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REQUIREMENTS FOR IMPROVED MODELING OF THE ORBITAL ATMOSPHERE

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Satellite accelerometer data are available for seven time periods during the period 1974-present. All seasons and latitudes up to 83^{o} are covered. Deviations between the accelerometer data and current models are greatest for high geographic latitudes and high geomagnetic index, although about a 15 percent standard deviation persists between the models and the accelerometer data even at low latitudes and geomagnetically quiet times.

Accelerometer data give density times the ballistic coefficient, (C_dA/m), and it is therefore necessary to estimate the time-line of the ballistic coefficient in order to obtain density.

REQUIREMENTS FOR IMPROVED THERMOSPHERIC NEUTRAL DENSITY MODELS

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WORKSHOP ON UPPER AND MIDDLE
ATMOSPHERIC DENSITY MODELING

HUNTSVILLE, ALABAMA

19 NOV 85

OUTLINE

- INTRODUCTION
- AFGL SATELLITE ACCELEROMETER DATA BASE
- RESULTS
  - MODEL EVALUATIONS
  - GEOMAGNETIC STORM ANALYSES
- DISCUSSION/CONCLUSIONS

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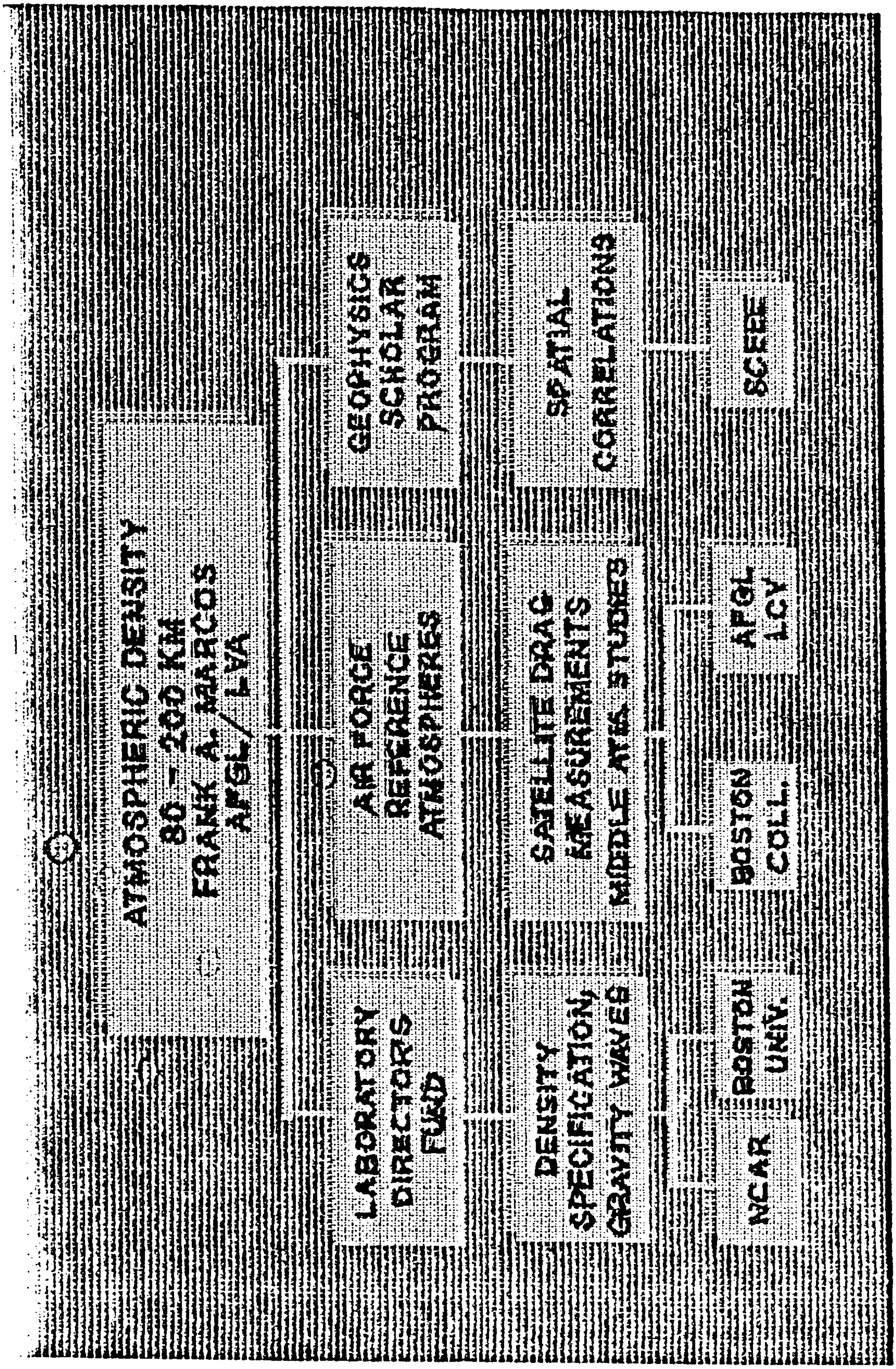
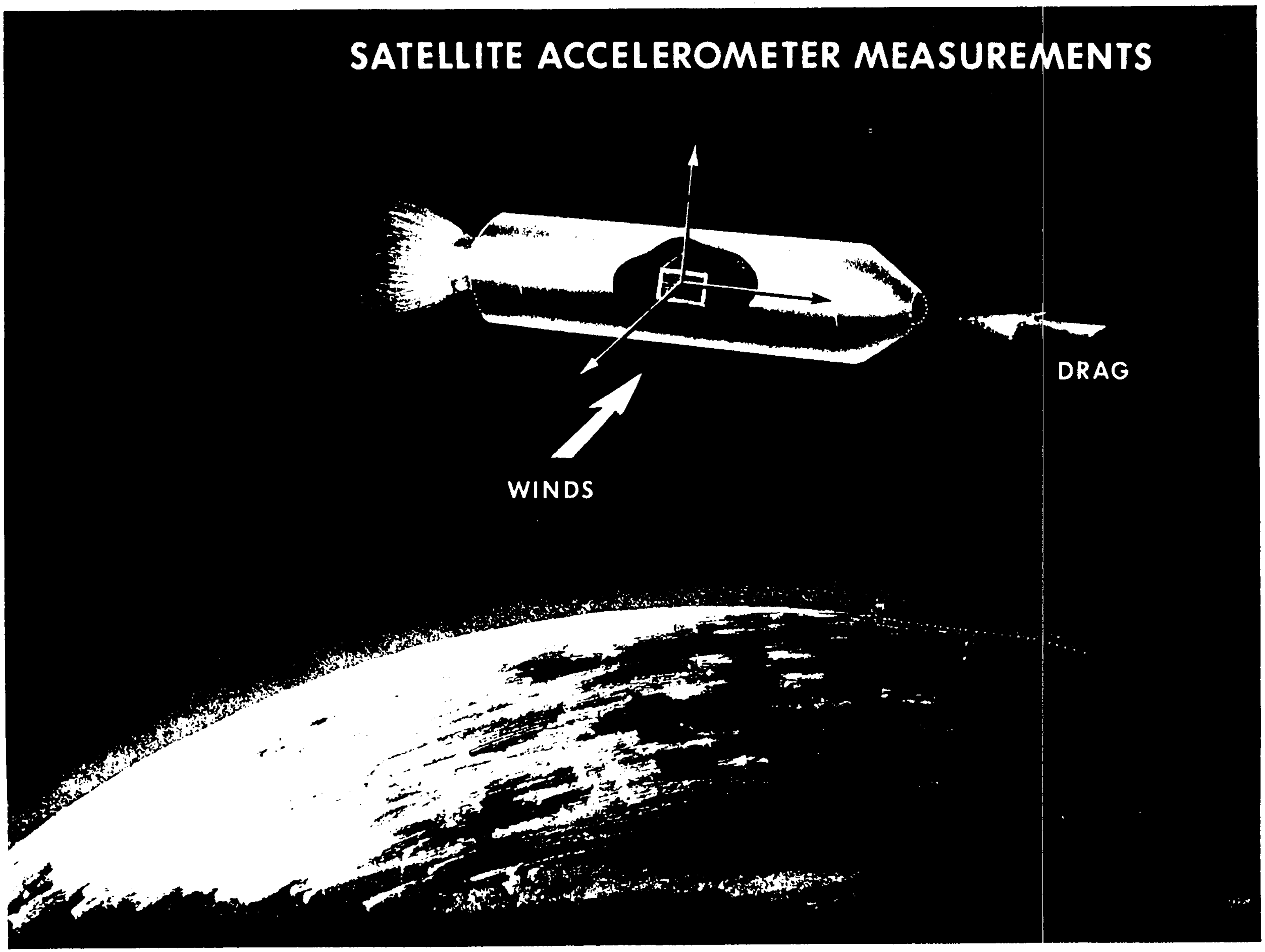
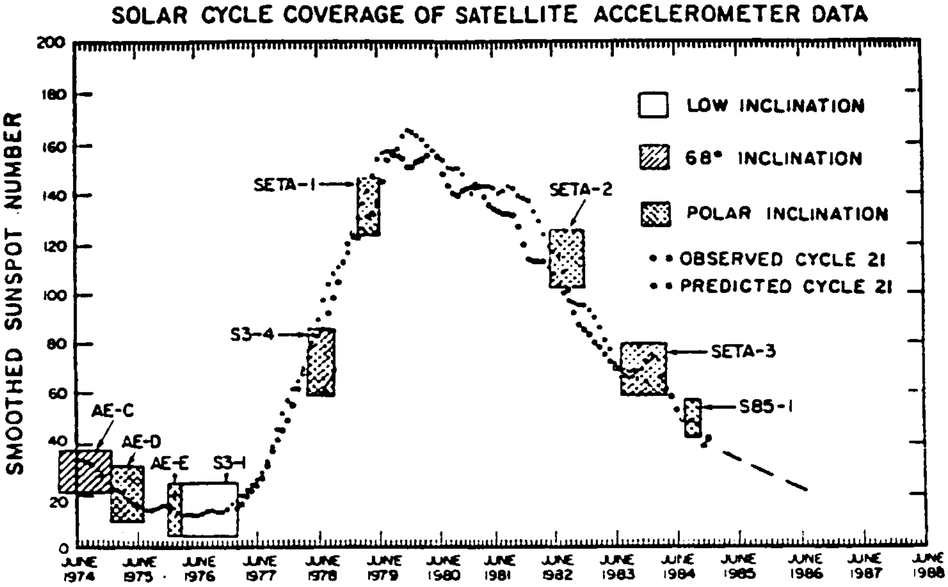




Cartoon showing orientation of accelerometer axes with respect to aerodynamic drag and cross-track wind vectors.



Satellite accelerometer flight history and solar activity vs. time.

TABLE 1. SATELLITE ACCELEROMETER DATA SOURCES

Satellite	Data Acquisition Period
AE-C	Jan - Dec 74
S3-1	Oct 74 - May 75
AE-D	Oct 75 - Jan 76
AE-E	Nov 75 - Nov 76
S3-4	May - Aug 78
SETA-1	Mar - Apr 79
SETA-2	May - Nov 82

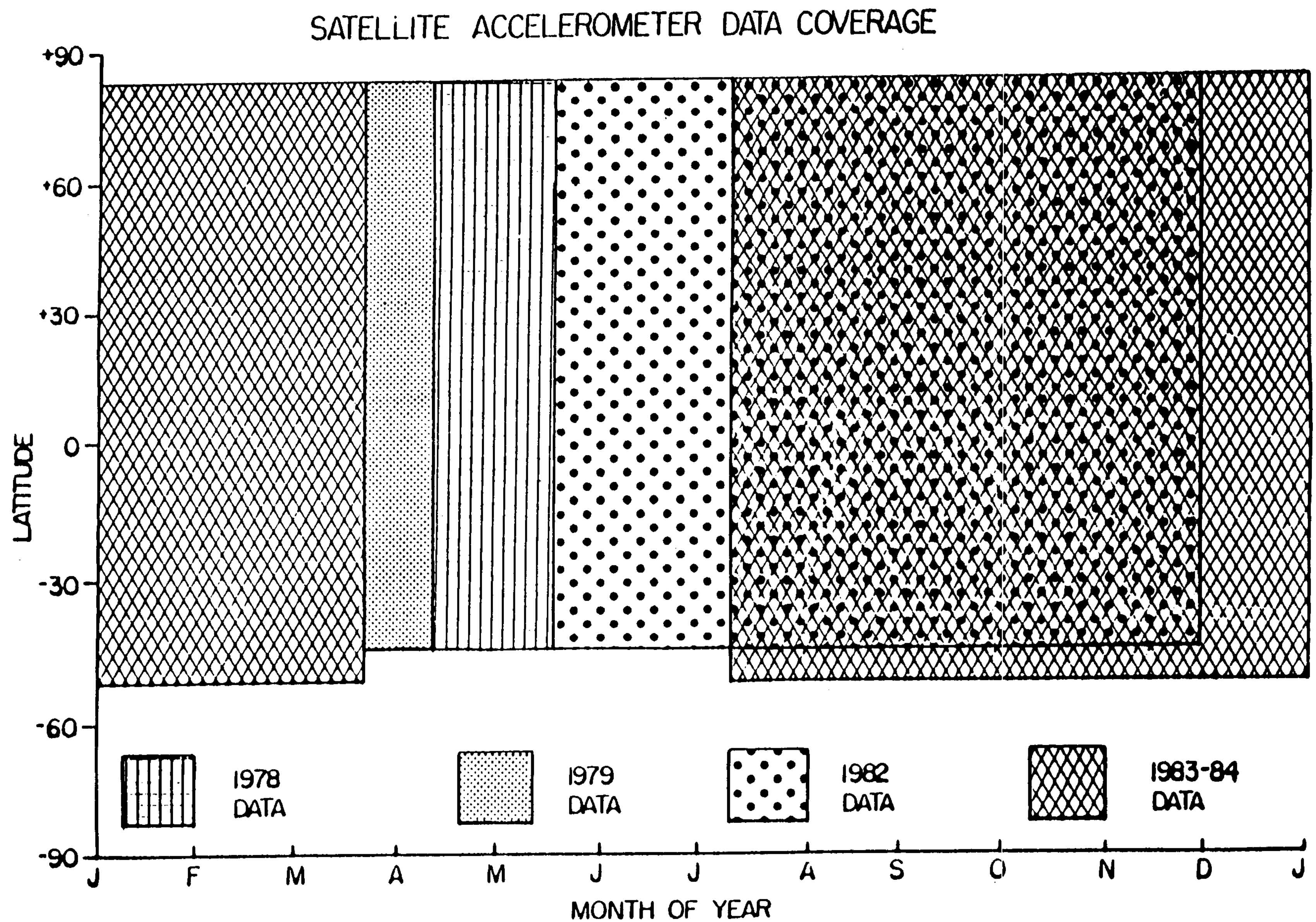
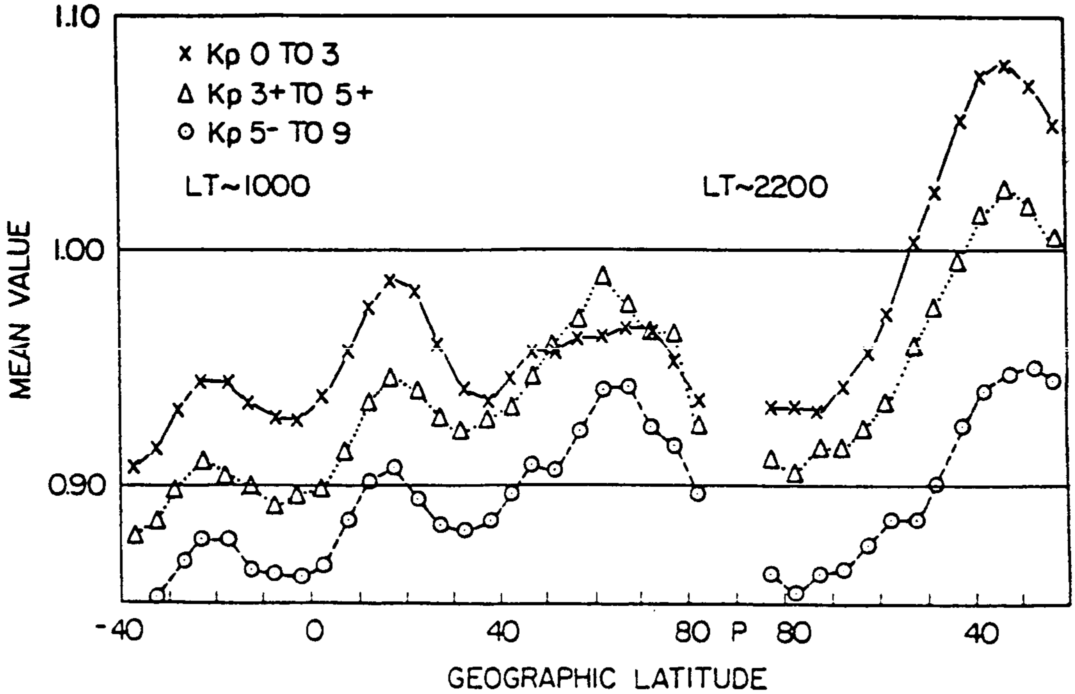
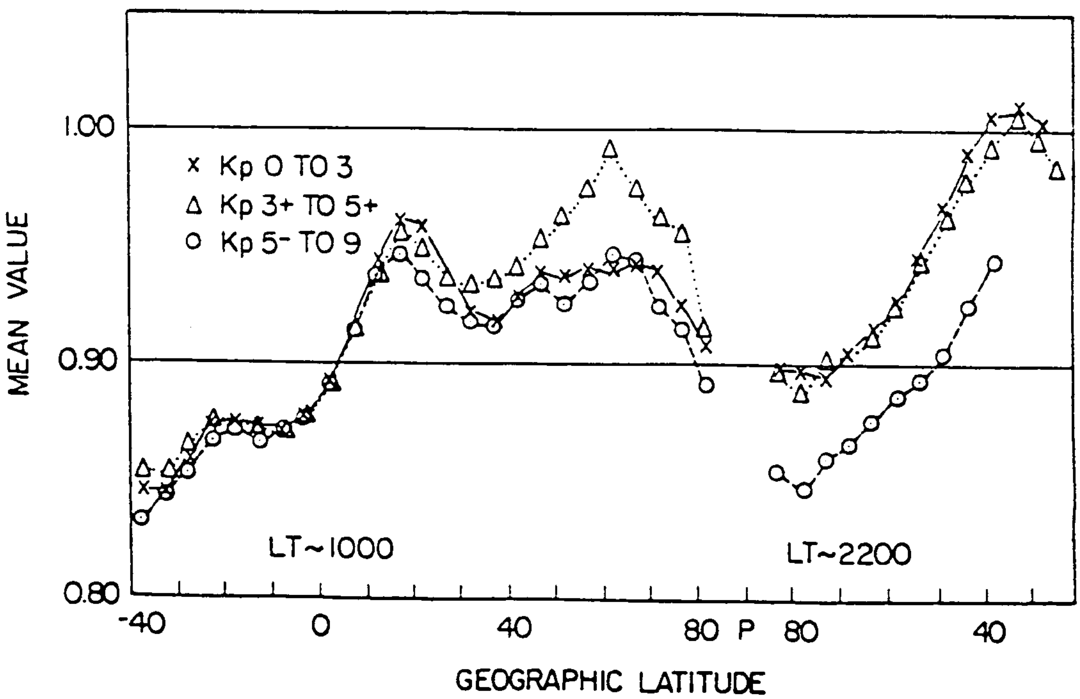

SATELLITE ACCELEROMETER DATA COVERAGE
LATITUDE
+90
+60
+30
0
-30
-60
-90
1978 DATA
1979 DATA
1982 DATA
1983-84 DATA
J F M A M J J A S O N D J
MONTH OF YEAR

TABLE 2. ACCELEROMETER, TOTAL MASS DENSITY RATIOS TO MODELS (ALTITUDE 150-240 KM)

	AE-C		AE-D		AE-E		S3-1		S3-4		SETA-1		SETA-2	
	$\bar{R}$	σ_R	$\bar{R}$	σ_R	$\bar{R}$	σ_R	$\bar{R}$	σ_R	$\bar{R}$	σ_R	$\bar{R}$	σ_R	$\bar{R}$	σ_R
MSIS83B	1.14	15.3	1.00	16.2	1.02	13.4	1.07	14.6	0.98	11.8	0.92	9.7	0.87	11.6
MSIS83A	1.15	15.6	1.00	16.4	1.04	14.1	1.08	14.8	0.99	12.1	0.93	10.1	0.88	11.8
MSIS79	1.09	14.5	1.00	16.8	1.01	13.7	1.00	14.6	0.98	11.5	0.96	11.7	0.92	11.7
MSIS77	1.09	14.2	1.00	16.5	1.01	13.6	1.00	14.2	0.98	11.2	0.96	11.5	0.92	11.2
J77	1.08	16.2	1.01	15.7	1.01	15.4	1.04	14.3	0.94	13.7	0.88	12.6	0.89	13.9
J73	1.10	14.3	1.03	15.1	1.06	13.8	1.06	13.5	0.96	11.6	0.92	9.8	0.92	10.2
J71	1.13	14.9	1.06	15.1	1.08	15.0	1.08	13.7	0.99	12.1	0.94	9.9	0.95	10.1
J70	1.08	17.6	0.99	15.9	1.00	15.9	1.04	14.6	0.97	12.0	0.99	9.3	0.93	10.4
J64	0.97	17.3	0.89	17.0	0.91	15.4	0.92	17.8	0.90	11.6	0.99	11.1	0.88	11.3
L-N	0.98	18.2	0.87	17.1	0.86	16.4	0.94	14.9	0.93	14.6	0.99	9.9	0.91	11.4
JWB	1.04	19.5	1.02	18.8	1.02	19.6	0.99	19.6	0.86	11.0	0.90	10.4	0.82	10.9
US66	0.98	16.8	0.90	15.8	0.91	15.4	0.95	14.4	0.90	11.5	0.99	11.0	0.88	11.2
US62	0.92	28.9	0.76	30.3	0.76	29.6	0.73	32.7	0.93	17.6	1.13	12.0	0.96	15.0
DENS	1.49	20.7	1.05	19.6	0.97	22.4	1.31	19.5	0.79	19.9	0.87	14.9	0.99	15.2



Mean values of SETA-1 data to J71 model plotted as a function of geographic latitude (three Kp bins).



Mean values of SETA-1 data to MSIS83 model plotted as a function of geographic latitude (three Kp bins).

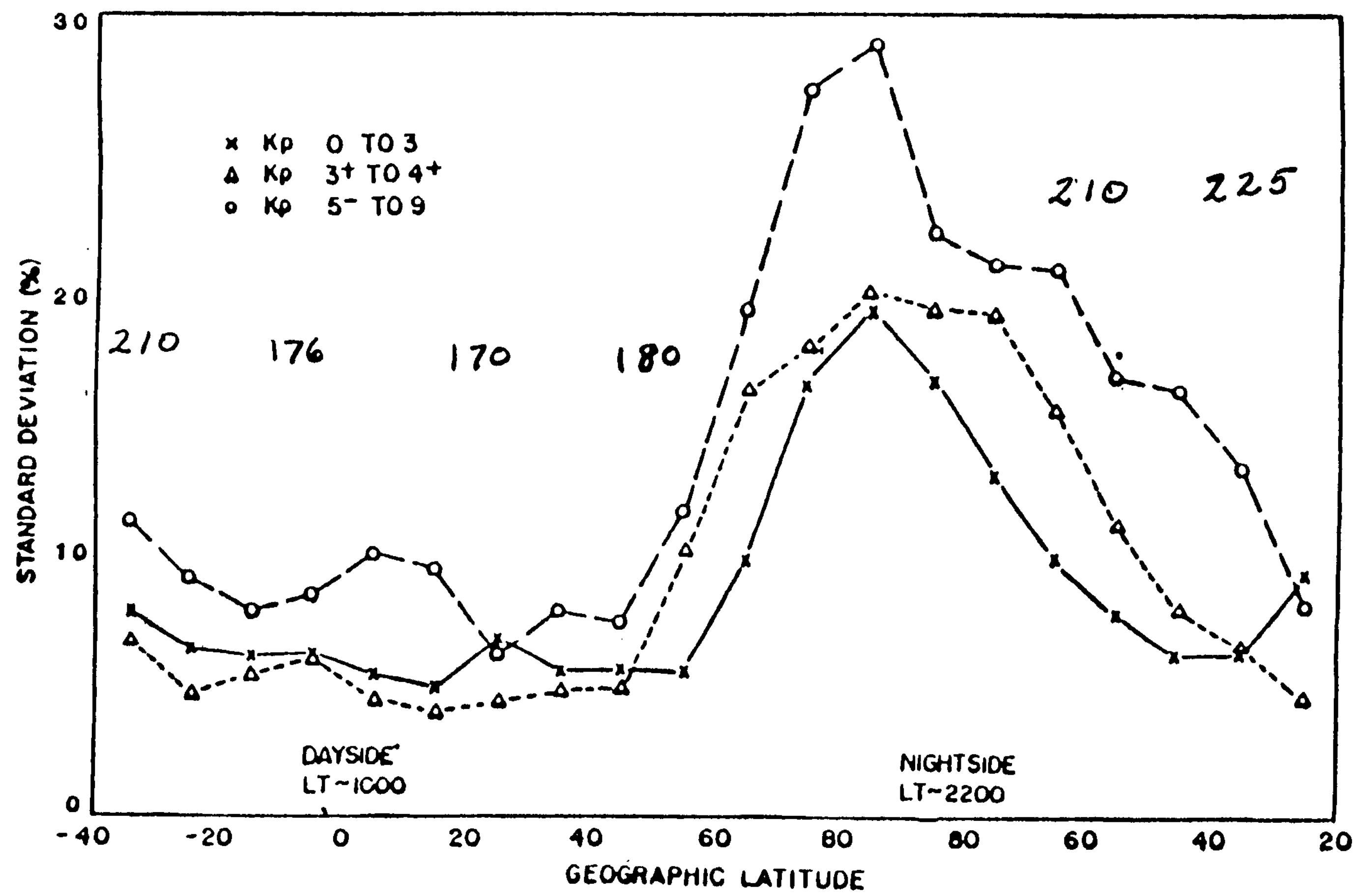


Figure 11a. Standard Deviations of Ratios of SETA-1 Density Data to J71 Model

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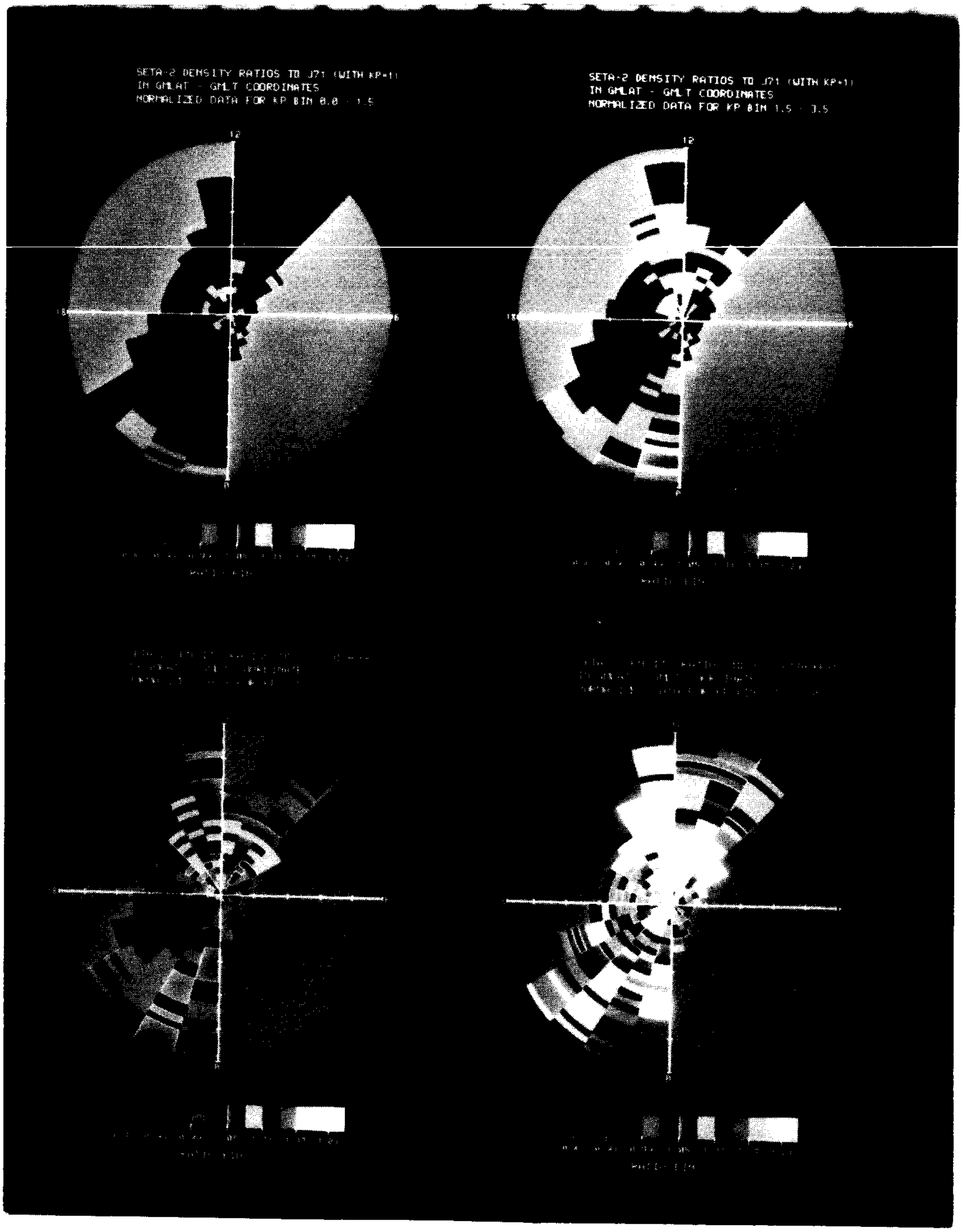

Fig. 7. SETA-1 density ratios to J71 (with Kp = 1) plotted in geomagnetic latitude - geomagnetic local time. The four Kp bins are: 0 + 1.5, > 1.5 to 3.5, > 3.5 to 5.5 and > 5.5.

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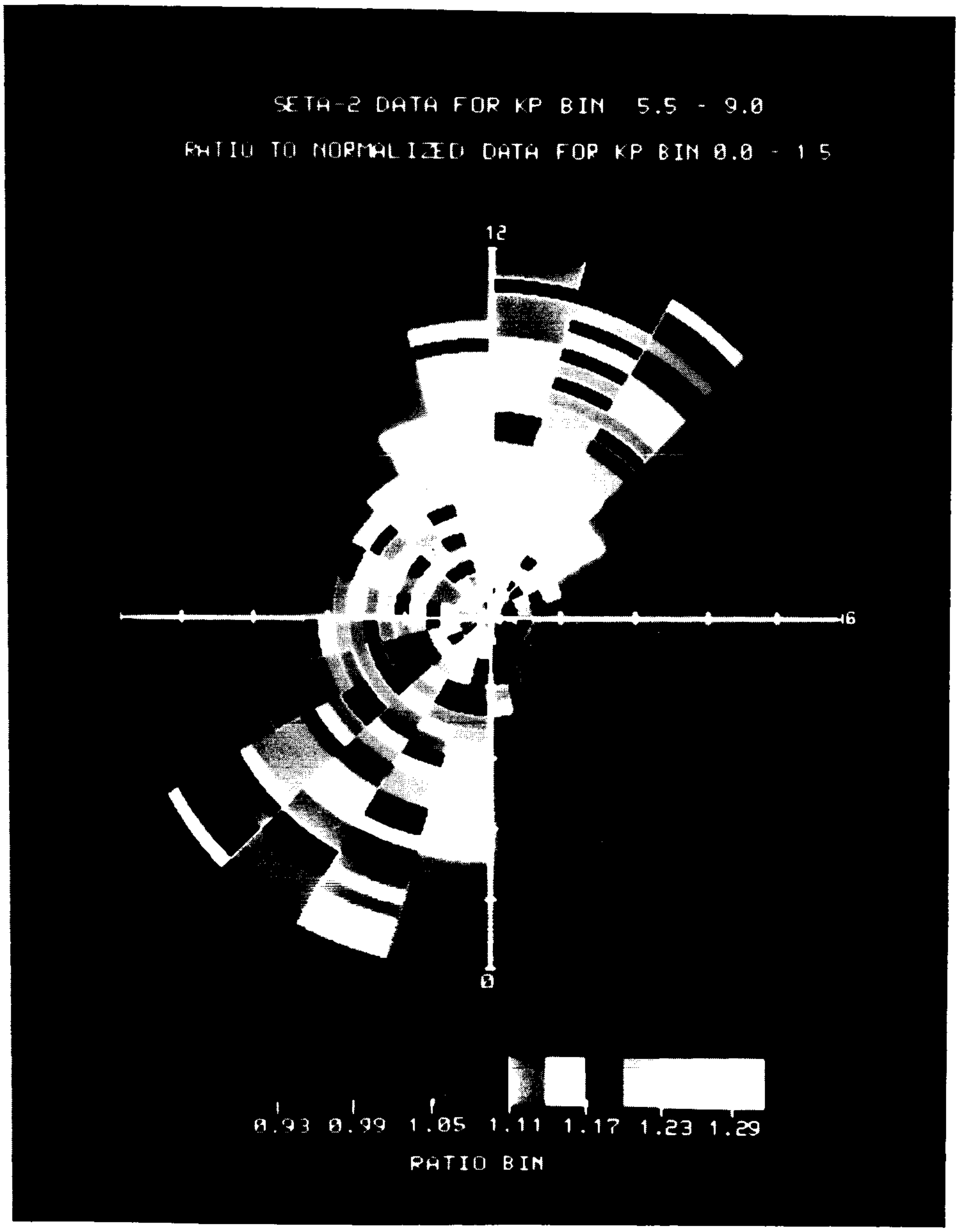


Fig. 8. Density response to geomagnetic activity calculated from the ratio of the > 5.5 Kp bin to the 0 to 1.5 Kp bin data of Fig. 7.

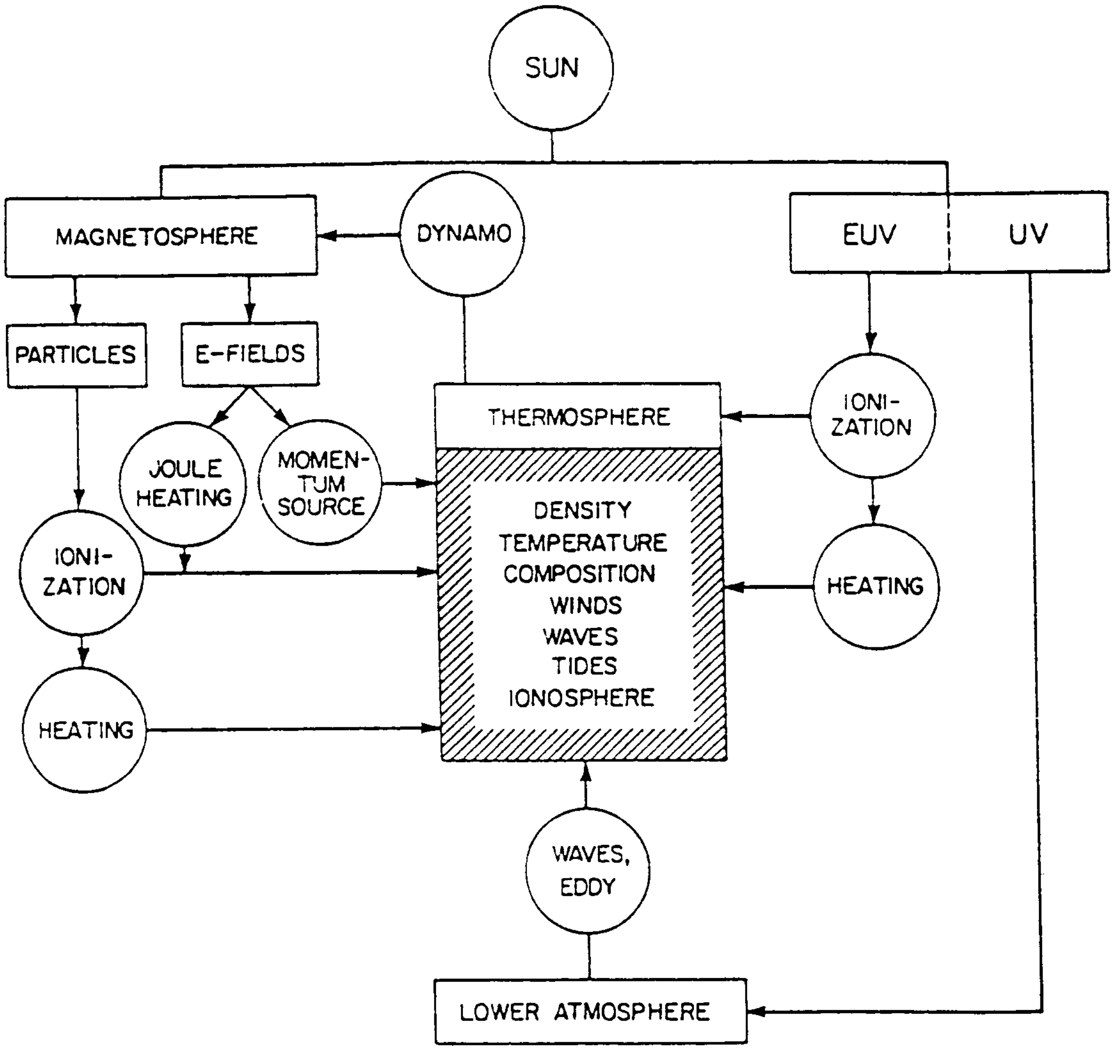
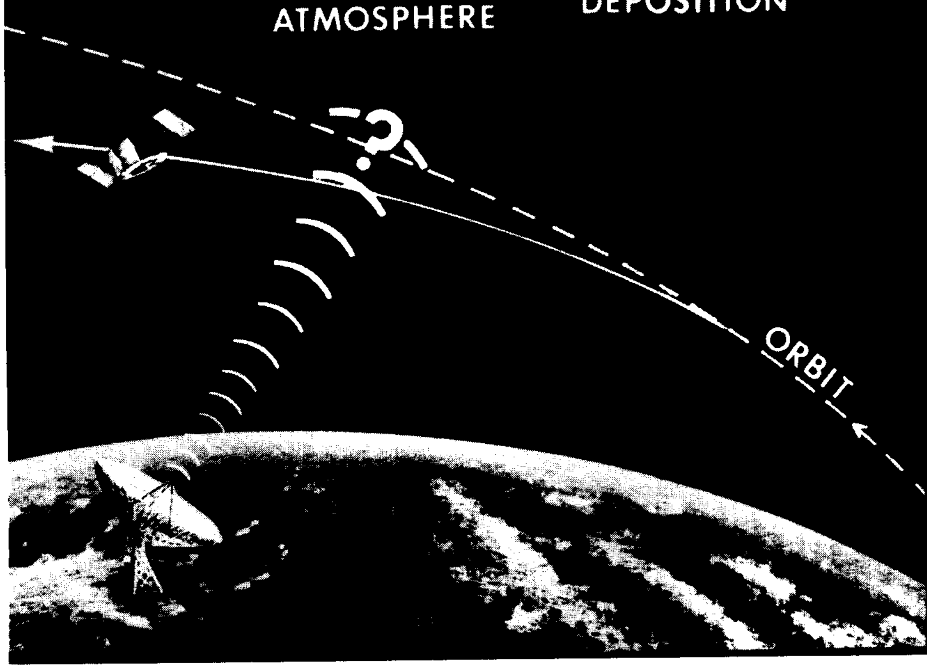


Fig. 9. Schematic block diagram illustrating interactions between the lower atmosphere, thermosphere and magnetosphere.

REQUIREMENTS

- DATA ANALYSIS VS. SOLAR/GEOPHYSICAL CONDITIONS
- REALISTIC ATMOSPHERIC HEATING INDICATORS
- DYNAMIC MODEL IMPROVEMENTS
- COORDINATED SATELLITE PROGRAM FOR LOWER THERMOSPHERE DYNAMICS



OBJECTIVE

- PREDICT SATELLITE DRAG AND ATMOSPHERIC DENSITY PERTURBATIONS.
- RELATE IONOSPHERIC ANOMALIES TO C^3 I SYSTEMS DISRUPTIONS.

DESCRIPTION

- GLOBAL DETERMINATION OF:
  - AERODYNAMIC DRAG
  - ATMOSPHERIC DENSITY
  - NEUTRAL COMPOSITION
  - HORIZONTAL WINDS
  - TEMPERATURE
  - IONOSPHERIC COMPOSITION
- RESULTANT DATA BASE USED TO DEVELOP NEW DYNAMIC MODELS FOR OPERATIONAL ORBIT DETERMINATION AND PREDICTION AND FOR COMMAND, CONTROL AND SURVEILLANCE SYSTEMS.