonal Outlook of the 2022-23 Southwestern Korea Meteorological Drought, *Environ. Res. Lett.*, 18, 104039. <https://doi.org/10.1088/1748-9326/acfb27>
3. Park, C.-K., J. Kam, H.-R. Byun, and D.-W. Kim, 2022: A Self-Calibrating Effective Drought Index (scEDI): Evaluation against Social Drought Impact Records over the Korean Peninsula (1777-2020). *J. Hydrol.* 613, 128357. <https://doi.org/10.1016/j.jhydrol.2022.128357>
4. Lee, E. and J. Kam, 2023, Deciphering the black box of deep learning for multi-purpose dam operation modeling via explainable scenarios, *J. Hydro.*, 626, 130177. <https://doi.org/10.1016/j.jhydrol.2023.130177>
5. Jeon, D., Lee, J. and Kim, C., 2022. User guide for kote: Korean online comments emotions dataset. arXiv preprint arXiv:2205.05300.

Acknowledgements:

We acknowledge Twitter/X, Google, and NAVER that provide near real-time data for online activities. This study was supported by the National Research Foundation of Korea (NRF) grant funded by the Korea government (MSIT) (No. 2021R1A2C1093866) and a Grant (2022-MOIS63-001) of Cooperative Research Method and Safety Management Technology in National Disaster funded by Ministry of the Interior and Safety (MOIS, Korea).

Thank You for Listening!

jhkam@postech.ac.kr

Please visit Our Research Group
Webpage:
hydrocliamtology.postech.ac.kr

