22. KOELZER, V. A. and PERRY M. FORD, Effect of Various Hydroclimatic Factors on Snowmelt Runoff, TAGU, pp 578-587, October 1956.

As noted in their introduction, the authors do not present methods of analysis which can be considered new. They do, however, record the results of an exceptionally large number of analyses (made possible through employment of high-speed electronic computers) on a limited number of forecast points, affording consideration of a variety of factors in a number of different forms.

RUNOFF FORECASTING AND SNOW SURVEYING IN CHILE

By

Enrique S. Arias[1/]

I. SITUATION.

Chile is a country with high mountains extending from latitude 18°.5 to 56°.S, from the tropics near the Polar circle. Rivers run from the Andes to the Pacific Ocean covering a very short distance across the country, through the Central Valley and the Coastal Range. This is specially a true picture in the Central Zone. In the great north there is a desert and the extreme south is crossed by channels running north and south, and archipelagos.

II. NEED TO FORECAST

The great part of the population is concentrated in Central Chile: Santiago, the Capitol, has 1.5 million people; the whole country about 6.5 millions. The Central Zone has a mediterranean climate, very similar to the one you have in California. Storms come from the Pacific Ocean. With this kind of climate in Central Chile there is a humid season in winter, when snow is stored in the Andes, and a specially dry summer and fall. Having great part of the land under irrigation and being by way of development of our water resources for other purposes, especially power production, there is a need for forecasting the runoff that is going to be produced every year in springtime and early summer, caused by snow melt.

III. WORK DONE BY ENDESA

(a) Snow Surveys

We have been working in snow surveys in ENDESA, experimentally near Santiago since 1951. There we measure a snow course and a recording snowgage. This last year (1956) we installed five more snow courses and several storage gages in different basins. Our highest snow course is about 10,500 feet over the sea level, the lowest is about 4,000 feet high. The two extreme basins under study are separated by around 600 miles.

The procedure used in field work is the same as the one used in this country. Up to this moment we have obtained good results. Due to the steepness and ruggedness of the terrain we haven't used snow vehicles. Traveling is done by foot.

In the snow course Portillo, with six years of record the maximum water content of the snow pack has varied between 13.1 to 58.3 inches, with an average of 23.6 inches. In the Northern Zone the average water content is lower, around 10 inches, and in the southern snow courses it is higher, around 40 inches. These figures are given only as a guide and they are only approximations.

Our plans are to extend snow surveying in Chile and to apply the data to other fields, especially Agriculture, obtaining for that purpose the cooperation of several other organizations that are concerned with this matter.

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(b) Runoff Forecasting

There is a great need for runoff forecasts in Chile, as I mentioned before. In ENDESA we have used all kinds of available data: rain records (generally of rain gages located in the Central Valley); streamflow records; and temperature records. We have used a few different methods of forecasting, principally the one established by the U. S. Weather Bureau, based on multiple correlation. In the near future we are planning to introduce the snow water equivalent data, as this data begins to be applicable.

We are not only interested in forecasting the total runoff to be produced by snow melt (from October through January or October through March in our country), but we are also concerned in forecasting flow with a short time of anticipation. This is necessary for dam operations and flood control. It is especially important for us to forecast the high flows and the lower flows. Up to this moment we have used almost exclusively a comparison of the current flow with the historical records, that in many cases have proved to be a good short procedure, especially in the cases where streams are almost entirely fed by snow.

We are looking forward to establishing more observation points in our Andes, thus being able to apply the data to obtain better forecasts.

I have been informed that during the last summer season in Chile (December through March 1957) more snow courses and shelter cabins have been installed in the mountains.

CEILINGS UNLIMITED

By

Robert W. Miller[1]/

We are always trying to find a quicker and easier way to perform a given task. In the case of snow surveys, the helicopter would seem to be the logical solution. Helicopter snow surveys certainly aren't a recent innovation—surveys were made by helicopter in some areas at least eight years ago. Realizing this, and that there has already been much said and written on the subject, I shall not try to approach the use of helicopters as a new panacea for all snow survey operations. Rather, the intent of this talk is to pass along the results of our rather brief experiences with this type of operation in the hope that they will be of some interest and/or value to those of you who might be contemplating a helicopter snow survey program.

The use of helicopters for snow surveys is extremely logical. Many years ago when helicopters were still in their infancy, Dr. Church prophesied that the day would come when many snow courses would be taken with the aid of helicopters. Almost as soon after World War II as helicopters became commercially available, the helicopter companies began promoting their use for snow surveys. In 1947, a contract was negotiated between an aircraft company and the U. S. Geological Survey in Washington for helicopter snow survey work. At that time, it was stated the helicopter could probably handle courses up to 11,500 feet. Four years and numerous helicopter improvements later, they decided the limit was nearer 6,500 feet. The State of California entered the helicopter snow survey picture on an emergency basis for a brief period in 1952. The results left much to be desired. The conclusion, at the end of approximately two weeks and about $9,000, was that for high elevation operation and for range the helicopter just didn't have it. It should be pointed out, however, that this was an emergency operation. As such, there was no time for such details as caching fuel supplies. In addition, the entire operation was carried out during extremely adverse weather conditions.

By the summer of 1956, helicopters seemed to have improved to the point where they might be practical. At least the situation seemed to justify a re-evaluation. The results of this re-evaluation seemed to be that from the point of view of time saved, effort saved, and possibly even

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