Climate Changes and their Effects on Natural Disaster in Zambia

Tazu Saeki
Research Institute for Humanity and Nature

1. Introduction

Some part of Zambia is located in Semi-Arid Tropics (SAT) where most of farmers live by agriculture depending on meteoric water and the farmers' livelihood tend to be affected by droughts thouguh some part of Zambia effort to manage water demand for irrigated agriculture, industry and hydropower (e.g. the Kafue flats [Herbertson and Tate, 2001]). Sakaida [1993] analyzed relationship between rainfall changes and maize production in Zambia using annual rainfall data of 23 stations and concluded that the effect of annual rainfall change on maize production was evident in the Southern province.

In Zambia located in SAT, to investigate resilience of the farmers against changes in ecological system and human activities, analysis and monitor of meteorological data are essential. This report aims to describe preliminary research results in this fiscal year and future possible research plan in terms of meteorology and related fields.

2. Preliminary field research in Zambia

During the field trip to Zambia in August 2005, we visited Meteorological Department, Ministry of Communications and Transport (Fig. 1) at Lusaka and interviewed an acting chief meteorologist, Forecasting and Research Division. As for meteorological data they operate 36 meteorological monitoring sites for meteorological elements such as temperature, precipitation, evaporation, air pressure, sunshine, and cloud cover. Some sites have been operated since 1950. We also visited two meteorological sites at Choma and Lusaka City Airport (Fig. 2 and 3).

Fig. 1 Meteorological Department, Zambia.

Otherwise official meteorological sites operated by Meteorological Department there are some voluntary stations at where mainly only rainfall data was recorded by villegers. These rainfall data are reported to Meteorological Department but are not merged with official data.

Fig. 2 Meteorological site at Lusaka City Airport.

Fig. 3. Meteorological site at Choma.

These voluntary-collected data are recorded only on papers as seen in Fig. 4.

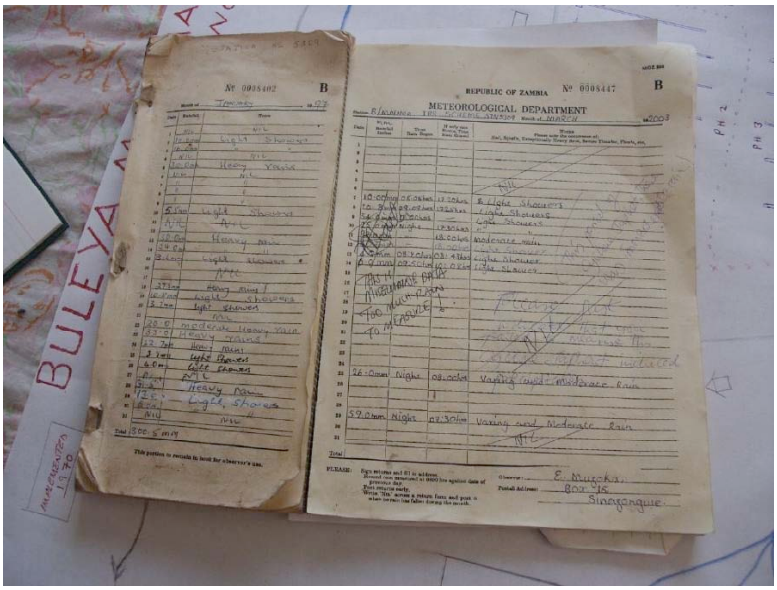

Fig. 4 Voluntary rainfall record at Sinamalima

Ministry of Communications and Transport reported that the first half (Oct-Nov-Dec) of the 2004/2005 growing season, rainfall performance was normal or above over most of areas in Zambia except for the western part but during the second half (Jan-Feb-Mar) of this rainy season they have not much rain as expected in the southern half of Zambia [The Director of Meteorology, 2005]. Farmers in the southern region also said that the 2004/2005 drought was heavy which was comparable to a big drought in 1991/1992.

As the first stage of our project we obtained annual rainfall data from 1993 to 2004 at 9 official meteorological sites as listed in Table 1 and Fig. 5. Figure 6 shows obtained annual

Table 1 List of meteorological monitoring sites at which we obtained rainfall data.

Site Code	Latitude [d m]	Longitude [d m]	Elevation [m]	Site Name
CHIPAT01	13 33	32 35	1032	CHIPATA MET
CHOMA001	16 51	27 04	1267	CHOMA MET
KAFUE001	15 46	27 55	987	KAFUE POLDER
LIVING01	17 49	25 49	986	LIVINGSTONE MET
LUSAKA01	15 25	28 19	1252	LUSAKA CITY AIRPORT
LUSAKA02	15 19	28 27	1154	LUSAKA INT. AIRPORT
MAGOYE01	16 08	27 38	1018	MAGOYE AGROMET
MTMAKU01	15 33	28 15	1213	MT. MAKULU AGROMET

rainfall from 1993 to 2004. As seen in Fig. 6 precipitation is highly variable at each sites. Precipitations in 1994-1995 and 1998 are relatively low than the other year, but severe damage to agriculture was not reported. We are planning to get and analyze monthly or more precise meteorological data at each sites.

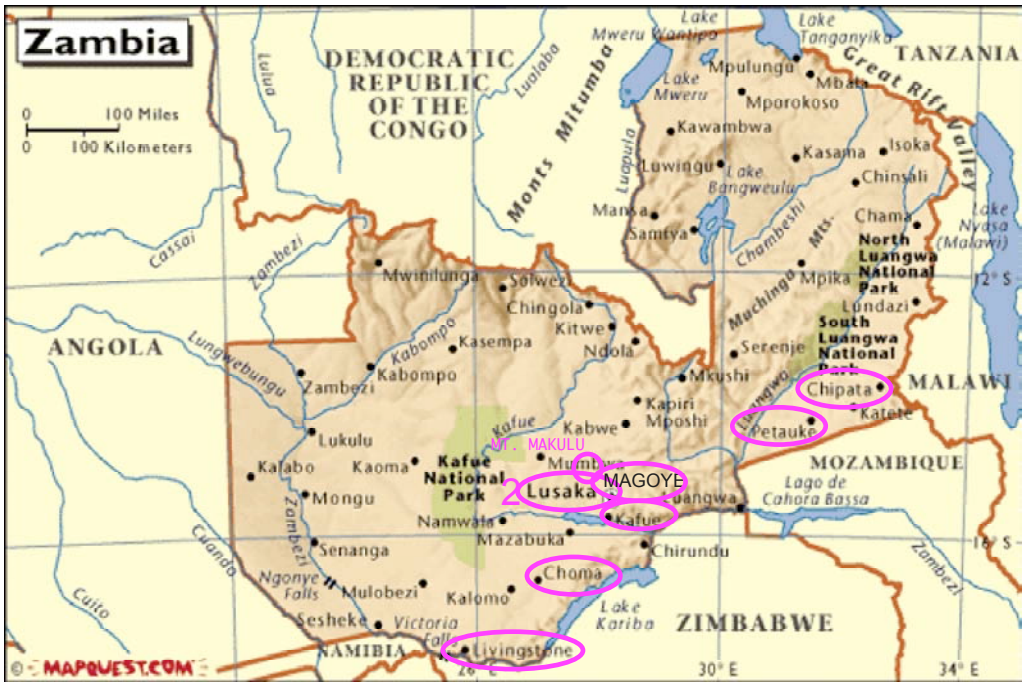

Fig. 5. Locations of the sites. (A Map is referred from http://www.mapquest.com .)

3. Future research plan

To estimate effects of variable climatic factors especially rainfall and impacts human activities on farming, measurement of plot-level (inside a village) rainfalls may be important. We will install small rain gauges as well as devices to measure basic meteorological parameters in some villages. Voluntary-recorded rainfall data and interviews with persons who record data might be helpful for village level analysis.

For a district level analysis, official data stored by Meteorological Department will be collected. Since a climate in Zambia is influenced by the Inter-Tropical Convergence Zone (ITCZ), the southeast wind over the Indian Ocean an analysis of global meteorological data set is helpful. In terms of district and continental scales RIHN has meteorological data set by ECMWF (European Centre for Medium-Range Weather Forcast). This data set contains operational and re-analysis data for major meteorological parameters for whole globe in resolution of 2.5˚ x 2.5˚, latitude and longitude respectively. More precise resolution data of 0.5˚ x 0.5˚ will be available from ECMWF in the next stage of this project. Analysis of

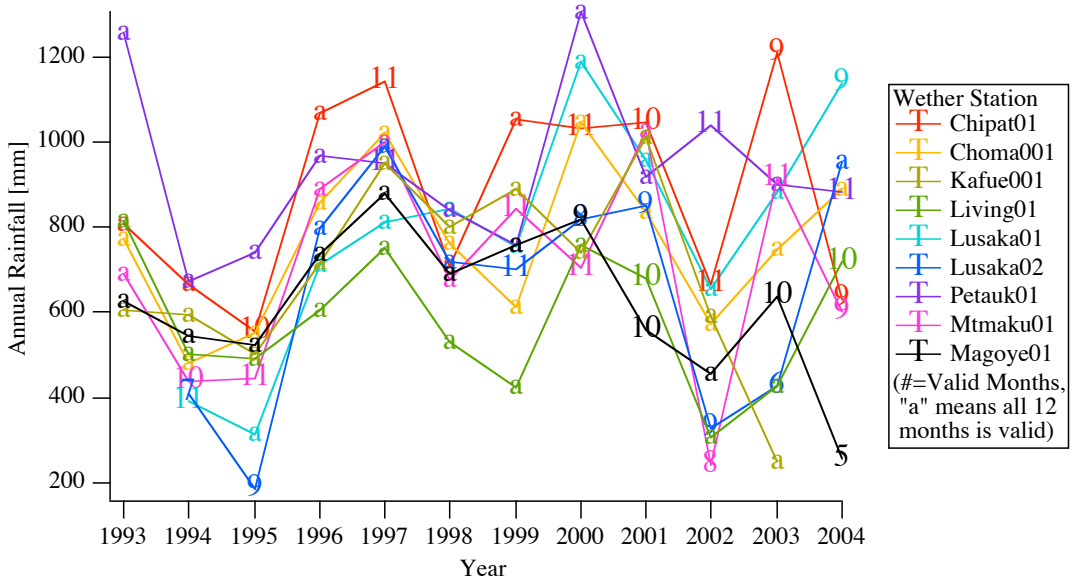

Fig. 6 Annual rainfall data from 1993 to 2004 at 9 official meteorological sites in Zambia

these data sets in a viewpoint of climate change in Zambia will be useful to resolve a relationship global climate change and its effect on Zambia. Model simulation by running a regional meteorological model might be inside the scope of our research to investigate meteorological condition in Zambia.

4. Conclusion

Through official and unofficial (interviews with farmers) information in Zambia, life of farmers in Southern and Eastern Provinces is affected by drought in 2004/2005 year which was comparable to 1991/1992 drought. By analysis of meteorological data in these two big drought years and a normal year including and monitoring the present whether we will be able to get some global and/or regional patterns of climate change of drought year and to integrate the results with the other results of this research project may results in finding what are the conditions of the droughts and farmers' resilience against variable environment.

References

The Director of Meteorology, Summary on the Rainfall Performance of the 2004/2005 Growing Season, *Weather Monitor, Ministry of Communications and Transport, Republic of Zambia*, 2005.

Herbertson, P. W. and E. L. Tate, Tools for Water Use and Demand Magnagement In South Africa, *Technical Reports in Hydrology and Water Resources, No. 73*, World

Meteorological Organization, 2001.

Sakaida, K, Rainfall Changes and their Effects on Maize Production in Zambia, *The Science Reports of the Tohoku University, 7th Series (Geography), Vol. 43, No. 1*, 1993.