LOOP RATING AND GRADING OF SUSPENDED SEDIMENT IN THE MARAROA (NOTE)

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Schouten (1977) and Wood (1977) have reported suspended sediment gauging sequences sufficiently detailed to demonstrate loop rating behaviour in which the concentration during the rising stage exceeds the concentration during the falling stage of the flood. These measurements were on rivers with catchments of 2.5 km^2 and 154 km^2 respectively and are similar to the measurements reported below from a 1219 km^2 catchment.

The Mararoa catchment (46 S 176 E) drains into the Waiau River at the southern extremity of New Zealand. The northern most 346 km^2 of the catchment drains through the Mavora lakes, and so only the remaining 873 km^2 contributes sediment to the Waiau river confluence where the gauging site is located. The mean flow of the Mararoa river is 28 $m^3 s^{-1}$.

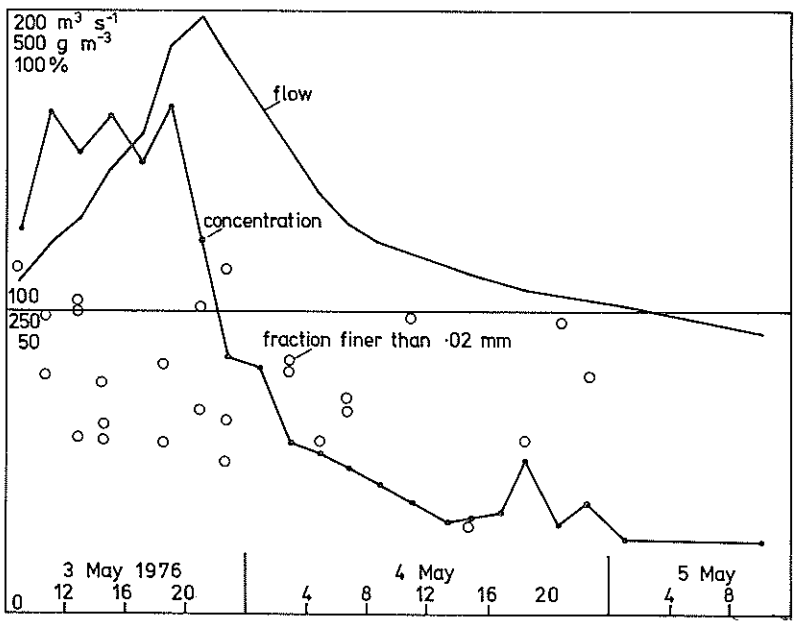

FIG.1 – Time series of flow, suspended sediment concentration and the fraction of suspended sediment finer than 0.02 mm.

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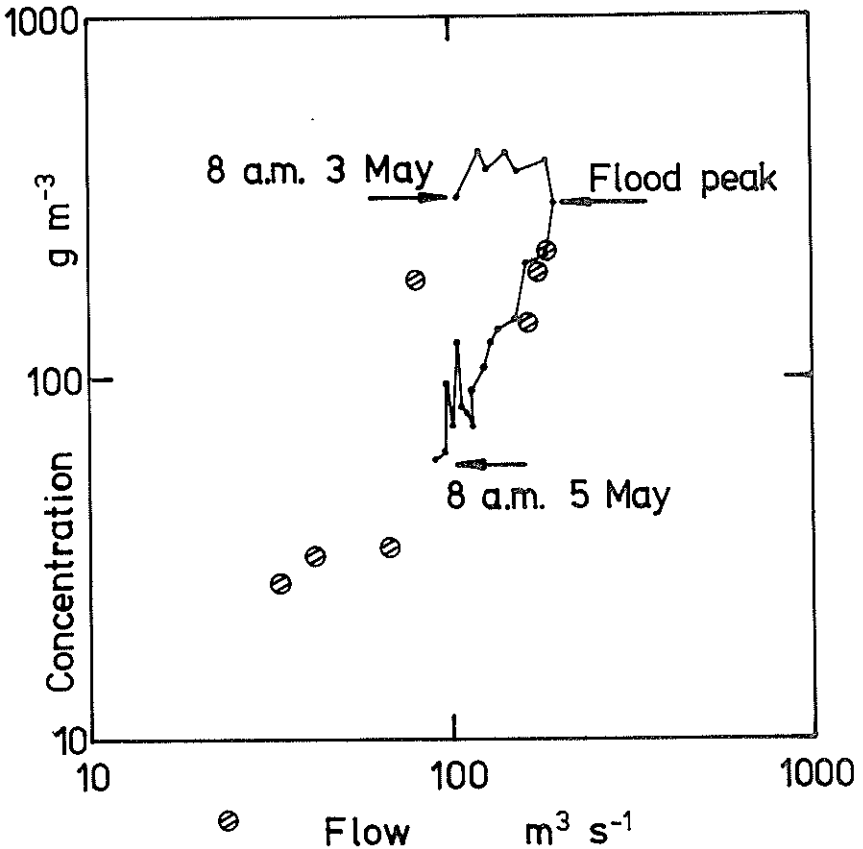

FIG.2 – Log–log plot of suspended sediment concentration versus flow. The line is the data also plotted on Fig.1 and the spots are gauging of other floods.

Depth integrated samples of suspended sediment at 3 verticals were taken at approximately 2 hour intervals throughout a flood on 3–5 May 1976. Separate stage to flow ratings were established by current meter for the zone of flow associated with each vertical. The mean concentrations plotted (Figs. 1 and 2), were calculated by weighting the zone concentrations by the zone flows. We believe more frequent sampling would not have provided more information than interpolation between these 2 hourly measurements. Less frequent sampling would not have been adequate on the rising stage but would have been adequate on the falling stage.

The scatter of the spot gaugings made on other floods which are also plotted on Fig.2 is consistent with the width of the loop in the concentration versus flow line. This result is important in that it explains part of the scatter of our sediment concentration data, and demonstrates the need for sampling both rising and falling stages.

The grain sizes in the sediment samples have also been analysed in a laboratory. Many samples from each flood were separately analysed and the results

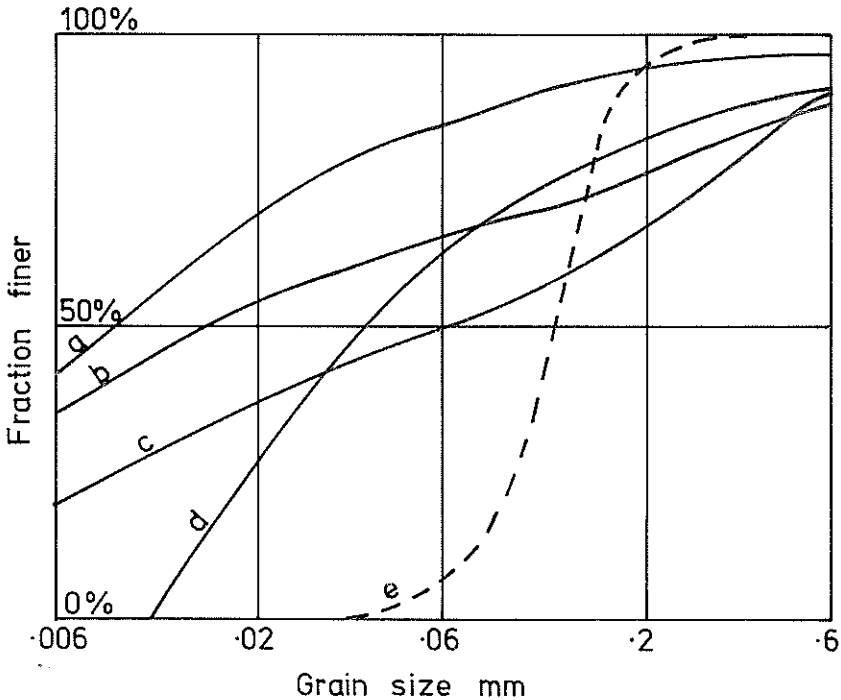

FIG.3 – Grain size distributions	Date	Number of samples
(a) Mararoa	30.9.77	5
(b) Mararoa	30.10.77	8
(c) Mararoa	3–4.5.76	26
(d) Roxburgh	1974	140
-(e) Shotover	1.2.52	1

plotted against time, flow and concentration but no correlations with these variables were found. For example the individual values of the fraction finer than .02 mm are plotted against time on Fig.1. The scatter of the individual values at other grain sizes is similar. When the individual values for all these samples at each grain size are averaged, curve c on Fig.3 is obtained.

Fig.3 shows the grain size distributions of suspended sediment load in three Mararoa floods, of the sediment trapped in Roxburgh lake on the Clutha River (Thompson 1976), and of a single suspended sediment sample from the Shotover River (Gillies 1956). The Roxburgh data were obtained by analysing sediment cores from the bed of the lake and differs from the suspended load in that coarse bed load is included and fine suspended load, which passes through the lake, is excluded. The catchment contributing sediment to Roxburgh lake which includes the Shotover is adjacent to the Mararoa catchment. In this region we can reasonably presume a grain size distribution within the band shown on Fig.3 provided the single Shotover sample is rejected as atypical. This is an important result for predictions of siltation processes in the Lake Manapouri outlet and the proposed Clutha Power Lakes.

REFERENCES

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