

a high order of accuracy, are brought to your attention as an explanation of why the Bureau can not immediately strengthen its river service to the extent known to be desirable. They are as follows:

"(1) The establishment of more and better placed rainfall stations, especially in head-water regions.

"(2) The installation of an adequate network of recording rain gages to enable the forecaster to know the intensity of the rainfall.

"(3) Surveys of the amount and condition of snow in the eastern mountains, from which little information concerning snow is now available. Reliable and prompt rainfall reports are not sufficient when the mountain regions hold a great amount of water in the form of snow, which is likely to be released by the rain.

"(4) Arrangements for a more reliable transmission of rainfall and river stage reports from the substations to the district centers. Except in very unusual cases the telephone and telegraph wires answer all purposes with a great degree of satisfaction, but in the unusual cases, which are emergencies, the greatest need for the reports exists, and a river forecaster without information from the drainage area above him is helpless. The problem is difficult to solve.

Cooperating "Hams"

"It has been suggested that radio stations should be established in the flood producing regions, manned by Weather Bureau employees, to transmit reports promptly under all conditions to the forecasting center. This would be a solution, but it is felt that the cost would not be justifiable; certainly it would not be until it could be shown definitely that the Weather Bureau had exhausted every other and less costly means for having reports transmitted satisfactorily. One plan proposed and being investigated is to have an arrangement under which amateur radio operators would transmit reports in times of emergencies.

"(5) Divide the country into eight sections for river administrative and forecasting purposes. Have a staff of men in each section to handle the river work. These men should be charged with placing and supervising the operation of the substations, the transmission of reports to the forecasting centers, with coordinating all phases of the work, with investigating the requirements for forecasts and arranging for meeting the requirements, with cooperation with other organizations engaged in river work, and with developing formulas for forecasting. Through a

close cooperation with the Geological Survey, discharge data are becoming available to the Weather Bureau for all of the rivers of the country, and these data can be used to a great advantage, in combination with Weather Bureau data, in the development of formulas that will enable considerable refinement to be introduced into the river stage and flood forecasts.

"The foregoing list of requirements for a river forecasting service of a high

CLIMATOLOGY

Great Floods on Great Rivers Encountered by Explorers

GREAT floods on America's great rivers are no new thing under the sun. They are recorded by the earliest Spanish explorers, who found that the Indians had adapted themselves to the flood problem by building great mounds as artificial hills of refuge for emergencies.

The chronicle of the expedition of Hernando de Soto, who discovered the Mississippi, tells of a terrific flood on the lower river, near Memphis, which lasted from mid-March until the end of May, in the year 1543. De Soto and his men had landed at Tampa Bay, Florida, traversed the states of Florida, Georgia, the Carolinas, and Alabama. Then they discovered and crossed the Mississippi, which De Soto called the Great River. After exploring Arkansas and Louisiana, the Spaniards again came back to the Great River, where their leader fell sick and died and was buried in its waters so that hostile Indians might not find and dishonor his body.

It was during their sojourn on the river that they were given the first view of a Mississippi flood that white men's eyes had ever beheld. Here is how the chronicler, Garcilaso de la Vega, was impressed:

"Then God, our Lord, hindered the work with a mighty flood of the Great River, which, at that time—about the eighth or tenth of March—began to come down with an enormous increase of water; which in the beginning overflowed the wide level ground between the river and the cliffs; then little by little it rose to the top of the cliffs. Soon it began to flow over the fields in an immense flood, and as the land was level without any hills there was nothing to stop the inundation.

order of accuracy is not merely something to be desired and not attained. Upon the contrary, it represents a plan set up by the Chief of the Weather Bureau more than a year ago, and a modest beginning toward its accomplishment was made on July 1 of this year. Small staffs have been placed both in the Missouri Valley and the upper Mississippi Valley, and other parts of the country will be taken care of as it becomes possible to do so."

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"On the 18th of March of 1543, which that year was Palm Sunday, when the Spaniards were marching in procession the river entered with ferocity through the gates of the town of Aminoya, and two days later they were unable to go through the streets except in canoes.

"The flood was 40 days in reaching its greatest height, which was the 20th of April, and it was a beautiful thing to look upon the sea where there had been fields, for on each side of the river the water extended over twenty leagues of land and all of this area was navigated by canoes, and nothing was seen but the tops of the tallest trees.

"On account of these inundations of the river the people build their houses on the high land, and where there is none, they raise mounds by hand, especially for the houses of the chiefs; the houses are constructed three or four stages above the ground, on thick posts that serve as uprights and between uprights they lay beams for the floors, and above these floors which are of wood, they make the roof, with galleries around the four sides of the house where they store their food and other supplies, and here they take refuge from the great floods.

"The floods do not occur every year, but when in the regions where the rivers have their source there have been heavy snows the preceding winter with rains in the following spring; and thus the flood of that year of 1543 was very great on account of the heavy snow which had fallen the preceding winter. These floods occur every 14 years, according to what an old Indian woman told us."

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