

Data Analyses in Connection with the
NATIONAL GEODETIC SATELLITE PROGRAM
Contract No. NSR 09-015-018

Quarterly Progress Report No. 13
for the period April 1, 1968, through June 30, 1968

Principal Investigator: Dr. C. A. Lundquist
Project Administrator: Mr. R. W. Martin

September 1968

Prepared for
National Aeronautics and Space Administration
Washington, D. C. 20546

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Data Analysis

During this quarter, E. M. Gaposchkin concentrated on improving the gravity-field-determination computer program for the Standard Earth calculation to be performed later this year. It has been extended and improved and is now working well. Analytical extensions to the gravity-field-determination program include the capability for handling zonal harmonics up to degree 21 in place of 14 as in 1966, and more powerful air-drag and solar-radiation-pressure theories. Other improvements include more refined techniques for treating doppler data and refinements in generalized data-processing programs.

The bulk of the computational effort this quarter was devoted to orbit determinations for use by Dr. Y. Kozai in a new zonal-harmonics determination this summer. Fourteen of the 15 satellite-observation files to be analyzed have been completed with mean elements determined independently every 2 days. These files, consisting of some 123,000 Baker-Nunn observations covering intervals of up to 5 and 6 years, are displayed in Table 1. Note the variety of inclinations in the satellite orbits used. Kozai's determination should result in a superior representation of the zonal harmonics up to degree 21.

Data Reduction

The analysis of simultaneous-observation data will begin next quarter when reduction of data for more than 500 observation pairs is complete. These data will allow four new Baker-Nunn stations to be included in the SAO

geometrical network. In addition, seven of the longer interstation lines will be considerably strengthened by the new data.

Table 2 shows the data to be analyzed, and Figure 1 illustrates the expansion and strengthening of the geometrical network.

International Participation

The 6-month program of cooperation with the French National Space Agency (CNES) in tracking six laser-reflecting satellites (including Geos 1 and Geos 2) was well under way at the end of this quarter. This program was discussed in Progress Report No. 12.

Observatories in Helsinki, Finland; Riga, Latvia; and Uzhgorod, USSR, have continued to report successful observations of Geos 2 flash sequences.

Table 1. Satellite observation files analyzed for zonal-harmonics determination.

	Inclination	Start date	End date	Observations
59 01A Vanguard 2	33°	12/24/59	7/28/66	15,790
60 09B Echo 1 Rocket	47	9/11/60	10/31/65	18,559
61 15A Transit 4A	67	8/8/61	12/5/64	3,227
61 15B Injun SR 3	67	8/5/61	1/20/64	2,497
61 28A Midas 4	96	2/13/62	3/9/66	32,139
62 29A Telstar 1	45	7/23/62	8/27/64	5,192
62 60A Anna 1B	50	10/31/62	5/8/66	8,979
62 68A Relay	48	12/29/62	6/3/65	2,257
63 13A Telstar 2	43	5/11/63	6/30/64	2,130
63 26A Geophysical Research	50	6/30/63	9/11/65	3,158
63 53A Explorer 19	79	12/19/63	6/12/67	8,644
64 01A	70	6/1/64	9/11/65	1,644
64 64A Explorer 22	80	10/11/64	6/3/67	1,420
65 81A OGO 2	87	10/15/65	12/9/66	4,593
65 89A Geos 1	59	11/8/65	3/25/67	<u>13,282</u>
			Total	123,511

Table 2. Simultaneous observation data available for analysis.

Station pair	Distance (km)	No. of pairs	Previously available pairs
<u>New Stations(*)</u>			
Comodoro Rivadavia, Argentina* - Peru	3251	34	-
Comodoro Rivadavia, Argentina* - Villa Dolores, Argentina	1561	33	-
Comodoro Rivadavia, Argentina* - Brazil*	5257	18	-
Brazil* - Spain	5402	34	-
Brazil* - Peru	4056	34	-
Brazil* - Curaçao	4150	9	-
Brazil* - Villa Dolores, Argentina	4163	14	-
Ethiopia* - South Africa	3945	37	-
Ethiopia* - Spain	5324	34	-
Ethiopia* - India	4687	24	-
Ethiopia* - Iran	2692	39	-
Ethiopia* - Greece*	3532	30	-
Greece* - Spain	2632	23	-
Greece* - Iran	2786	30	-
<u>Long Ties</u>			
New Mexico - Peru	6287	7	24
Spain - Curaçao	6465	7	35
Spain - Florida	6581	16	28
Japan - Hawaii	6142	7	19
Japan - Johnston Island	5275	3	18
Florida - Cold Lake, Canada	3859	15	46
Hawaii - Cold Lake, Canada	5238	11	19
<u>Others</u>			
New Mexico - Rosamond, California	1088	31	-
Spain - Malvern, United Kingdom	1768	27	17

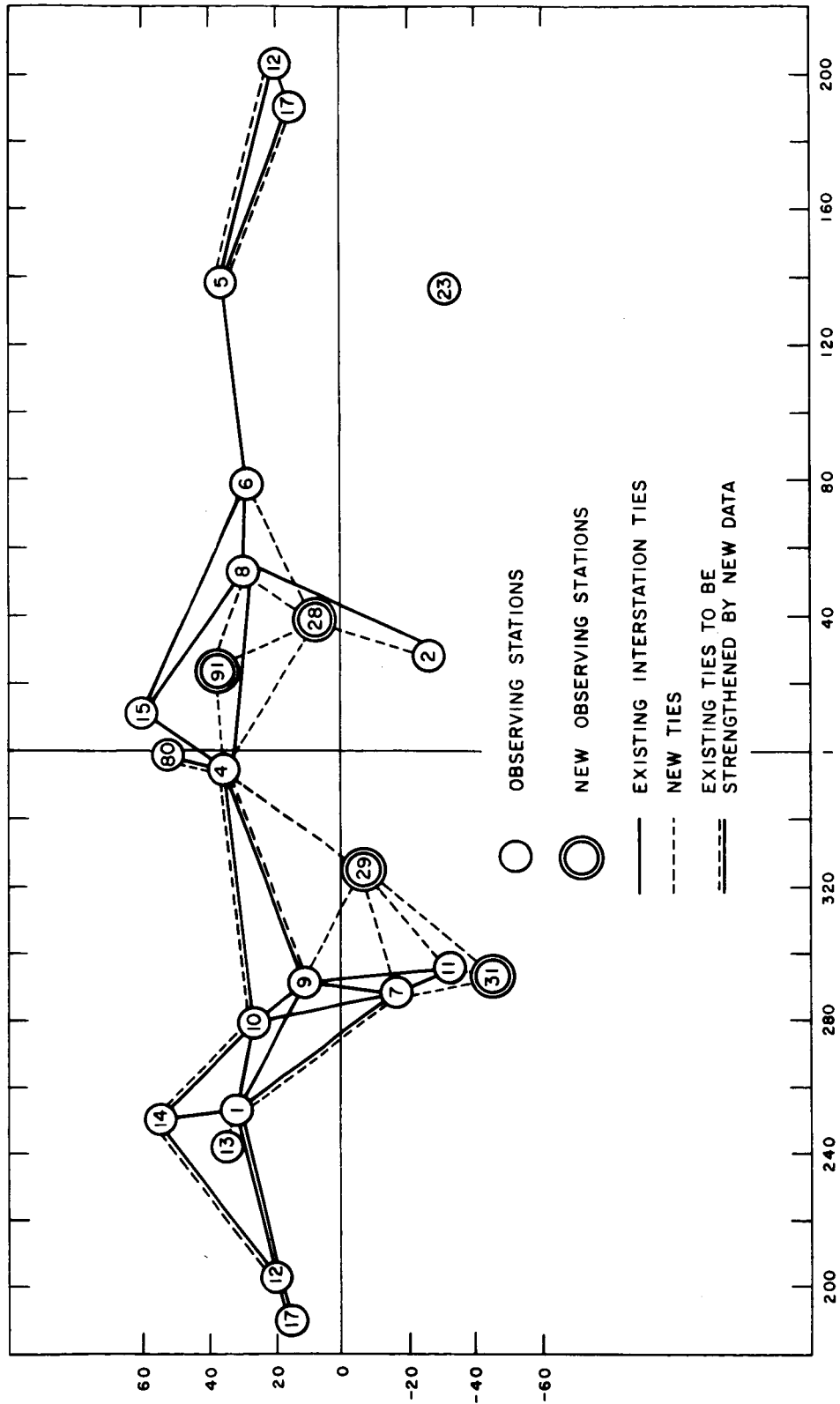


Figure 1. SAO geometrical network.