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Comparisons of Drought Institutions Between the U.S. and Korea

Sungbyung Chae
University of Nebraska - Lincoln

Comparisons of drought institutions between the U.S. and Korea

An Undergraduate Thesis

By Sungbyung Chae

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Thesis Advisor: Dr. Michael Hayes

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ABSTRACT

Drought occurs in basically dry area around the area of less precipitation but it affects all around the world that can occur anywhere there is a deficit of rainfall from expected levels. This happened by the extreme climate event over land lower precipitation over a period of months to years. This could affect agricultural systems around the world, within food, ecologically atmosphere condition and also the habitation food security. From the developing in the modern technology, since the environment of nature is the basic element of living creature, human would be facing the challenging of agriculture, forestry, fisheries and food security problems in the future. Those world climate change not only effect around the desert area but also became aridity desertification area.

Comparing eastern and western institutions could give some decent synergy for the future global drought. This thesis will examine the NDMC (National Drought Mitigation Center) located at the University of Nebraska-Lincoln and K-Water, which is a federal level ministry dealing with drought events located in South Korea.

Korea Peninsula have good condition to cultivate with crop agriculture techniques needed to overcome the only focus raining only summer and some weather period. Recent droughts in South Korea have had large environmental and economic impacts across the country. Changes in rainfall and hydrologic patterns due to climate change can potentially demonstrate extreme droughts occurs and affect the future availability of water resources.

Distribute the maps of certain areas and compare each with drought impact types. The Drought Monitor can make an accurate and variety kinds of information sources become available. While this process, it is able to attach many different products from regional and global drought system in the world such as NIDIS (National Integrated Drought Information System) by grading standard level of drought from D0 to D4. D3 is the point that USDA (United States

Department of Agriculture) use as a criteria for an agricultural relief (Van Loon, et al. 2013).

Keywords. NDMC, drought, USDA, drought monitoring, SPI

Background Objective

Since with global warming, climate change is happening around the world, I want to study that field in the future and also want to use my experience and knowledge of studying water science as my major. I selected drought as my research topic given that droughts are important in both the U.S. and Korea where I am from originally. I began to make research questions of how to differentiate and compare the effects of climate change impacts on developing countries like North Korea and developed countries such as South Korea and America by water stress and human population effect on economic issues. Especially in the United States around California 2011 to 2016, and there were the mega droughts occurs around the East to Midwest area last 10 years and Rocky Mt. surrounds. Some areas have cooled while others have warmed, a reflection of normal climate variability and differing regional climate controls. Likewise, some areas have experienced increased droughts while others have had more floods. Changes in Nebraska's climate are occurring within the context of these global and regional changes, and the consequent impacts and opportunities for Nebraska are related to changes occurring outside the United States.

(IPCC, C.B. Field, V. Barros, at el., 2012)

I am interested in the economic and social impacts of this particular natural hazard. Because of their role in monitoring drought and being involved in the development of the world, Korea

and U.S. Drought Monitor product, focusing the U.S. institution, I would like to highlight is the National Drought Mitigation Center located at the University of Nebraska-Lincoln. According to both institutions, I would make the hypothesis that the drought had been extended in both Korea and U.S. in modern centuries. With climate change uncertainly with population growth both putting strain on Future water supply reliability, it is even more important to understand drought impacts. Here I compare drought monitoring by the time, example of the drought concerns. This illustration of The U.S. Drought Monitor that is a weekly assessment of drought.

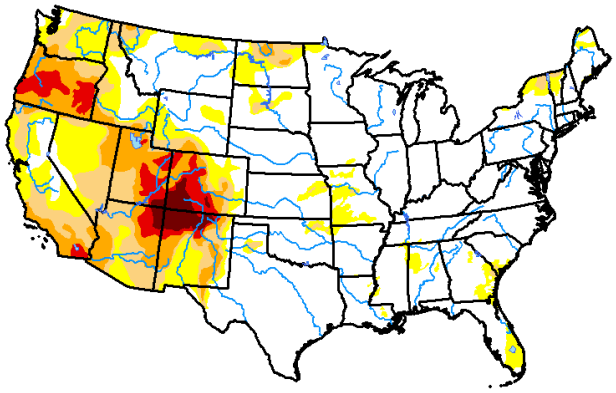

Fig1. Drought classification in U.S. Oct

This is the drought classification and the more red color means the more severe drought condition. Compare to the one above (November, 2018) and the below examples (October, 2018) it is able to see the time goes, drought gathering more around the Midwest area**.** Figure 2 highlights a period when severe drought was occurring across the U.S. in November 2018.

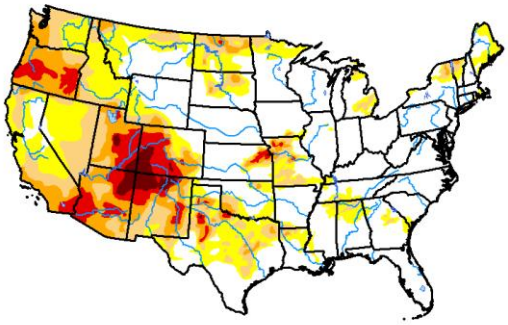

Fig2. Drought classification in U.S. Nov

Introduction

Through the modern environment issues with global warming, investigating the drought from the last century, it is able to find the connection climate change. This could affect agricultural systems around the world, within food, ecologically atmosphere condition and also the habitation. From the developing in the modern technology, since the environment of nature is the basic element of living creature, human would be facing the challenging of agriculture, forestry, fisheries and food security problems in the future. (Begueria, S., S. M. 2014) Those world climate change not only effect around the desert area but also became desertification area getting drought due to global warming especially surround earth's pole that destroyed ozone layer. (McMaster, G. S. 1997)

Drought occurs anywhere around the world, with an increase in occurrence within drought reasons but maybe more often in basically dry areas. Around the area of less precipitation have severe drought but it affects all around the world. According to the drought monitor which is

able to check the drought condition in methodological process, there was a big desertification happens in Russia in 2000 and in the world there were many drought happens in 1994, it can be natural hazard in any locations in the world. This happened by the extreme climate event over land lower precipitation over a period of months to years. Drought is a temporary dry period, by the permanent arid and also any areas even in America near Rocky mountain from last 10 years, it have been dried from east to west coast over the states and from the center Texas, to the whole area of Oklahoma in couple of cases from dam from the big water storage usages of the river stream to Mexico. This is the science indicates that, with climate change from drought-monitoring through the improved assessment data measuring methods in U.S. which is drought-monitor, droughts may increase of frequency and intensity in the future by over temperature by the hot industrial gases. (droughtmonitor.unl.edu)

Not only the America territory and south part of the earth such as Africa, Oceania and Asia also have lots of area of lack of water and becoming desertification. Some lands are classified as country of water shortage even have enough moisture amount average annually. There are many kinds of reasons and here is one example of rainfall focusing on some season period. For instance, Korea Peninsula have good condition to cultivate with crop agriculture techniques needed to overcome the only focus raining only summer and some weather period. Nowadays the peace issues drive from Korea to the U.S. and to the world so far is being a hot topic globally. Not only for the Eastern Asians or South Korean solider who discharged army, but also the world futurologists are focusing to North Korea not only for the political issues but also the environment researching way to thesis that is one of the highly vulnerable countries facing the threat of harsh natural disaster and has experienced more frequent disasters in recent years. These disasters have eventually led to food shortages and large reductions in crop yields. Currently, both official international agencies and the North Korean part had identified the

extreme drought event, the worst in 100 years according to the North Korean government. The object of this study was an estimation of the extreme drought events in last years, and to apply climatic drought for monitoring in North Korea. Characteristics of the extreme drought in North Korea are weekly examined by using the Standardized Precipitation Evapotranspiration Index (SPEI). The drought characteristics given by the SPEI results are compared with a Standardized Precipitation Index (SPI) results and drought impact information to understand how these indices can explain the drought conditions within the country. These results have shown that the SPEI could be an effective tool to provide improved spatial and temporal drought conditions to inform management decisions for drought policy. Basically, climate change is one of the most significant issues facing the world because it is predicted to alter climate patterns and increase the frequency of extreme weather events.

(Palmer and Raisanen, 2002)

Since the drought affect by the area, not only the developing countries but also developed countries like South Korea has also experienced severe droughts and water scarcity problems that have influenced agriculture, food prices, and crop production in recent years global warming. Traditionally, summertime focus problem like water shortage and desertification. (Brown et al.2008)

Recent droughts in South Korea have had large environmental and economic impacts across the country. Changes the pattern of in rainfall focusing and hydrologic patterns due to climate change can potentially demonstrate extreme droughts occur and affect the future availability of water resources. So that is necessary to evaluate drought vulnerability for water resources planning and management and enhance identify the appropriate actions to conduct a drought risk analysis in the context of climate change.

An environmental disaster that are recognized as droughts and have attracted to the natural environmentalists such as environmentalists, ecologists, hydrologists, meteorologists, geologists, and agricultural scientists. Virtually, all climatic zones, such as high as well as low rainfall areas and are the most related to the reduction in the amount of precipitation received over an extended time period, such as a season or a year. Temperatures, high winds and low relative humidity that characteristics of rains are including distribution of rainy days during crop growing seasons, intensity and duration of rain.

According to the rising of climate change and water demand for recent years have a lot of focus on global drought scenarios. The drought is the best-characterized nature hazard by multiple climatological and hydrological parameters. The relationships between these two sets of parameters are necessary to develop measures for mitigating the impacts of droughts. Initiating with a discussion definitions of drought, this paper attempts to provide the fundamental concepts of drought reviewing in concept, classification of droughts, drought indices, historical droughts using climatic studies, and the relation between droughts and large-scale climate changes. Conclusions for the gaps exist and more research needs to be focused and set. (Zeng, 2003)

Eventually, drought is a natural hazard with often significant socially related to society, economic, and environmental consequences. Through the public policy issues related to drought range, it needs to be treated to solve the problems getting from the drought by to know how to identify and measure drought to how be well prepare for, mitigate, and respond to drought impacts, and who lost their fortune associated costs to overwhelm. (IPCC, 2012)

Normally, the drought happens from typical types of meteorologically initially, agricultural to hydrological and socioeconomic finally political so far by the time and duration of the event. (National Drought Mitigation Center, University of Nebraska, Lincoln, Nebraska, USA.)

Distribute the maps of certain areas and compare each with drought impact types would be the good resolution of the drought. The Drought Monitor can make more accurate analysis and help to combine variety kinds of information sources to become available to analysis it.

Materials and Methods

To be formed in a narrow sense that definitions of drought is suggested, but rather should incorporate both physical and social measures that have a local or regional significance, drought occurs in high as well as in low rainfall areas, long-term average, such a "creeping phenomenon" that deserve to make a study with relative around the world with variety systems that able to use in many science technology methods such as remote sensing, drought methodology, water supply like dams that able to supply a reliable sources of water from the streams over the linking environmental impact. The drought problem that need the help to improve and over the vegetation, solving the natural big issues with studying a characteristic of irrigation development that would be also able to impact the economics from the management of agriculture like crop water use in evaportranspiration that need to be evaporation and transpiration, for example with corn use over 90% and it is need to be proper and accurate data for water use to be solve the problem of lack of water. (Wilhite, D.A., 1992)

Significant air temperature changes have occurred globally during the last century around the world, which are spatially variable to considerable degree and agroecosystem productivity from indicating by agro-climate indicator.

The method and historical data would be used in U.S. drought monitor system. Since there is

no single definition works in all circumstances, planners and agricultural producers need to rely on the complete setting of map for indicating properly (Wilhite, 1992). Distribute the maps of certain areas and compare each with drought impact types. The Drought Monitor can make an accurate and variety kinds of information sources become available. While this process, it is able to attach many different products from regional and global drought system in the world such as NIDIS (National Integrated Drought Information System). Through those systems, I can analyze data by topics and interactivity in current and past conditions. Basically, the categories that is going to be used in the Drought Monitor by the magnitude condition. Each category is containing the drought condition distinguished by percentile chance of the drought. For example, category D0 means the area is abnormally and D4 is the exceptional level. In order to outlook the forecasts being predicted, it is need to find the impacts how drought is affecting the nature. So various sources are required to compute with observations such as soil moisture, vegetation, fire, temperature and precipitation. The Drought Monitor also depicts the classification of drought impact types by associated in the agriculture, water, and the fire categories. In that case, it is able to compare differences of drought reasons by variety impacts. DIR (Drought Impact Reporter) is an effective tool that is an interactive data based on drought impact in certain area by location, data, type and cost build stake holder, government, media other reports. South Korea also use drought monitor in K-water which is a federal level of the institution.

Basically I would collect the data through federal website and facilities, I do need specific extra budget except my own devices and tickets. Initially, visited Korea water center and ask some questions for analyzing data and interviewing for arranging data.

Result

In this study, the magnitudes of East Asian droughts are spatially and temporally shown by using CRU(Climate Research Unit) monthly precipitation data from 1951 to 1996. The SPI climate issued that a drought index also for American 1900s to 2000s data for annual deviation levels. Here is the result of stationarity that is the idea of natural system unchanging envelope in fundamental concept with earth climate changing.

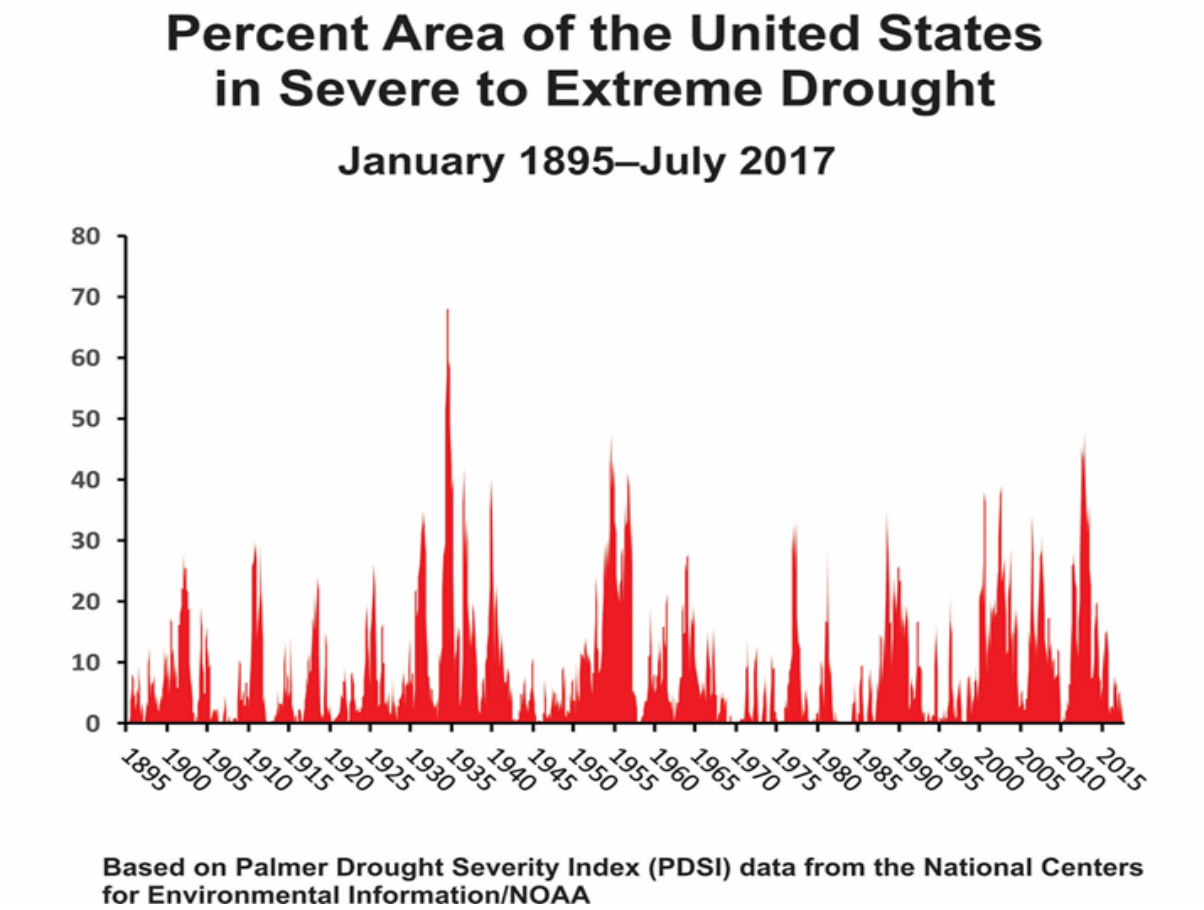

Table1. stationarity past to future in U.S.

It is the percent of the United States in severe and extreme drought according to the Palmer Drought Severity Index (PDSI) for every month period 1895 to 2017. As you can see, drought

is a normal part of the climate for all the U.S. during the period and there is not actually any time when drought does not occur. But one can also see the major droughts in the U.S.: the 1930s, 1950s, mid 1960s, 1970s, 1988, 2002, and 2012. (Pereira, L. 2002)

The results of the power spectrum analysis shown in figure below, showing two significant intervals of months and years in Korea.

Table2. critical search for drought in Korea 50 years.

Event index	Beginning month(year/month)	Ending month(year/month)	Duration (months)	Drought intensity
1	1951.2	1951.5	4	Severe
2	1951.7	1951.8	2	Severe
3	1951.10	1951.12	3	Severe
4	1952.3	1952.4	2	Severe
5	1952.6	1952.8	3	Severe
6	1968.7	1968.7	1	Severe
7	1968.10	1968.10	1	Severe
8	1974.2	1974.3	2	Severe
9	1977.3	1977.3	1	Severe
10	1978.5	1978.6	2	Severe
11	1982.10	1983.1	4	Extreme
12	1983.2	1983.4	2	Severe
13	1983.6	1983.6	1	Severe
14	1988.9	1988.10	2	Severe
15	1988.11	1989.1	3	Extreme
16	1989.2	1989.6	5	Severe

17	1994.9	1994.10	2	Severe
18	1994.12	1995.4	5	Severe
19	1995.6	1995.6	1	Severe
20	1995.7	1995.7	1	Extreme
Sum(month)			47	Severe(44), Extreme(3)

(Lee YH, Choi YJ, Oh JH. 2000)

Drought events in Korea (36.25°N, 127.75°E) estimated from the 12-month SPI for the period of 1951 to1996. Severe and extreme droughts as categories of $-2.0<SPI\leq-1.5$ and $SPI\leq-2.0$ respectively

Discussion

I believe the successful drought policy is by monitoring with early warning, vulnerability with impact assessment and mitigation managing. The result of drought analyzing study indicated that analyzed a similar soil moisture data set generated at high resolution over the contiguous USA. This simple comparison of proxy data is insufficient, and more comprehensive work should be done in the future. Most drought events in Korea are seasonally specific, mainly occurring from autumn to the next spring, escaped in winter even it would be very dry season. The 12-month SPI, used as a drought index in this study, does not provide for the seasonality of Korean drought. It is also necessary to consider other time scales so as to

utilize the SPI's full potential. The SPIs of different time scales, such as 3, 6, 24, and 48 months, will be investigated and compared with the12-month SPI in future work to examine shorter terms or longer terms of droughts over those areas. Since the spatial relationships of extreme climate events will be different for the time scale considered, other statistical methods (e.g. data mining techniques) should be used rather than just simple correlation analysis to identify better spatial and temporal characteristics of extreme drought events for preserving water.

In the following discussion, short duration, high intensity events are referred to as short-term. Long duration, low intensity events are referred to as long term. It should be noted that the spatial extent calculated here is not necessarily contiguous and this is more likely the case for larger regions as drought can occur in multiple disconnected locations at the same time. Over North America, the 1950s were the decade of most spatially extensive and prolonged drought in the west and central regions, as expected. NDMC is good tool for agricultural and Kwater is a good private tool for public hydrological part, if they focus on both side each other, there would be a huge synergy effect for the water usage against the drought since an anthropogenic changes to the land surface alter infiltration surface runoff and storage of water affect the development of drought. For the conclusion of reflected by the research, in the future, it is needed to measure the drought and weather condition ahead so that able to prevent the future slow natural weather disaster.

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