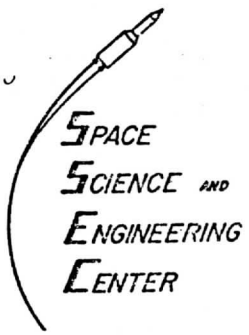
UW/SSEC

VAS SYSTEM DEFINITION

REVIEW

9 NOVEMBER 1976



THE UNIVERSITY OF WISCONSIN

Agenda for System Definition Review

on November 9, 1976

at SSEC in Room 148

9:00 a.m.	I.	INTRODUCTION -- R. Krauss A. Objectives B. Description of Proposed Tasks C. SSEC Approach to VAS Demonstration
10:00 a.m.	II.	FRAMEWORK FOR SYSTEM DEFINITION -- L. Sromovsky A. Stages in System Development B. Structure of a System Definition C. General Definition of System Elements D. Role of Feedback Interactions E. Role of Man Interactions
11:00 a.m.		COFFEE BREAK
11:15 a.m.	III.	DATA COLLECTION -- P. Menzel A. What Sources and Why B. Concept for Selection of VAS Operating Mode C. Status of Data Collection Definition
Noon		LUNCH
1:30 p.m.	IV.	ANALYSIS -- H. Revercomb A. Inputs and Outputs B. Techniques
2:30 p.m.	V.	SYNTHESIS AND MODELLING -- L. Sromovsky and V. Suomi A. Basic Object of Synthesis B. Required Synthesis Functions C. Types of Models Used in Synthesis D. Addition of New Information E. A Process for Data Set Synthesis F. Status
3:30 p.m.		COFFEE BREAK
3:45 p.m.	VI.	PROGRAM PLAN -- V. Suomi

I. INTRODUCTION

A. OBJECTIVES

B. DESCRIPTION OF PROPOSED TASKS

C. SSEC APPROACH TO VAS DEMONSTRATION

PURPOSE OF VAS SOUNDING RESEARCH

1. INCREASE OUR UNDERSTANDING OF SHORT-LIVED WEATHER PHENOMENA.

2. INCREASE OUR ABILITY TO PREDICT SHORT-LIVED WEATHER PHENOMENA.

(p. 4 NASA VAS Demonstration Project Plan)

4.5.2.1 Summary of UW Tasks

The UW group will perform the following tasks:

A ° Continue to assist NASA in the design, development, and testing of the VAS instrument;

B ° Conduct a thorough system design analysis prior to launch to determine anticipated performance, error budget, and optimum operating modes for specific objectives;

C ° Research techniques for VAS data;

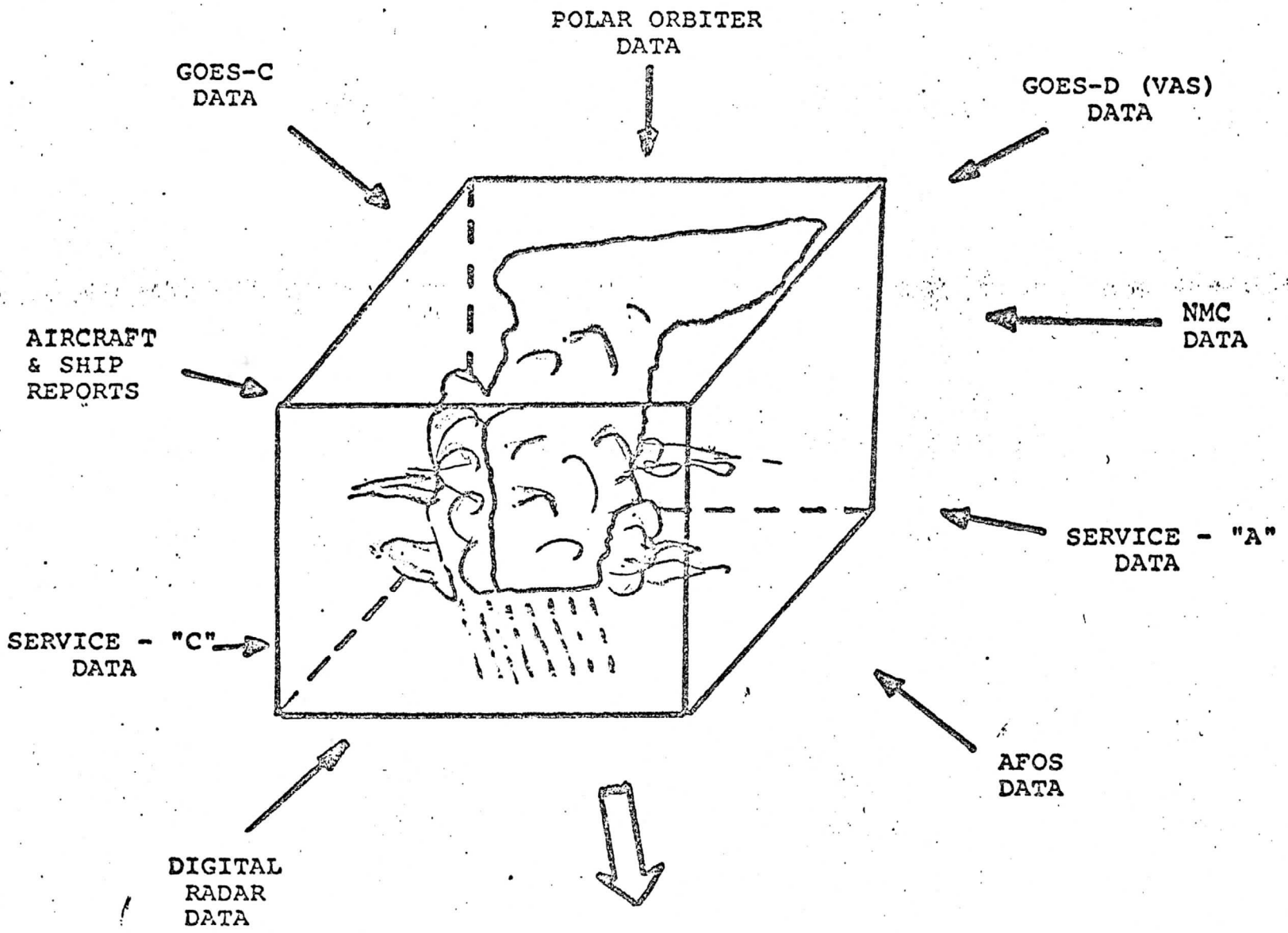
D ° Develop the optimized data processing system which meets the requirements of the VAS demonstration;

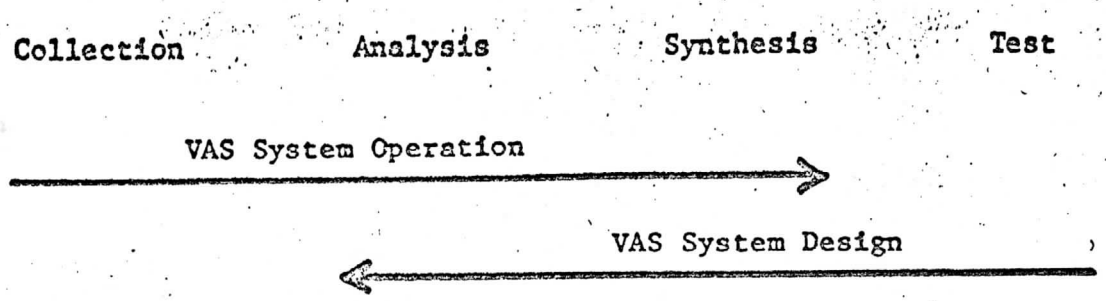
E ° Implement a prototype data processing system in time for the VAS launch, including remote terminals at NASA/GSFC and NOAA/NESS;

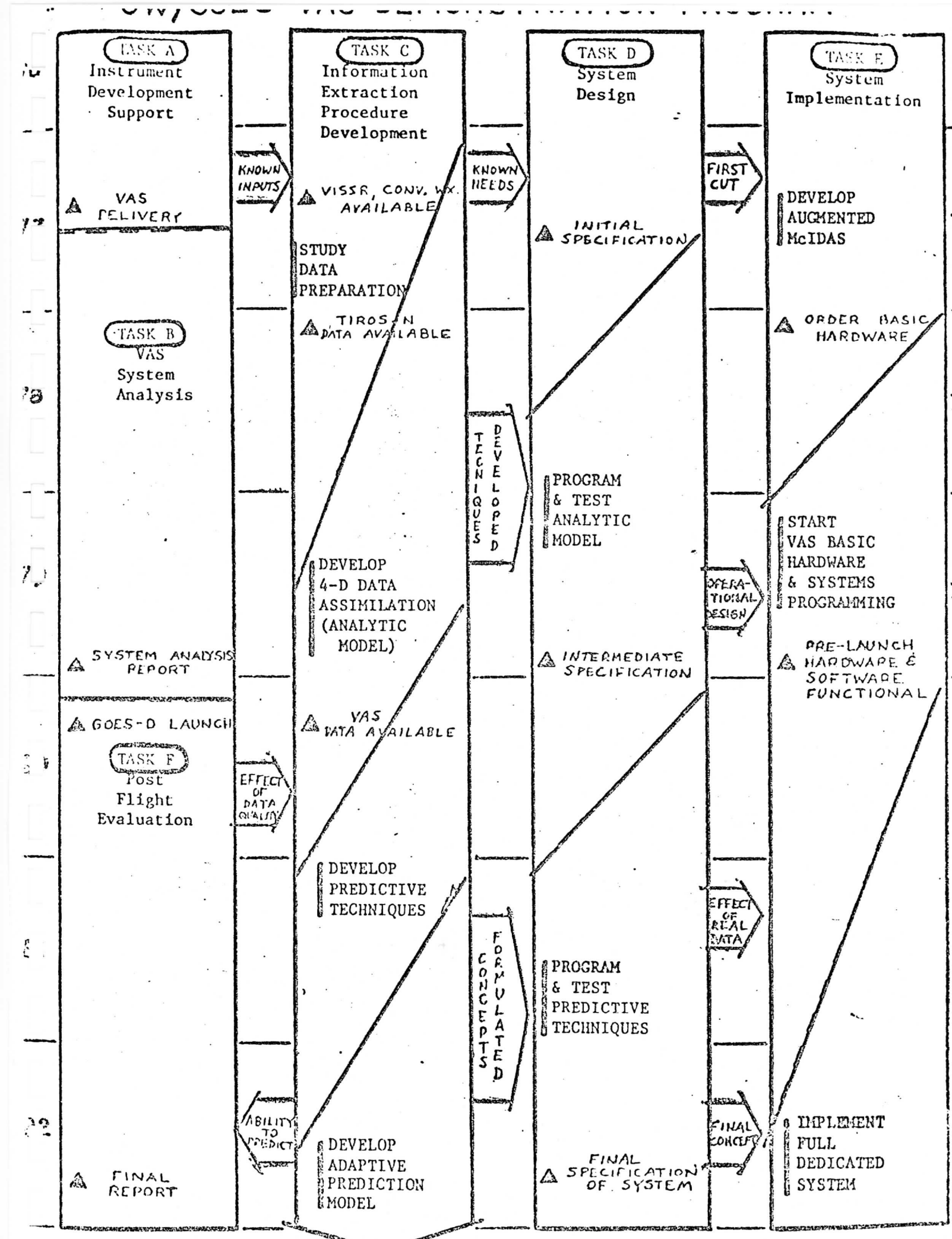
F ° Collect and process post-launch data and evaluate VAS system performance and operational capabilities.

This effort extends over nearly 5 years as necessitated by the scheduled launch in early 1980. The requested level of support is heaviest during the 2 years prior to launch when the major processing system development and implementation are scheduled. Over these 5 years, modifications of specific tasks and schedule are anticipated and will be made to conform to the final NASA plans for the VAS demonstration.

THE PRIMARY NEED



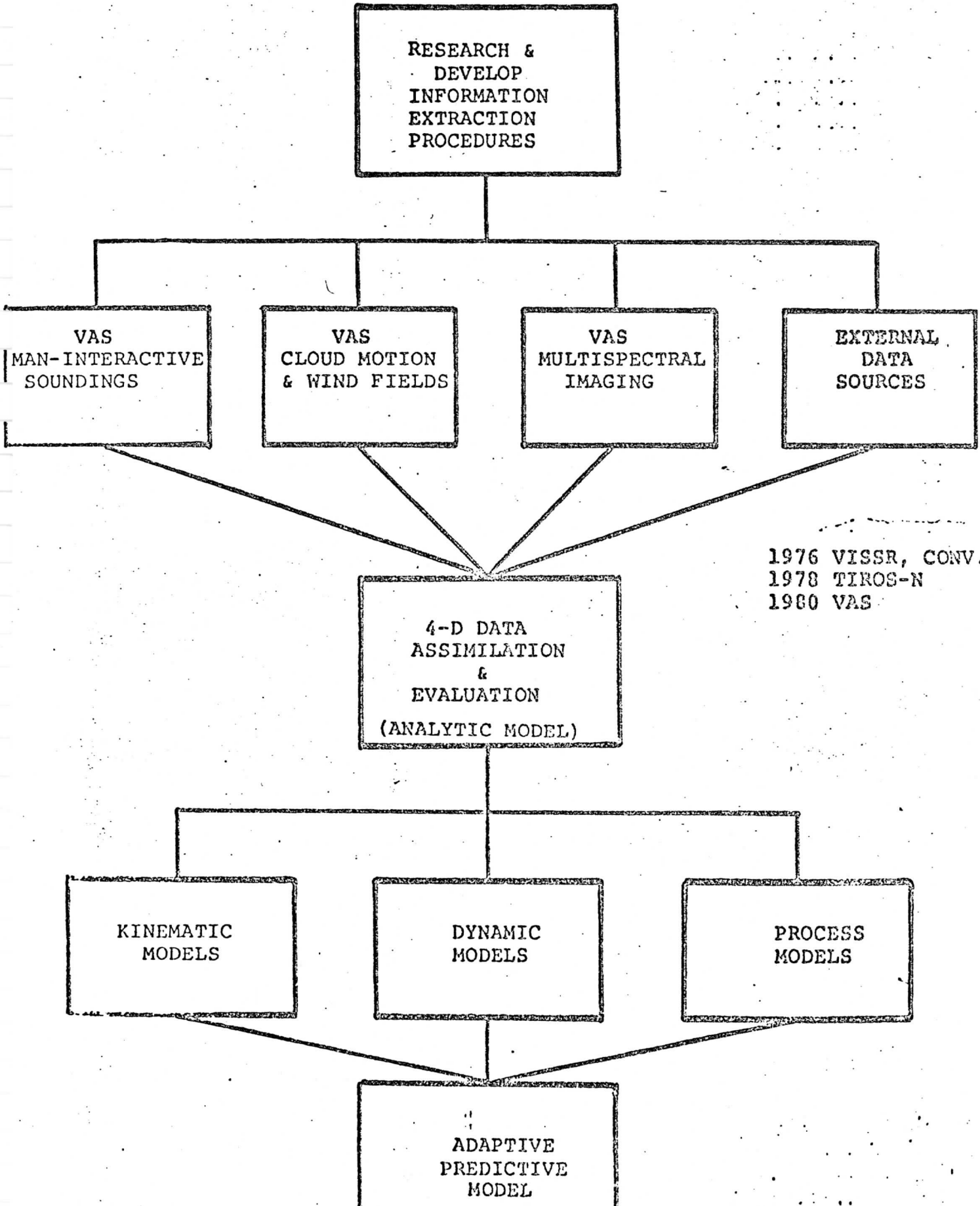

Collection
Analysis
Synthesis
Test
VAS System Operation
VAS System Design


TASK A
Instrument Development Support
VAS DELIVERY
TASK B
VAS System Analysis
SYSTEM ANALYSIS REPORT
GOES-D LAUNCH
TASK F
Post Flight Evaluation
FINAL REPORT
TASK C
Information Extraction Procedure Development
KNOWN INPUTS
VISSR, CONV. WX. AVAILABLE
STUDY DATA PREPARATION
TIROS-N DATA AVAILABLE
DEVELOP 4-D DATA ASSIMILATION (ANALYTIC MODEL)
VAS DATA AVAILABLE
EFFECT OF DATA QUALITY
DEVELOP PREDICTIVE TECHNIQUES
ABILITY TO PREDICT
DEVELOP ADAPTIVE PREDICTION MODEL
KNOWN NEEDS
TECHNIQUES DEVELOPED
CONCEPTS FORMULATED
TASK D
System Design
INITIAL SPECIFICATION
PROGRAM & TEST ANALYTIC MODEL
INTERMEDIATE SPECIFICATION
PROGRAM & TEST PREDICTIVE TECHNIQUES
FINAL SPECIFICATION OF SYSTEM
FIRST CUT
OPERATIONAL DESIGN
EFFECT OF REAL DATA
FINAL CONCEPT
TASK E
System Implementation
DEVELOP AUGMENTED McIDAS
ORDER BASIC HARDWARE
START VAS BASIC HARDWARE & SYSTEMS PROGRAMMING
PRE-LAUNCH HARDWARE & SOFTWARE FUNCTIONAL
IMPLEMENT FULL DEDICATED SYSTEM

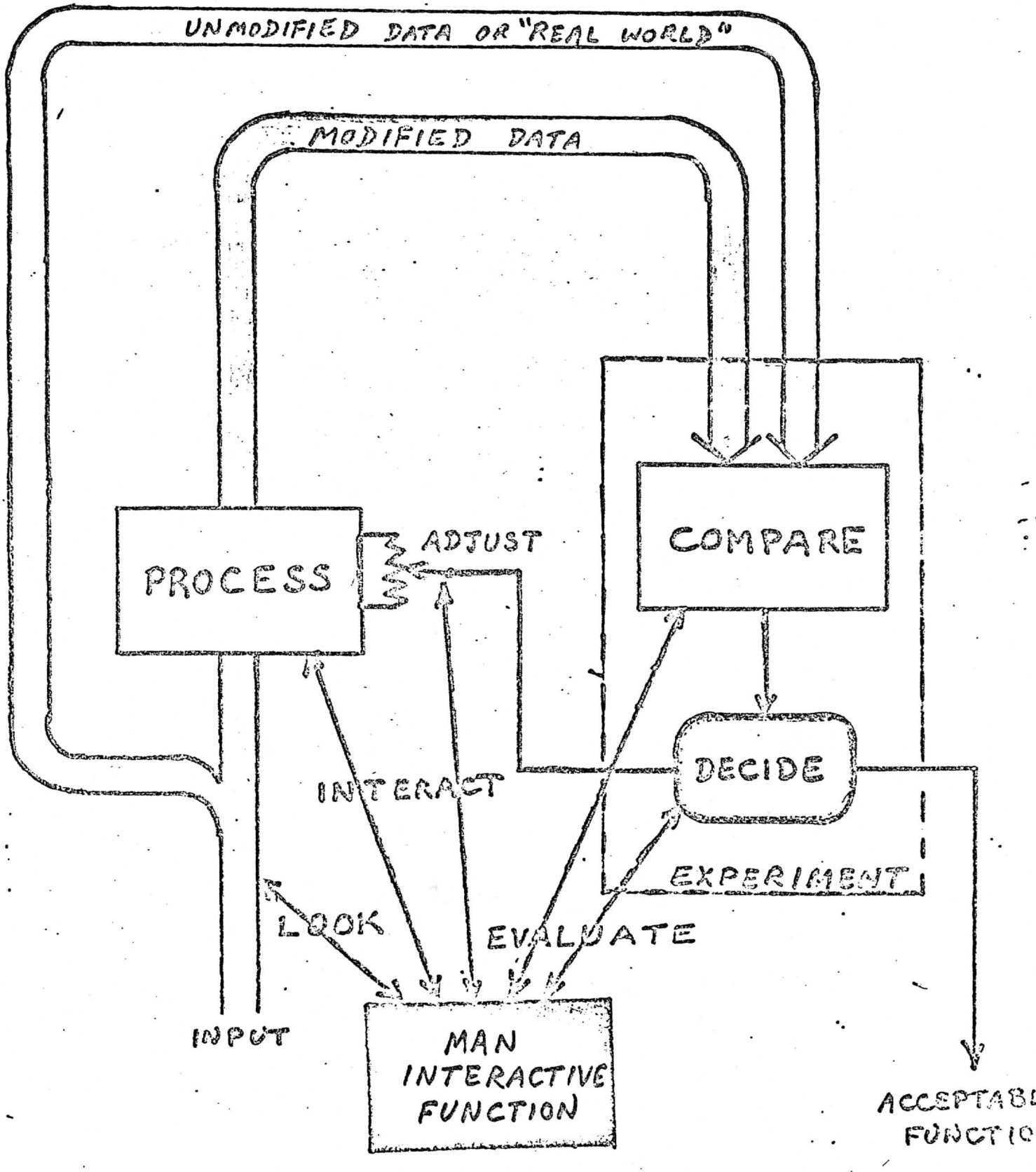
SSEC APPROACHES TO THE VAS DEMONSTRATION

1. Approach to processing concept development
   --CLOSED LOOP FEEDBACK
2. Approach to system concept development
   --McIDAS EXPERIENCE
3. Approach to system specification
   --VOLUME/WORK ANALYSIS
4. Approach to system evaluation
   --PURPOSES OF VAS RESEARCH

APPROACH TO TECHNIQUE AND PROCEDURE DEVELOPMENT (Task C)

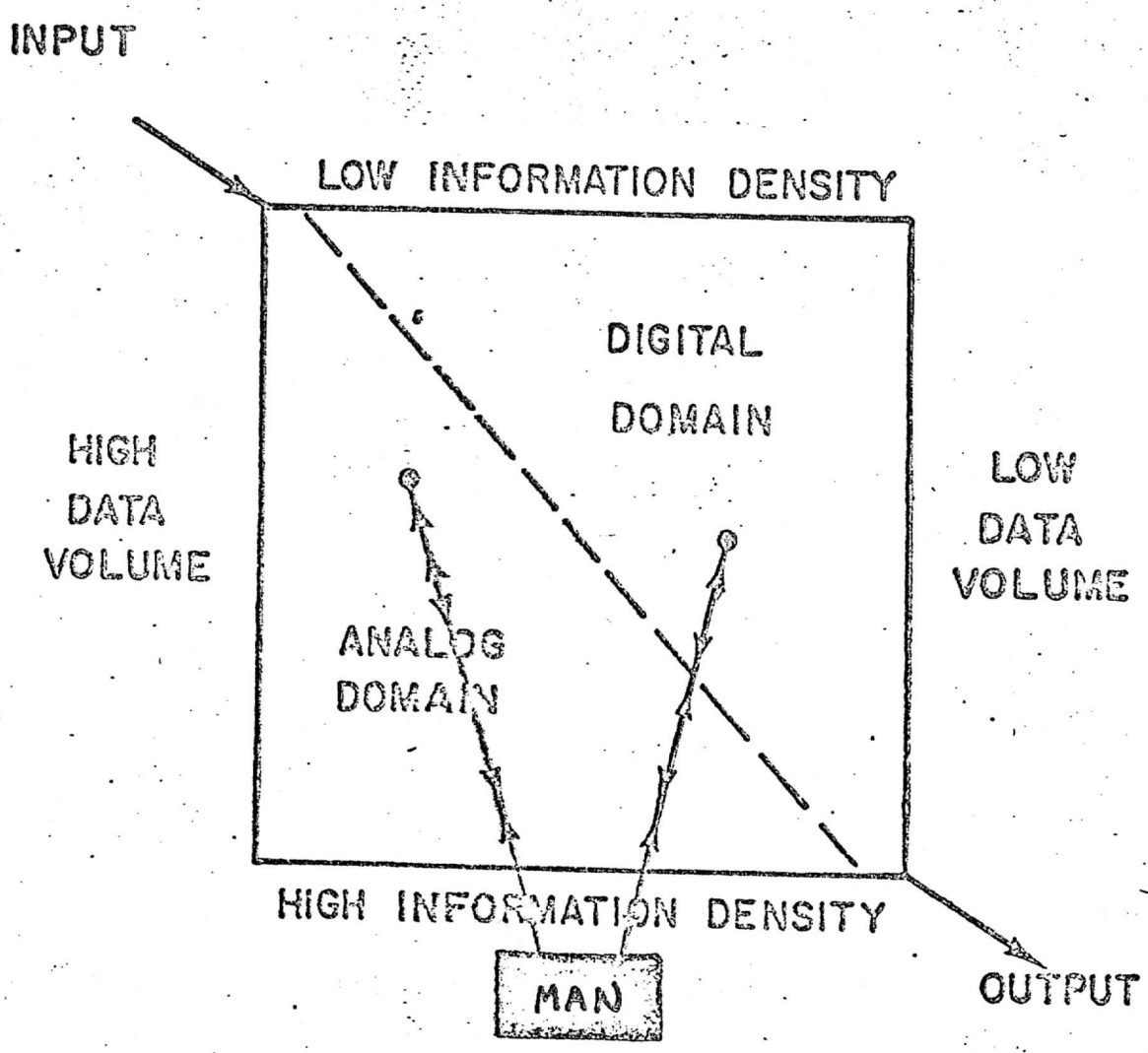


SCHEMATIC OF PROCESS OF TECHNIQUE DEVELOPMENT



THE McIDAS APPROACH TO CONTINUOUS FLOW DATA PROCESSING

(Tasks D & E)

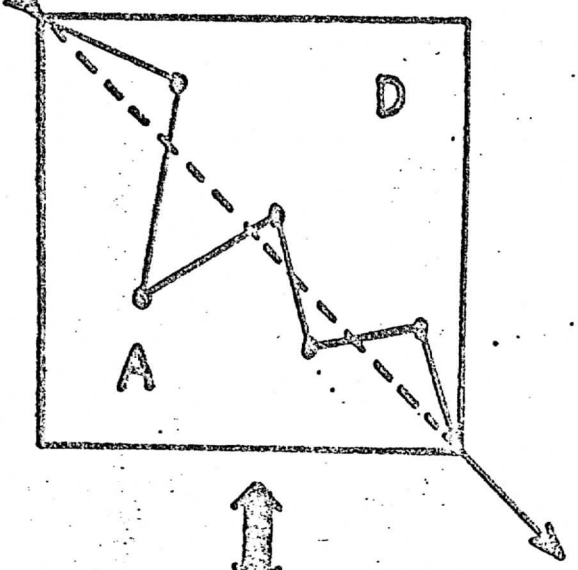


APPROACH TO SPECIFICATION OF INITIAL SYSTEM DESIGN

(Tasks D & E)

MULTIPLE DATA SOURCES

- SMS/GOES (VAS)
- NIMBUS-F
- NOAA
- NMC
- NWS/AFOS
- COMEDS
- RADAR, ETC.



- NOAA SPECIFICATIONS
- REQUIREMENTS
- COMPATIBILITY
- SPECIAL NEEDS OF USERS
- NMC/AFOS COMPATIBILITY

OPERATOR

WEATHER INFORMATION

KINDS OF OBJECTIVE MANIPULATIONS & THEIR PRIMARY USES:

INFORMATION SOURCE		MAIN PURPOSE (MENU)
☆ COMPOSITE DATA	—	DESCRIBE ATMOSPHERIC STATE AND ONGOING PROCESSES
☆ ENHANCED DATE	—	DESCRIBE CHANGES, EVOLUTION GRADIENTS, DISCONTINUITIES
☆ DERIVED DATA	—	INFERENCES, INTERPOLATIONS EXTRAPOLATIONS IN TIME SYNTHETIC DATA DERIVATION

SYSTEM

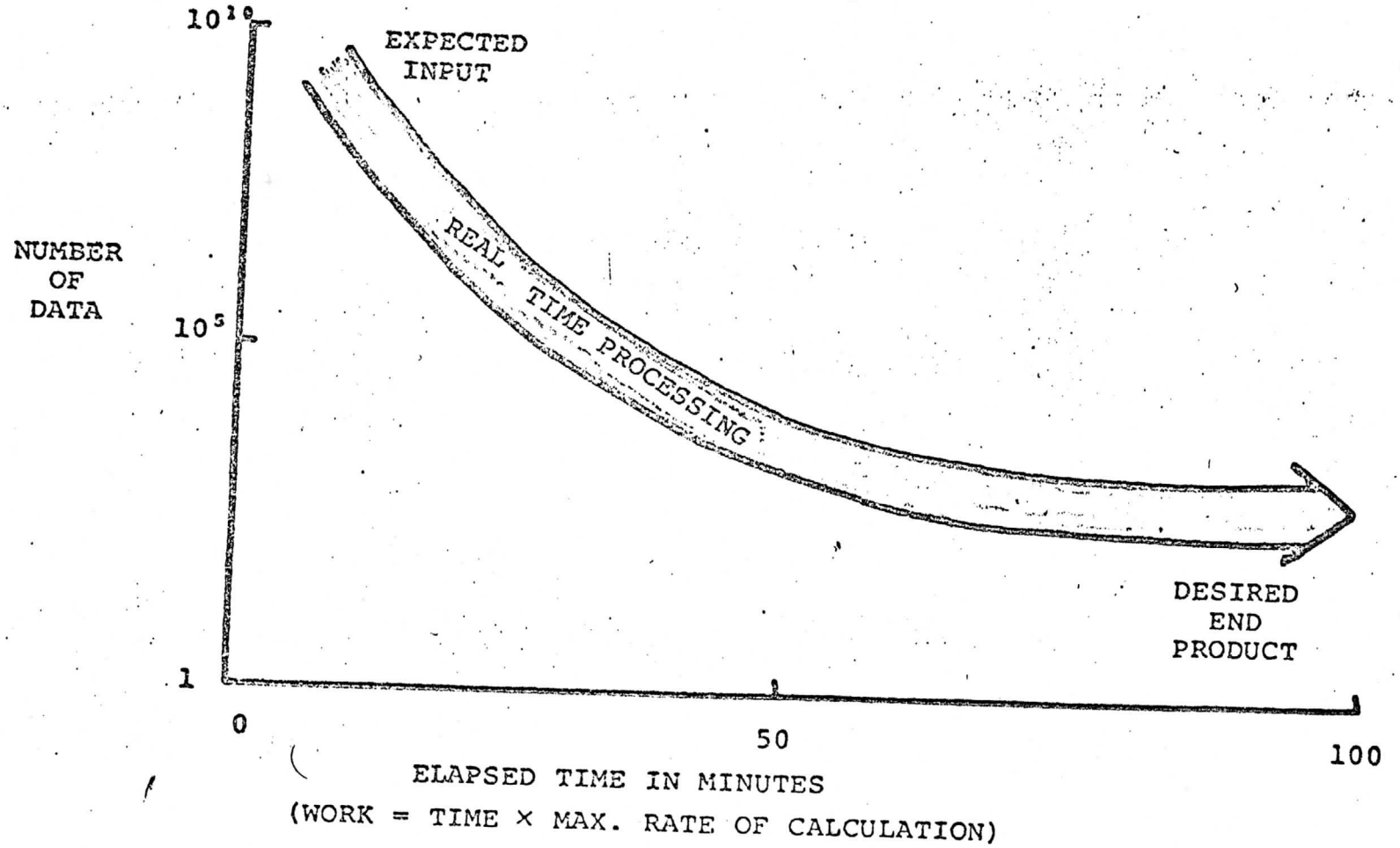
(=PROCESSES)

PREDICTION

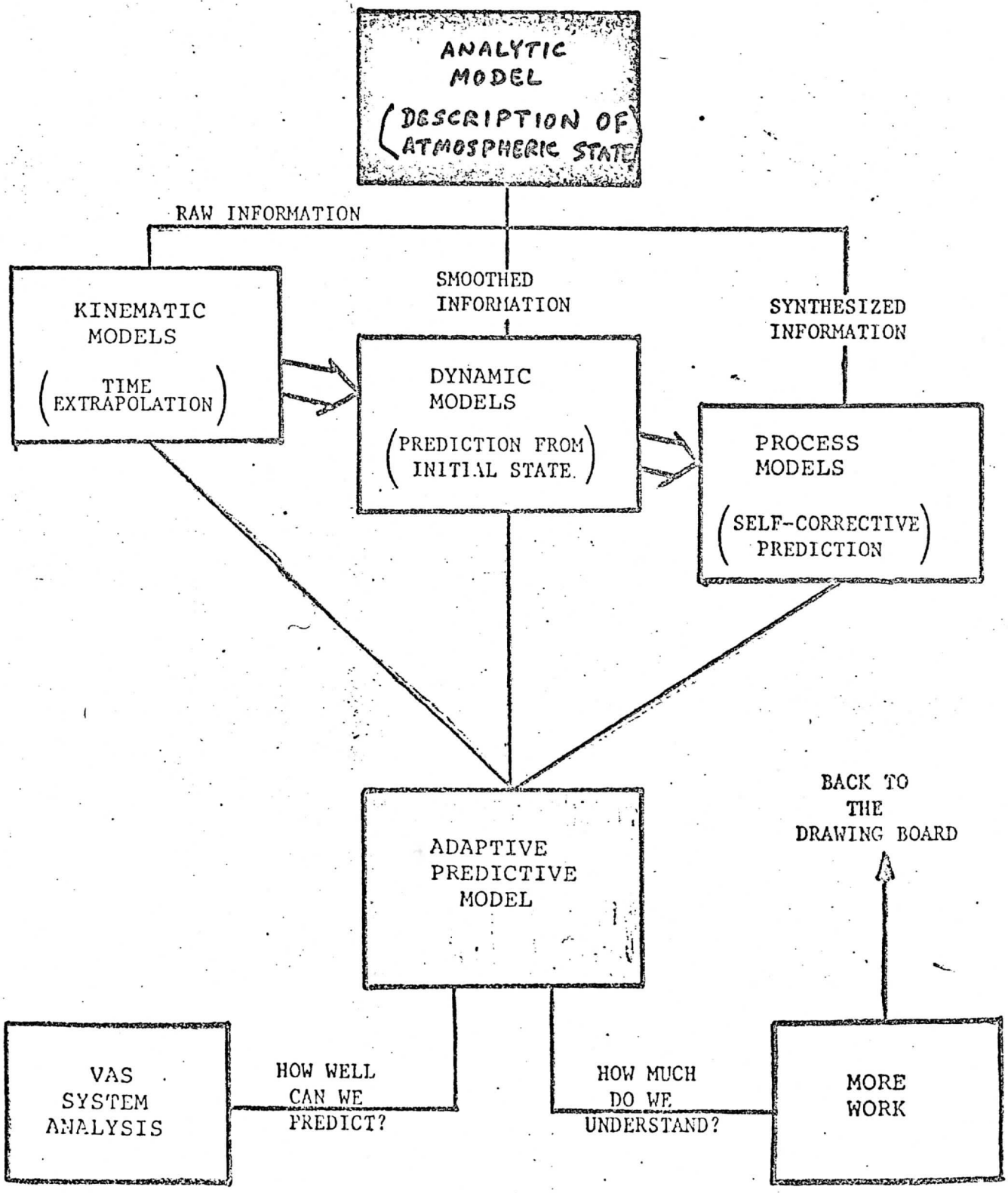
(=KNOWLEDGE)

ANALYSIS OF DATA VOLUME VS. APPLIED WORK

(Tasks D&E)



SYSTEM EVALUATION APPROACH (Task F)



II. FRAMEWORK FOR A SYSTEM DEFINITION

A. STAGES IN SYSTEM DEVELOPMENT

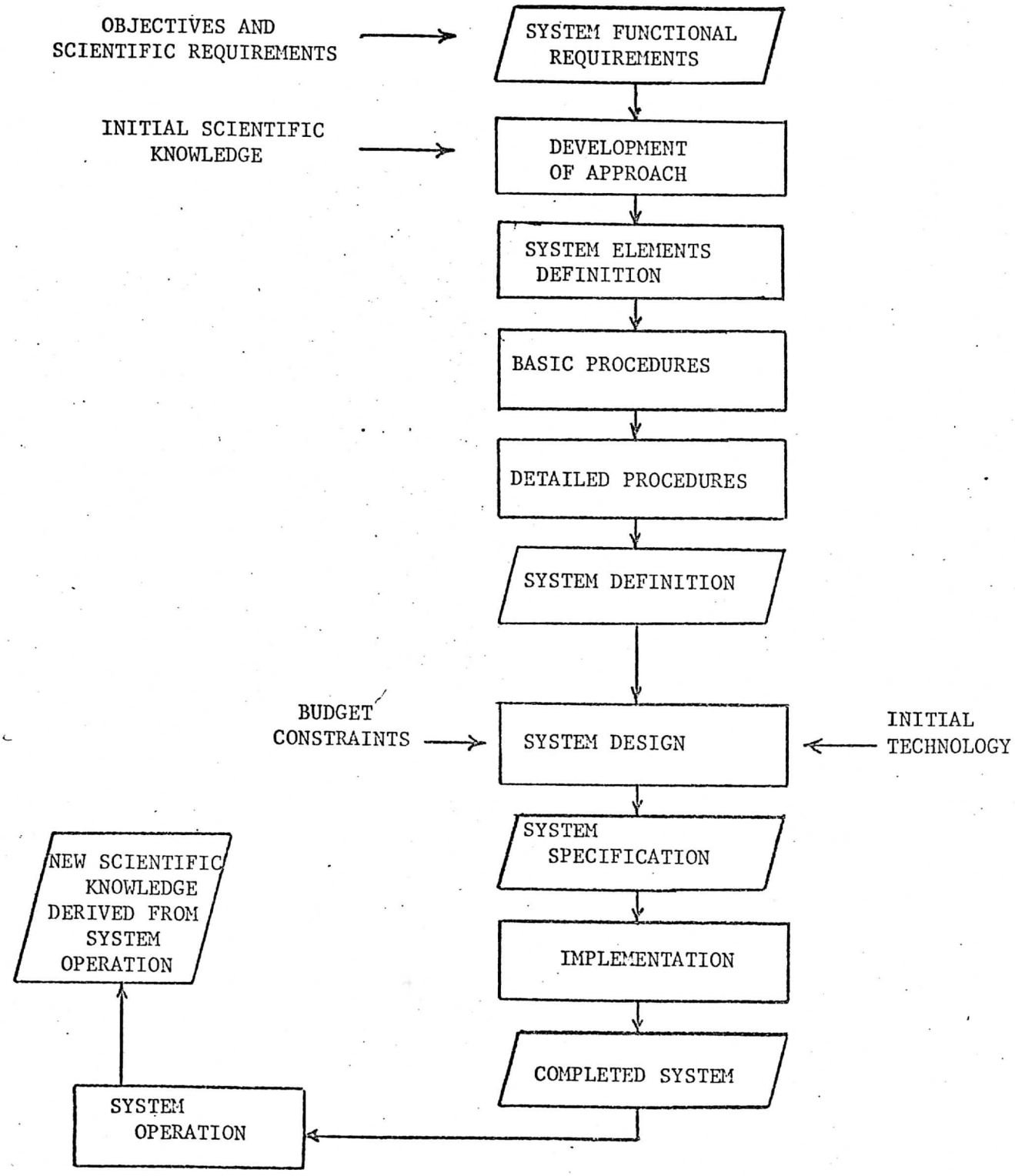
B. STRUCTURE OF A SYSTEM DEFINITION

C. GENERAL DEFINITION OF SYSTEM ELEMENTS

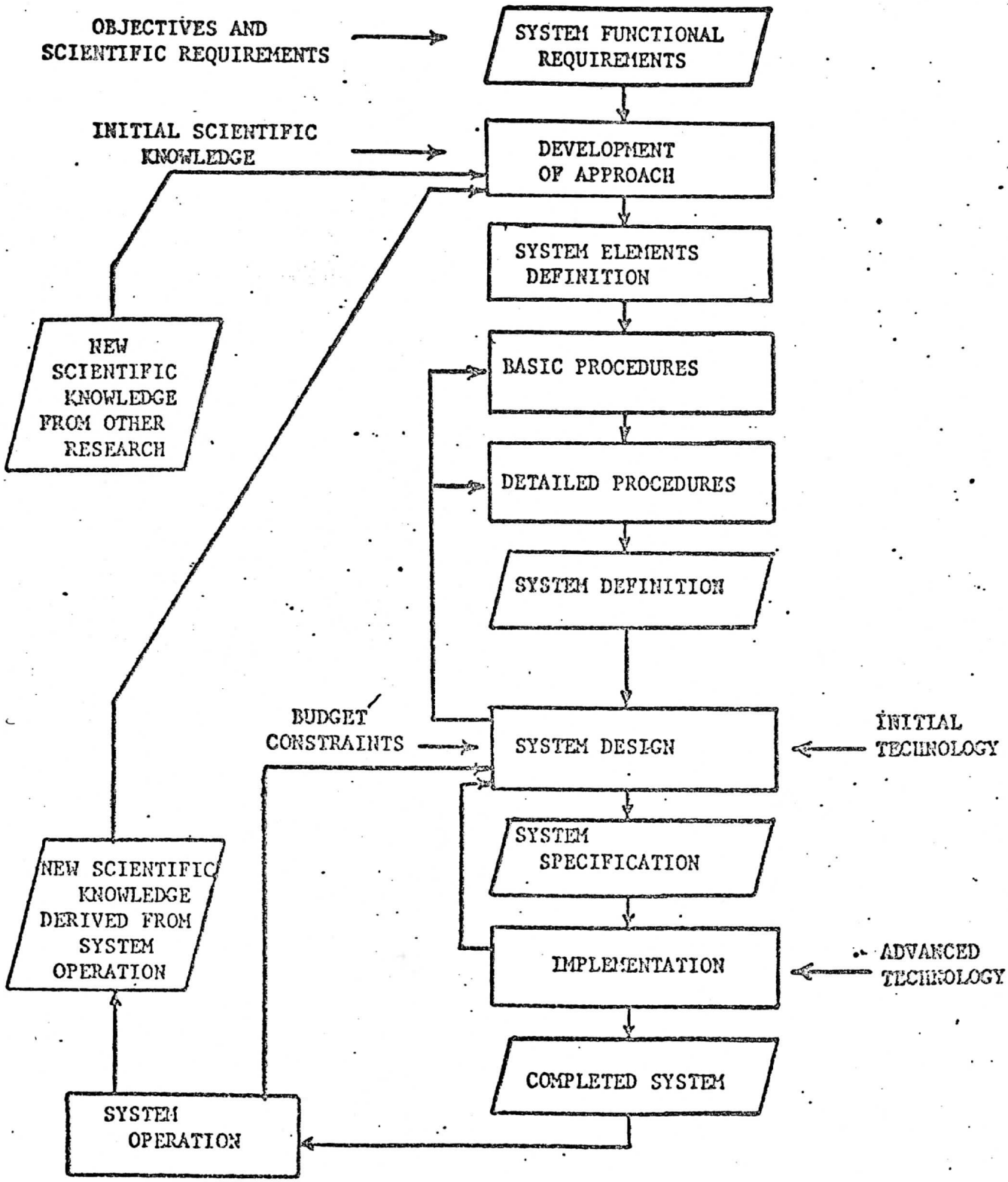
D. ROLE OF FEEDBACK INTERACTIONS BETWEEN ELEMENTS

E. ROLE OF MAN INTERACTIONS

A. STAGES IN SYSTEM DEVELOPMENT



A. STAGES IN SYSTEM DEVELOPMENT
(DEVELOPMENT IS A FEEDBACK NETWORK THAT MUST BE CAPABLE OF ADAPTING TO NEW INFORMATION)



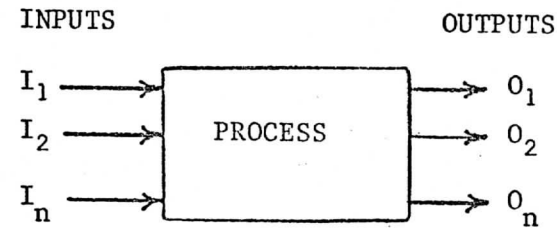
B. STRUCTURE OF A SYSTEM DEFINITION

COMPONENTS OF A DEFINITION:

INPUTS, OUTPUTS, PROCESSES, AND INTERACTIONS

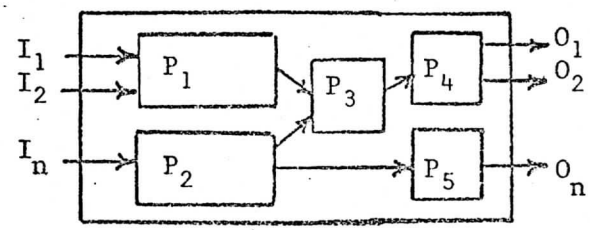
LEVEL 1

(SYSTEM FUNCTION)



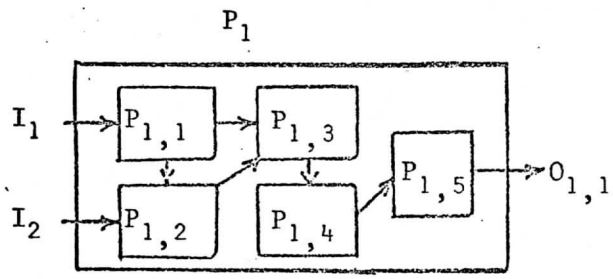
LEVEL 2

(FUNCTIONAL ELEMENTS AND INTERACTIONS)



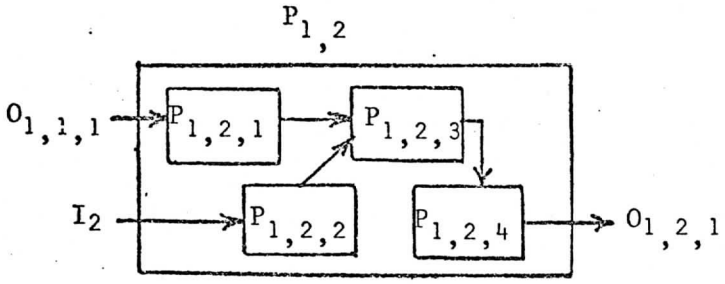
LEVEL 3

(BASIC PROCEDURES FOR EACH ELEMENT)

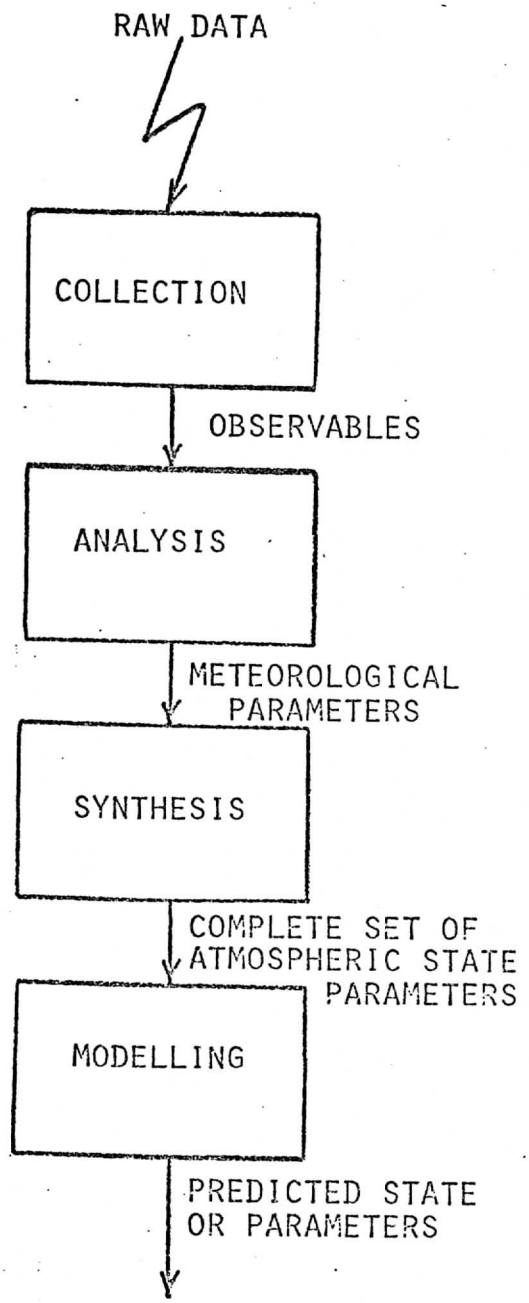


LEVEL 4

(DETAILED PROCEDURES FOR EACH BASIC ELEMENT)



C. GENERAL DEFINITION OF SYSTEM ELEMENTS (1)



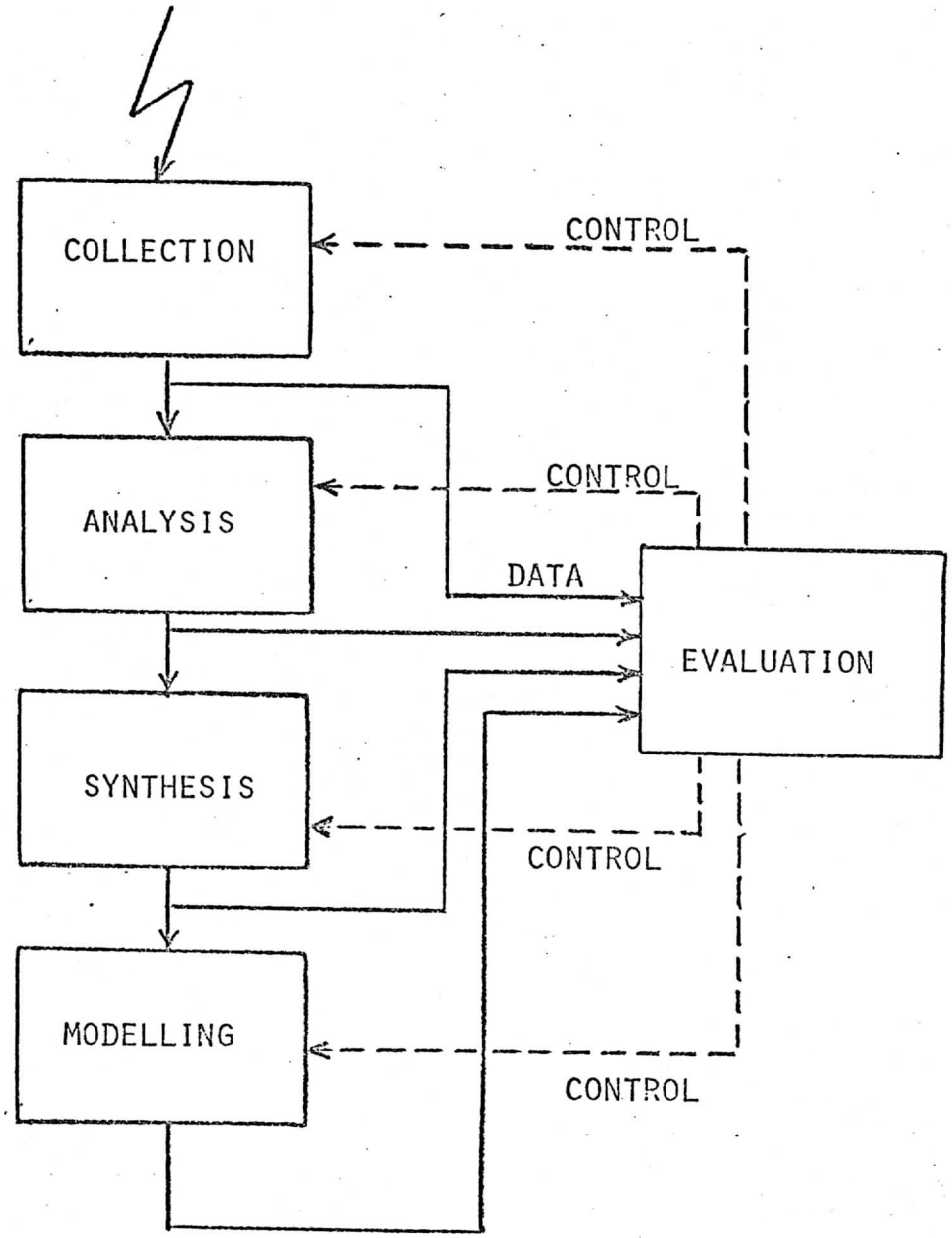
RECEIVE RAW DATA, PREPROCESS TO OBTAIN PHYSICAL OBSERVABLES, AND FILE

PROCESS OBSERVABLES TO DERIVE METEOROLOGICAL PARAMETERS

PRODUCE COMPLETE AND CONSISTENT 4-DIMENSIONAL DATA SET OF ATMOSPHERIC STATE PARAMETERS

PREDICT FUTURE STATE OF ATMOSPHERE OR DETERMINE AUXILIAR DESCRIPTORS; USE NUMERICAL DYNAMIC MODELS WHERE POSSIBLE

GENERAL DEFINITION OF SYSTEM ELEMENTS (2)



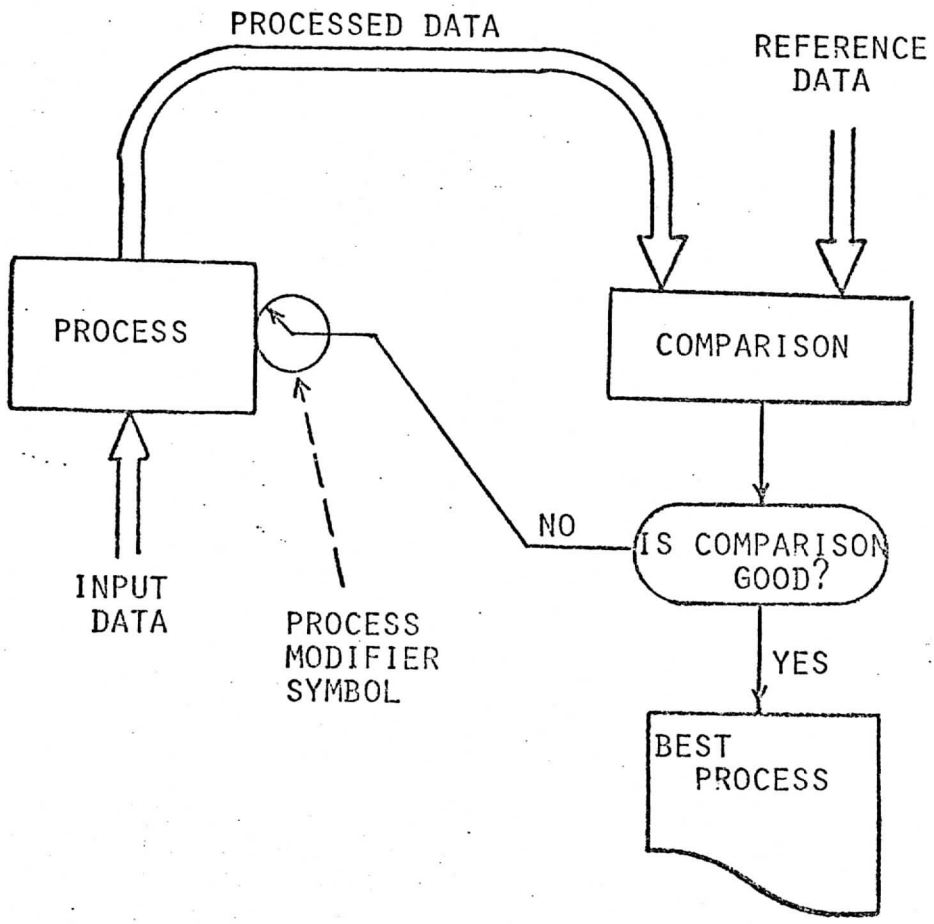
EVALUATION - COMPARISON OF ANY OUTPUT WITH A REFERENCE STANDARD, TESTING THE EFFECT OF A PROCESS ON THE COMPARISON, AND CONTROLLING DATA AND/OR PROCESS TO OPTIMIZE PERFORMANCE

D. ROLE OF FEEDBACK INTERACTIONS IN SYSTEM EVOLUTION (1)

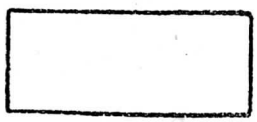
- EVALUATION MUST OCCUR AT EACH STAGE IN SYSTEM DEVELOPMENT
- OUTPUT OF EACH ELEMENT WILL BE COMPARED AGAINST REFERENCE STANDARDS AT EACH STAGE
- PROCESSES AND/OR DATA INPUTS WILL BE MODIFIED TO DETERMINE EFFECTS ON COMPARISON
- BASED ON RESULTS OF PROCESS MODIFICATION TESTS, PROBLEM AREAS WILL BE IDENTIFIED AND MODIFIED PROCESSES WILL BE RATED
- WHERE POSSIBLE TESTED IMPROVEMENTS WILL BE IMPLEMENTED

ROLE OF FEEDBACK (2)

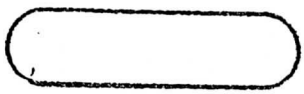
EXAMPLE OF FEEDBACK LEARNING:



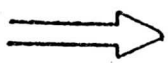
CODE:



PROCESS ACTIVITY



DECISION

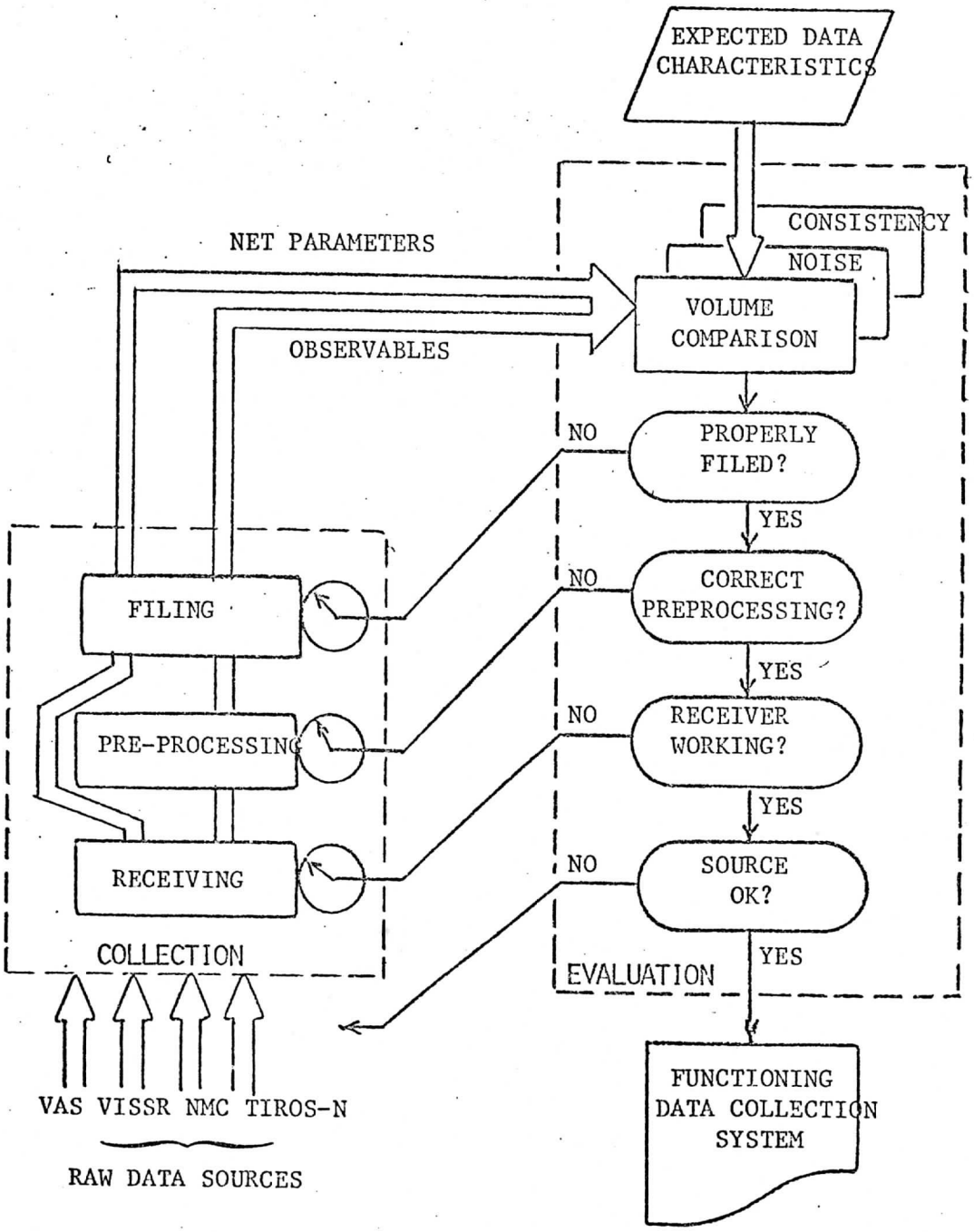


DATA FLOW

TEST FLOW

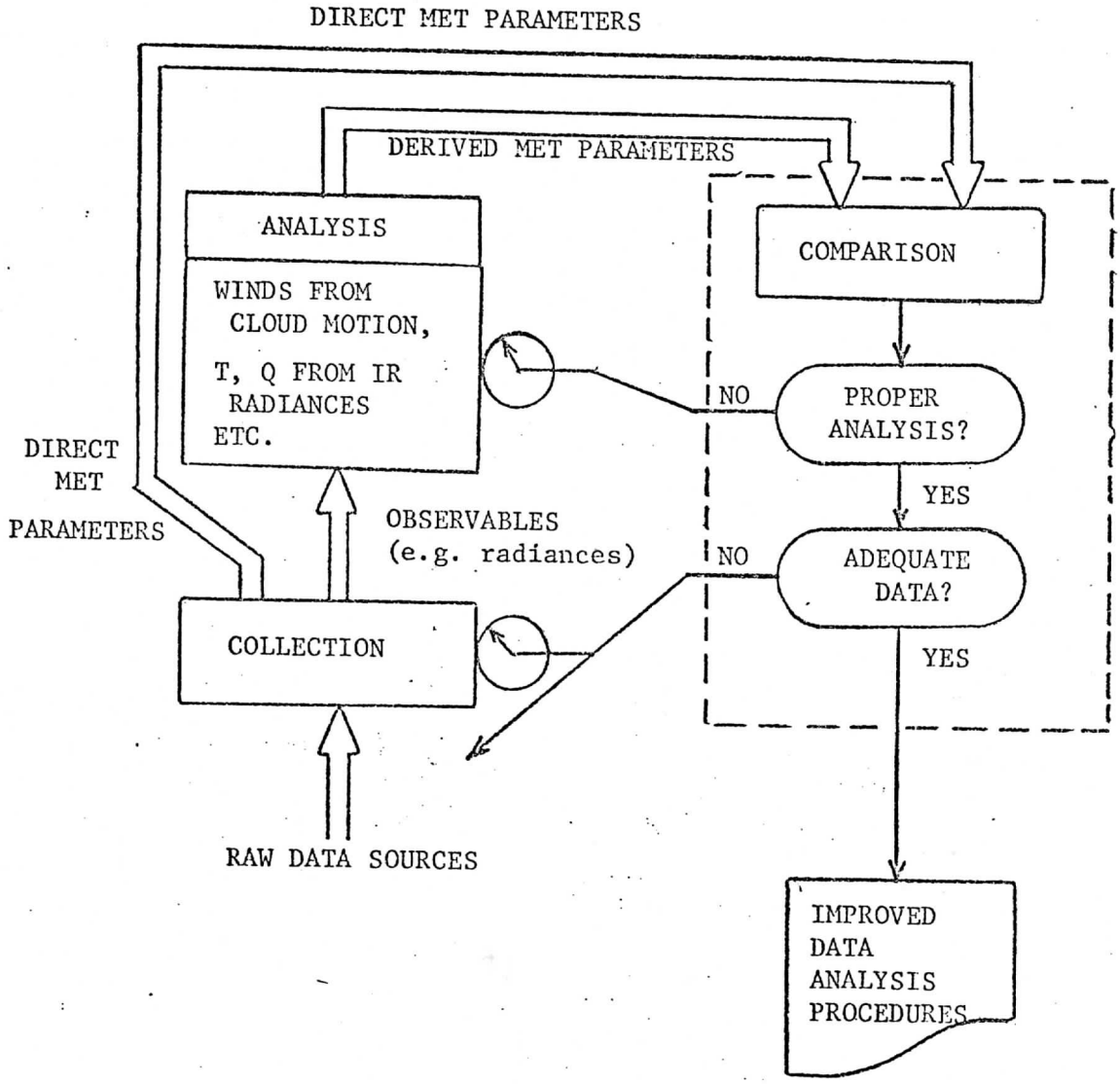
ROLE OF FEEDBACK (3)

TESTING AND ADJUSTMENT OF DATA COLLECTION SYSTEM



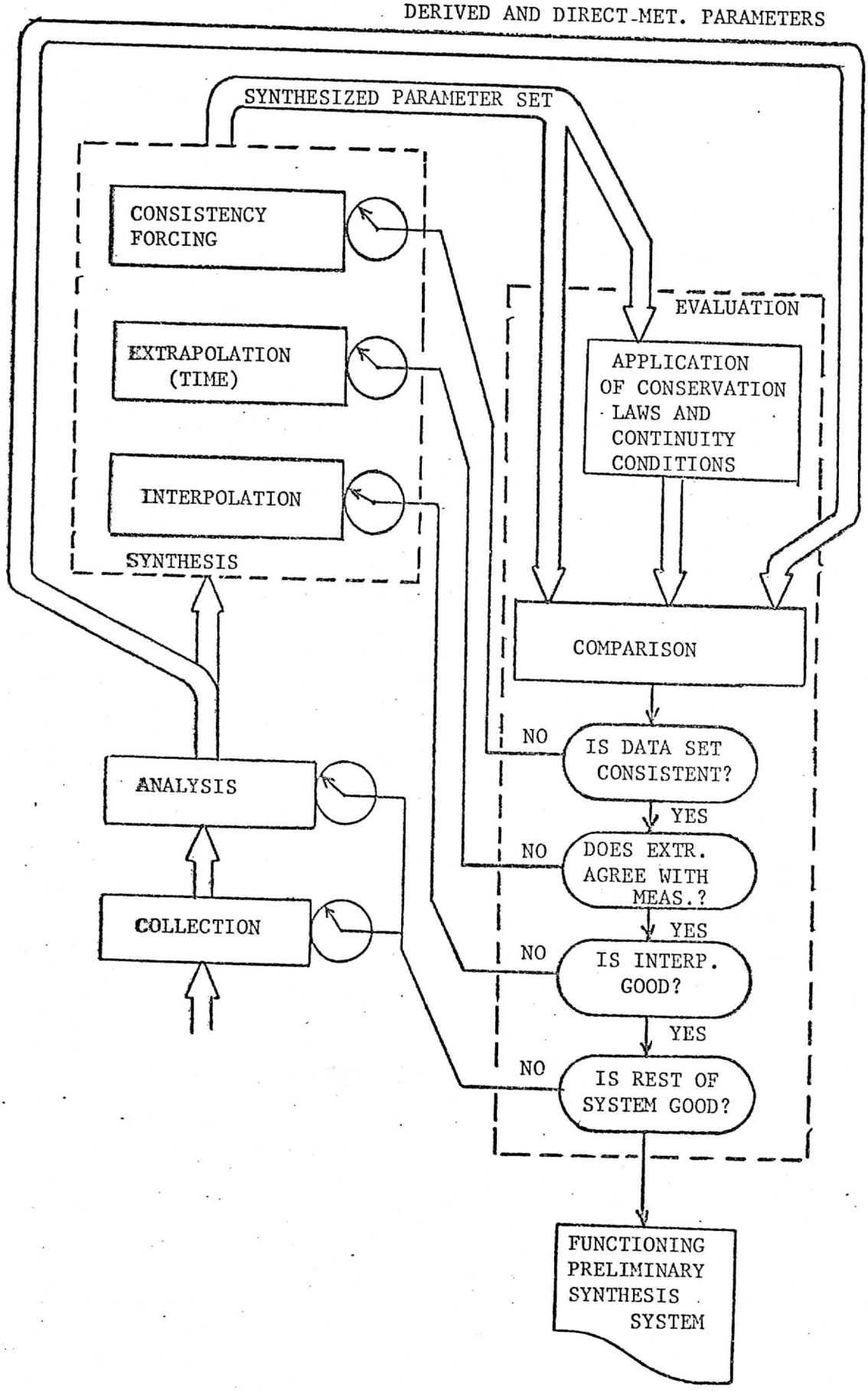
ROLE OF FEEDBACK (4)

TESTING AND OPTIMIZATION OF
DATA ANALYSIS SYSTEM



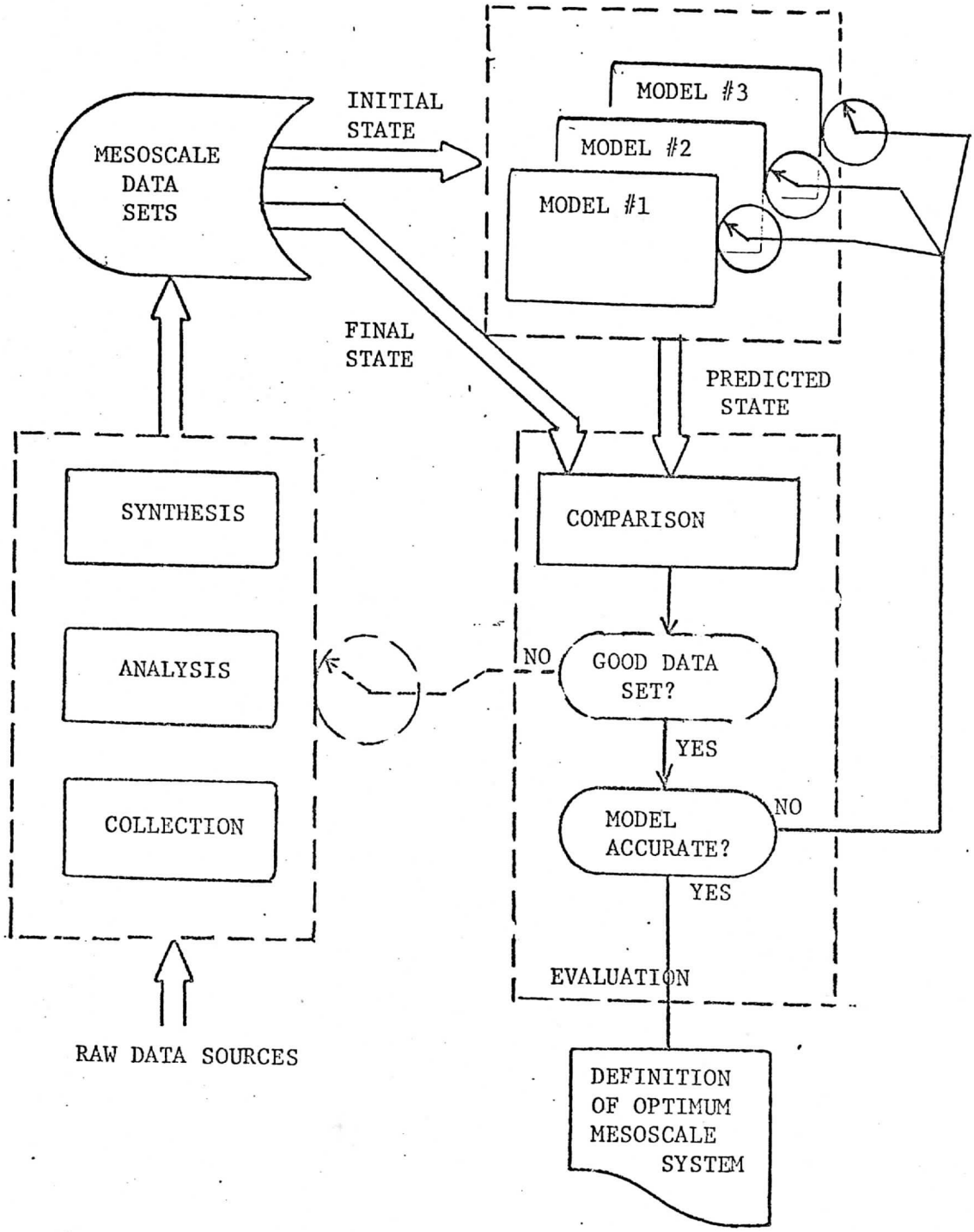
ROLE OF FEEDBACK (5)

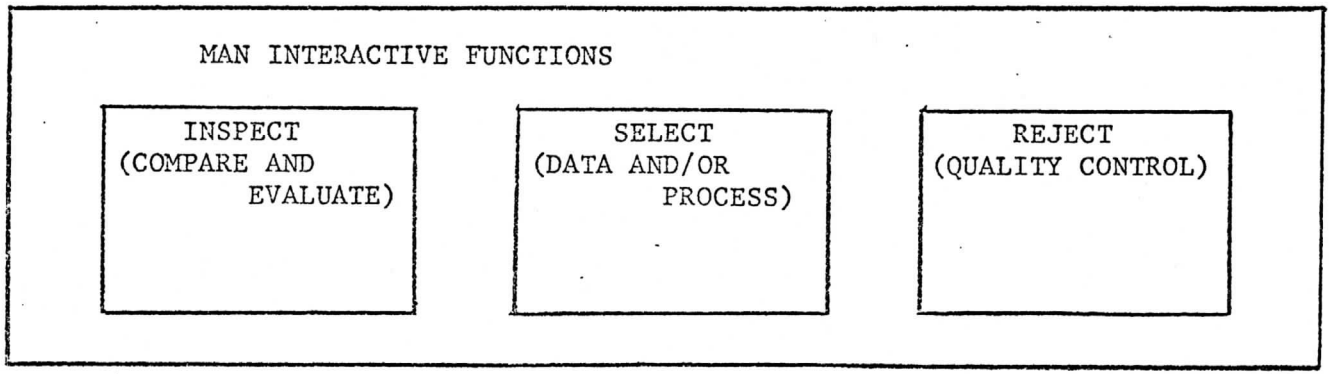
TESTING AND ADJUSTMENT OF SYNTHESIS PROCESS

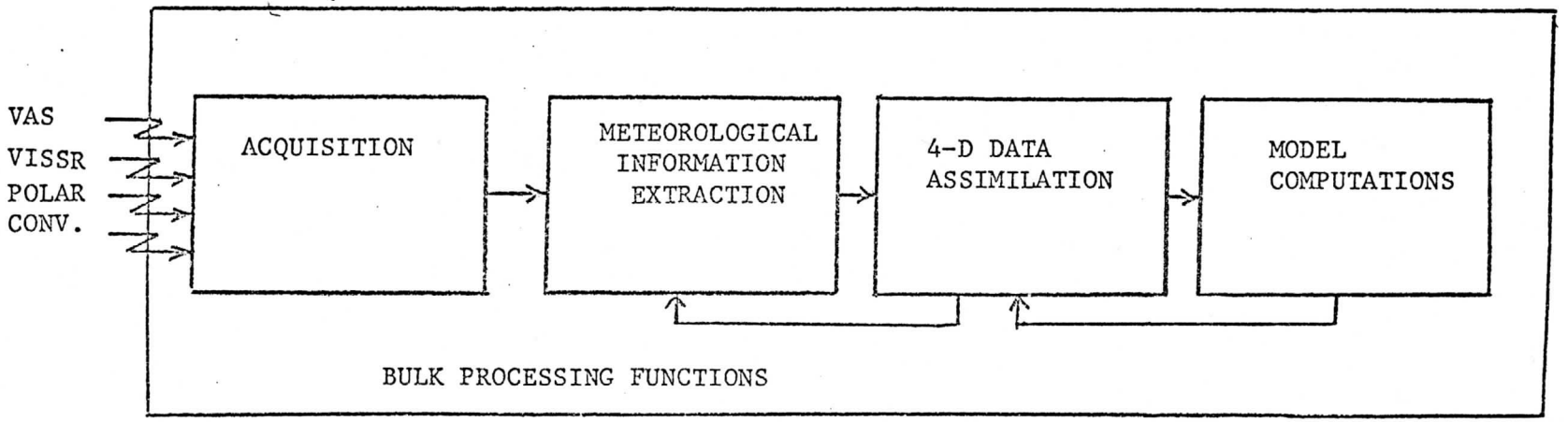


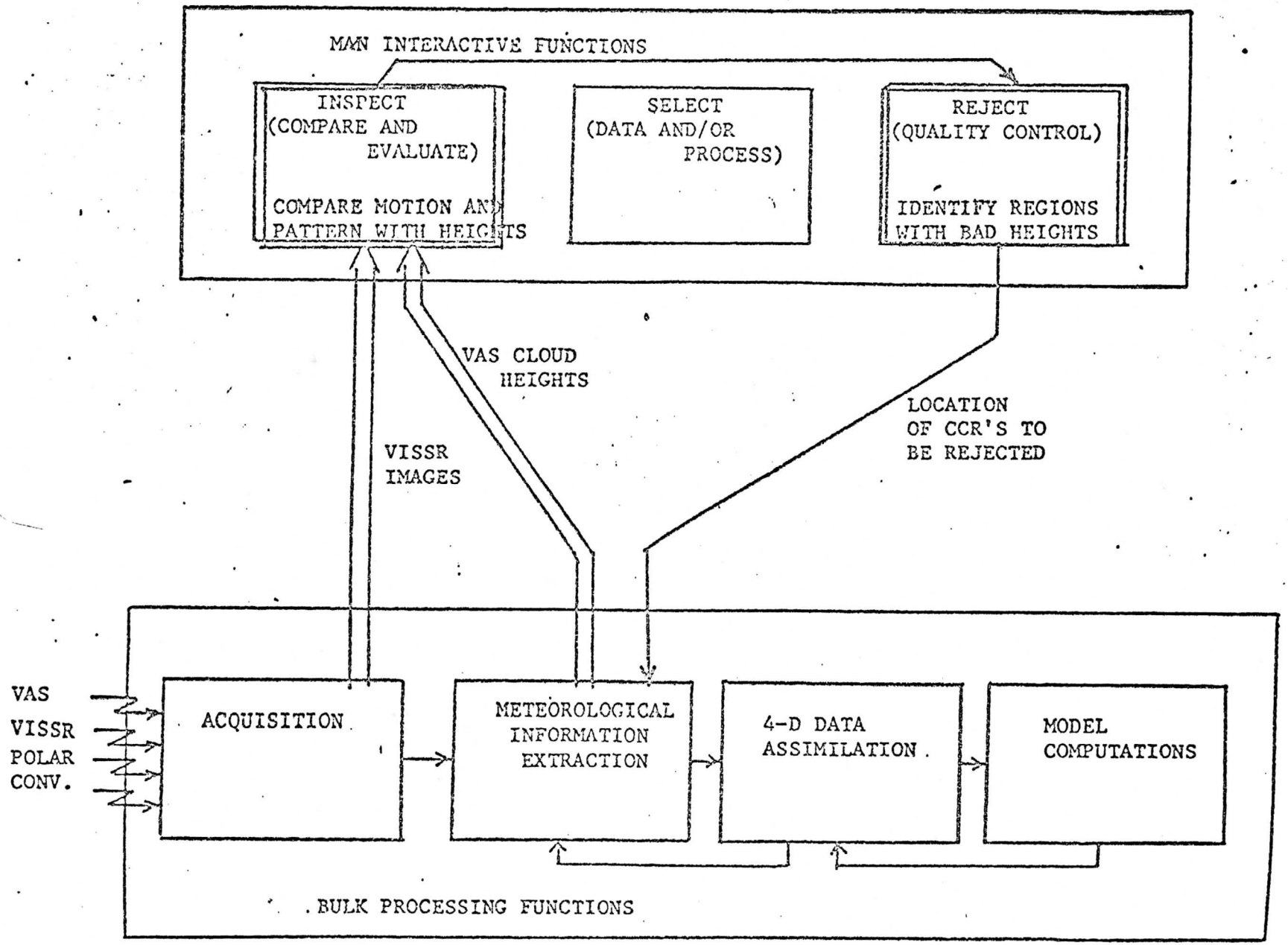
ROLE OF FEEDBACK (6)

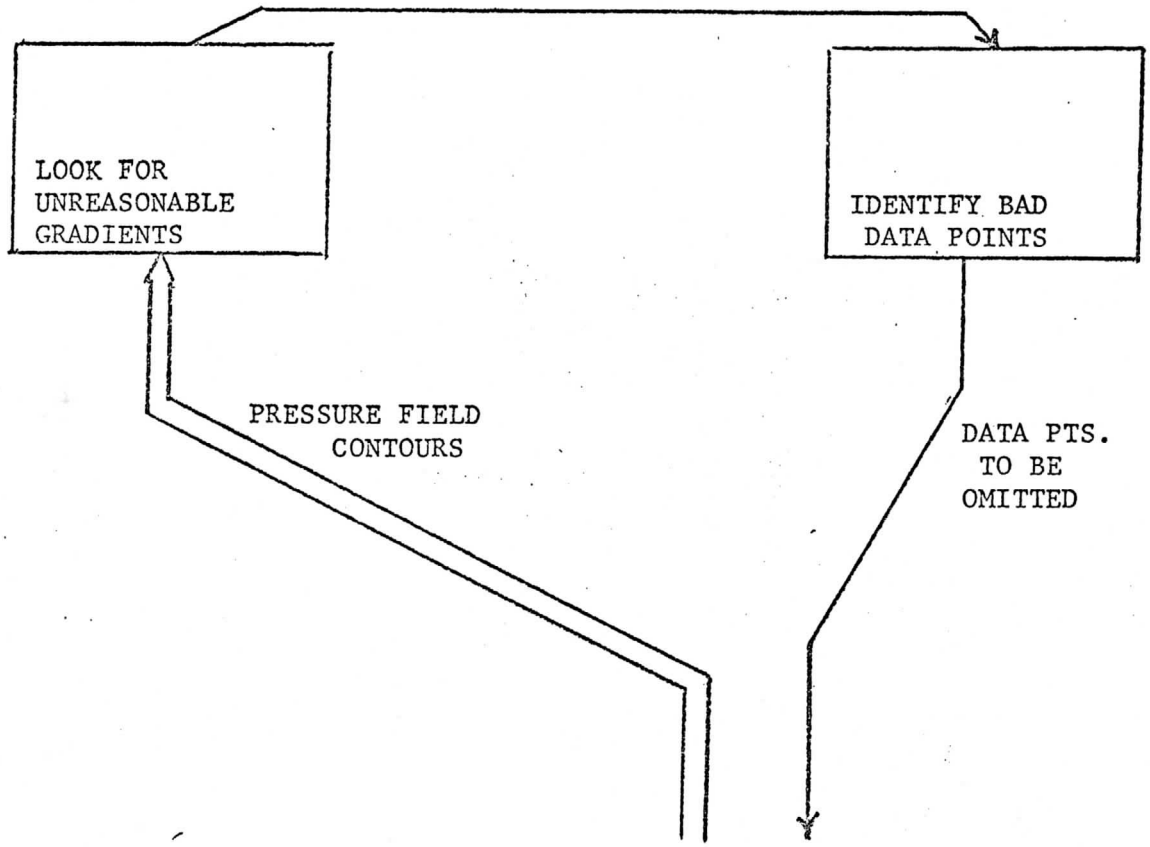
USE OF SYSTEM IN MODEL EVALUATION (STAGE I)
AND IN SYSTEM OPTIMIZATION (STAGE II)

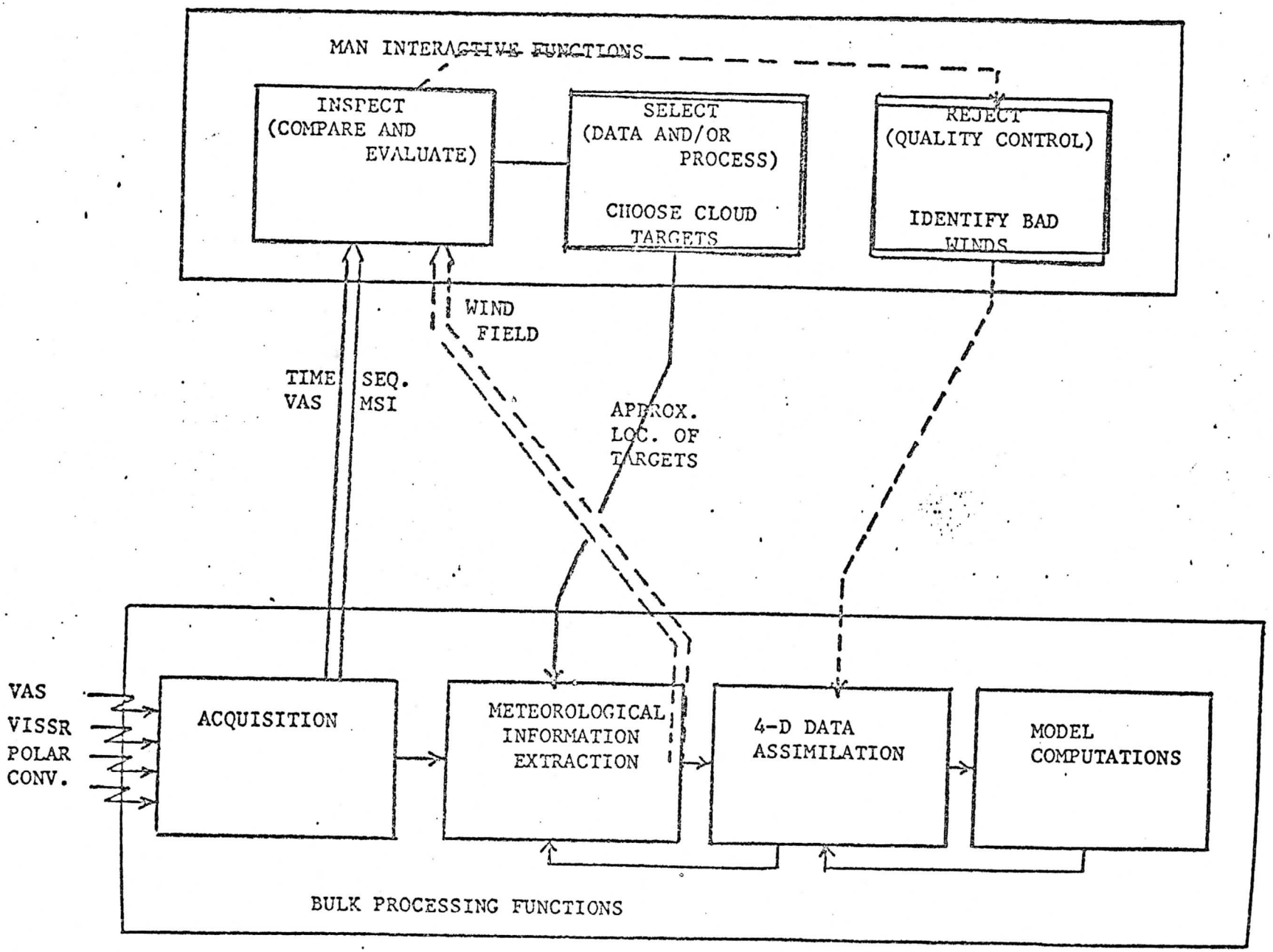


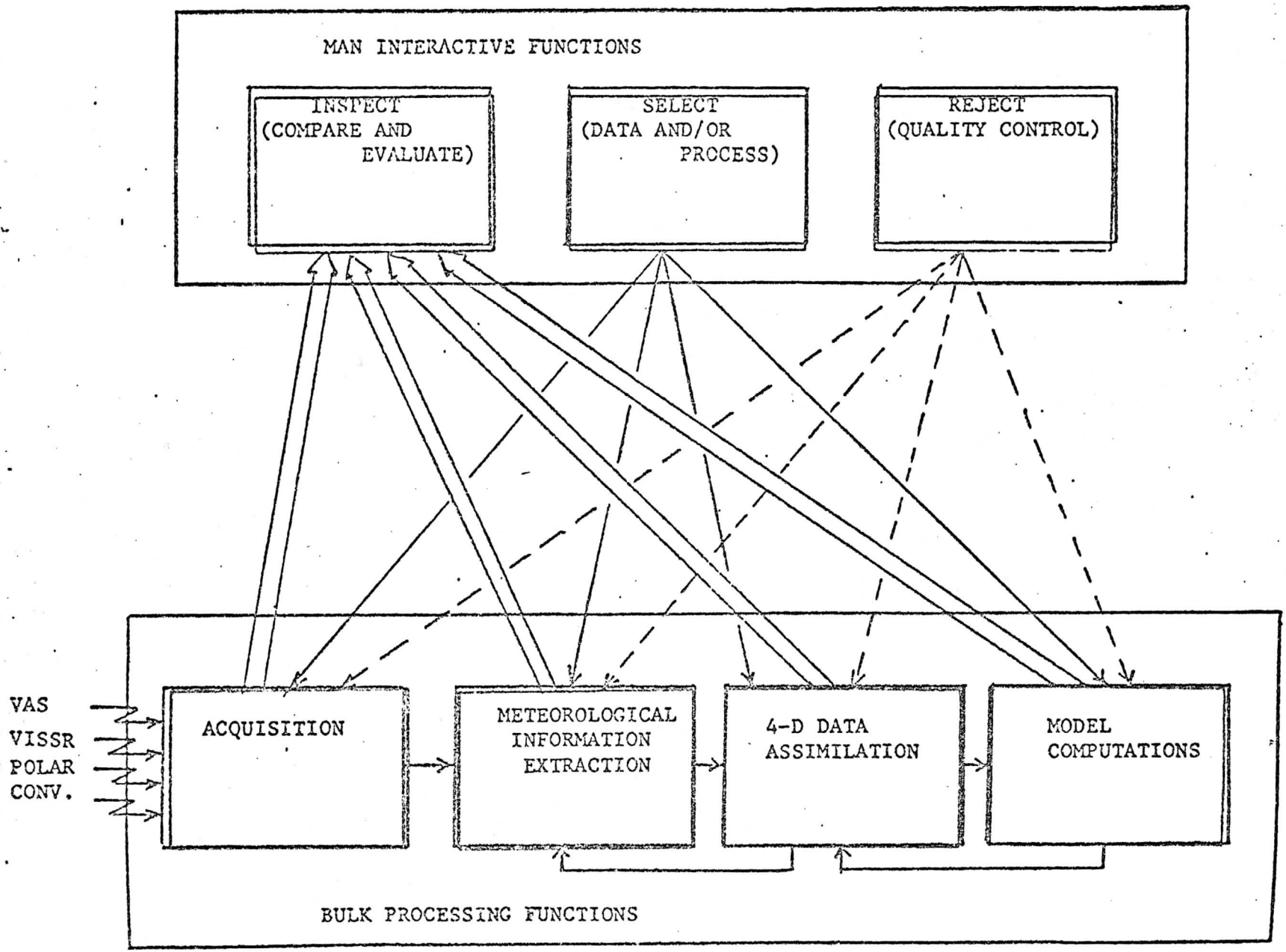

MAN INTERACTIVE FUNCTIONS
INSPECT (COMPARE AND EVALUATE)
SELECT (DATA AND/OR PROCESS)
REJECT (QUALITY CONTROL)


VAS
VISSR
POLAR
CONV.
ACQUISITION
METEOROLOGICAL INFORMATION EXTRACTION
4-D DATA ASSIMILATION
MODEL COMPUTATIONS
BULK PROCESSING FUNCTIONS


MAN INTERACTIVE FUNCTIONS
INSPECT (COMPARE AND EVALUATE)
COMPARE MOTION AND PATTERN WITH HEIGHTS
SELECT (DATA AND/OR PROCESS)
REJECT (QUALITY CONTROL)
IDENTIFY REGIONS WITH BAD HEIGHTS
VAS CLOUD HEIGHTS
VISSR IMAGES
LOCATION OF CCR'S TO BE REJECTED
VAS
VISSR
POLAR
CONV.
ACQUISITION
METEOROLOGICAL INFORMATION EXTRACTION
4-D DATA ASSIMILATION
MODEL COMPUTATIONS
BULK PROCESSING FUNCTIONS


LOOK FOR
UNREASONABLE
GRADIENTS
IDENTIFY BAD
DATA POINTS
PRESSURE FIELD
CONTOURS
DATA PTS.
TO BE
OMITTED


MAN INTERACTIVE FUNCTIONS
INSPECT (COMPARE AND EVALUATE)
SELECT (DATA AND/OR PROCESS)
CHOOSE CLOUD TARGETS
REJECT (QUALITY CONTROL)
IDENTIFY BAD WINDS
WIND FIELD
TIME SEQ. VAS MSI
APPROX. LOC. OF TARGETS
VAS
VISSR
POLAR
CONV.
ACQUISITION
METEOROLOGICAL INFORMATION EXTRACTION
4-D DATA ASSIMILATION
MODEL COMPUTATIONS
BULK PROCESSING FUNCTIONS


MAN INTERACTIVE FUNCTIONS
INSPECT (COMPARE AND EVALUATE)
SELECT (DATA AND/OR PROCESS)
REJECT (QUALITY CONTROL)
VAS
VISSR
POLAR
CONV.
ACQUISITION
METEOROLOGICAL INFORMATION EXTRACTION
4-D DATA ASSIMILATION
MODEL COMPUTATIONS
BULK PROCESSING FUNCTIONS

III. DATA COLLECTION

1. What sources will be used to observe mesoscale phenomena? How will they be useful?

2. A concept for the selection of the VAS operating mode.

3. The status of the definition of Data Collection from the different sources.

Describing the Mesoscale with VAS and Ancillary Data

- To "see" all aspects of mesoscale phenomena, acquire as complete a four dimensional data set as possible.

- Sources of meteorological observations include

  a. VAS
  b. VISSR
  c. polar orbiting satellites
  d. conventional weather data (NMC, AFOS, or Kansas City)
  e. digital radar

- Different sources satisfy meteorological knowledge requirements necessary to monitor and predict mesoscale phenomena.

KNOWLEDGE REQUIREMENTS (listed in order of importance)	SOURCE				
	VAS	Polar Orbiter	VISSR	Conventional Weather	Radar
1. Boundary Layer Motion Field	X			X	
2. Vertical Stability	X	X		X	
3. Surface Temperature	X	X	X	X	
4. Temperature Lapse Rate	X	X		X	
5. Regions of Strong Convective Activity	X		X	X	X
6. Middle and Upper Tropospheric Motion	X		X	X	
7. Pressure Field in Boundary Layer				X	
8. Moisture Field	X	X		X	
9. Convergence and Divergence	X		X	X	
10. Wind Shear and Jet Stream	X		X	X	

Mesoscale Phenomena

Space and Time Resolution

Atmospheric Condition	Resolution Desired	
	Space	Time
Stable	200-400 Km	1-2 Hr
Active	20-50 Km	1-2 Hr
Severe	20-50 Km	5-15 Min

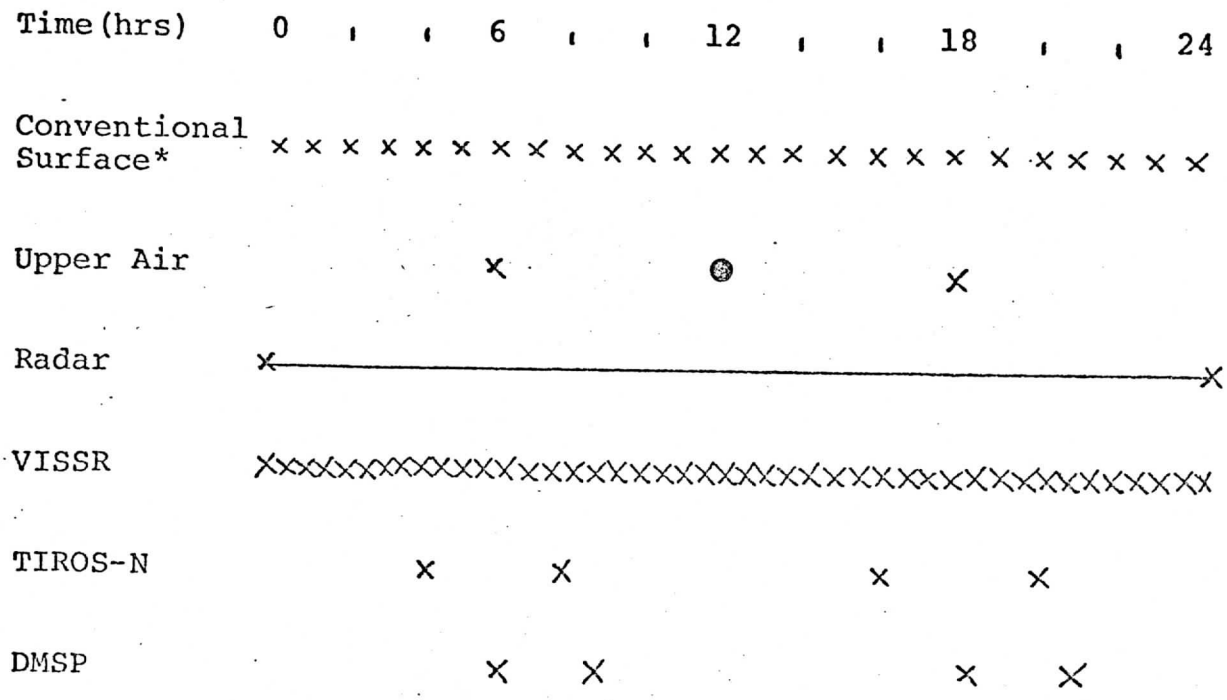
note: Synoptic scale phenomena are adequately parameterized by observations separated by 300-400 Km at 4-6 hour intervals.

VAS will fill

observation time and space

gaps

Timeliness of Ancillary Data



* Capability to incorporate Special Observations

⊛ Information here is derived from NMC Model (departures from balance then indicate possible areas of interest)

Location of Mesoscale Knowledge Requirements

Location	Physical Field Mass	Motion	Thermal	Moisture	Hydrometeor	Other
Earth Surface and Boundary Layer	X	XX	XX	X	X	XX
Middle Troposphere		XX	X	X		X
Upper Troposphere		X				
General Atmosphere						XX

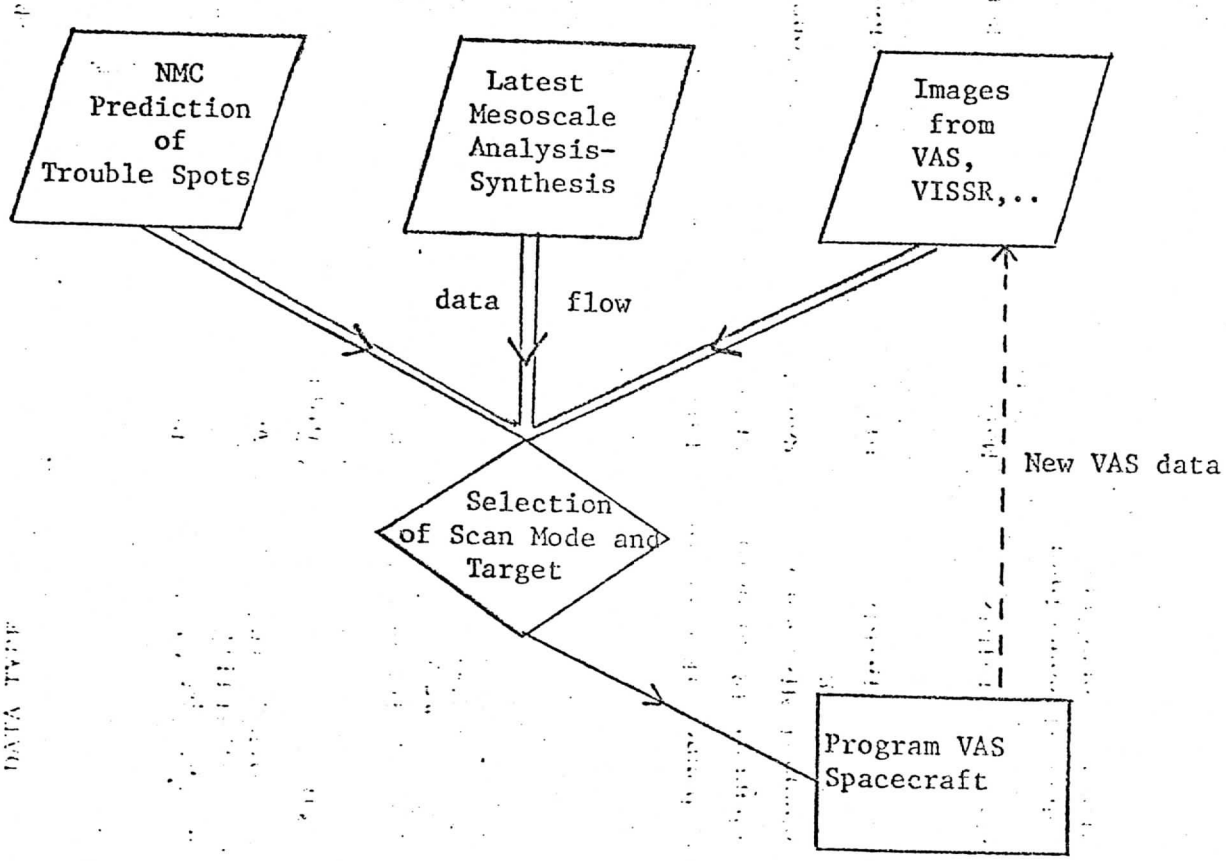
Ancillary Data will

- Provide description of the boundary layer
- Provide ground truth information
- Provide soundings where there are clouds

Ancillary Data

SOURCE	DATA TYPE	REMARKS
Conventional Weather Data		
- surface	T_s, P_s, v_s, cloud hts. visibility	Description of Boundary Layer, Ground Truth Information Auxilliary Data for Clear Column Retrieval
- upper air	T(P, Q(P), v(P)	Vertical Resolution of Temperature and Humidity Fields
- radar	radar	Liquid Water Content
VISSR	high resolution visible images, IR window images	Description of Motion Fields, Cloud Types
Polar Orbiting Satellites		
- TIROS-N		
BSU	14 channel IR sounding	Intercomparison Soundings with VAS
SSU	3 channel IR sounding	Stratospheric Soundings
MSU	4 channel Microwave sounding	Soundings in Cloudy Regions
AVHRR	high res. visible images	Different Viewing Angle than VISSR helps with Cloud Height Determination
- DMSP	high res. visible images IR channel soundings Microwave soundings	More Complete Data Base, Better Cloud Height Determinations

Concept for Selection of VAS Operating Mode



Status of Data Collection Definition

	Conventional Weather[x]	VISSR	TIROS-N	VAS
Reception	defined	defined	not defined[y]	defined
Decoding Signal	defined	defined	not defined	partially defined
Reformatting and Averaging	defined	defined	not defined	partially defined
Calibration	N/A	defined	being defined at NOAA	partially defined
Navigation	N/A	defined	being defined at NOAA	partially defined
Archiving	not defined	not defined	not defined	not defined

x plan to implement NMC phone line in 77

y three alternatives are under consideration

Data Collection Capability Available on McIDAS Now

	z			
	✓	✓		
	✓	✓		
	✓	✓		
	✓	✓		
	✓	✓		
	✓	✓		

z Kansas City phone line available

TIROS-N DATA Acquisition Options

Acquisition Mode	Information Received*	Remarks
VHF Antenna	Basic Sounding Unit, Stratospheric Sounding Unit, Microwave Sounding Unit (this data is located in the TIP-TIROS Information Processor)	real time coverage
S-band Antenna	TIP and Advanced Very High Resolution Radiometer (AVHRR)	coverage at 1 Km resolution received real time
Suitland hook-up	S/C tape recorder (includes TIP, AVHRR, and global data)	global coverage at 4 Km resolution; limited area coverage at 1 Km resolution; tape recorder play back may not be timely for real time analysis

* HIRS data will also be available, but acquisition mode necessary is unclear at this time.

IV. ANALYSIS:

Extraction of meteorological determinations from observables

Outline

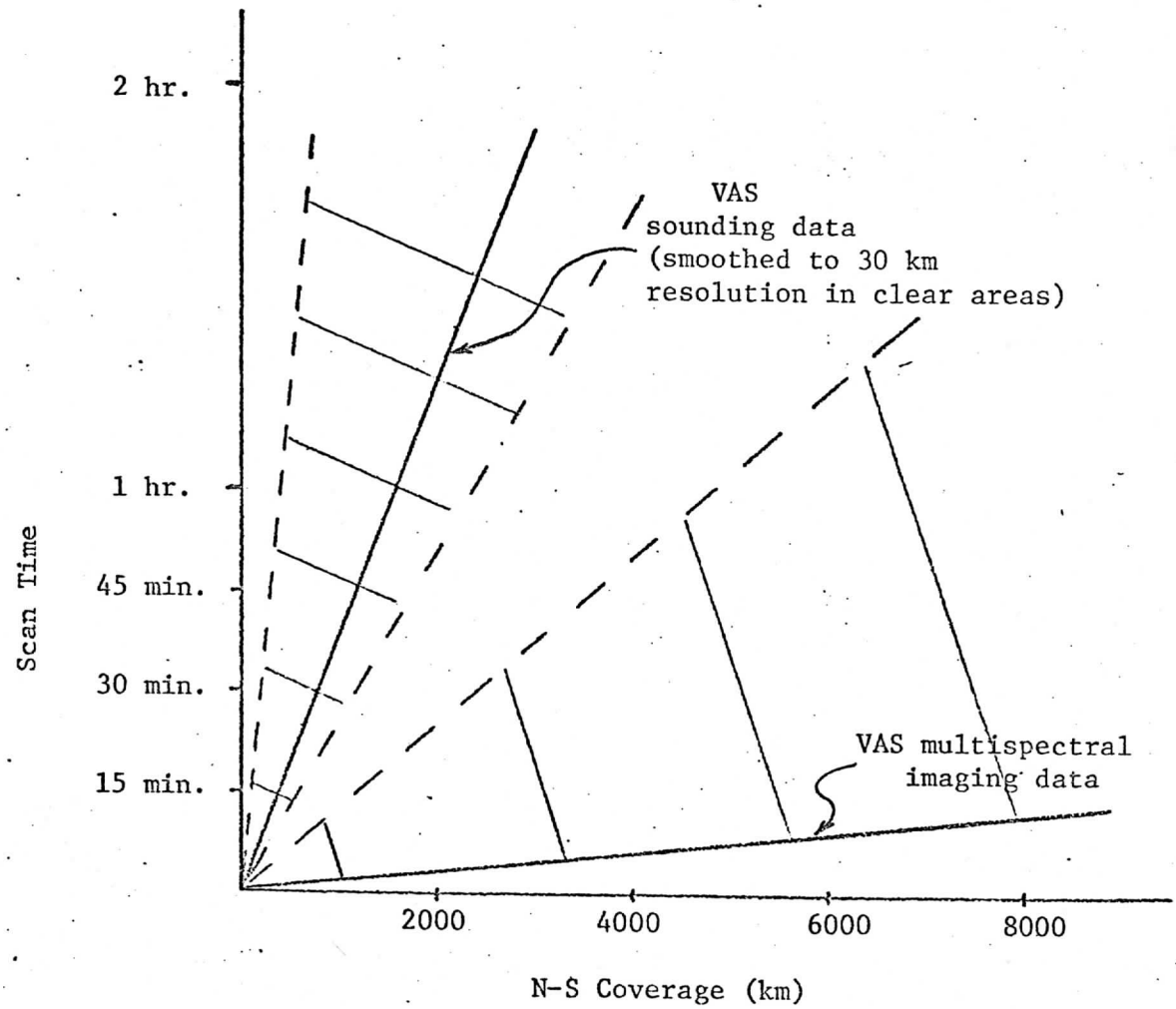
1. Inputs & Outputs
2. Techniques
   a. General description
   b. Specific algorithms

PRIMARY INPUT TYPES

Type	Characteristics of Observables
Sounding Data	• Spectral radiances giving complete vertical coverage • Sampling sufficient to give 1 Wark accuracy after time & space smoothing
Imaging Data	• Spectral radiances chosen for specific application (incomplete vertical coverage) • Sampling required varies with application

SPACE & TIME SCALES FOR VAS

SOUNDING & IMAGING DATA



OUTPUTS

Clear areas:

- Water vapor fields
- Winds from water vapor tracking
- Temperature fields
- Surface temperature

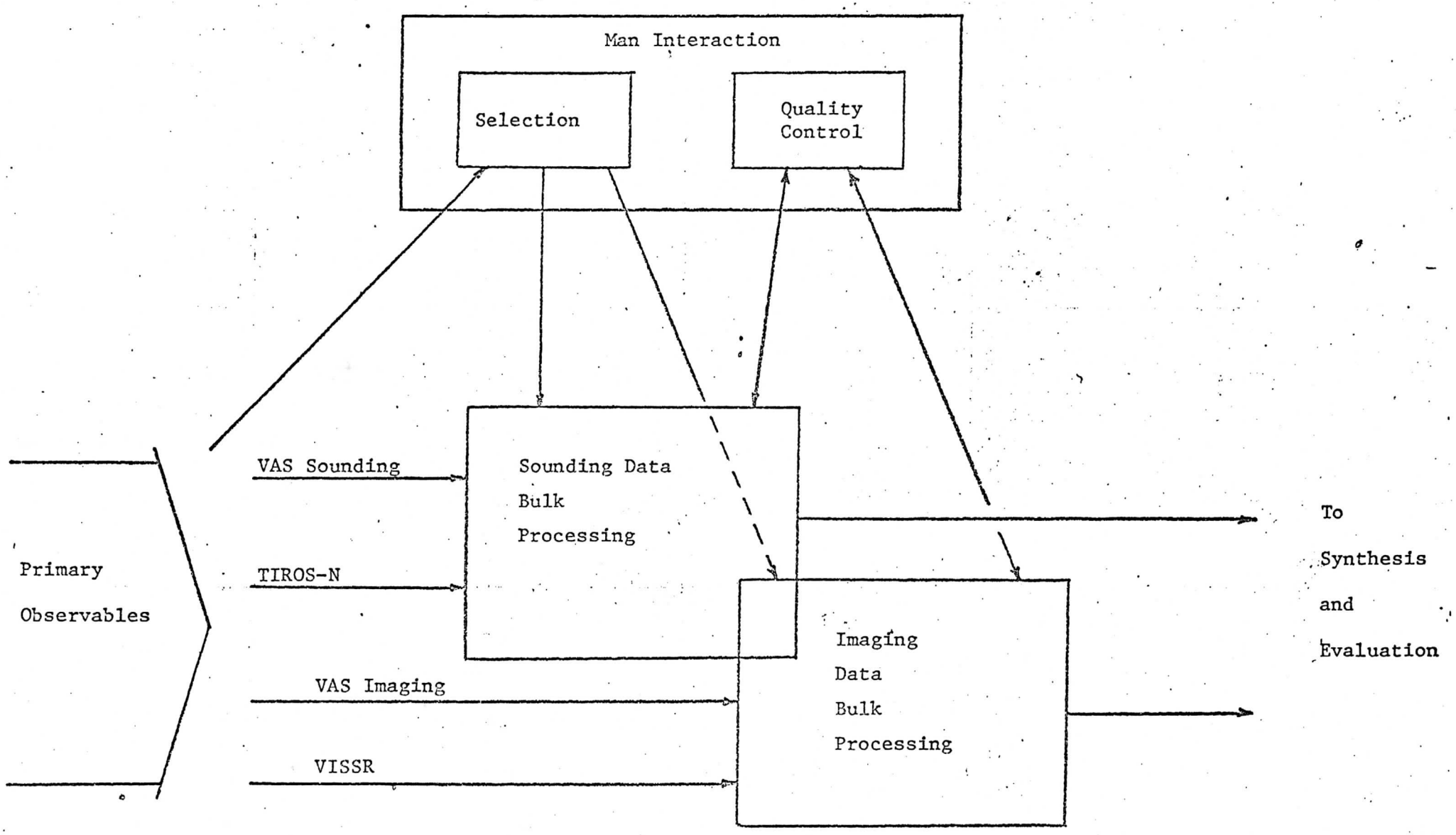
Cloudy areas:

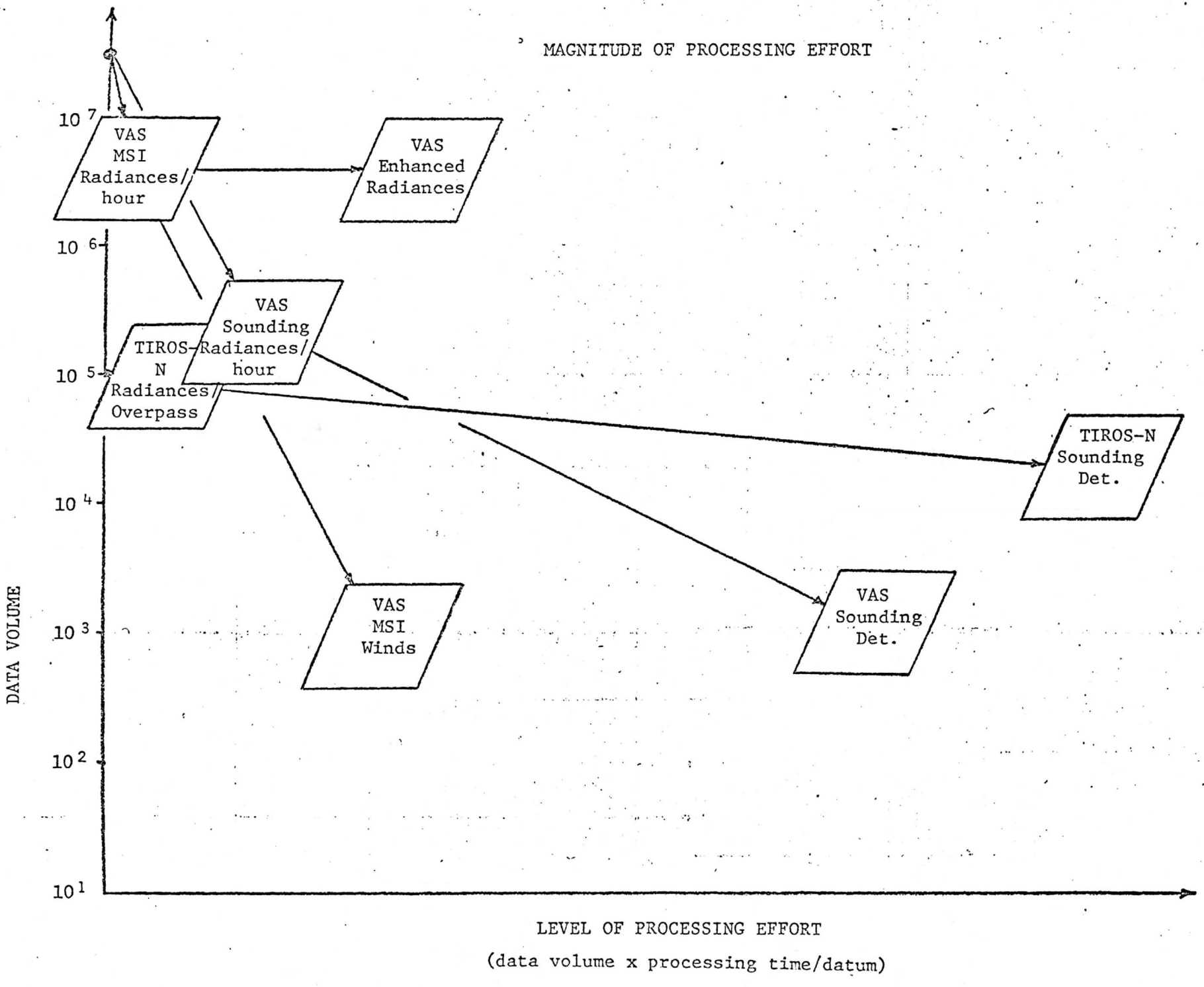
- Winds from cloud tracking
- Cloud heights
- Liquid water content
- Cloud types

OVERVIEW OF TECHNIQUE STATUS

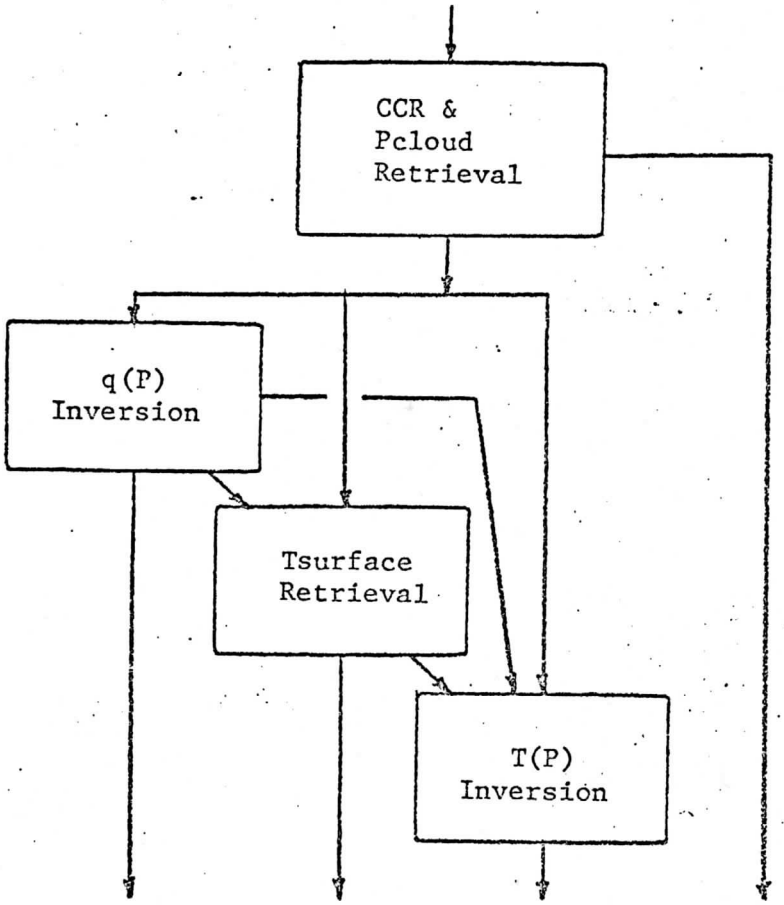
	Input Sources	Outputs	Status of Analysis Techniques
Sounding Analysis	Primary sources: VAS TIROS-N Auxilliary sources: Assimilated data Historical data VISSR images	q(P) T(P) Pcloud Tsurface	Existing polar orbiting sounder techniques need adaptation to interactive small machine environment.
Imaging Analysis	Primary sources: VAS VISSR Auxilliary sources: Assimilated data	- Cloud motion winds - Pcloud - Water vapor motion winds Liquid water content Tsurface Water vapor distribution Lower tropospheric temperature Cloud type	- McIDAS techniques directly applicable - Existing polar orbiter techniques applicable - Need development

MAN INTERACTION IN ANALYSIS

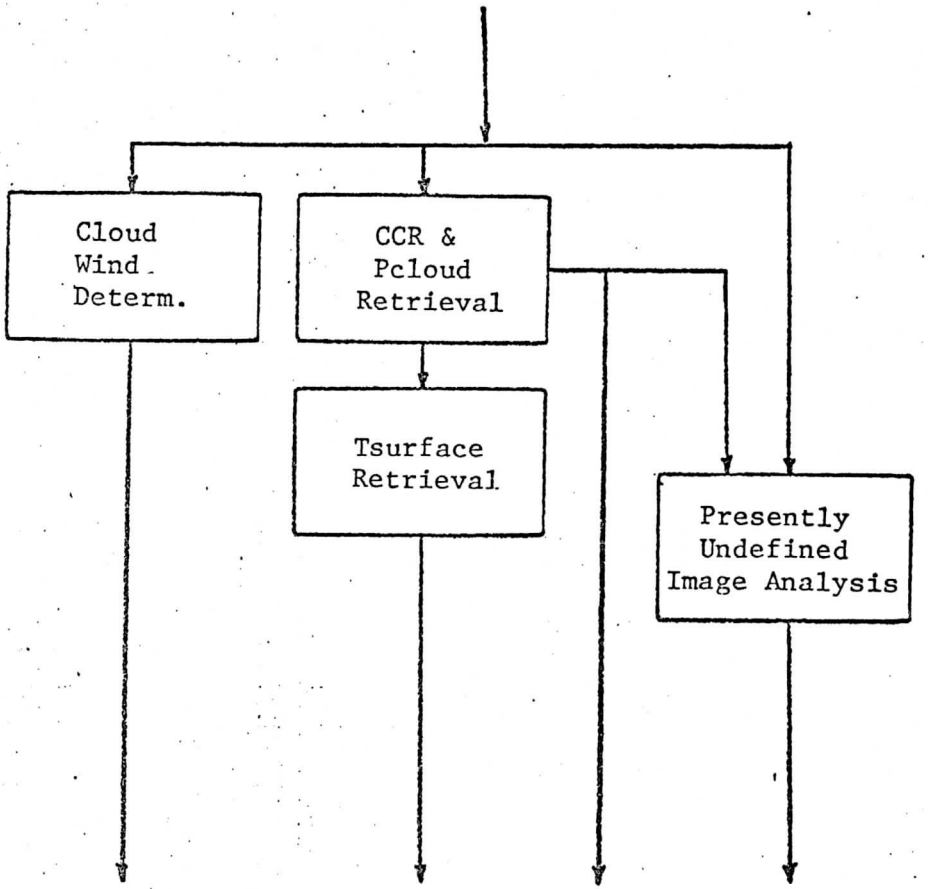



MAGNITUDE OF PROCESSING EFFORT
10^7
VAS MSI Radiances/ hour
VAS Enhanced Radiances
10^6
VAS Sounding Radiances/ hour
10^5
TIROS-N Radiances/ Overpass
TIROS-N Sounding Det.
10^4
VAS MSI Winds
VAS Sounding Det.
10^3
10^2
10^1
DATA VOLUME
LEVEL OF PROCESSING EFFORT
(data volume x processing time/datum)

PROCESSING TECHNIQUE SEQUENCE



SOUNDING ANALYSIS



IMAGING ANALYSIS

EXISTING TECHNIQUES

OUTPUT	TECHNIQUE	DATA REQUIRED	STATUS
Clear Column Radiances (CCR)			
- Initial Classification of cloud coverage	man interactive - man distinguishes between clear, overcast, broken one cloud type & broken mixed cloud types	- time sequence visible & IR window channel radiances	- undeveloped: McIDAS experience shows feasibility
	objective techniques - use standard dev. of window radiances to distinguish broken clouds from clear or overcast conditions	- window channel radiances	- used for NIMBUS 5 processing (appropriate use of man and objective techniques will be evaluated on McIDAS)
	- compare 11.2 black body temperature with surface T estimate to detect overcast	- window channel radiances - surface temperature estimate	
- CCR for Clear or overcast areas	average radiances	- any channel	- may require undeveloped diffraction correction if if clouds nearby
- CCR for Broken cloud cover	histogram technique + non-statistical paired FOV technique	- window channel radiances - sounding channel radiances	- established technique, except that diffraction correction techniques need testing for VAS
	eigenvector paired FOV	- all VAS or TIROS-N channels - radiance eigenvectors from historical set of radiances	- developed by NESS for TIROS-N

EXISTING TECHNIQUES (continued)

OUTPUT	TECHNIQUE	DATA REQUIRED	STATUS
Temperature fields	eigenvector regression inversion	- All VAS or TIROS-N channels - Regression matrix from historical set of radiance and temperature profiles	developed by NESS for TIROS-N
Temperature time gradient fields	minimum information inversion	- VAS 12 channel sounding data at 2 times - Atmospheric transmission fns - Water vapor fields - Surface temperature - Surface pressure	established technique - has not been applied to time domain data
Water vapor mixing ratio fields	eigenvector regression inversion	- All VAS or TIROS-N channels - Regression matrix from historical set of radiance and mixing ratio profiles	developed by NESS for TIROS-N
Cloud heights and amounts	eigenvector technique	- All VAS or TIROS-N channels - Radiance eigenvectors from historical set of radiance profiles	- developed by NESS for TIROS-N
	dual channel techniques	- Colocated cloud sensitive channel radiances - Clear column radiances for these channels	- used for NIMBUS-5 processing
	visible & window channel technique	- Visible intensities - Window channel radiances	- used for VISSR on McIDAS

EXISTING TECHNIQUES (continued)

OUTPUT	TECHNIQUE	DATA REQUIRED	STATUS
Wind direction and speed	cloud tracking	visible or IR window channel time sequence images	developed & tested for VISSR on McIDAS
Surface temperature over water	radiation transfer equation + spatial or temporal continuity	- IR window channel clear column radiances - atmospheric transmission fns. - temperature field estimates - water vapor field estimates	- well known technique
	dual window channel technique	- long and short wave window channel clear column radiances - surface temperature estimate - incident solar radiation	- used for NIMBUS-5 processing

MAJOR AREA REQUIRING DEVELOPMENT:

VAS Image Analysis

eg. Techniques for obtaining

1. Water vapor motion winds
2. Liquid water content
3. Surface temperature
4. Water vapor distribution
5. Lower tropospheric temperature
6. Cloud type

V. SYNTHESIS AND MODELLING

A. BASIC OBJECT OF SYNTHESIS

B. REQUIRED SYNTHESIS FUNCTIONS

C. TYPES OF MODELS USED IN SYNTHESIS

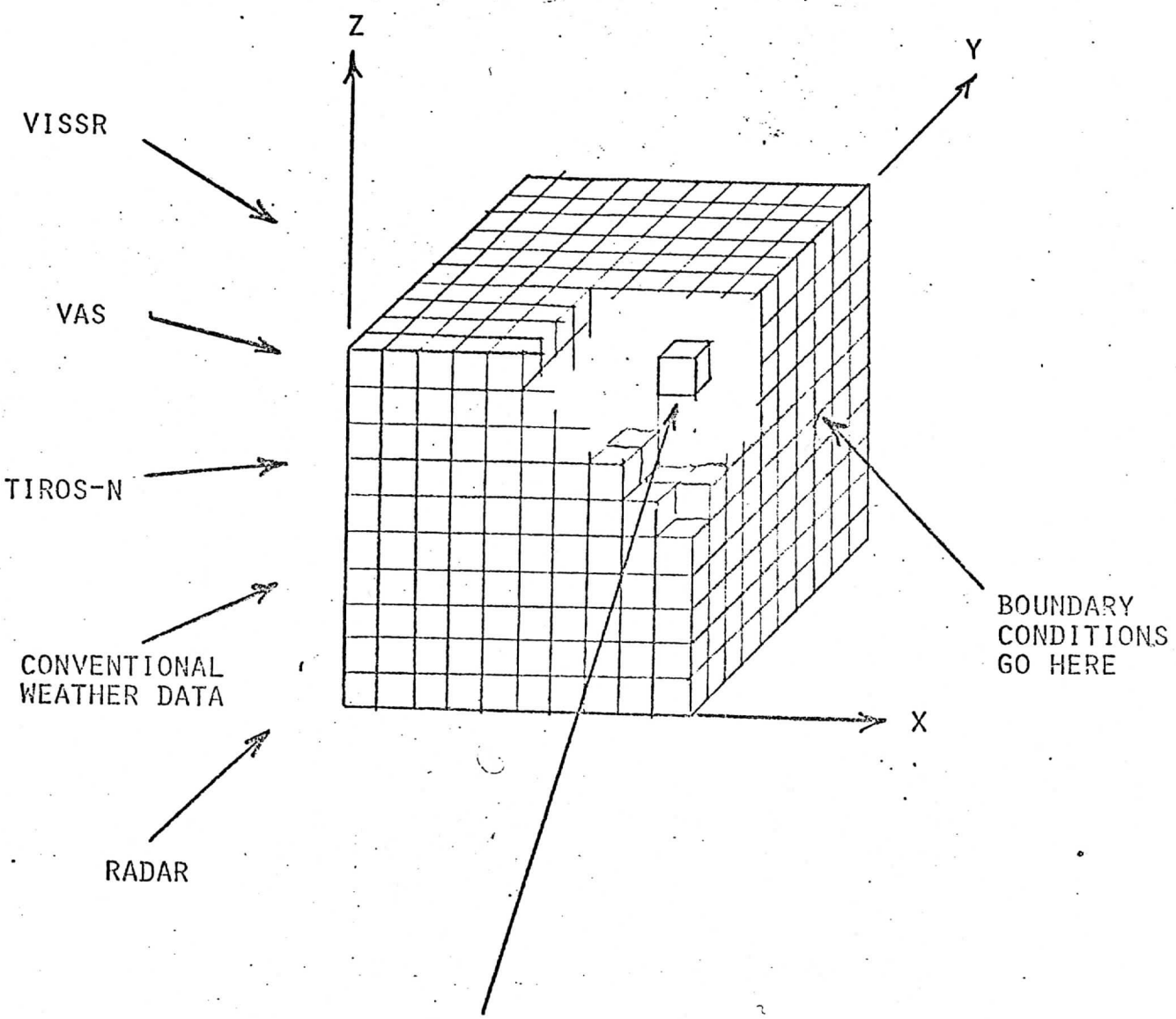
D. ADDITION OF NEW INFORMATION

E. A PROCESS FOR DATA SET SYNTHESIS

F. STATUS

A. BASIC OBJECT OF SYNTHESIS

(A COMPLETE MEAL FOR THE MODEL)

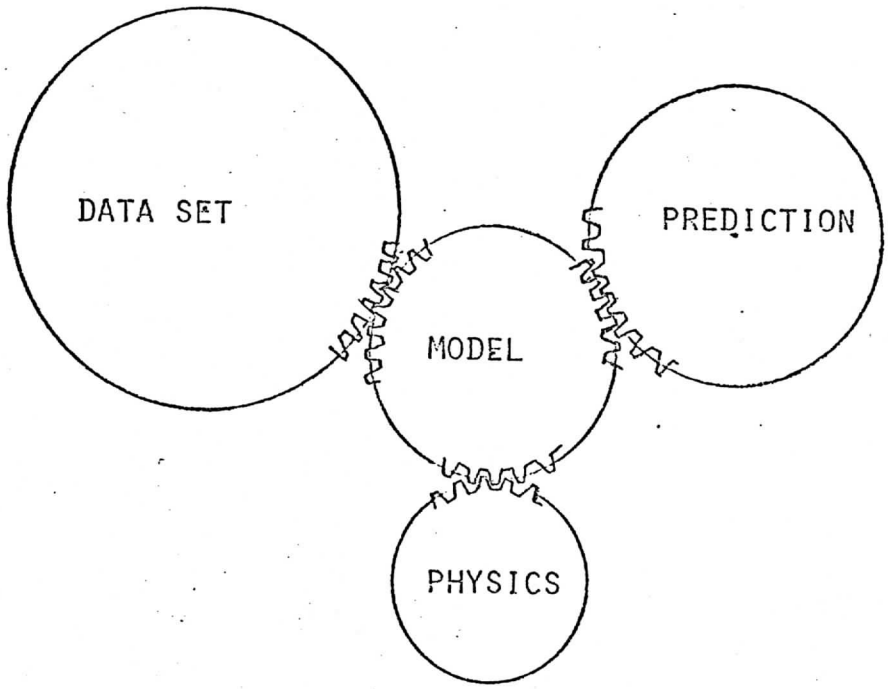


EVERY BOX IN THE MESOSCALE VOLUME
IS FULL OF NUMBERS:

$(T, P, Q, \vec{V}, \text{liq. } H_2O, \ldots)$

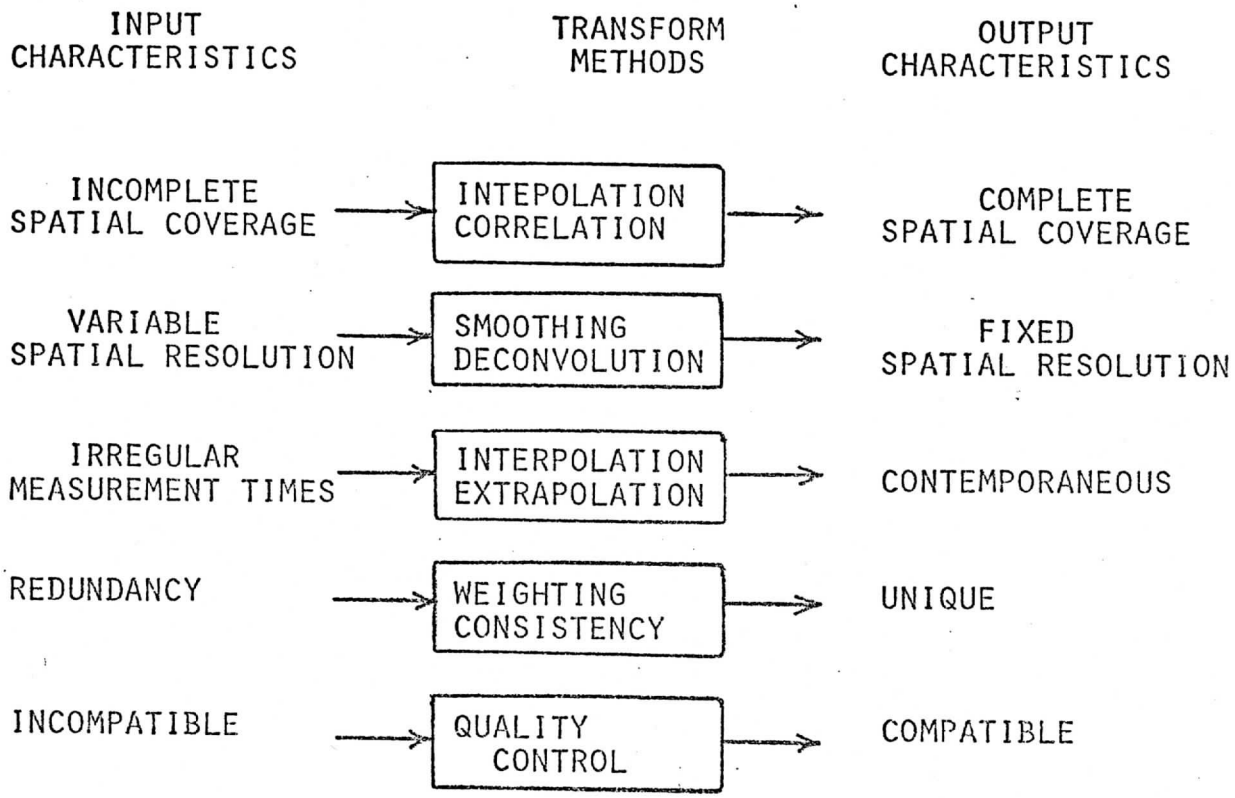
A. SECONDARY OBJECTIVE

(THE MEAL MUST BE DIGESTABLE)



- THE DATA SET MUST BE CONDITIONED TO MESH WITH THE MODEL
- DATA CONDITIONING VARIES WITH THE MODEL BEING USED
- INCREASING RESOLUTION OF DATA SET ULTIMATELY REQUIRES MORE PHYSICS TO POWER THE MODEL

B. DATA SET SYNTHESIS FUNCTIONS



C. TYPES OF MODELS USED IN SYNTHESIS

- INTERPOLATION MODEL: DETERMINES VALUES ON A UNIFORM GRID FROM MEASUREMENTS MADE ON A NON-UNIFORM GRID

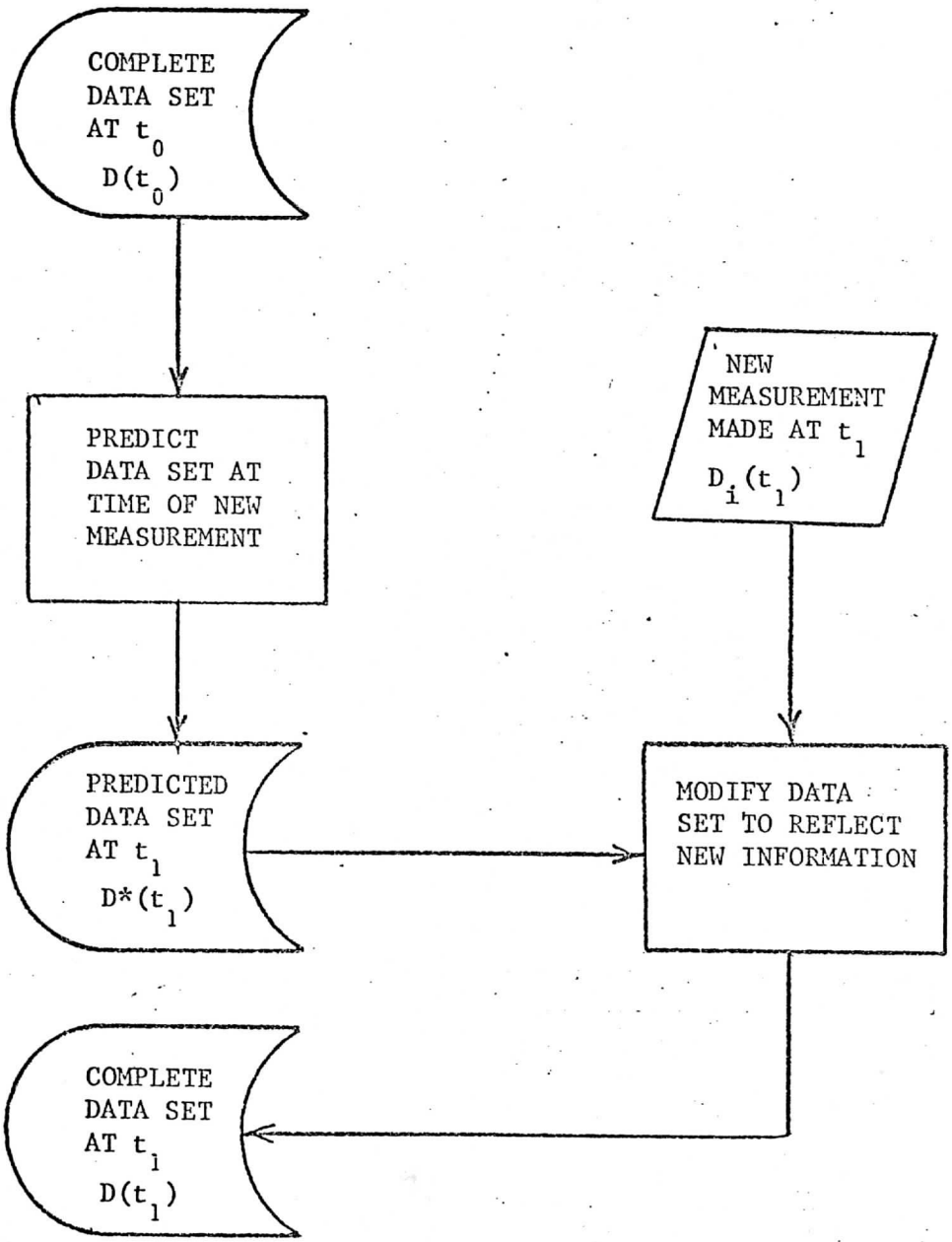
- DIAGNOSTIC MODEL: DERIVES SECONDARY PARAMETERS (E.G. RAIN AREAS) FROM PRIMARY PARAMETERS (E.G., T, P, Q); USED TO CHECK CONSISTENCY OF DERIVED AND OBSERVED SECONDARY PARAMETERS

- INITIALIZATION MODEL: PREPARES DATA SET FOR PREDICTIVE MODELS BY FILTERING DATA TO ELIMINATE SCALES AND PROCESSES INAPPROPRIATE TO THE MODEL

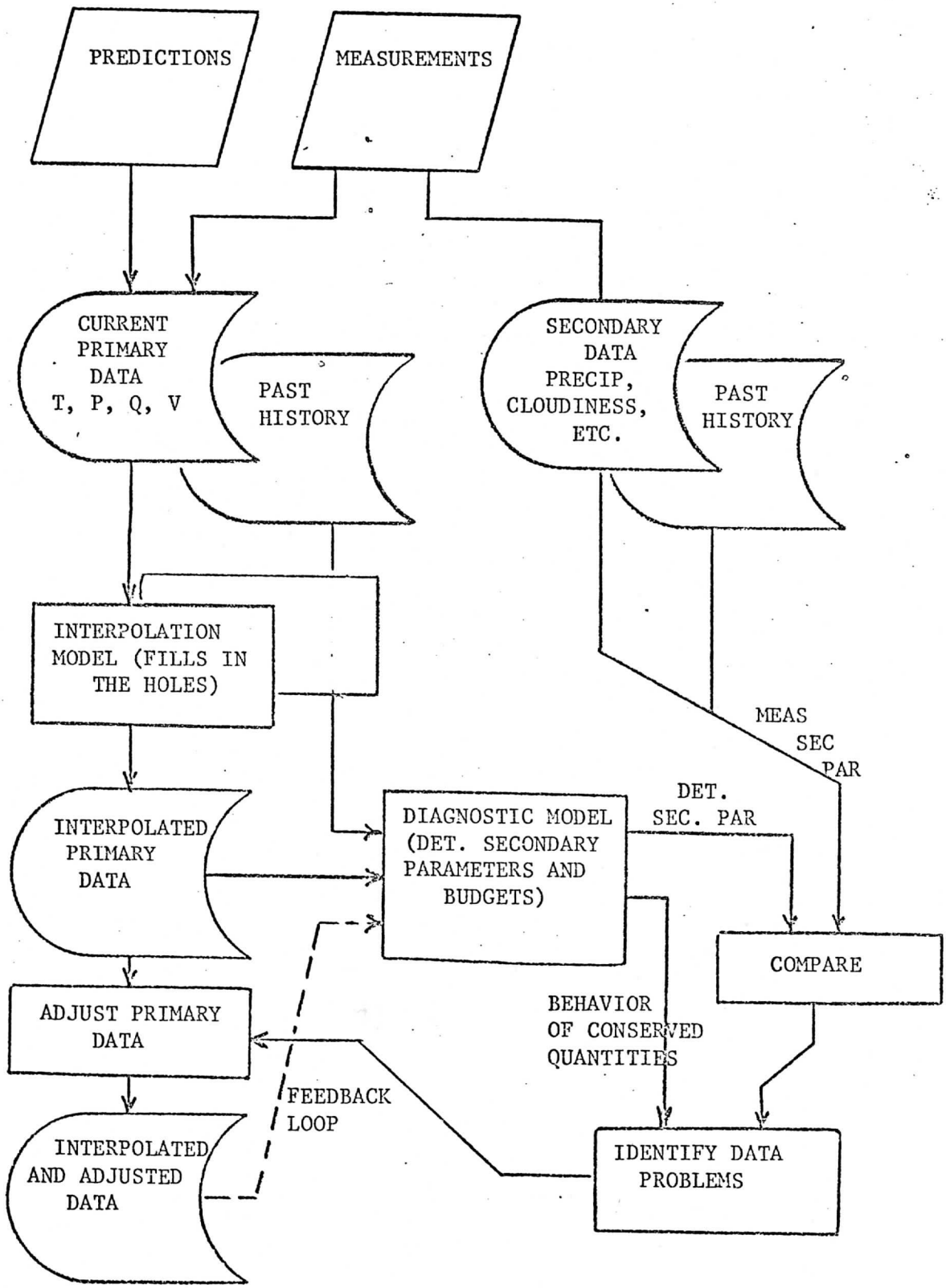
- PREDICTIVE MODEL: PREDICTS FUTURE VALUES OF PRIMARY PARAMETER FROM INITIAL CONDITIONS

- EXTRAPOLATION MODEL: A SUBSET OF PREDICTIVE MODELS, CHARACTERIZED BY SIMPLICITY AND USEFUL ACCURACY ONLY FOR VERY SHORT TIMES

UPDATING DATA SET WITH NEW INFORMATION



A PROCESS FOR DATA SET SYNTHESIS



F. STATUS OF SYNTHESIS AND MODELLING

- RELIABLE MESOSCALE PREDICTION MODELS NOT NOW AVAILABLE AND NOT NOW INCLUDED IN VAS SYSTEM; DEVELOPMENT OF SUCH MODELS EXPECTED TO PROGRESS WITH IMPROVED DATA SETS AS PROVIDED BY VAS SYSTEM;

- DIAGNOSTIC MODELS ARE AVAILABLE NOW; WILL BE INCLUDED IN VAS SYSTEM*; WILL SERVE AS PRIMARY EVALUATOR OF SYNTHESIZED DATA QUALITY

- CONSISTENCY FORCING (PRIMARY DATA ADJUSTMENT) PRESENTLY DEPENDS ON HUMAN INTERACTION USING SUBJECTIVE TECHNIQUES AND DIAGNOSTIC FEEDBACK

- INTERPOLATION MODELS ARE ABUNDANT BUT MAINLY TWO DIMENSIONAL; REQUIRES DEVELOPMENT

* WILL ALSO BE IMPLEMENTED IN MCIDAS OUTSIDE OF VAS PROGRAM