Floods and Flood Danger in Iceland

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ABSTRACT

Runoff data are given for 50 drainage areas all over Iceland, describing flood characteristics in direct runoff rivers, spring-fed rivers and glacier rivers. Seven types of floods are defined: rain floods, melt floods, rain and melt-floods, jökulhlaups, step-bursts, man-made floods and geological event floods.

Representative flood areas are described and possible flood protection is discussed. Special attention is given to the Hvítá — Ölfusá area, which is the most seriously threatened flood area in Iceland.

INTRODUCTION

Floods play an important role in hydrology, destroy lives and damage land and other property. Although floodplains are not densely populated in Iceland, flood studies are important for future land use planning. The present paper discusses mapping of potential flood areas in Iceland and classifies the observed flood types. Further, flood danger is described in the most threatened areas, and measures for flood protection are discussed.

ICELANDIC FLOODPLAINS

Iceland is a convenient model for earth and hydrological studies. The chain of events is rapid and clear. The most typical floodplains are those of the old rivers of northern and eastern Iceland, e.g. the lowlands of Skagafjördur and Eyjafjördur and Útmannasveit in the East by the Selfljót river. We may consider the lowland of Eyjafjördur inland of Akureyri as an example. The farmers of Eyjafjördur have situated their farms up on the mountain sides on either side of the plains of Eyjafjördur. They have realized, that the plain is an area where the river dominates in flood condition.

But how do the large floods happen on these floodplains? It is apparent that the large flood is the result of the interplay of many factors. The first stage is the large flood of the river in the valley of Eyjafjördur. That alone is not sufficient to flood all the lowland. The sea level at the estuary at the head of the fjord is very important. A high sea level is sufficient to prevent flow many kilometres inland. A high sea level can be the result of various conditions, as is generally known, e.g. high tide of the tidal stream, on-shore wind, low atmospheric pressure. The situation can also be such that the flow to the sea is hindered because the river bed is in a bad condition, i.e. it has an unusually poor transport ability due to ice, sediment, or that the flow is even hindered by growth or constructional operations as well as many other factors. Some of these factors can be calculated as regards their frequency and the rise in water level which they cause. In other cases figures do not apply so that the total effect becomes unclear e.g. what factors work together to cause a rise in water level and what factors do not? This long list should be sufficient to show that it is clear that a variable and usually long period of time elapses between large floods. The water level alone is not sufficient in this case to show what the flow is each time. In other words: The connection between water level and flow is broken and confused by various obstacles. For this reason flow recording stations are situated above the floodplains, where the same water level always gives the same flow (in m^3/s). On large rivers abroad it also proves economical for other reasons to have the flow recording stations above the floodplain and in fact a good distance away from them, so that it's possible to give flood warnings well in advance.

Throughout almost the entire history of Icelandic farming, floodplains have been the greatest and best hay producing land, but half a century ago they suddenly lost their value. It is pretty certain that