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ANOMALOUS SPRINGTIME FLOODING OF NORTH SLOPE RIVERS

BY

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INTRODUCTION AND BACKGROUND

This report represents a response on the part of the Outer Continental Shelf Environmental Assessment Program, Research Unit 267, to a request by the state of Alaska, Department of Fish and Game. Its intent is to document the earliest- dates that Alaskan North Slope rivers, and in particular the Shaviovik, have flooded in springtime. The data used have been collected and archived by the Geophysical Institute, University of Alaska, in order to aid ongoing academic research in general and also to aid private industry and state and federal agencies in questions of environmental conditions.

We would like to emphasize that in questions such as this we, as university research scientists, attempt to remain strictly impartial regarding issues our data may be applied to.

DATA

The data presented here as figures 1 through 7 are enlargements from archived imagery acquired by the Tyros series of spacecraft. These images are generally available up to two to three times per day but, of course, are cloud cover dependent. The images were chosen for each year on the basis of the first date that well-developed floodingwas clearly taking place. In general, the possibility of cloud cover would tend to make the documented observations later than the date of first occurrence. However, cloud cover did not appear to limit data availability in the cases shown here. On the images presented here, the Shaviovik River has been indicated by a black arrow.

RESULTS

The dates of the documented flooding are tabulated as Table 1.

YEAR	MONTH	DAY
1974	5	24
1975	5	31
1976	6	10
1977	6	4
1978	6	8
1979	5	2
1980	5	29

Table 1. Dates of documented North Slope river breakup

The average of these dates is May 28. Tine standard deviation is approximately 13 days. It is interesting to note that all the dates except May 2 fall within one standard deviation of the mean value. Were these dates a normal distribution we would expect 64% *of* the dates to fall within this 13-day bracket,yet 86% did. The apparently anomalous date, May 2, is clearly altering the statistical pattern from what should be expected from a normal distribution.

Eliminating May 2 from the data set yields an average date of June 2 and a standard deviation of six days. Now the data set appears to be a normal distribution.: 66% of the dates fall within one standard deviation of the mean. The anomalous date is 5 standard deviations away from the mean, with a probability of occurrence less than .01% Conversely, in the case of including the May 2 date in the data set, it would have a probability of occurrence of around 3%.

DISCUSSION

It is difficult to base climatological statistics on such a small data set as used here. There is a tendency to suspect that statistics over a period of fifty to one hundred years are represented by normal distributions but that over shorter periods systematic trends tend to dominate. For instance, the results here suggest that the average river flooding date is around June 1. There is no assurance that the six late dates reported here represent a short-term systematic trend to later dates and the May 2 date, while early,' is not as anomalous as the statistical analysis would suggest.

On the other hand, there could be a systematic mechanism that frequently causes early flooding but it has only operated once in the past seven years. The data set certainly isn't large enough to determine its frequency of occurrence.

In a case such as this, the best opportunity to determine a predictive capability far these sorts of events is to associate them with causal relationships. In the case of riverine flooding, one would suspect an association with cumulative thawing degree days in the watershed. An attempt was made to perform this analysis, but the required data was not readily available, (the data that do exist are not entirely adequate) and some estimation was required here immediately. An attempt will be made to test this relationship in the near future.

CONCLUSIONS

It would appear that the apparently unusually early North Slope river flooding date, May 2, is a true anomaly and that the average flooding date is around June 1. However, because of the possibility of short term causal relationships, it is not possible to rule out a second occurrence of this event in the near future..

In the event that the latter were true, the relationship would probably depend OIL temperatures within the period up to one month prior to the flooding. Longer term predictions would be based on long-range weather forecasting.

When basing regulatory decisions on events such as these., one needs to determine the acceptable probability of occurrence of an adverse event. In this case of riverine flooding, the probability of occurrence on May 2 appears very small and the probability on June I looms quite large. We see no clear reason to exclude May 2 from the statistical data set... . particularly if this is a hint of systematic anomalies of incertain recurrence frequency.

The statistics then suggest that the probability of flooding before a given date is as follows:

Date	Probability of prior flooding
May 28	50%
May 15	16%
May 9	4%
May 2	2%

Table 2. Statistical probability of prior flooding of North Slope rivers.