

General Disclaimer

One or more of the Following Statements may affect this Document

- This document has been reproduced from the best copy furnished by the organizational source. It is being released in the interest of making available as much information as possible.
- This document may contain data, which exceeds the sheet parameters. It was furnished in this condition by the organizational source and is the best copy available.
- This document may contain tone-on-tone or color graphs, charts and/or pictures, which have been reproduced in black and white.
- This document is paginated as submitted by the original source.
- Portions of this document are not fully legible due to the historical nature of some of the material. However, it is the best reproduction available from the original submission.

1. REPORT NO.	2. GOVERNMENT ACCESSION NO.	3. RECIPIENT'S CATALOG NO.
4. TITLE AND SUBTITLE Use of the LANDSAT-2 Data Collection System in the Colorado River Basin Weather Modification Program.	5. REPORT DATE June 30, 1975	6. PERFORMING ORGANIZATION CODE
	9. PERFORMING ORGANIZATION REPORT NO.	
7. AUTHOR(S) Dr. A.M. Kahan (IN024)	10. WORK UNIT NO.	
9. PERFORMING ORGANIZATION NAME AND ADDRESS Division of Atmospheric Water Resources Management Bureau of Reclamation Denver, Colorado 80225	11. CONTRACT OR GRANT NO. 23030	
	13. TYPE OF REPORT AND PERIOD COVERED Type II Progress Report April 1, 1975 - June 30, 1975	
12. SPONSORING AGENCY NAME AND ADDRESS Goddard Space Flight Center Greenbelt, Maryland 20771	14. SPONSORING AGENCY CODE	
15. SUPPLEMENTARY NOTES		
16. ABSTRACT The progress of work for operational use of the LANDSAT Data Collection System to aid in the forecasting and control of weather modification operations as part of the Colorado River Basin Pilot Project conducted by the Bureau of Reclamation is contained in this report. The LANDSAT hydrometeorological network continued to serve as a useful tool to obtain near-real time data. Significant progress was made in the development of the wind averaging circuits with initial field test being conducted during the reporting period.		
17. KEY WORDS AND DOCUMENT ANALYSIS a. DESCRIPTORS-- Satellite Data Collection System, Weather Modification, Hydrometeorology, Electronic Wind Data Averaging. b. IDENTIFIERS-- c. COS, TI Field/Group		
18. DISTRIBUTION STATEMENT Available from the National Technical Information Service, Operations Division, Springfield, Virginia 22151.	19. SECURITY CLASS (THIS REPORT) UNCLASSIFIED	21. NO. OF PAGES
	20. SECURITY CLASS (THIS PAGE) UNCLASSIFIED	22. PRICE \$3.00

(E75-10404) USE OF THE LANDSAT-2 DATA COLLECTION SYSTEM IN THE COLORADO RIVER BASIN WEATHER MODIFICATION PROGRAM Progress Report, 1 Apr. - 30 Jun. 1975 (Bureau of Reclamation) 6 p HC \$3.25
 CSCL 04B G3/43 00404
 Unclas
 N75-33459

"Made available under NASA sponsorship in the interest of early and wide dissemination of Earth Resources Survey Program information and without liability for any use made thereof."

USE OF THE LANDSAT-2 DATA COLLECTION SYSTEM IN THE
COLORADO RIVER BASIN WEATHER MODIFICATION PROGRAM

"Made available under NASA sponsorship
in the interest of early and wide dis-
semination of Earth Resources Survey
Program information and without liability
for any use made thereof."

Dr. Archie M. Kahan, Chief
Division of Atmospheric Water
Resources Management
Bureau of Reclamation
Denver, Colorado 80225

June 30, 1975

Type II Progress Report for Period from April 1, 1975 - June 30, 1975

Prepared for:

Goddard Space Flight Center
Greenbelt, Maryland 20771

Type II Progress Report
LANDSAT-2

- a. Title: Use of LANDSAT-2 Data Collection System in the Colorado River Basin Weather Modification Program

LANDSAT Follow-on Investigation No. 23030

- b. GSFC ID No. of P.I.: IN024

- c. Problems:

During the period April 1, 1975 through June 30, 1975 two problems developed which effected the quality or schedule of the work.

One problem was associated with performance of sensors at two stations: Lime Mesa and Wolf Creek North. At Lime Mesa extremely heavy precipitation occurred during March and early April. During the April servicing trip to the site via helicopter maintenance personnel were unable, in the limited amount of time available, to locate the precipitation gage and stand which was buried under the snow pack by extremely heavy snowfall. The DCP continued to transmit normally and equipment was subsequently located and maintenance performed. However, data transmitted subsequently was invalid, apparently due to moisture trapped in cables connecting the DCP and precipitation gage. At the Wolf Creek North station it was decided a potential interference problem between LANDSAT and the stream gage on-site recorder existed. In order to assure the streamflow data during the critical high flow runoff period were accurate, USGS personnel disconnected the streamflow data input to the DCP. Since streamflow data were the primary data desired the DCP was removed on May 7th rather than after May 15th or originally scheduled.

The second problem involved the interface between the wind averaging circuits and the LANDSAT DCP. The interface was checked out and appeared to be functioning properly during preliminary testing at WSSI. While time for checkout and debugging of the wind averaging components was allowed in the project schedule the problems proved to be more complex to locate than anticipated thus causing revision of the schedule for this portion of the work.

The first system was installed at the Jersey Jim site in early May. Checkout of the system using the LANDSAT test set indicated proper operation. However, data were not being received in Denver via the satellite link. The system was examined to a limited extent at the field site and still appeared to be functioning properly. The system was left operating at Jersey Jim while the interface was examined in greater detail at WSSI using the #2 system. This examination revealed that when the DCP test set was not connected to the DCP, a noise pulse was generated on the interface lines each time the DCP transmitter turned on. This noise pulse simulated the serial data clock from the DCP to the wind averaging system. This caused the wind averaging circuits to turn off the DCP trigger command too soon, disabling the data transmission. The interface was then redesigned and the #2 system installed at Jersey Jim during late June.

Checkout of the #2 system at WSSI prior to installation at Jersey Jim was delayed due to a data accessing problem caused by LANDSAT data transmission frequency in excess of that for which the computer programs were written. During checkout, in order to look at more data, the DCP transmission rate had been increased from one transmission every 60 seconds to one transmission every 10 seconds. This caused the data file for that station to fill up very **quickly**. The computer program used to access that file looks only at the first 500 (approximately) entries and will not output anything beyond that point. This caused the data to appear as if the system **were not** operating. This limitation was bypassed by directly accessing the data file and returning to the slower DCP transmission date.

d. Accomplishments:

The work accomplished during the period April 1 - June 30 and the progress planned during the next reporting period are as follows.

I. Work Accomplished

A. Hydrometeorological Data Collection Stations

Three of the five stations were operated during the quarter with operation of two stations discontinued for the reasons discussed in the preceding sections. Three stations: Wolf Creek Pass, Upper San Juan, and Castle Creek operated satisfactorily routinely throughout the quarter as discussed in Table 1.

Table 1: LANDSAT Data Collection Platforms -
Quarter ending June 30, 1975

Site Name	Parameters	Comments
Wolf Creek Pass	Air Temperature Precipitation Battery Voltage	All data parameters were transmitted routinely during period. DCP operation continuous and satisfactory. Fluctuations noted in precipitation data record for two periods, suspected cause bridging of gage due to extremely large storms occurring April and May.
Upper San Juan	Air Temperature Precipitation Snow Pillow Battery Voltage	Data parameters transmitted routinely during period, DCP operated continuously and satisfactorily. Temperature and precipitation data look good, snow pillow data not useable due to damaged sensor per previous report.

Castle Creek	Air Temperature	Data parameters transmitted rou-
	Precipitation	tinely entire period, DCP operated
	Battery Voltage	continuously and satisfactorily.
		Fluctuations noted early May in
		precipitation record, similar to
		Wolf Creek Pass data, bridging of
		gage suspected. Temperature data
		looks good during period.

B. Wind Averaging Circuit Development and Humidity Sensor Evaluation

A major objective of the LANDSAT Follow-on program is the development of a wind averaging system which will provide more useful data for weather analysis and forecasting. To accomplish this objective, a digital wind averaging system has been designed by WSSI which will average wind speed and wind direction for a period of approximately 8.5 minutes immediately preceding each hour. The system incorporates an internal memory which stores the data from the most recent eight hours. These data are then transmitted via the LANDSAT system, providing the user with wind data over the previous eight hour period.

Fabrication of both wind averaging systems was completed during this reporting period. Checkout of one system is complete. It was installed at the Jersey Jim site during late June and is operating properly at this time. The second system is currently being tested at WSSI where it will be set up to operate side by side with a continuous recording wind sensor. This evaluation site replaces the Muleshoe site originally selected, since the equipment at Muleshoe is scheduled to be removed during July or early August.

Accurate and reliable measurement of relative humidity is a major problem associated with collection of hydrometeorological data at remote stations. The objective of this phase of the LANDSAT Follow-on program was to survey the available relative humidity sensors and determine if technology advancements have resulted in a sensor with characteristics compatible with application at remote sites. If a suitable sensor was found, it would be obtained for testing and evaluation.

The available sensors were surveyed and a Hygrometrix model 8501 sensor and associated signal conditioning electronics was selected for testing. The unit has been ordered for a 60 day evaluation period and will be tested during July and August. The PCRC-11 relative humidity sensor is also being evaluated since it has been used previously with the LANDSAT network in the San Juans. Data from three PCRC-11's are being compared, with simultaneous measurements obtained using a hygrothermograph and a sling psychrometer.

II. Progress Planned During Next Reporting Period

Work items planned for the period July 1 through September 30, 1975 include the following:

1. The LANDSAT 5 station hydrometeorological will be removed from the field sites coincident with removal of the Colorado River Basin Pilot Project network by early August. This equipment will be allowed to operate on a no maintenance basis until removal to gain supplementary information regarding network maintenance minimum frequency required.
2. Assemble the hydrometeorology data collected.
3. Install the second wind averaging system at WSSI, complete field test of #1 unit at the Jersey Jim site, develop software to handle wind averaging data. Add relative humidity, temperature, and radiation sensors to #2 system, add relative humidity temperature, and precipitation sensor to #1 system, these tests to be completed at WSSI.
4. Complete all items of work and tests on 5 station hydro-meteorological network and two wind averaging systems by September 30, 1975. Submit final report within 60 days following completion of work.

e. Significant Results:

The results of this work to date are the following:

1. Operation of the LANDSAT Data Collection System continues to indicate the network is a practical means to obtain data in near-real time to aid in forecasting and control of weather modification operations.
2. Tests of the wind averaging circuit development indicate the methodology is feasible and that successful field tests should be obtained during the next reporting period.

f. Publications:

There were no published articles; and/or papers pre-prints, inhouse reports, or abstracts of talks that were released during the reporting period.

g. Recommendations: None

h. Funds Expended:

Total expenditure on this investigation through June 30, 1975 is \$17,198.

i. Data Use: N/A

j. Aircraft Data: N/A