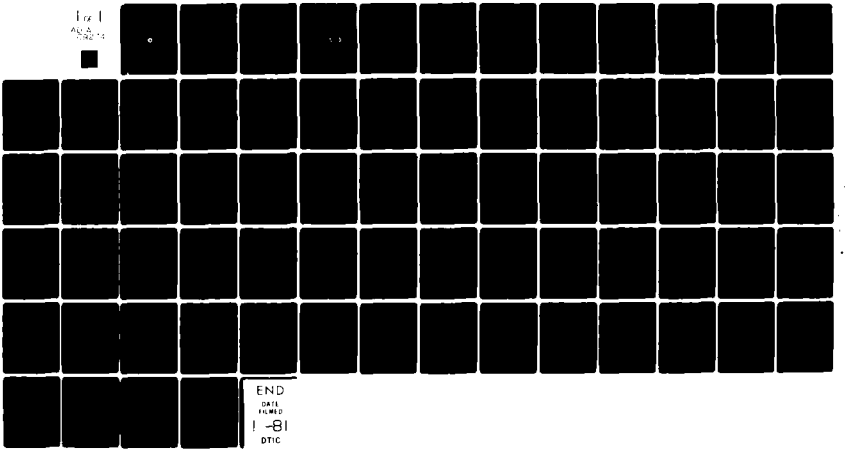
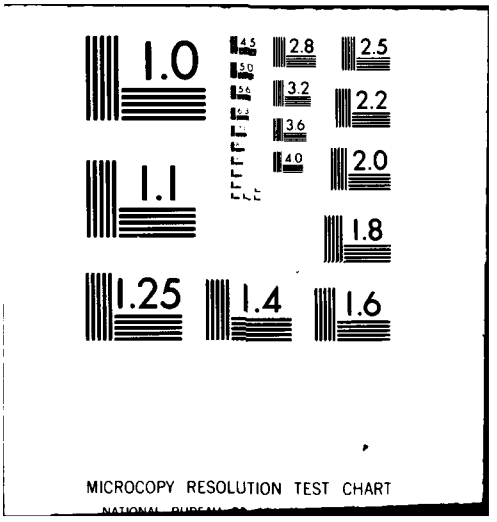
AD-A092 742 ANALYTIC SCIENCES CORP READING MA F/G 17/7
OMEGA SIGNAL COVERAGE PREDICTION DIAGRAMS FOR 10.2 KHZ. VOLUME --ETC(U)
OCT 80 R R GUPTA, S F DONNELLY, P M CREAMER DOT-CG-951480-A
UNCLASSIFIED TASC-TR-3077-2-VOL-2 NL



END
DATE FILMED
1-81
DTIC


1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
4.5
5.0
5.6
MICROCOPY RESOLUTION TEST CHART

LEVEL III

10

(6)

OMEGA SIGNAL COVERAGE PREDICTION DIAGRAMS FOR 10.2 kHz.

VOLUME II. INDIVIDUAL STATION DIAGRAMS.

AD A092742

(10) Radha R./Gupta
Stephen F./Donnelly
Paul M./Creamer
Suzanne/Sayer

THE ANALYTIC SCIENCES CORPORATION
One Jacob Way
Reading, Massachusetts 01867

(14) TASC-TR-3077-2-VOL-2

(12) 72

(11) October 1980

(9) FINAL REPORT. Sep 79-Oct 80

(15) DOT-CG-95148Ø-A

Document is available to the U.S. public through the National Technical Information Service, Springfield, Virginia 22161

DTIC ELECTE DEC 10 1980 S D

Prepared for

U.S. DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD
Omega Navigation System Operations Detail
Washington, D.C.

DTIC FILE COPY

404565

80 12 08 003

NOTICE

This document is disseminated under the sponsorship of the Department of Transportation in the interest of information exchange. The United States Government assumes no liability for its contents or use thereof.

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
	AD-A092 742	

4. Title and Subtitle
OMEGA SIGNAL COVERAGE PREDICTION DIAGRAMS FOR 10.2 kHz

5. Report Date
October 1980

6. Performing Organization Code

7. Author(s) R.R. Gupta, S.F. Donnelly, P.M. Creamer, and S. Saver

8. Performing Organization Report No.
TR-3077-2

9. Performing Organization Name and Address
THE ANALYTIC SCIENCES CORPORATION
One Jacob Way
Reading, Massachusetts 01867

10. Work Unit No. (TRAIS)

11. Contract or Grant No.
DOT-CG-951480-A

12. Sponsoring Agency Name and Address
U.S. Department of Transportation
U.S. Coast Guard
Omega Navigation System Operations Detail
Washington, D.C. 20593

13. Type of Report and Period Covered
Final Report
Sept. 1979 - Oct. 1980

14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

Individual Omega station and composite (Omega Navigation System) 10.2 kHz signal coverage prediction diagrams have been developed for eight times. The diagrams show the global accessibility of "usable" 10.2 kHz signals at eight fixed diurnal/seasonal times for two usable signal access criteria. Criterion I requires: signal-to-noise ratio (SNR) > -20 dB (in a 100 Hz noise bandwidth) and $\Delta\phi \leq 20$ centicycles (cec), where $\Delta\phi$ is the modal interference-induced phase deviation in the signal phase relative to the reference signal phase. Criterion II differs from Criterion I in that the SNR > -30 dB. Volume I presents the diagram development methodology and contains individual station nighttime modal interference diagrams. Each modal interference diagram identifies regions throughout the world where $\Delta\phi \leq 20$ cec for nighttime propagation conditions.

Volume II presents 64 individual Omega station diagrams (Mercator projection): eight selected coverage times for each of eight stations. Each diagram displays the SNR and $\Delta\phi$ contours for a designated signal access criterion and coverage time.

17. Key Words	18. Distribution Statement
OMEGA Very Low Frequency Propagation Omega Signal Coverage Diagram Omega Modal Interference Diagram	Document is available to the U.S. public through the National Technical Information Service Springfield, Virginia 22161

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
UNCLASSIFIED	UNCLASSIFIED		

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

16. ABSTRACT (Continued)

Volume III contains 48 composite coverage diagrams which embody the eight coverage times, two signal access criteria, and three different projections (North and South pole centered Azimuthal Equal Distance, and Mercator). Each diagram displays the global accessibility of usable signals from the system for a designated signal access criterion and coverage time.

Volume IV tabulates the bearing angles of great circles to each Omega station. These angles are computed at latitude/longitude grid points having a uniform spacing of four degrees.

Accession For
NTIS GRA&I [X]
DTIC TAB [ ]
Unannounced [ ]
Justification
By
Distribution/
Availability Codes
Dist | Avail and/or Special
A

DTIC
ELECTE
DEC 10 1980
S D
D

PREFACE

This volume contains 64 individual Omega station 10.2 kHz signal coverage prediction diagrams prepared for eight selected times: 0600 and 1800 GMT in February, May, August, and November. The key for locating diagrams in this report is given in the Table of Contents. Each station diagram displays the following station contours at the designated coverage time:

- -20 and -30 dB (decibels) SNR (signal-to-noise ratio) threshold contours (solid line)
- 20 cec (centicycles) $\Delta\phi$ threshold contour (dotted line) where $\Delta\phi$ is modal interference-induced phase deviation in the signal phase from the reference signal phase.

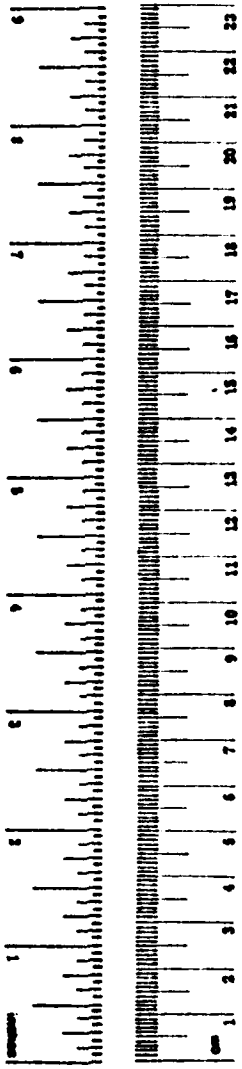
In each diagram, the SNR is above (or $\Delta\phi$ is below) the threshold level on the side of the contour in the direction of the indicated arrow. Receiver noise bandwidth is assumed to be 100 Hz for all diagrams and the radiated power of each transmitting station is taken to be 10 kW.

METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
		MASS (weight)		
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
		VOLUME		
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.96	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

*1 in = 2.54 (exactly). For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures, Price $2.25, SD Catalog No. C13.10:286.



Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
		AREA		
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
		MASS (weight)		
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
		VOLUME		
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
		TEMPERATURE (exact)		
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F

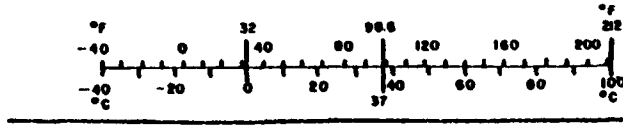
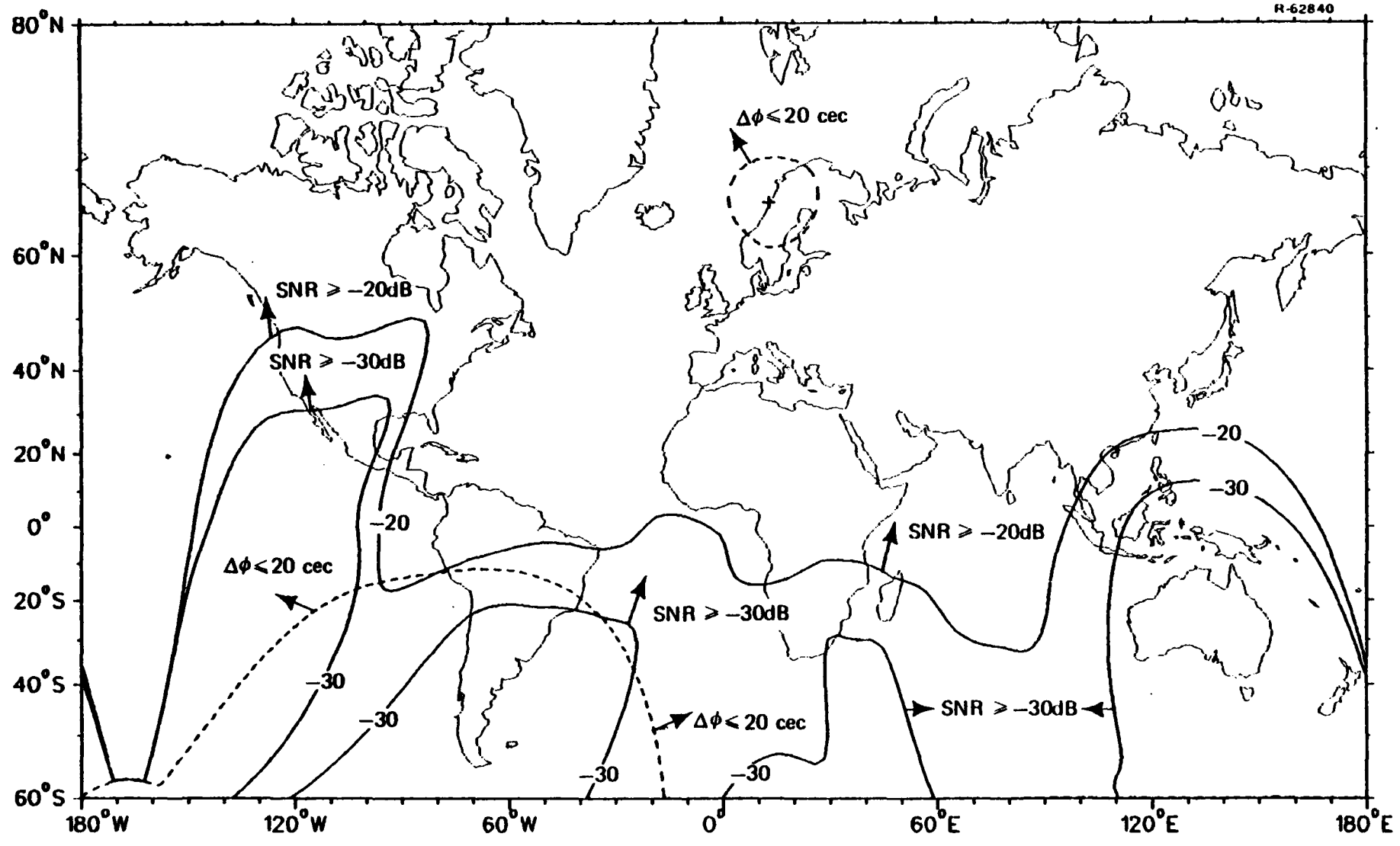
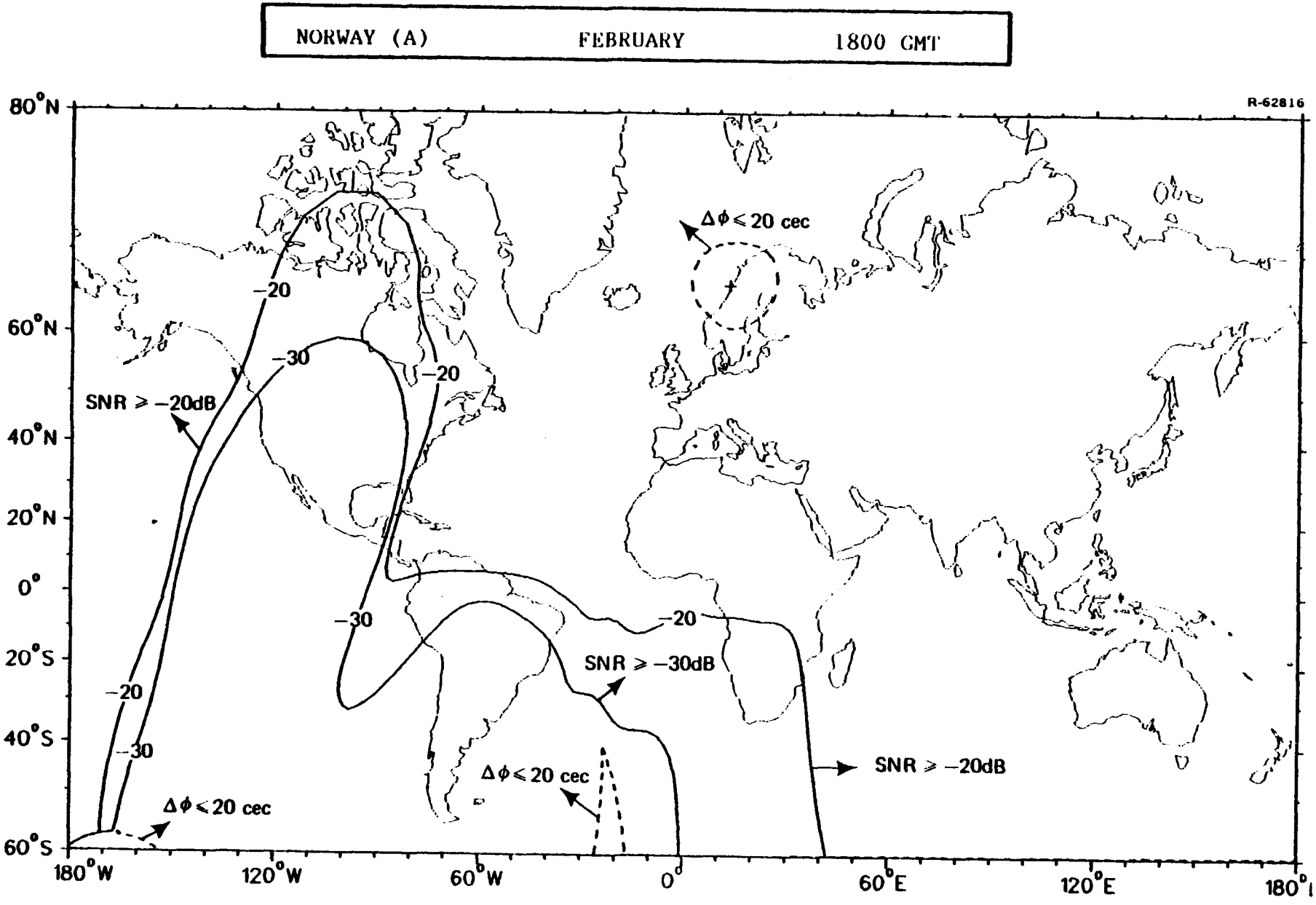


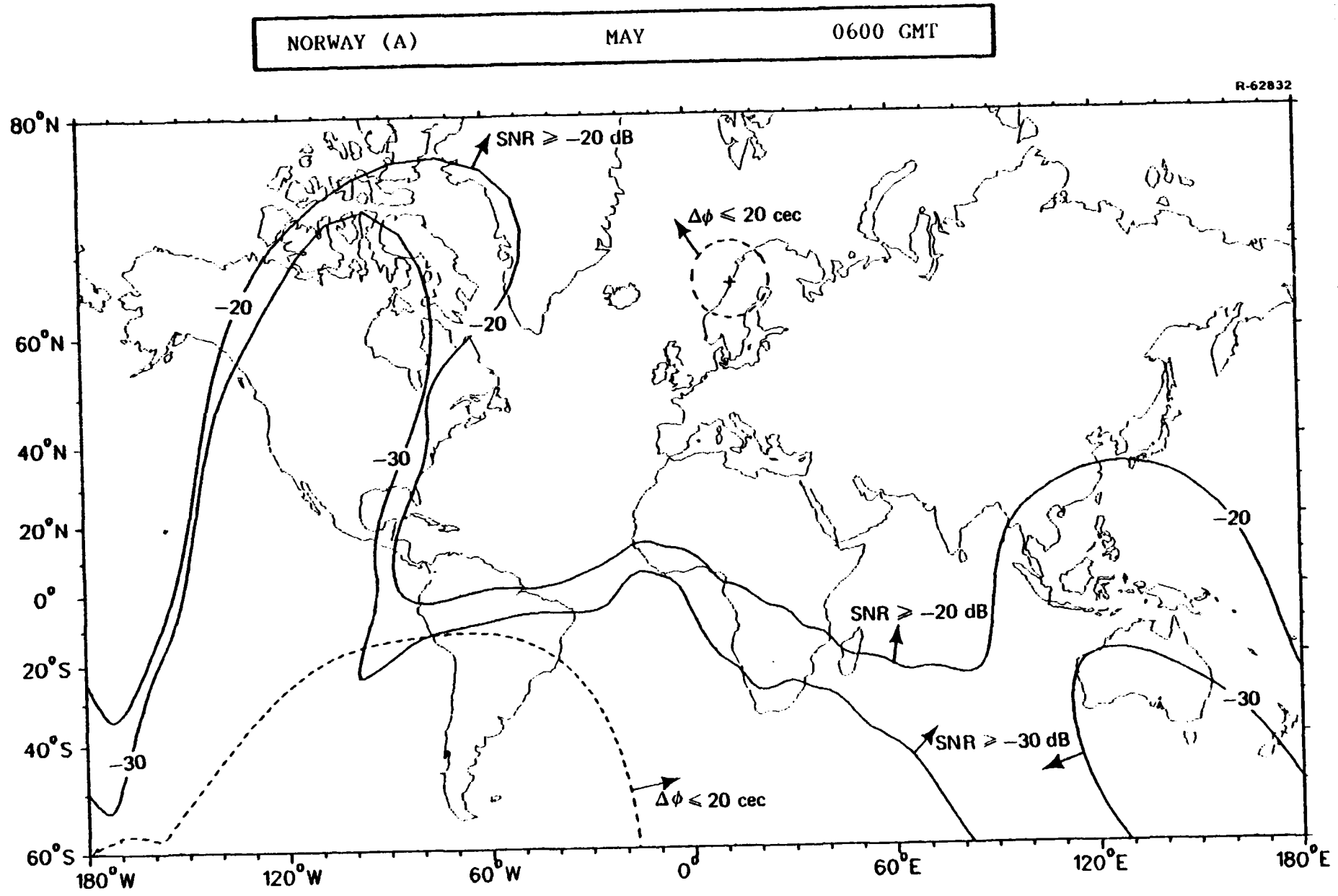
TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

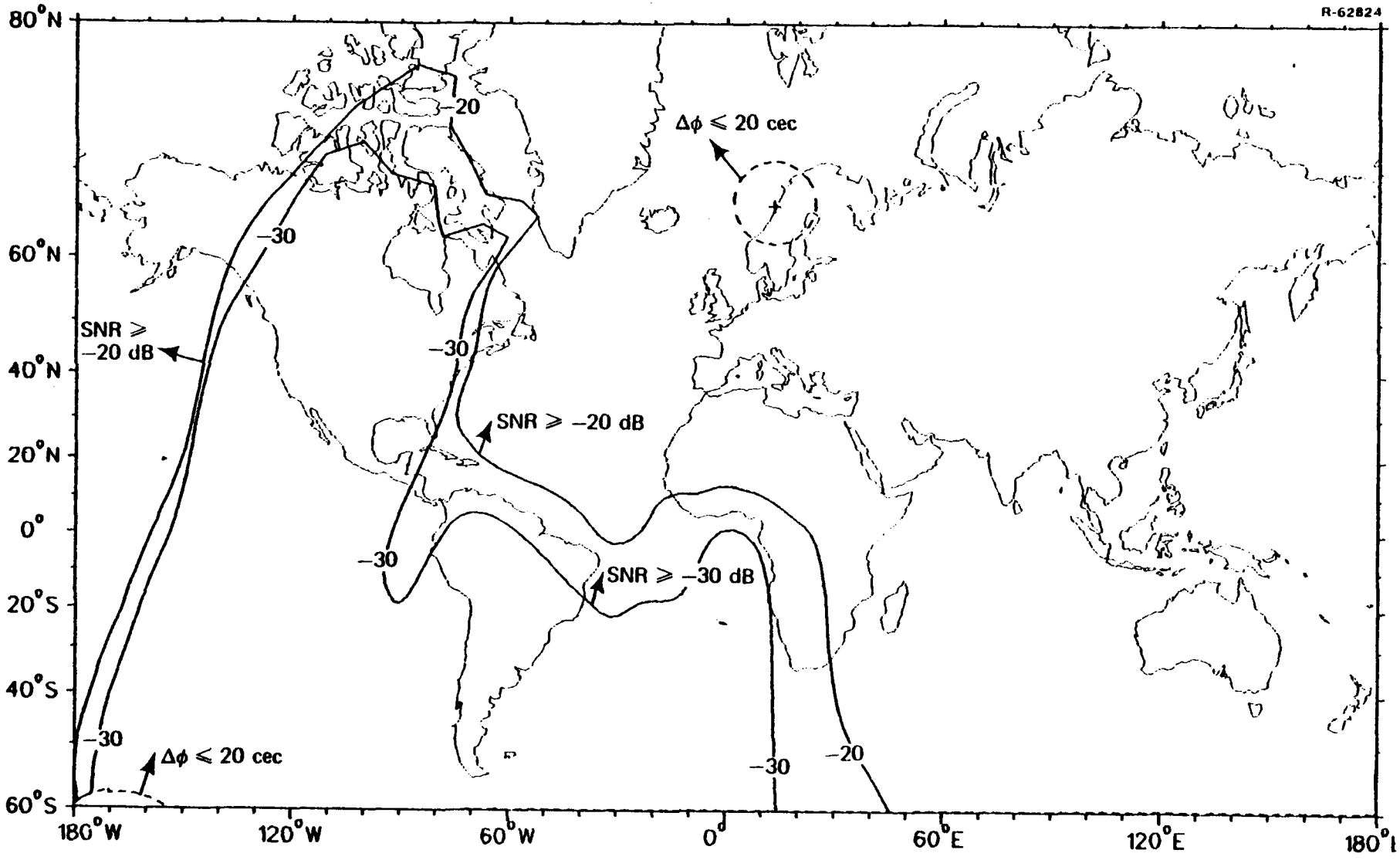
NORWAY (A) FEBRUARY 0600 GMT

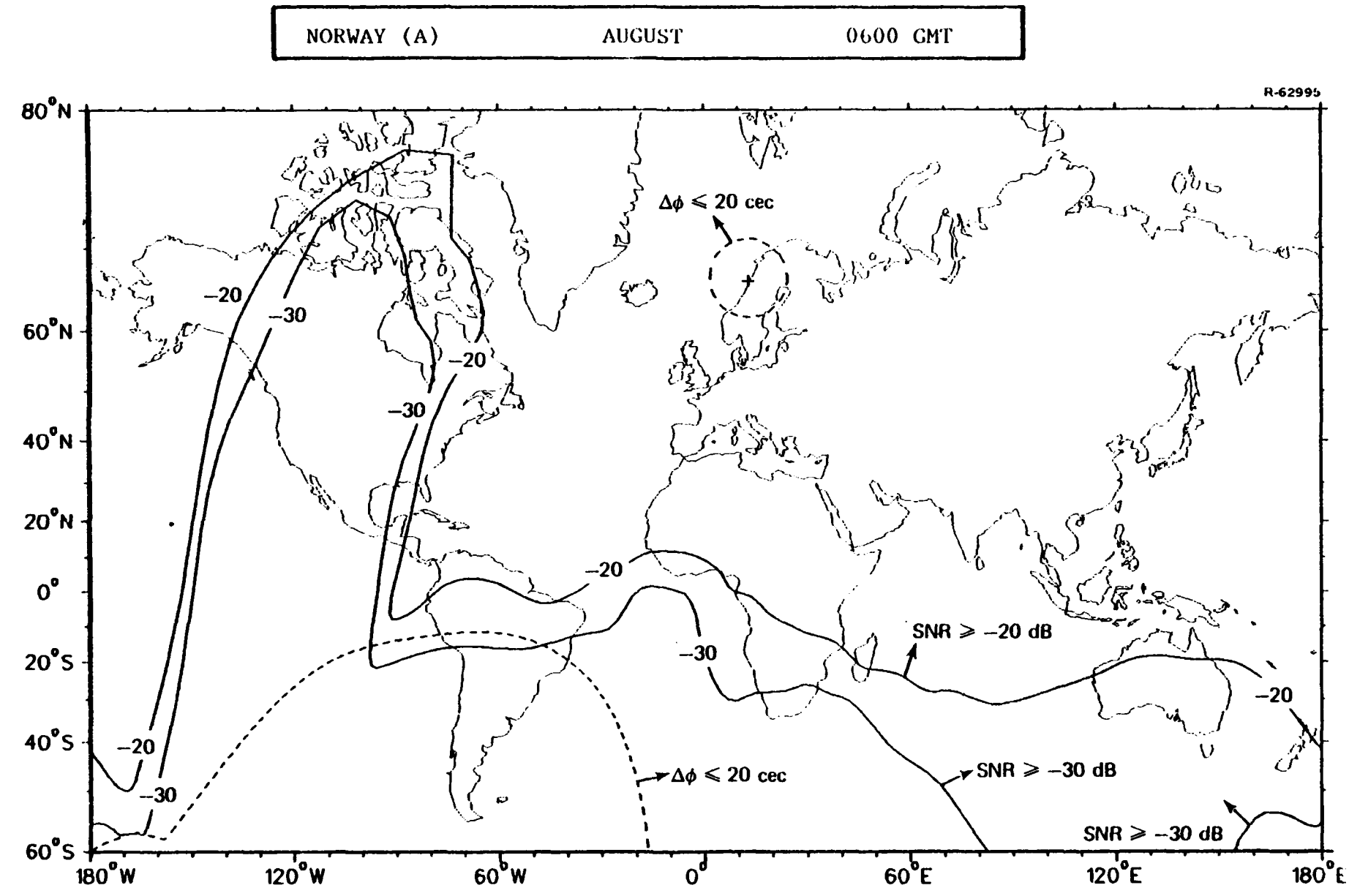


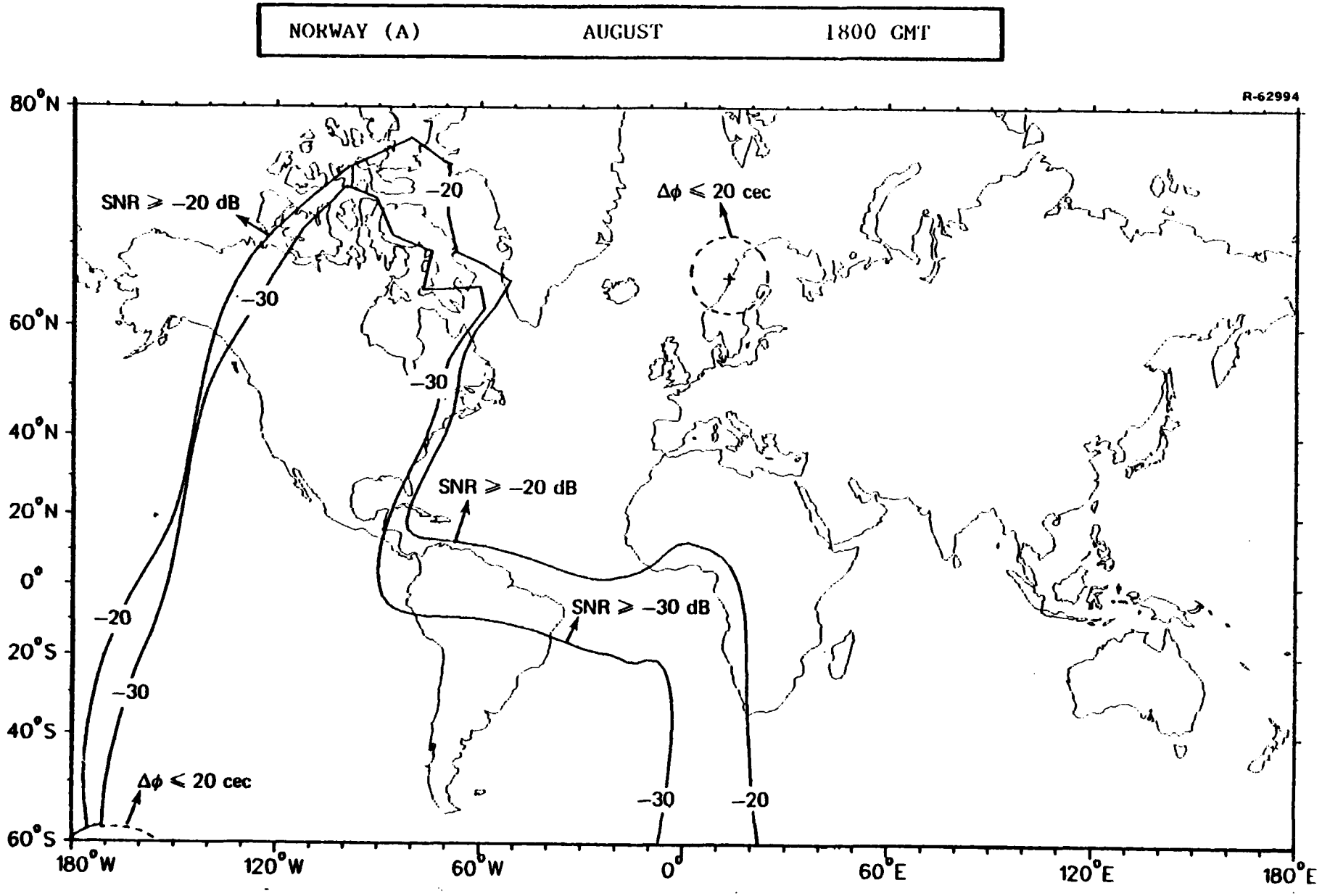

NORWAY (A) FEBRUARY 1800 GMT
R-62816
80°N
60°N
40°N
20°N
0°
20°S
40°S
60°S
180°W
120°W
60°W
0°
60°E
120°E
180°
SNR ≥ −20dB
−20
−30
−20
−30
−20
SNR ≥ −30dB
SNR ≥ −20dB
−20
−30
Δϕ ≤ 20 cec
Δϕ ≤ 20 cec
Δϕ ≤ 20 cec


NORWAY (A)
MAY
0600 GMT
R-62832
80°N
60°N
40°N
20°N
0°
20°S
40°S
60°S
180°W
120°W
60°W
0°
60°E
120°E
180°E
SNR ≥ −20 dB
Δφ ≤ 20 cec
−20
−30
SNR ≥ −20 dB
SNR ≥ −30 dB
Δφ ≤ 20 cec

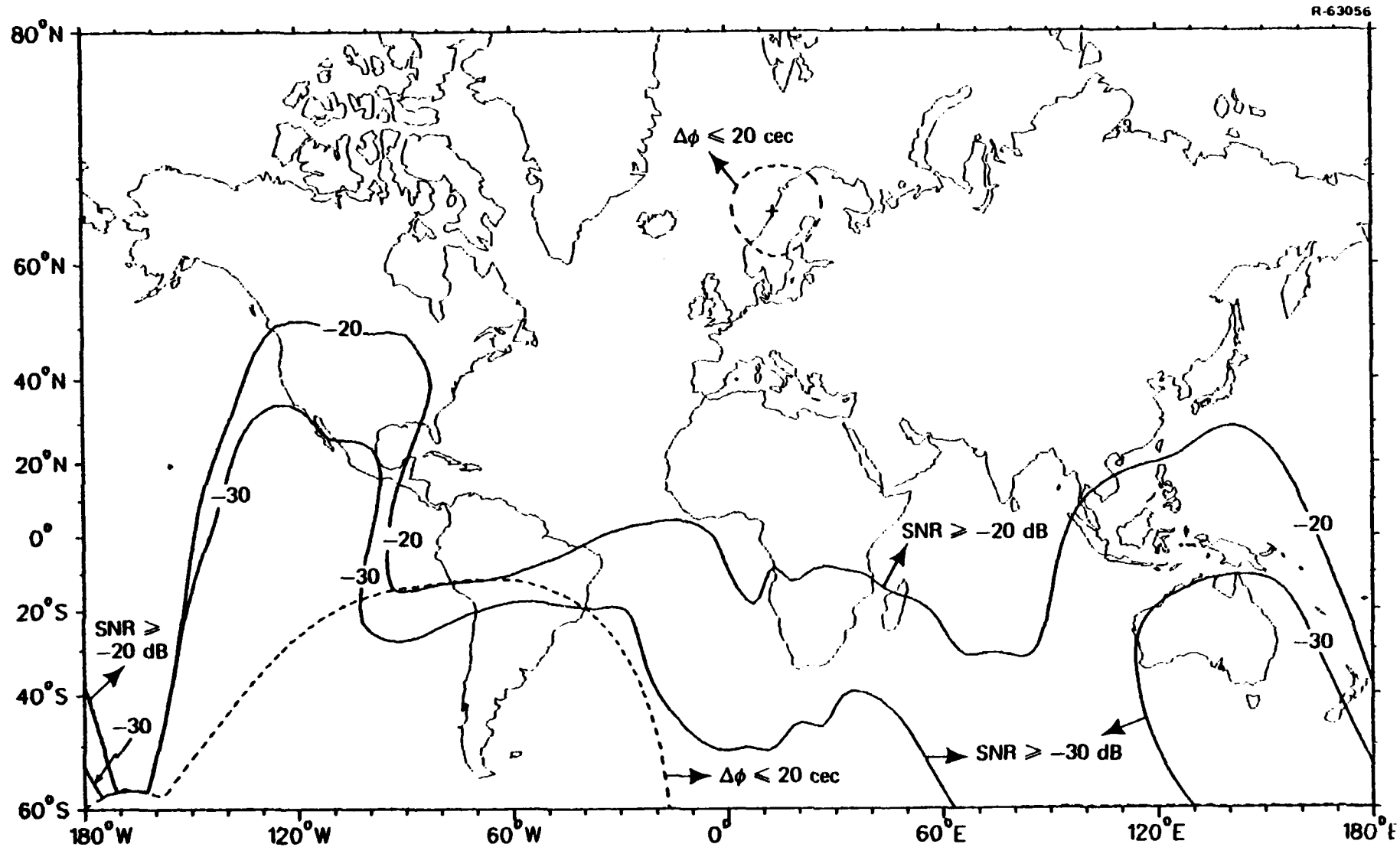
NORWAY (A) MAY 1800 GMT

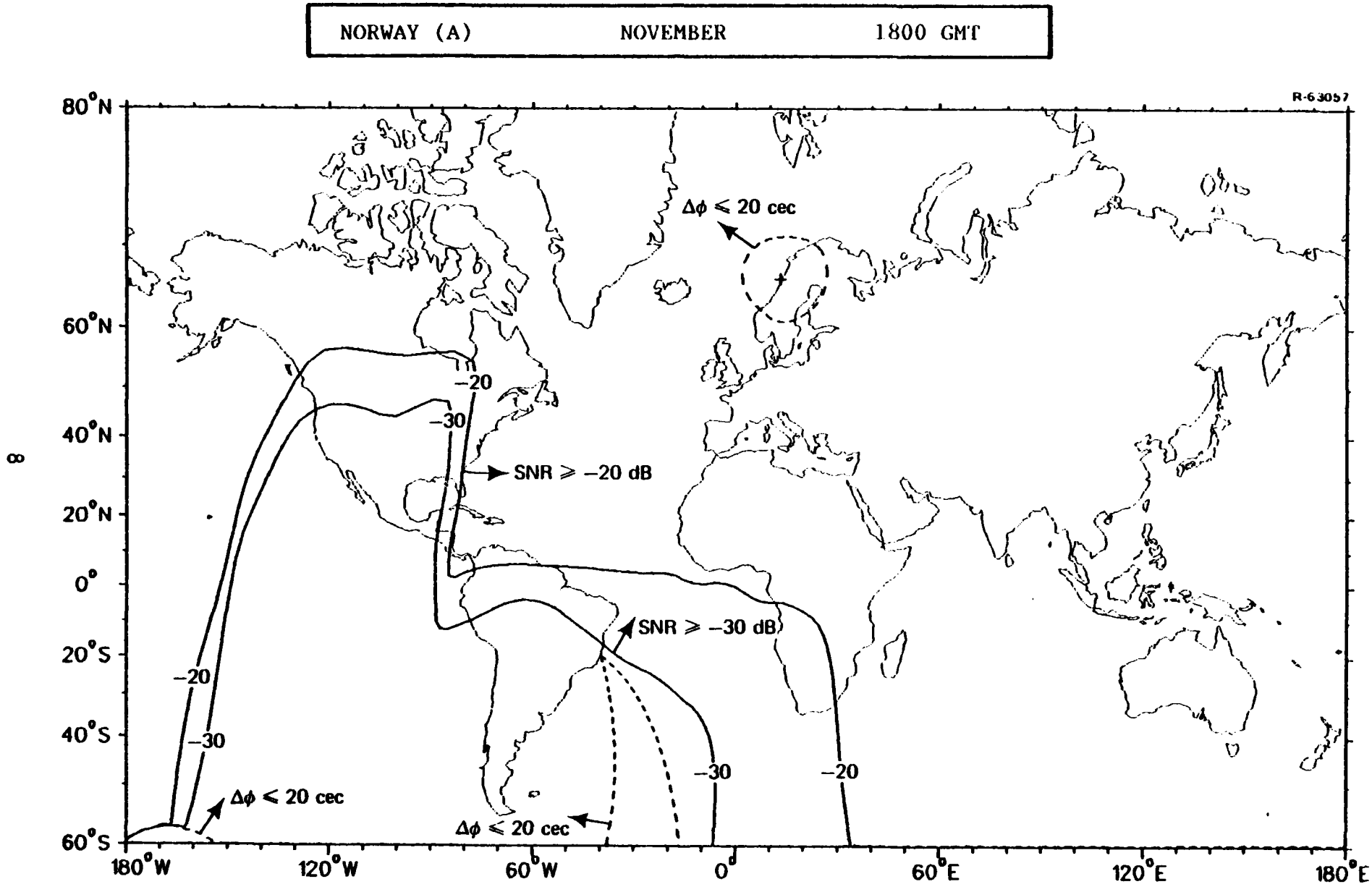



NORWAY (A)
AUGUST
0600 GMT
R-62995
80°N
60°N
40°N
20°N
0°
20°S
40°S
60°S
180°W
120°W
60°W
0°
60°E
120°E
180°E
Δϕ ≤ 20 cec
-20
-30
-20
-30
-20
-30
-20
-30
SNR ≥ -20 dB
SNR ≥ -30 dB
SNR ≥ -30 dB
Δϕ ≤ 20 cec

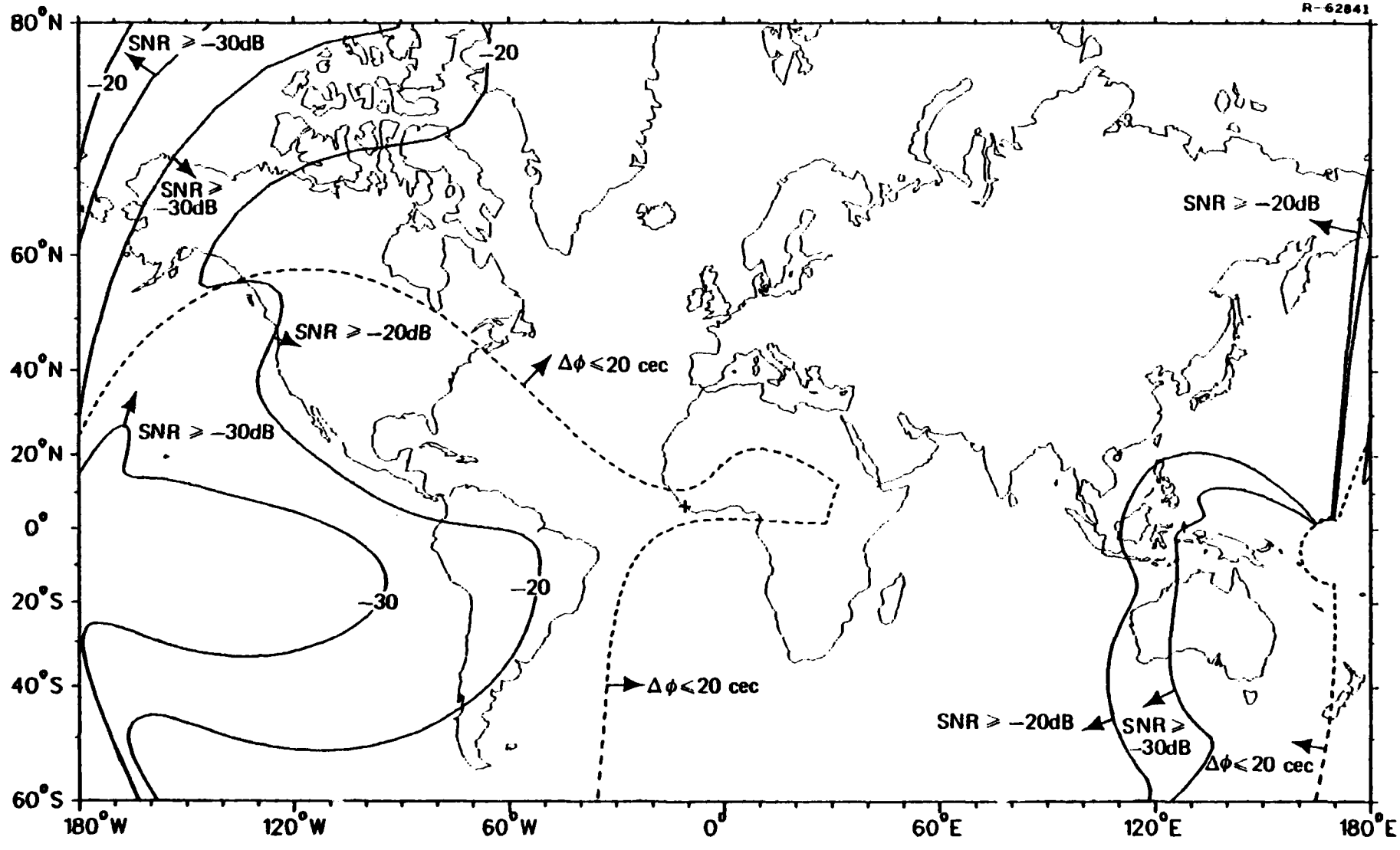

NORWAY (A) AUGUST 1800 GMT
R-62994
80°N
60°N
40°N
20°N
0°
20°S
40°S
60°S
180°W
120°W
60°W
0°
60°E
120°E
180°E
SNR ≥ −20 dB
−20
−30
Δφ ≤ 20 cec
SNR ≥ −20 dB
−30
SNR ≥ −30 dB
−20
−30
Δφ ≤ 20 cec
−30
−20

NORWAY (A)	NOVEMBER	0600 GMT

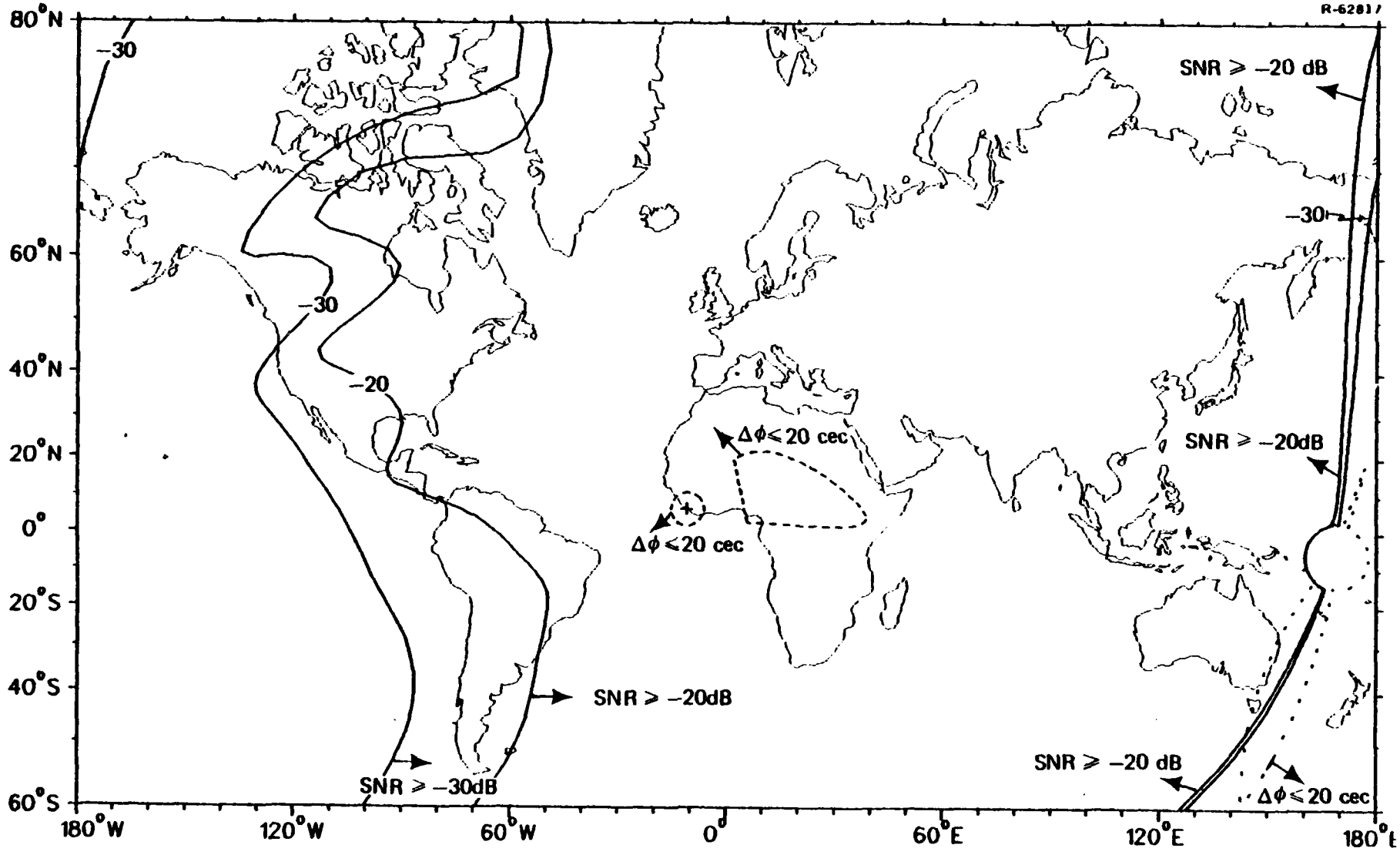



NORWAY (A) NOVEMBER 1800 GMT
R-63057
80°N
60°N
40°N
20°N
0°
20°S
40°S
60°S
180°W
120°W
60°W
0°
60°E
120°E
180°E
Δφ ≤ 20 cec
SNR ≥ −20 dB
SNR ≥ −30 dB
−20
−30
Δφ ≤ 20 cec
Δφ ≤ 20 cec
−30
−20

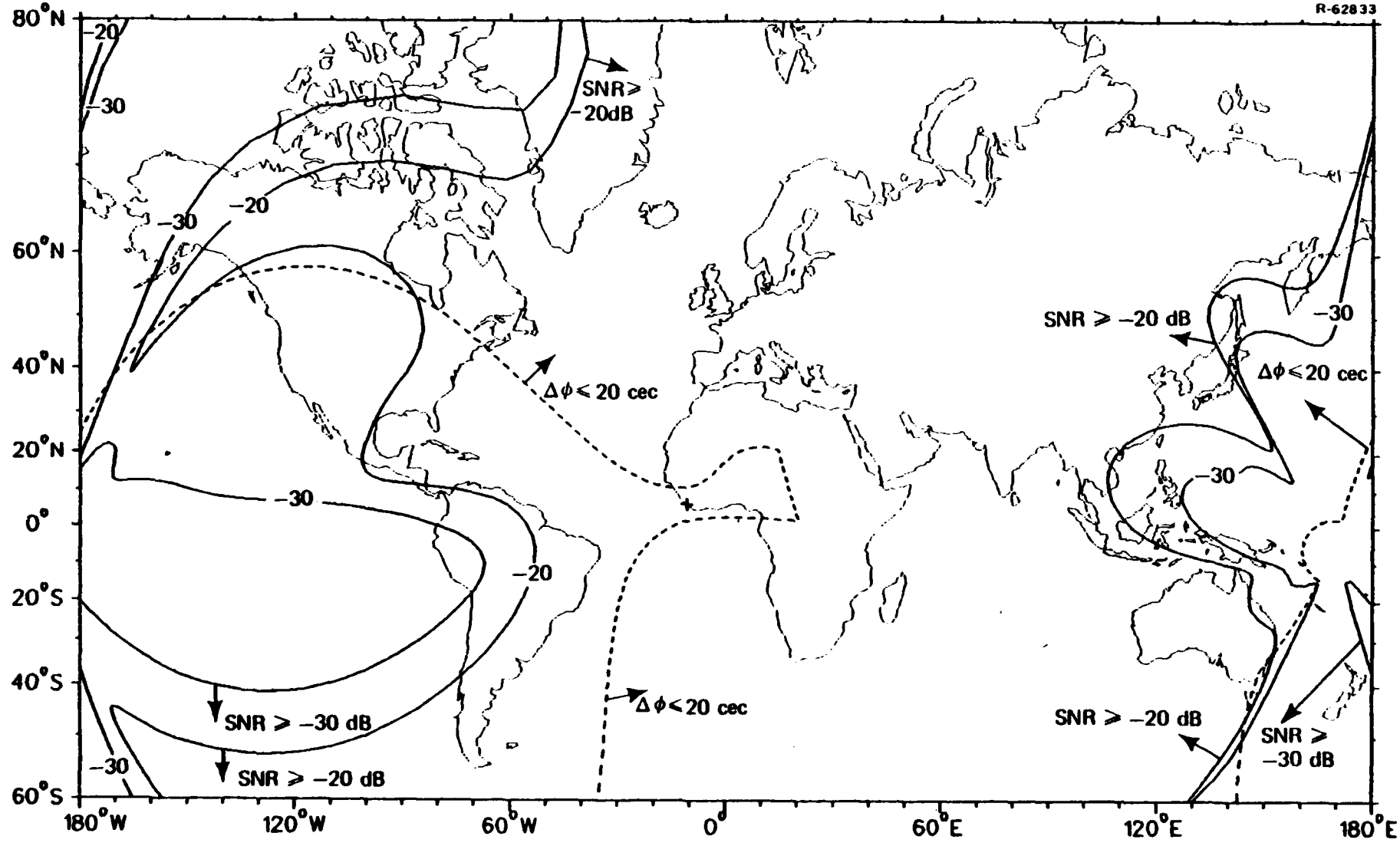
LIBERIA (B) FEBRUARY 0600 GMT

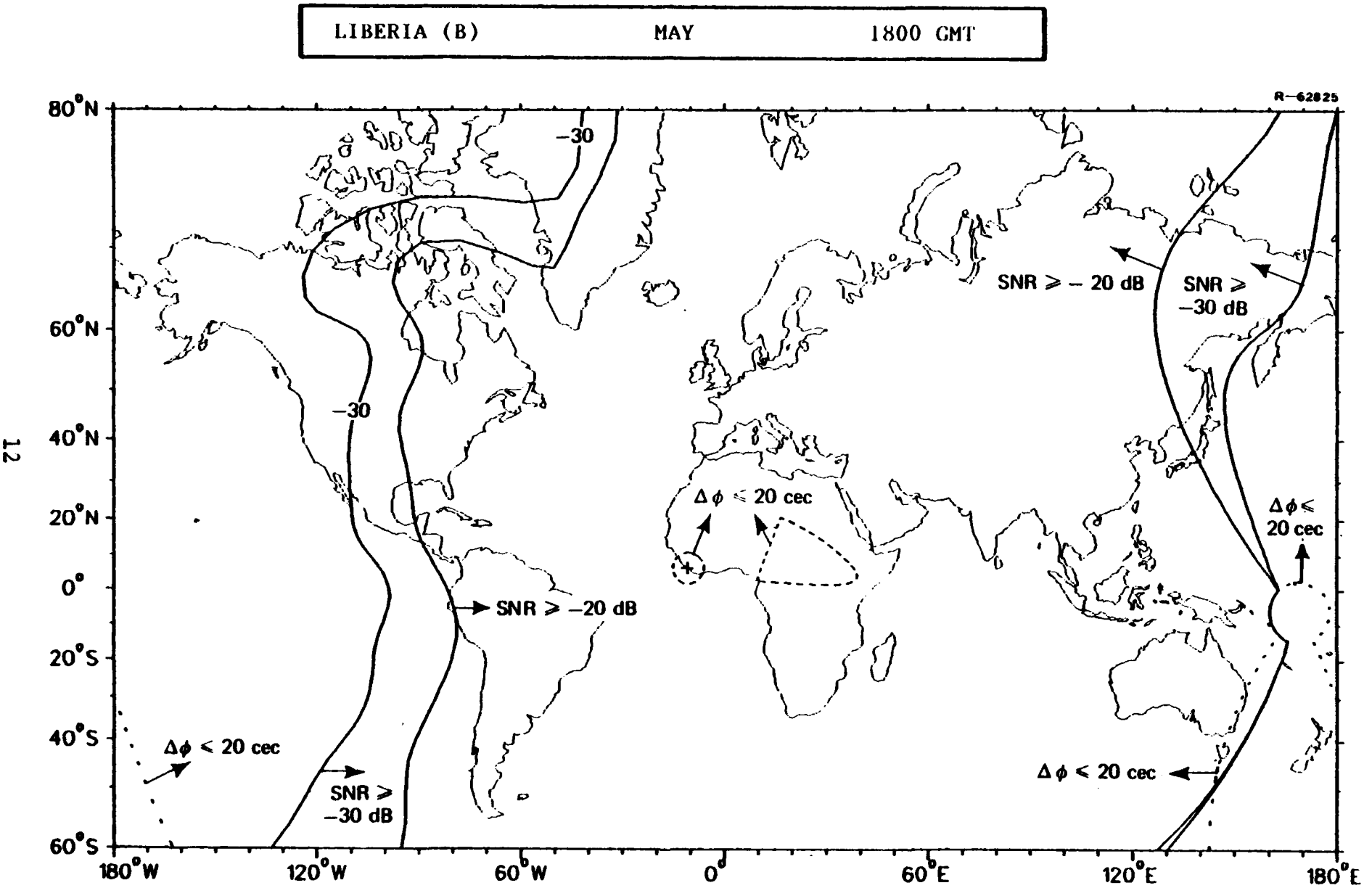


LIBERIA (B) FEBRUARY 1800 GMT

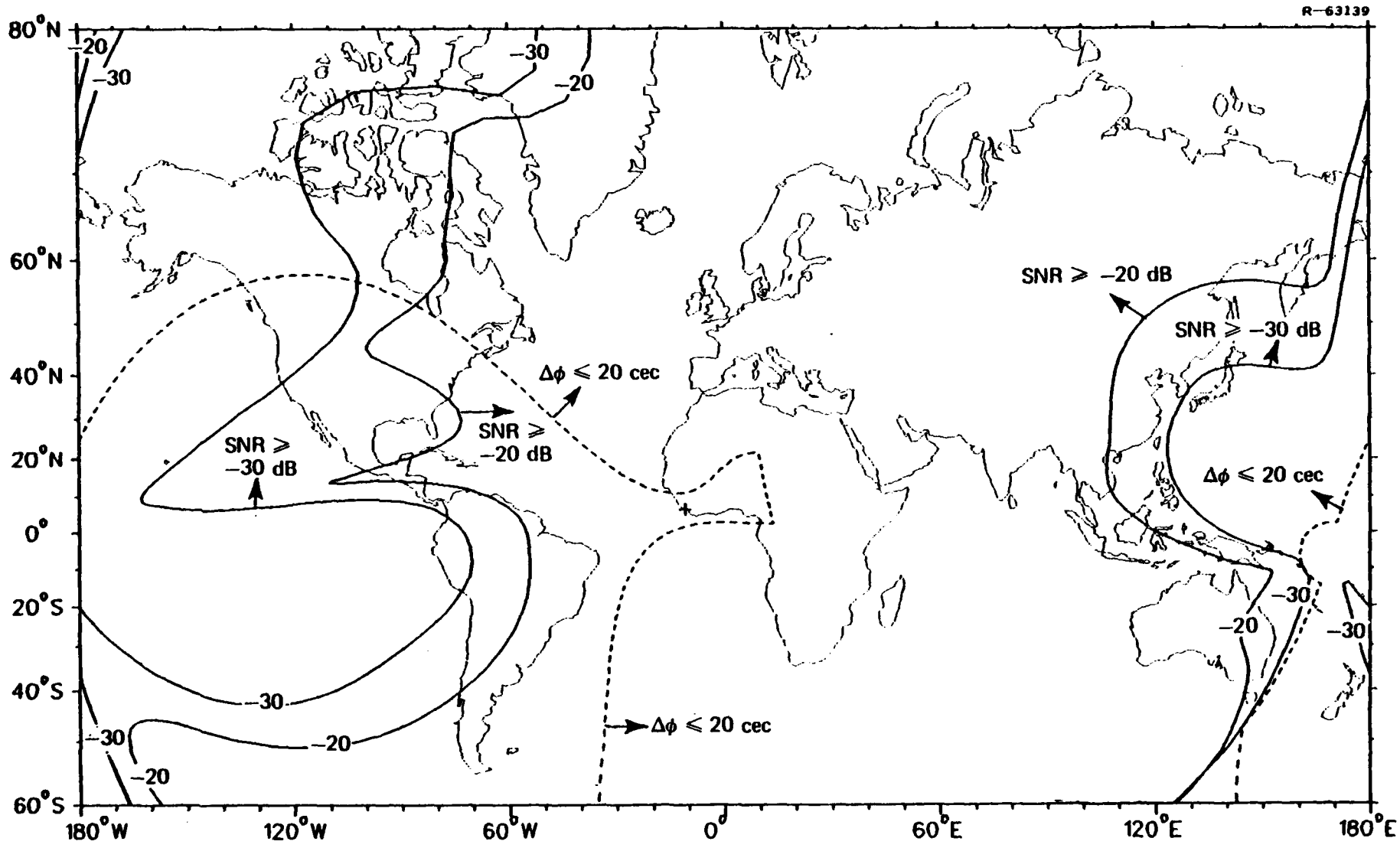


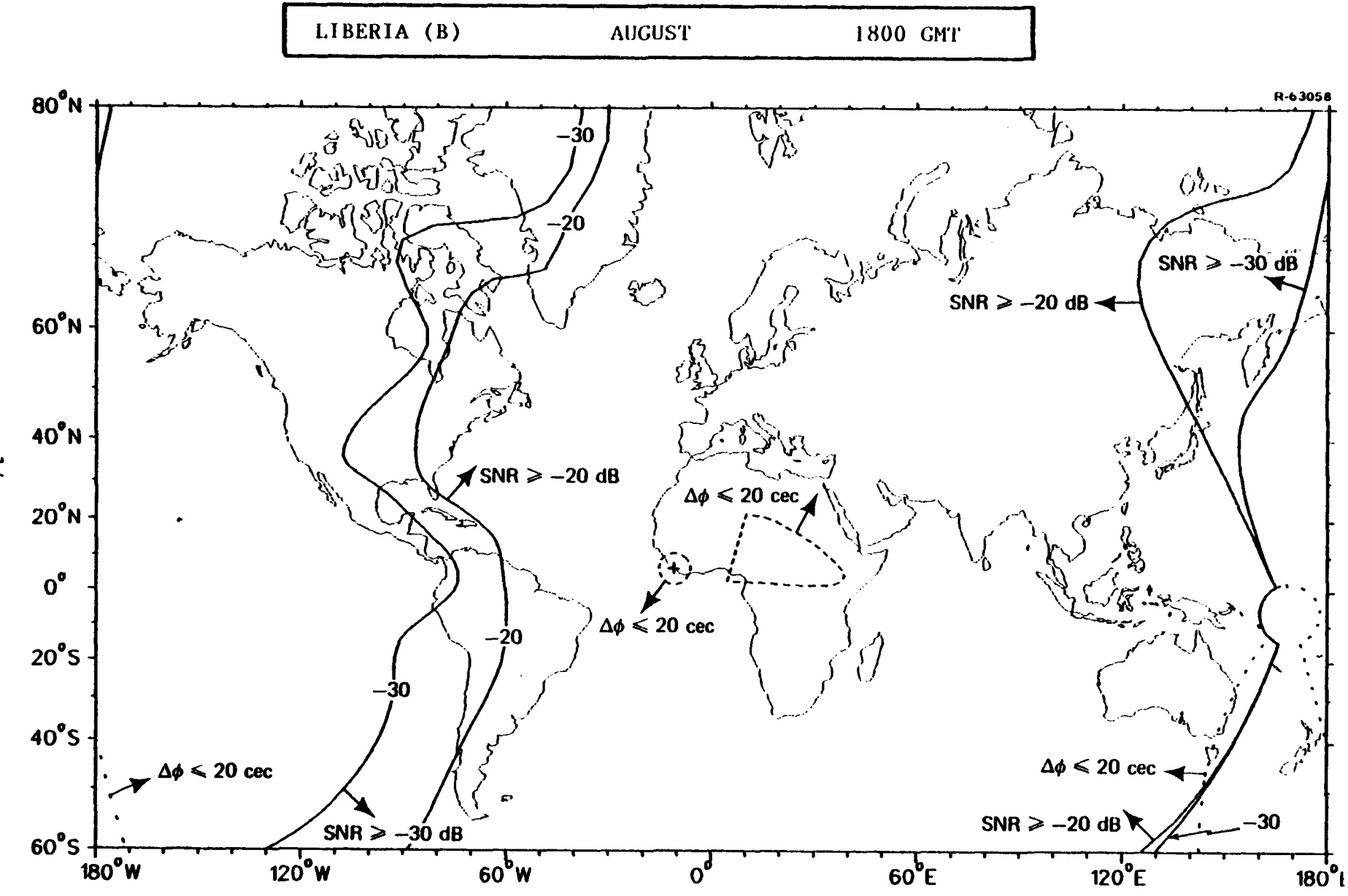
LIBERIA (B) MAY 0600 GMT



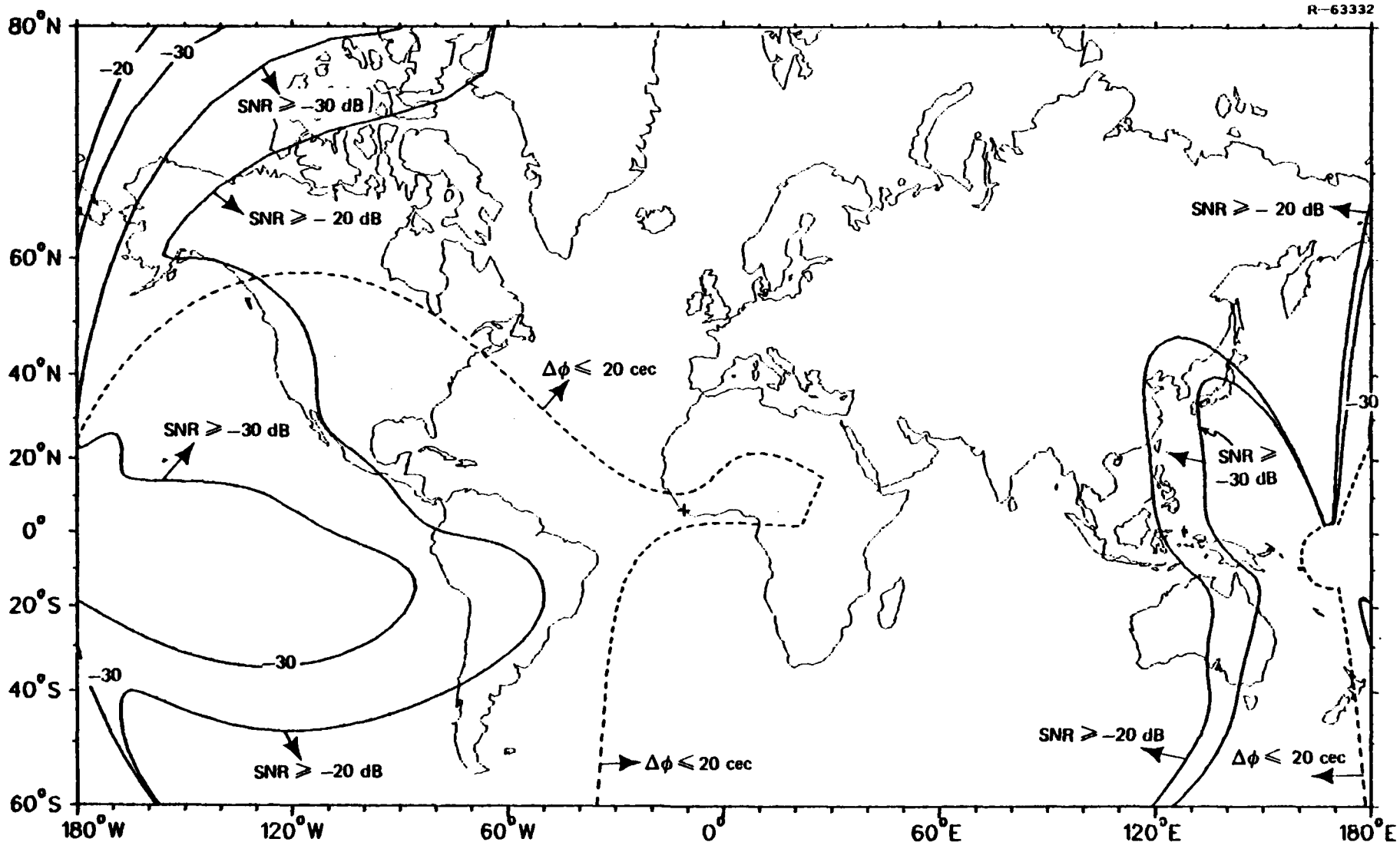

LIBERIA (B)
MAY
1800 GMT
R-62825
80°N
60°N
40°N
20°N
0°
20°S
40°S
60°S
180°W
120°W
60°W
0°
60°E
120°E
180°E
-30
-30
SNR ≥ -20 dB
SNR ≥ -30 dB
SNR ≥ -20 dB
SNR ≥ -30 dB
Δφ ≤ 20 cec
Δφ ≤ 20 cec
Δφ ≤ 20 cec
Δφ ≤ 20 cec

LIBERIA (B)	AUGUST	0600 GMT

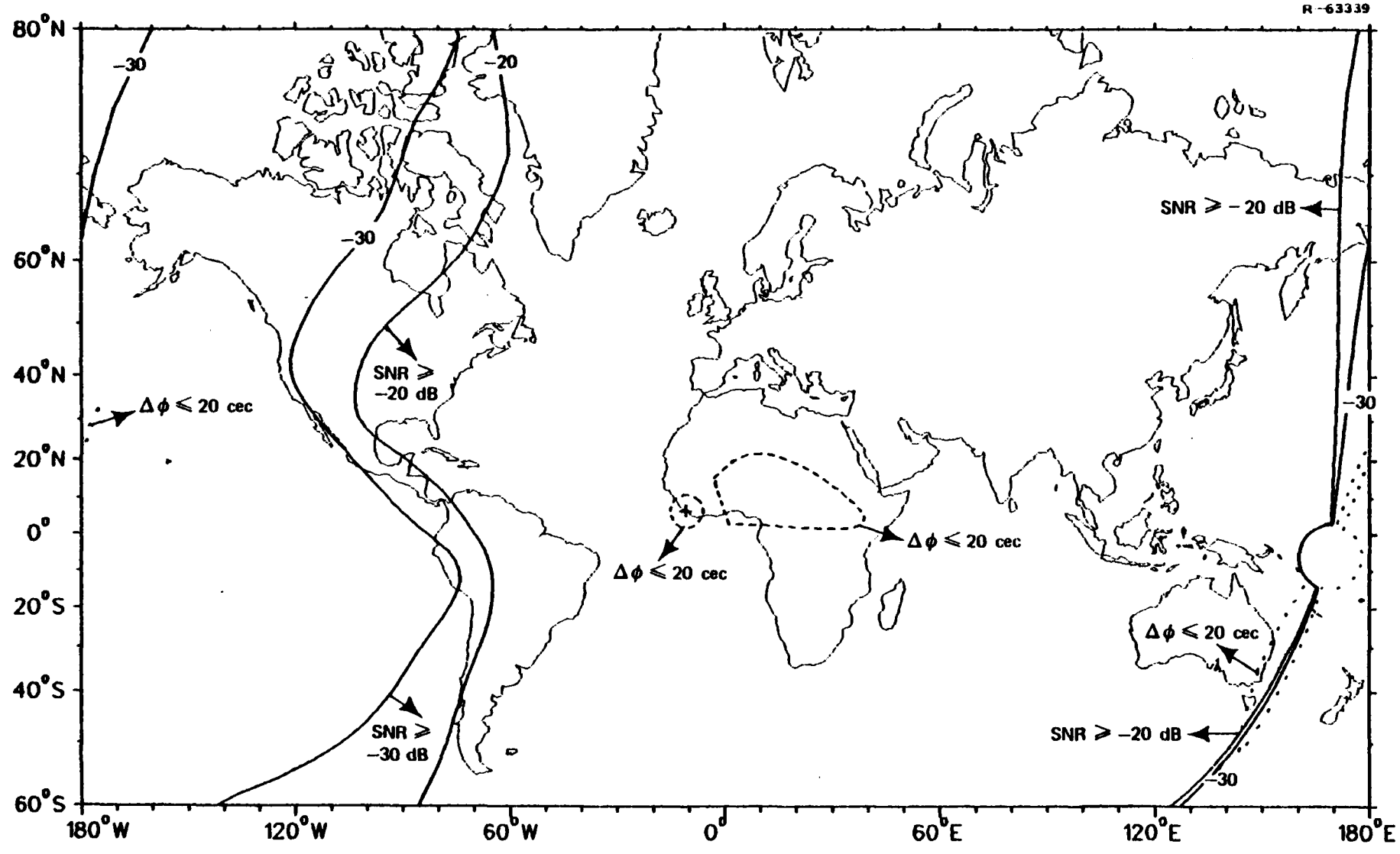



LIBERIA (B)
AUGUST
1800 GMT
R-63058
80°N
60°N
40°N
20°N
0°
20°S
40°S
60°S
180°W
120°W
60°W
0°
60°E
120°E
180°E
-30
-20
SNR ≥ -30 dB
SNR ≥ -20 dB
Δφ ≤ 20 cec
SNR ≥ -20 dB
Δφ ≤ 20 cec
-20
-30
Δφ ≤ 20 cec
SNR ≥ -30 dB
Δφ ≤ 20 cec
SNR ≥ -20 dB
-30

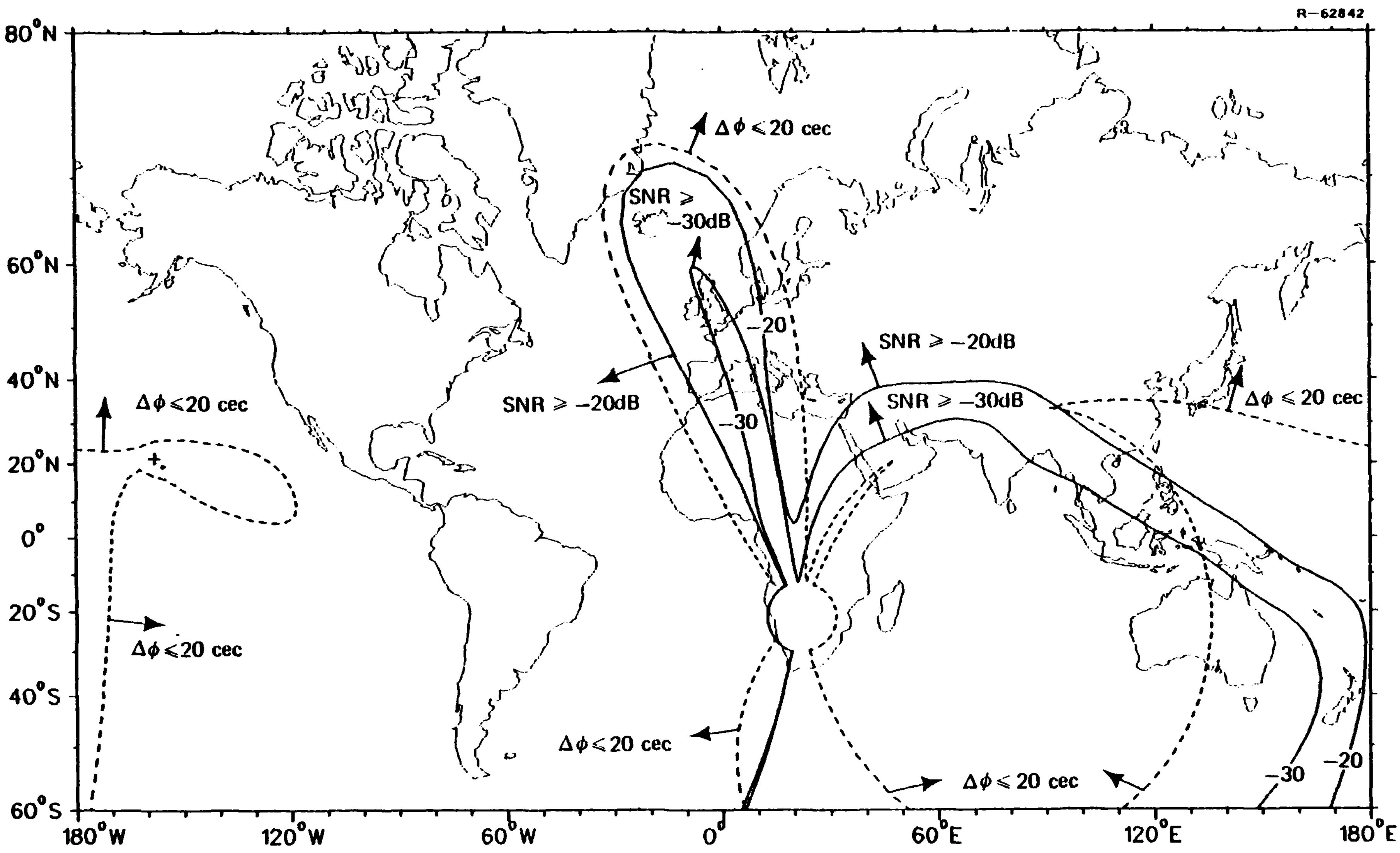
LIBERIA (B)	NOVEMBER	0600 GMT



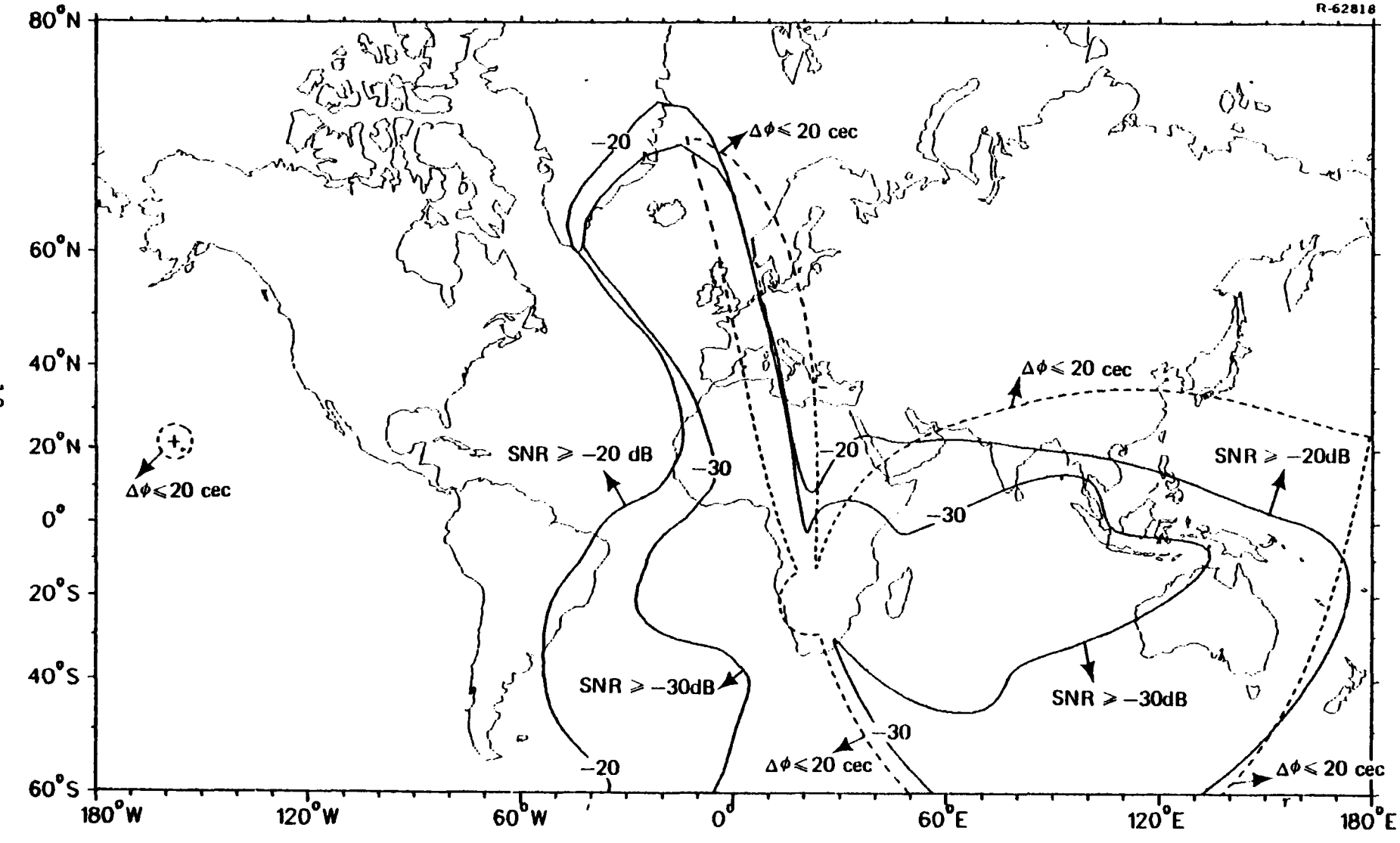
LIBERIA (B)	NOVEMBER	1800 GMT

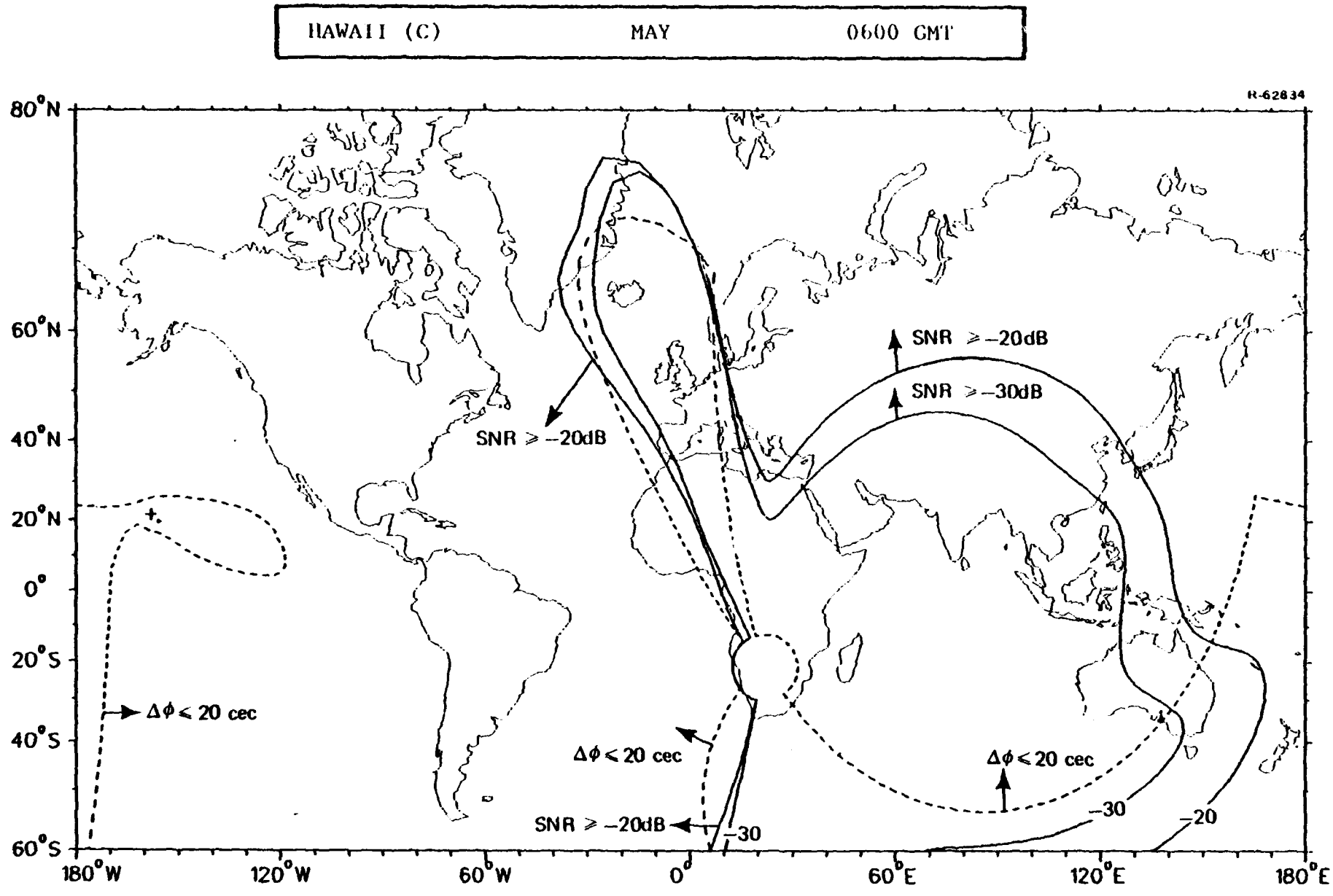


HAWAII (C) FEBRUARY 0600 GMT

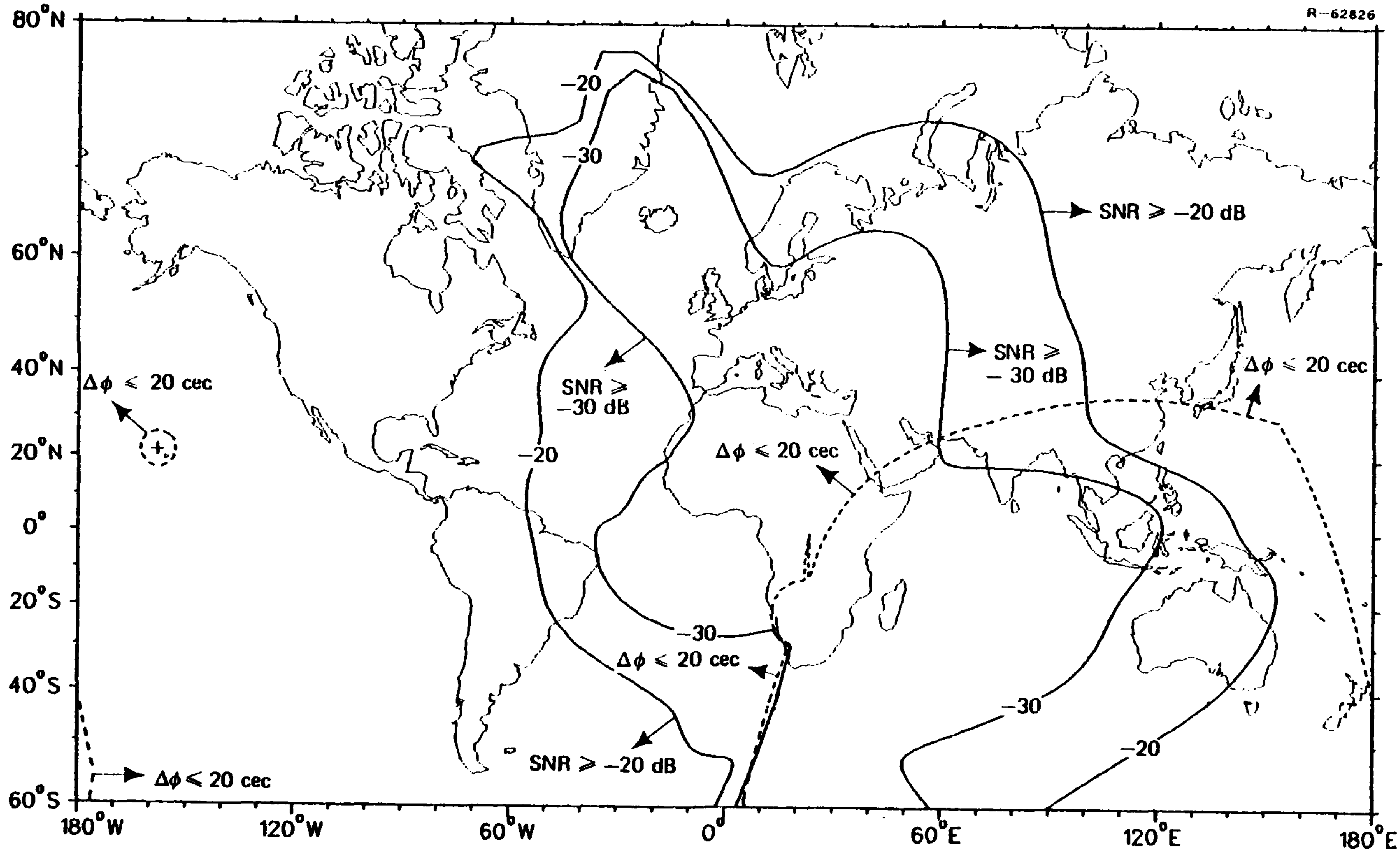


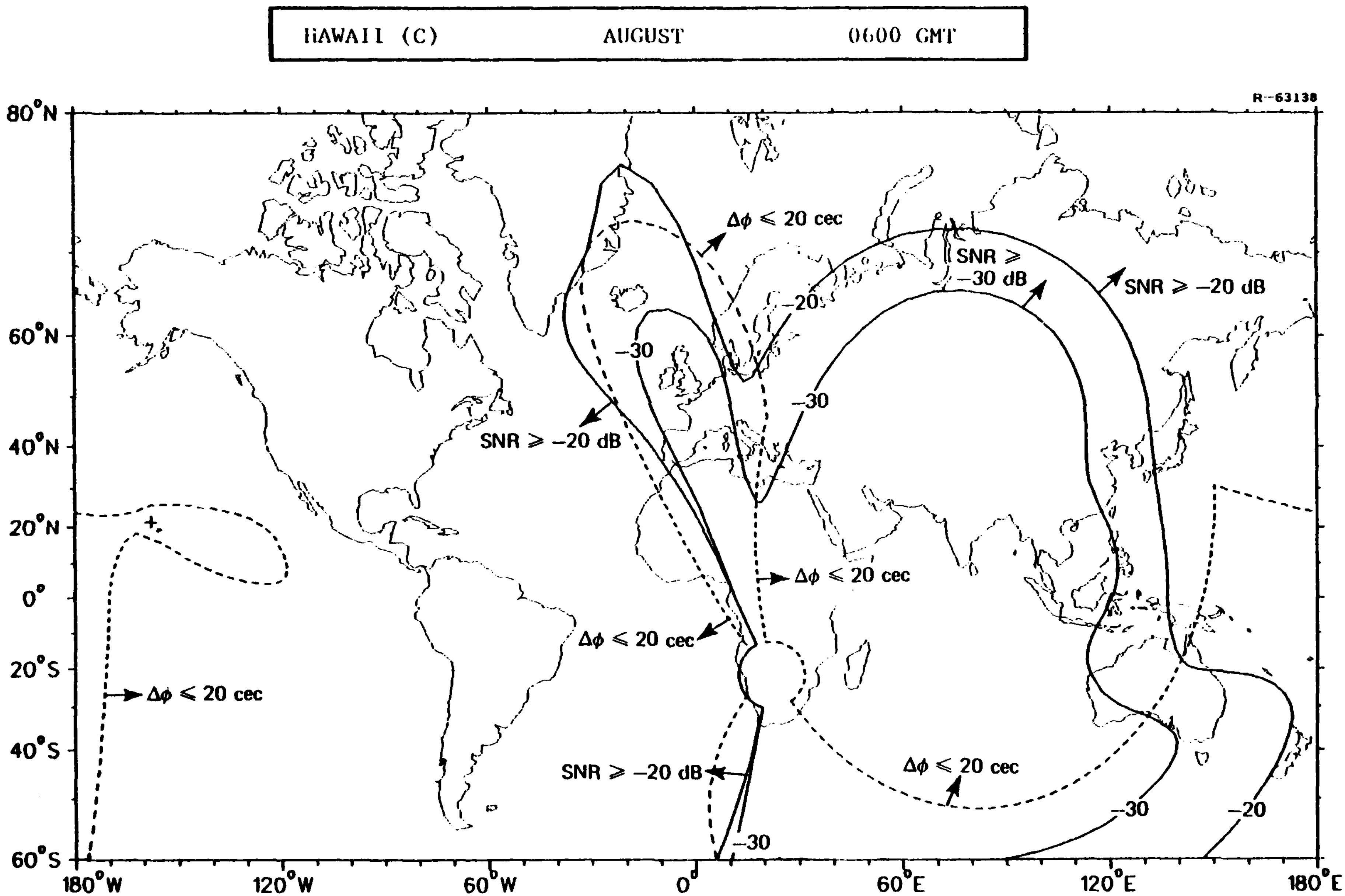
HAWAII (C) FEBRUARY 1800 GMT

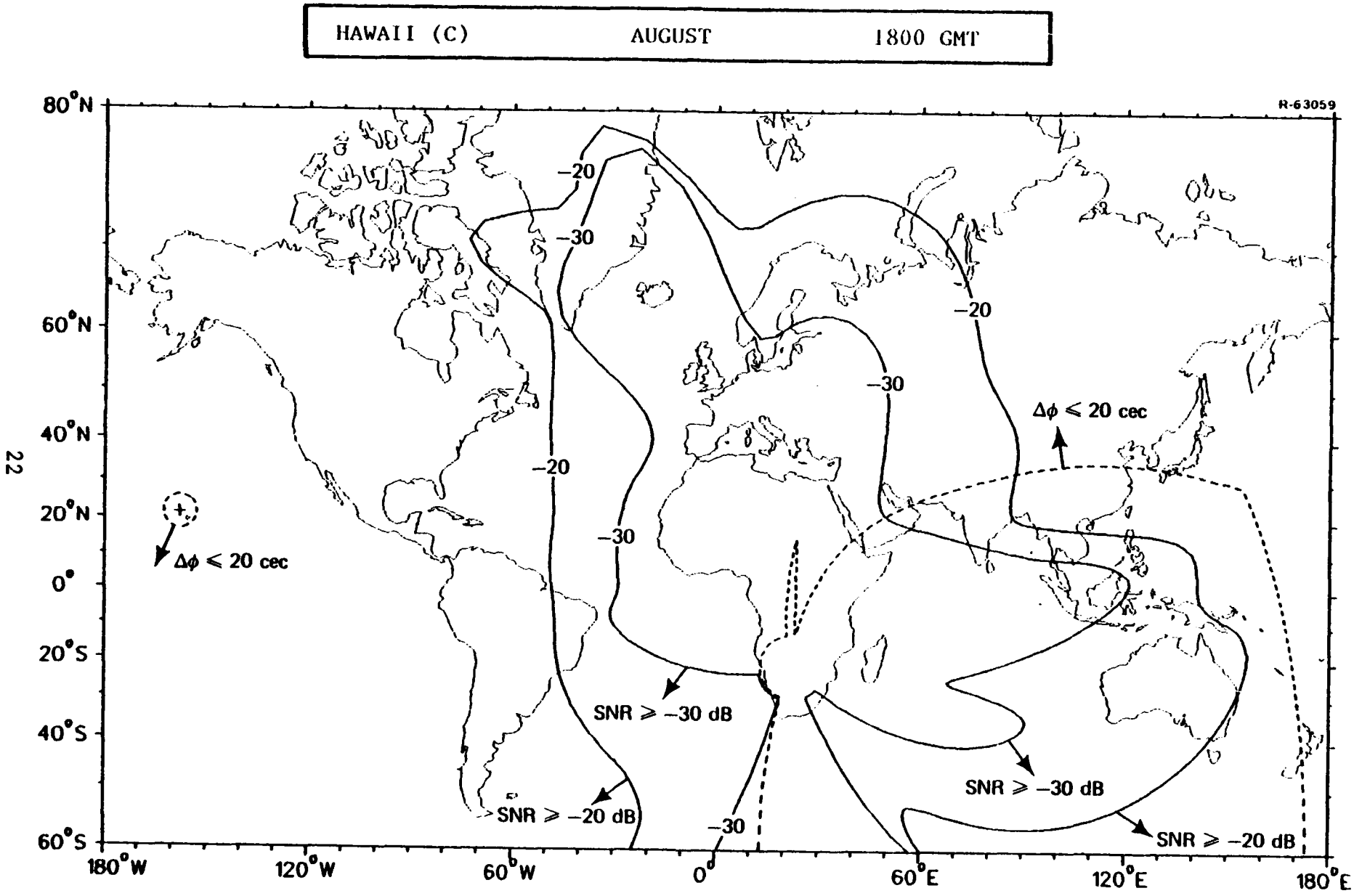


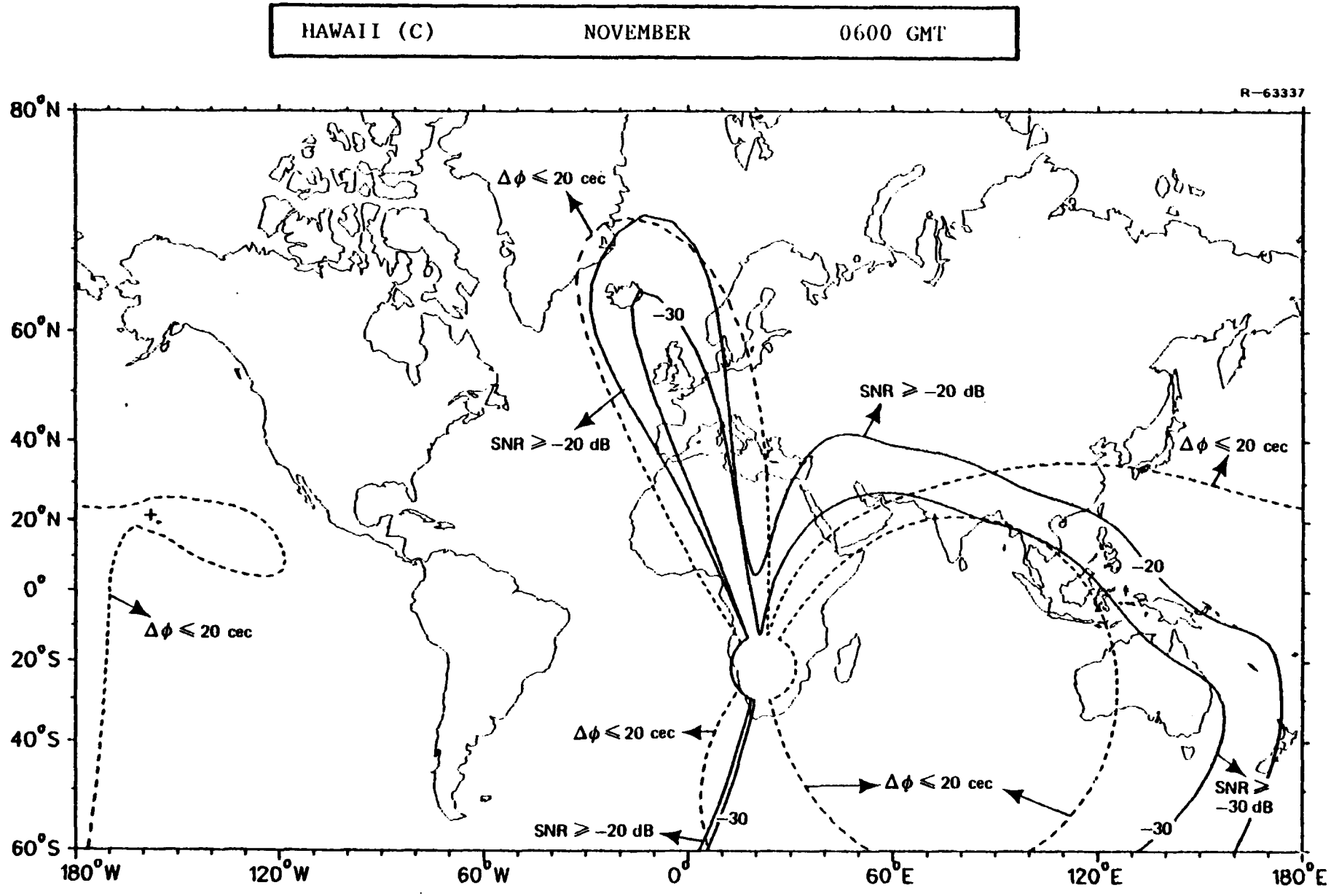

HAWAII (C)
MAY
0600 GMT
R-62834
80°N
60°N
40°N
20°N
0°
20°S
40°S
60°S
180°W
120°W
60°W
0°
60°E
120°E
180°E
SNR ≥ −20dB
SNR ≥ −30dB
SNR ≥ −20dB
Δϕ < 20 cec
Δϕ < 20 cec
Δϕ < 20 cec
SNR ≥ −20dB
−30
−30
−20

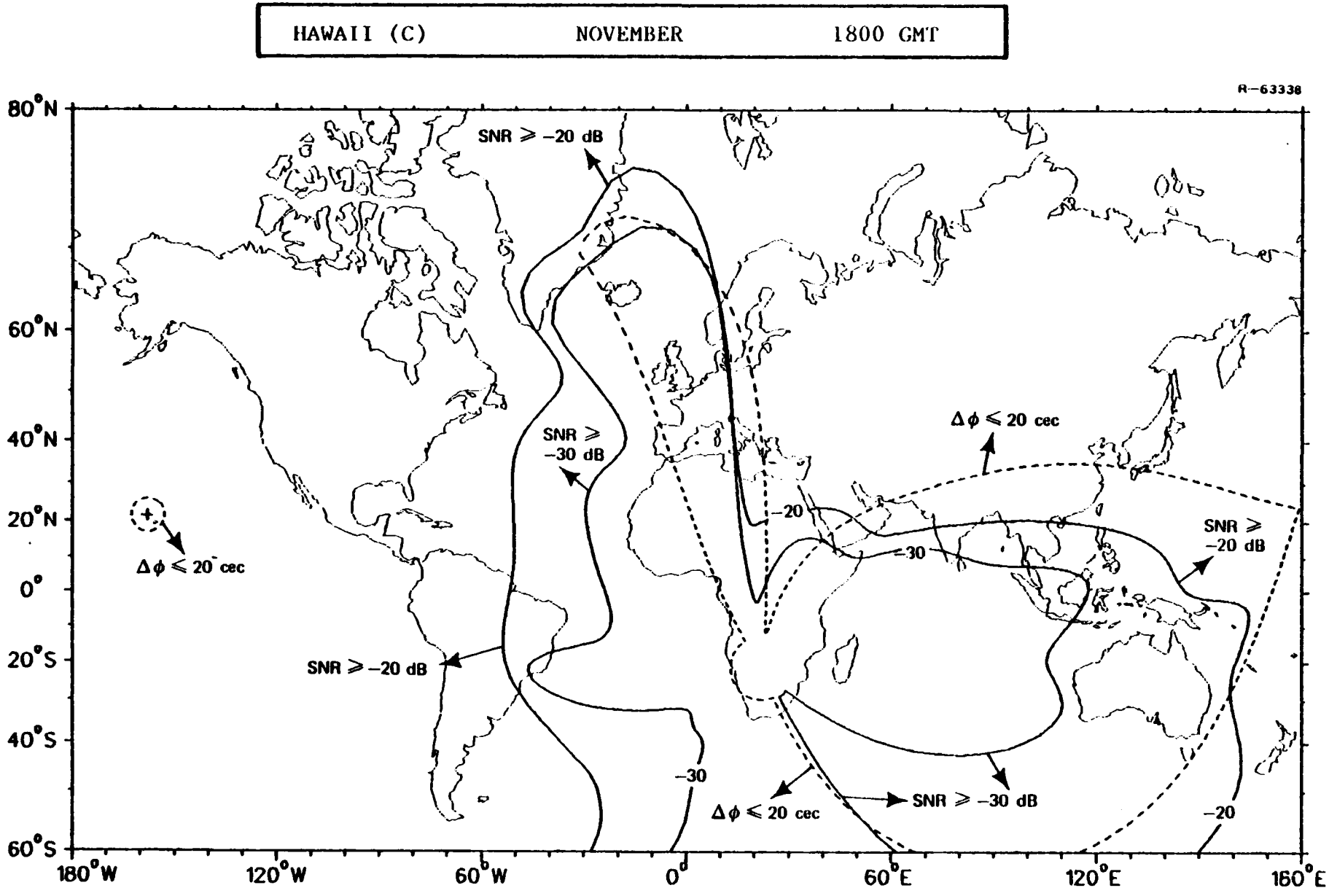
HAWAII (C) MAY 1800 GMT



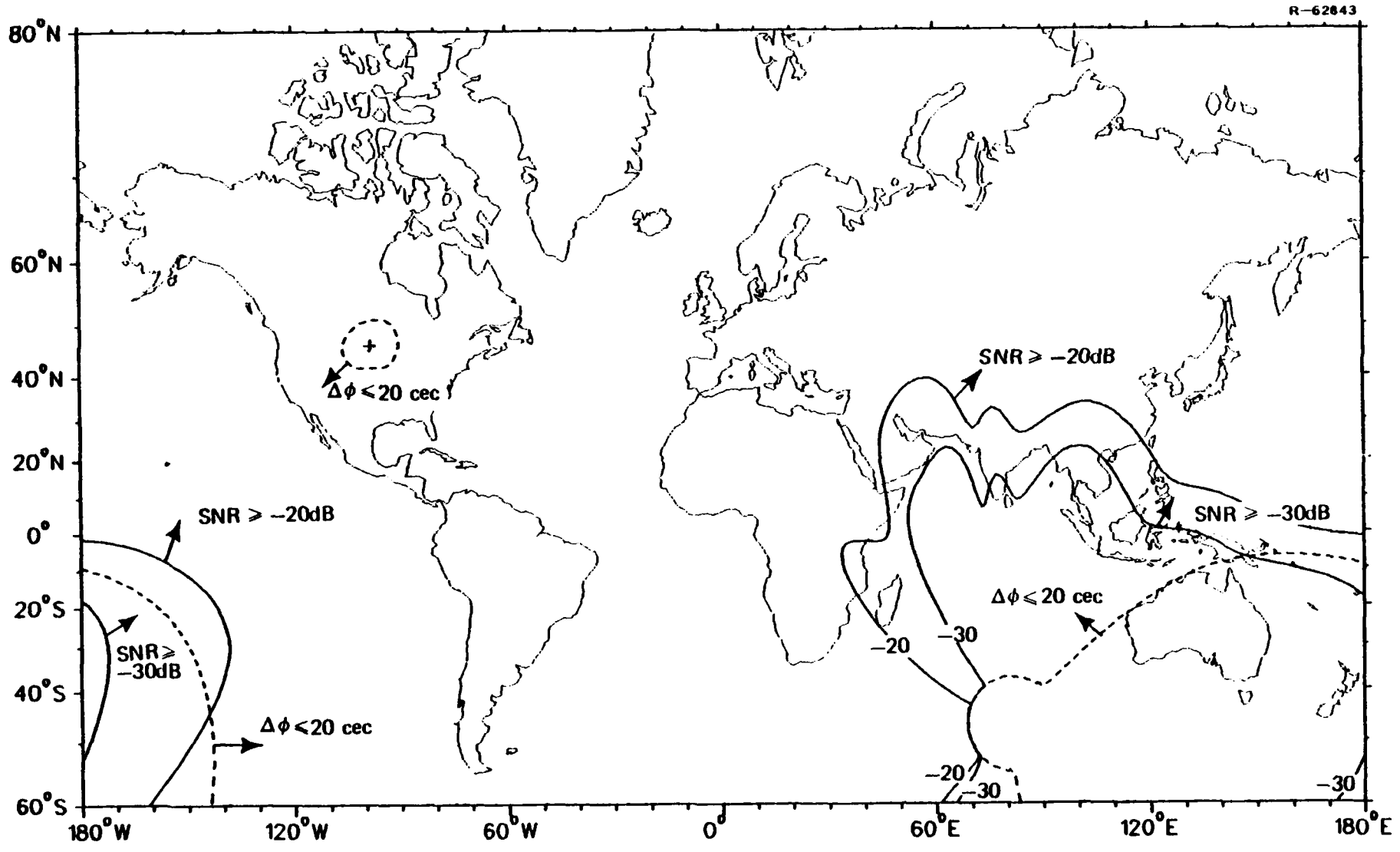

HAWAII (C)
AUGUST
0600 GMT
R-63138
80°N
60°N
40°N
20°N
0°
20°S
40°S
60°S
180°W
120°W
60°W
0°
60°E
120°E
180°E
SNR ≥ −20 dB
SNR ≥ −30 dB
Δφ ≤ 20 cec
−20
−30


HAWAII (C) AUGUST 1800 GMT
R-63059
80°N
60°N
40°N
20°N
0°
20°S
40°S
60°S
180°W
120°W
60°W
0°
60°E
120°E
180°E
-20
-30
-20
-30
-20
-30
-30
Δφ ≤ 20 cec
Δφ ≤ 20 cec
SNR ≥ -30 dB
SNR ≥ -20 dB
SNR ≥ -30 dB
SNR ≥ -20 dB

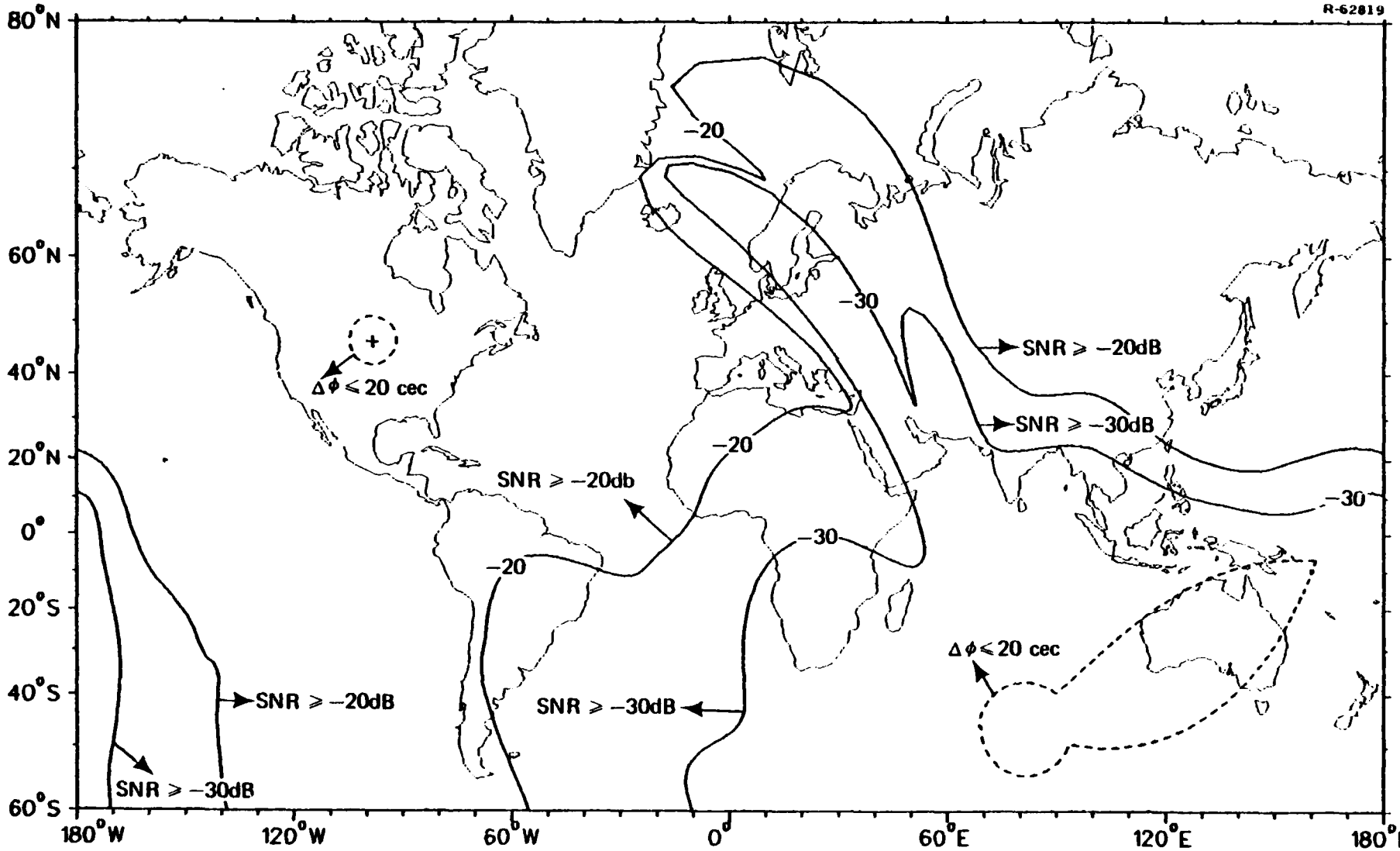

HAWAII (C) NOVEMBER 0600 GMT
R-63337
80°N
60°N
40°N
20°N
0°
20°S
40°S
60°S
180°W
120°W
60°W
0°
60°E
120°E
180°E
Δφ ≤ 20 cec
SNR ≥ −20 dB
−30
−20
SNR ≥ −30 dB

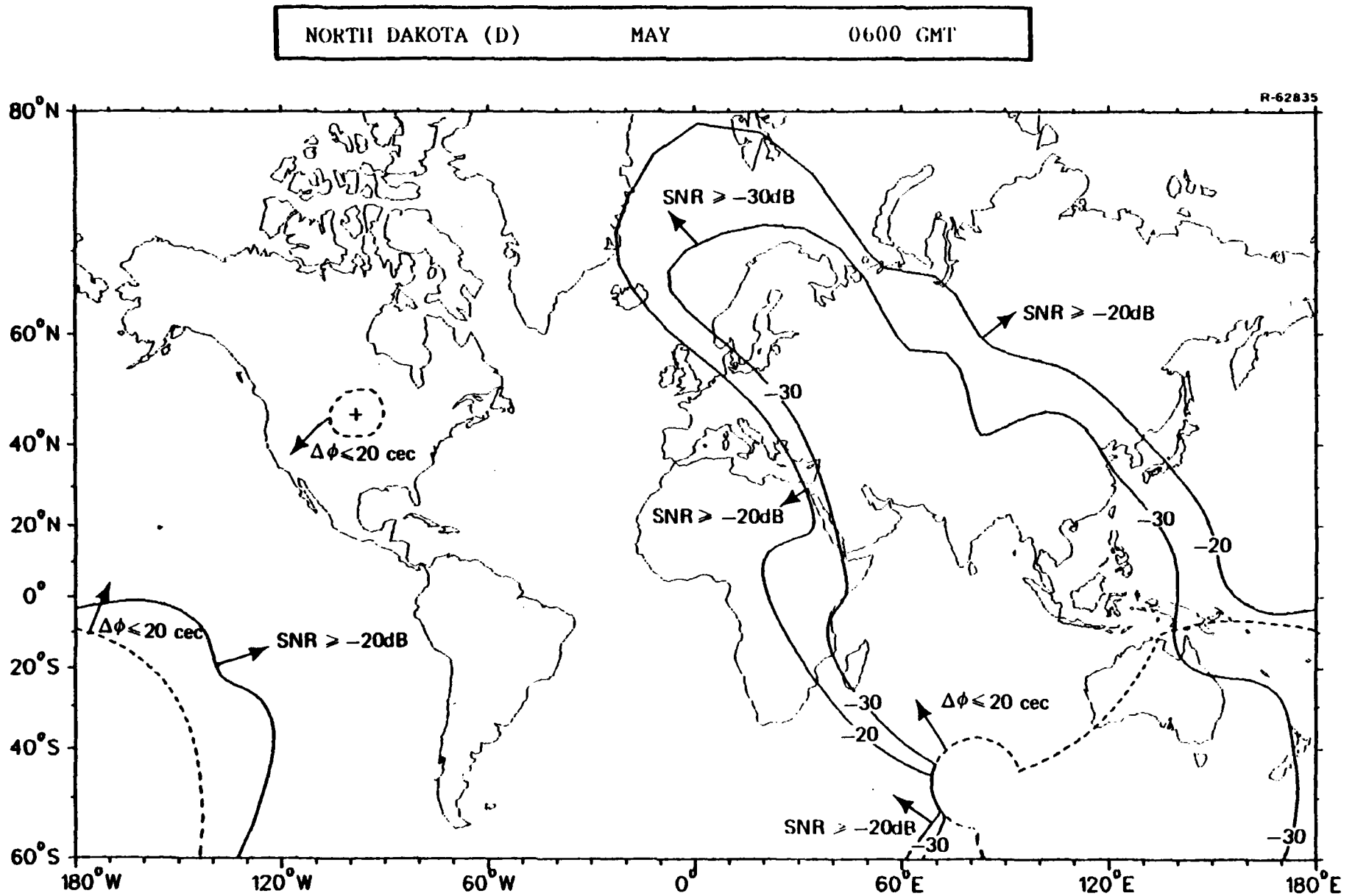

HAWAII (C) NOVEMBER 1800 GMT
R-63338
80°N
60°N
40°N
20°N
0°
20°S
40°S
60°S
180°W
120°W
60°W
0°
60°E
120°E
160°E
SNR ≥ −20 dB
SNR ≥ −30 dB
Δφ ≤ 20 cec
−20
−30
SNR ≥ −20 dB
Δφ ≤ 20 cec
SNR ≥ −20 dB
−30
Δφ ≤ 20 cec
SNR ≥ −30 dB
−20

NORTH DAKOTA (D)	FEBRUARY	0600 GMT

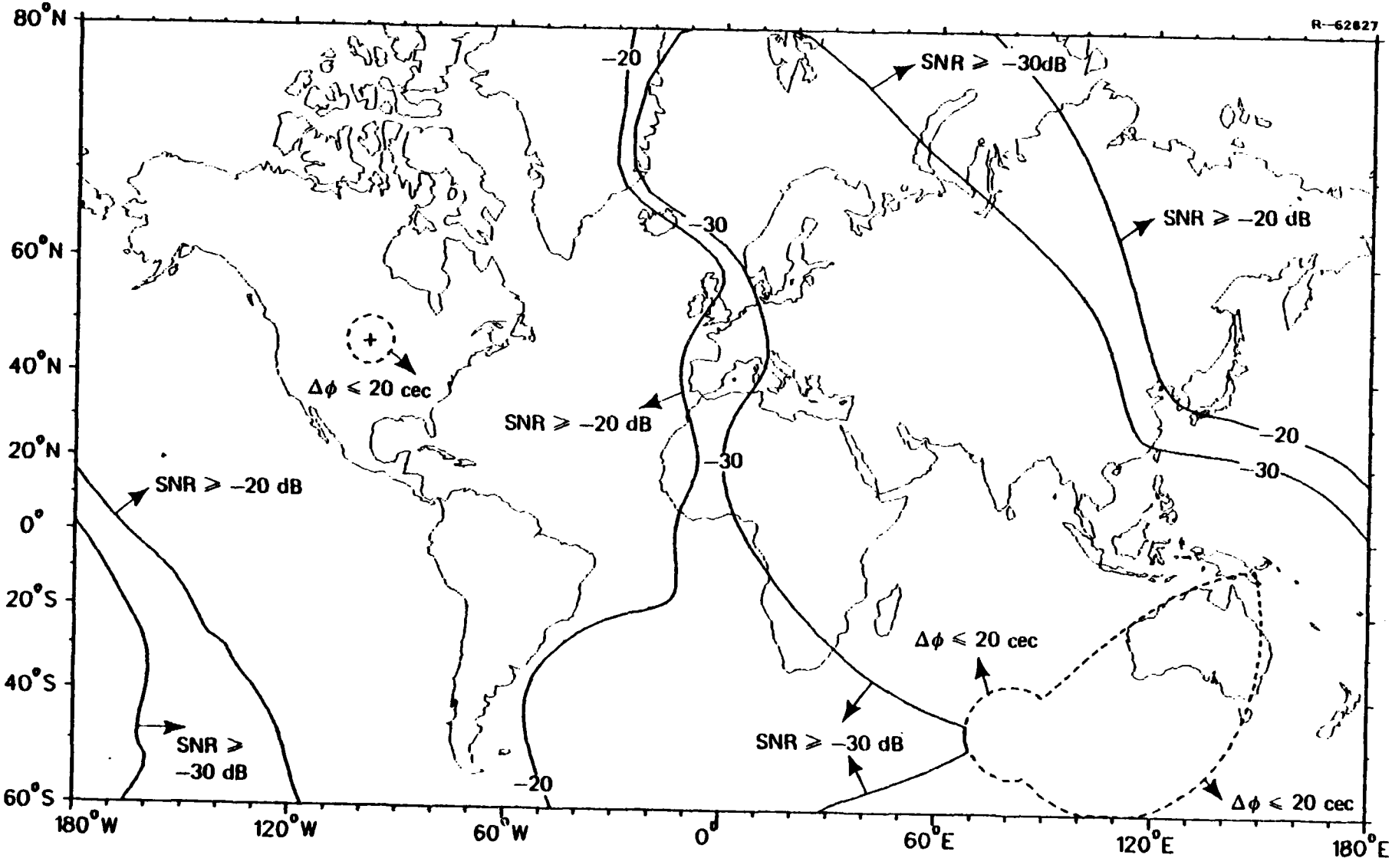


NORTH DAKOTA (D) FEBRUARY 1800 GMT

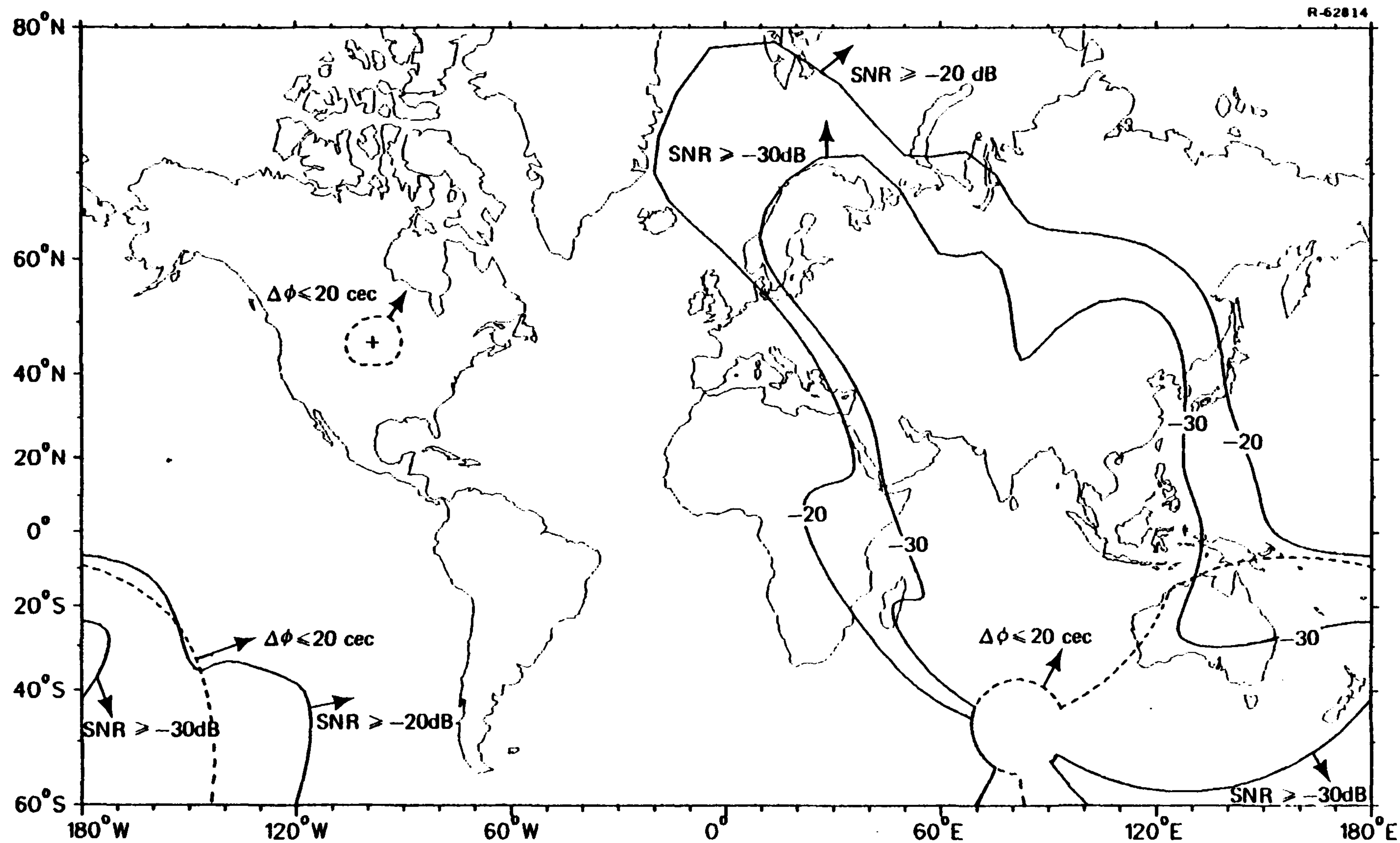



NORTH DAKOTA (D) MAY 0600 GMT
R-62835
80°N
60°N
40°N
20°N
0°
20°S
40°S
60°S
180°W
120°W
60°W
0°
60°E
120°E
180°E
SNR ≥ −30dB
SNR ≥ −20dB
−30
−20
Δϕ≤20 cec
SNR ≥ −20dB
Δϕ≤20 cec
SNR ≥ −20dB
−30
−20
Δϕ≤20 cec
SNR ≥ −20dB
−30
−30
−20
−30

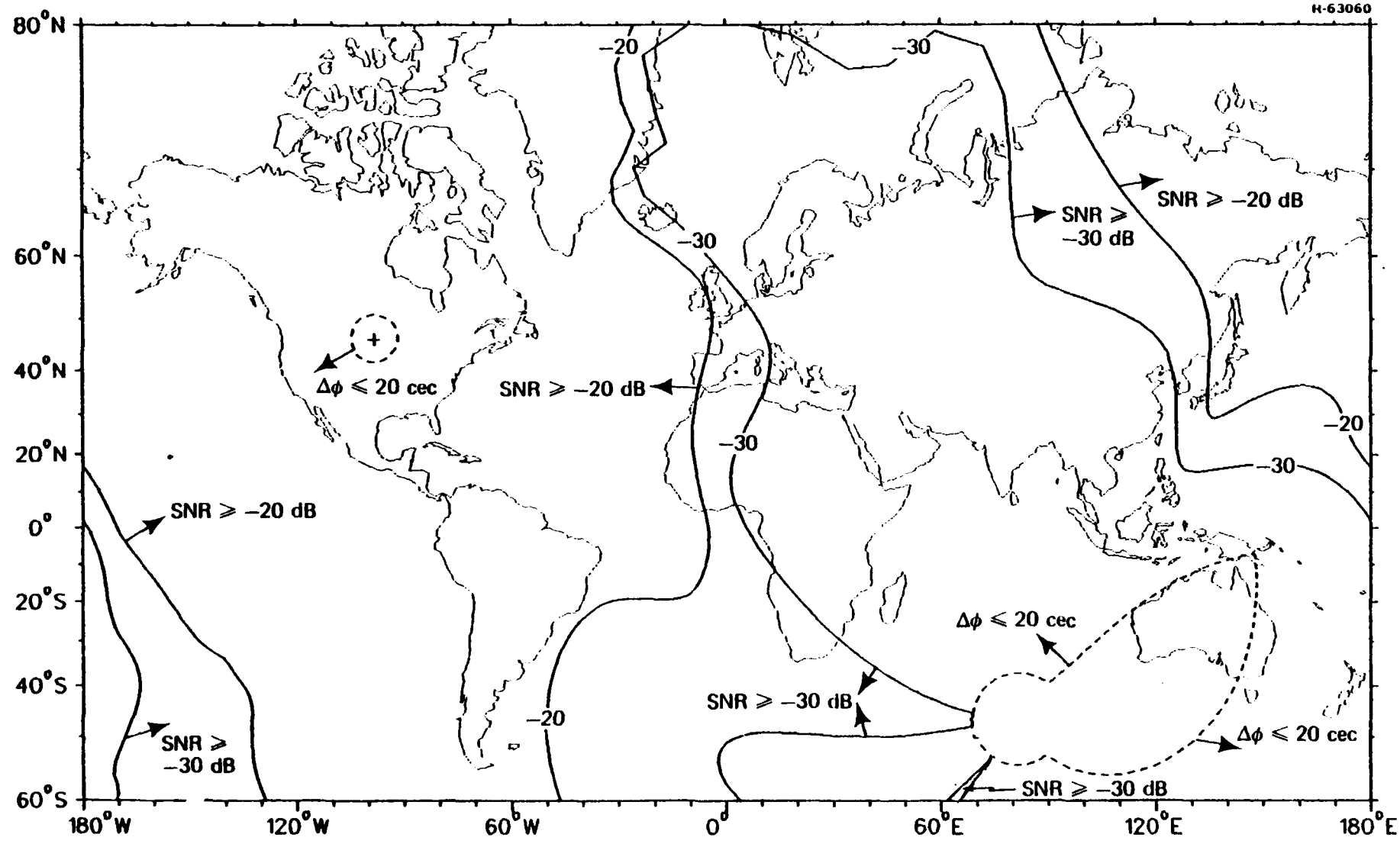
NORTH DAKOTA (D) MAY 1800 GMT



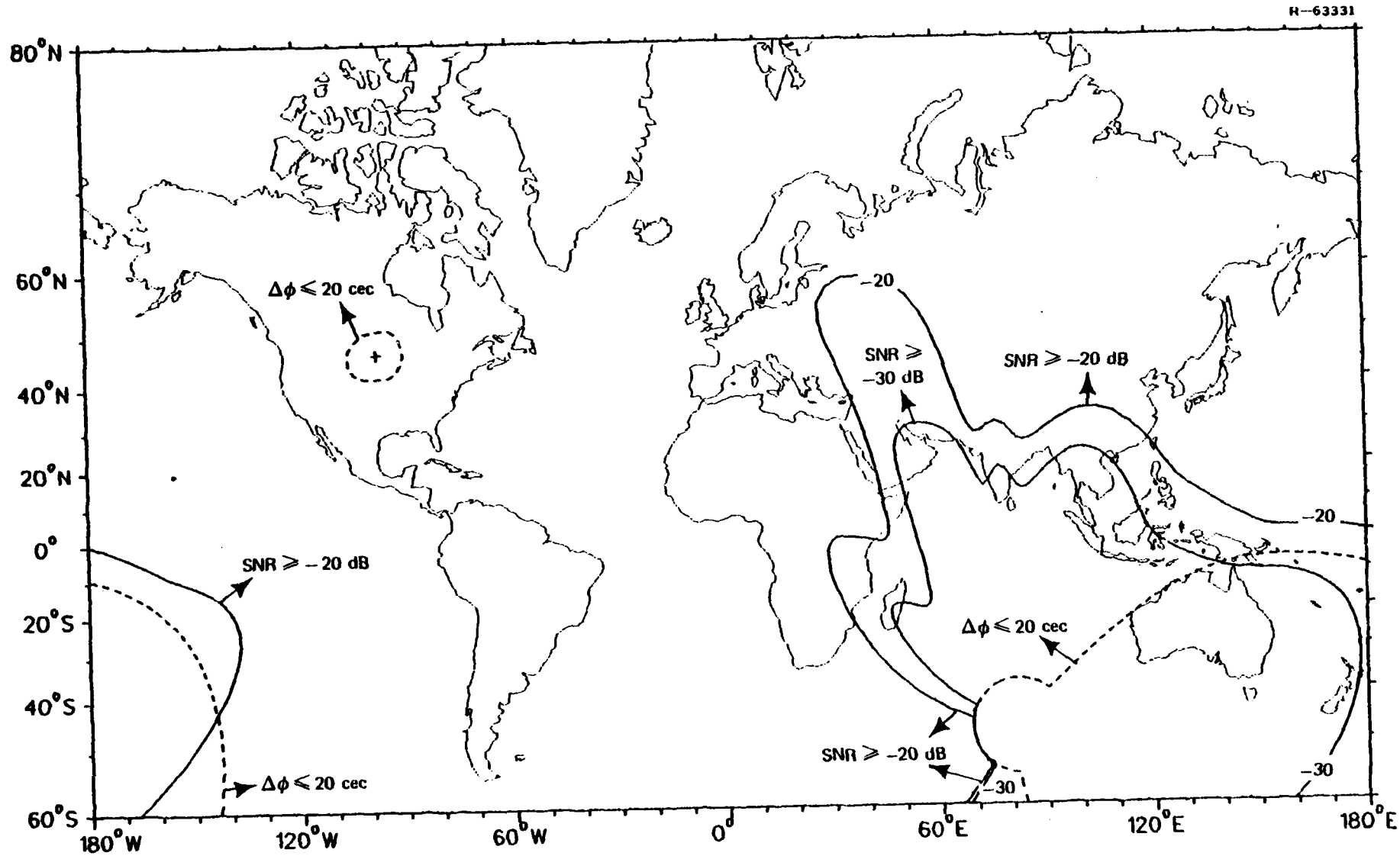
NORTH DAKOTA (D) AUGUST 0600 GMT



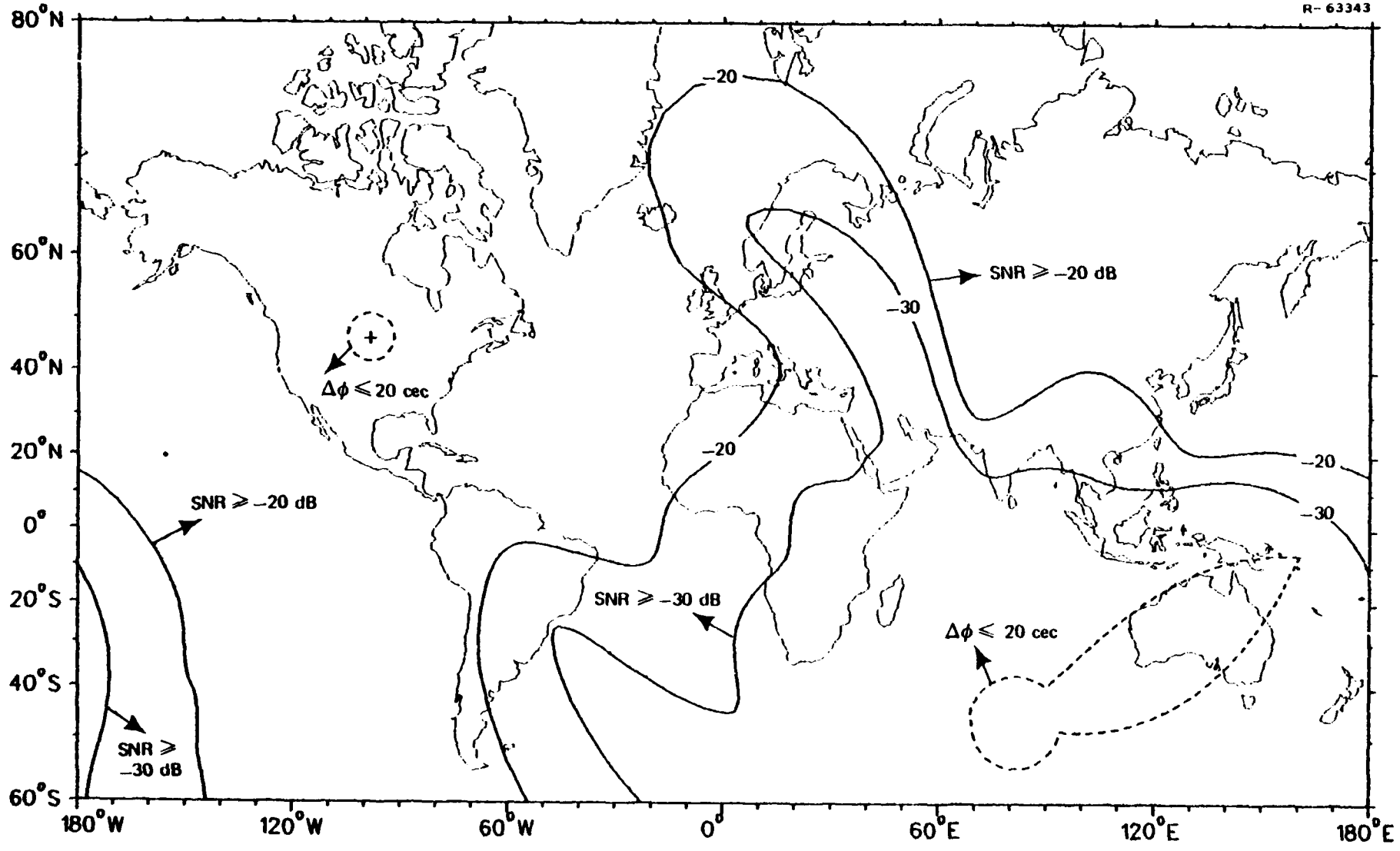
NORTH DAKOTA (D) AUGUST 1800 GMT

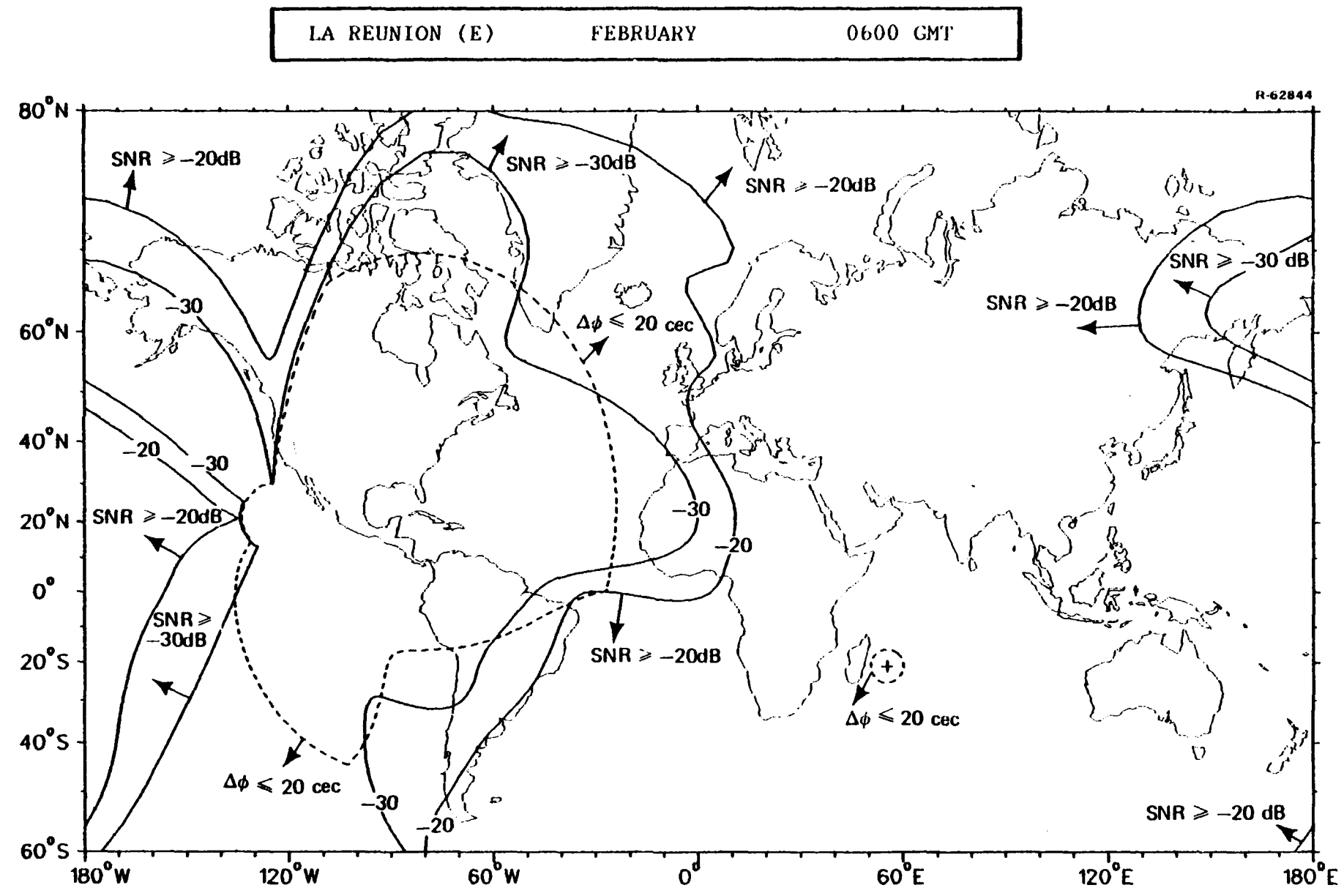


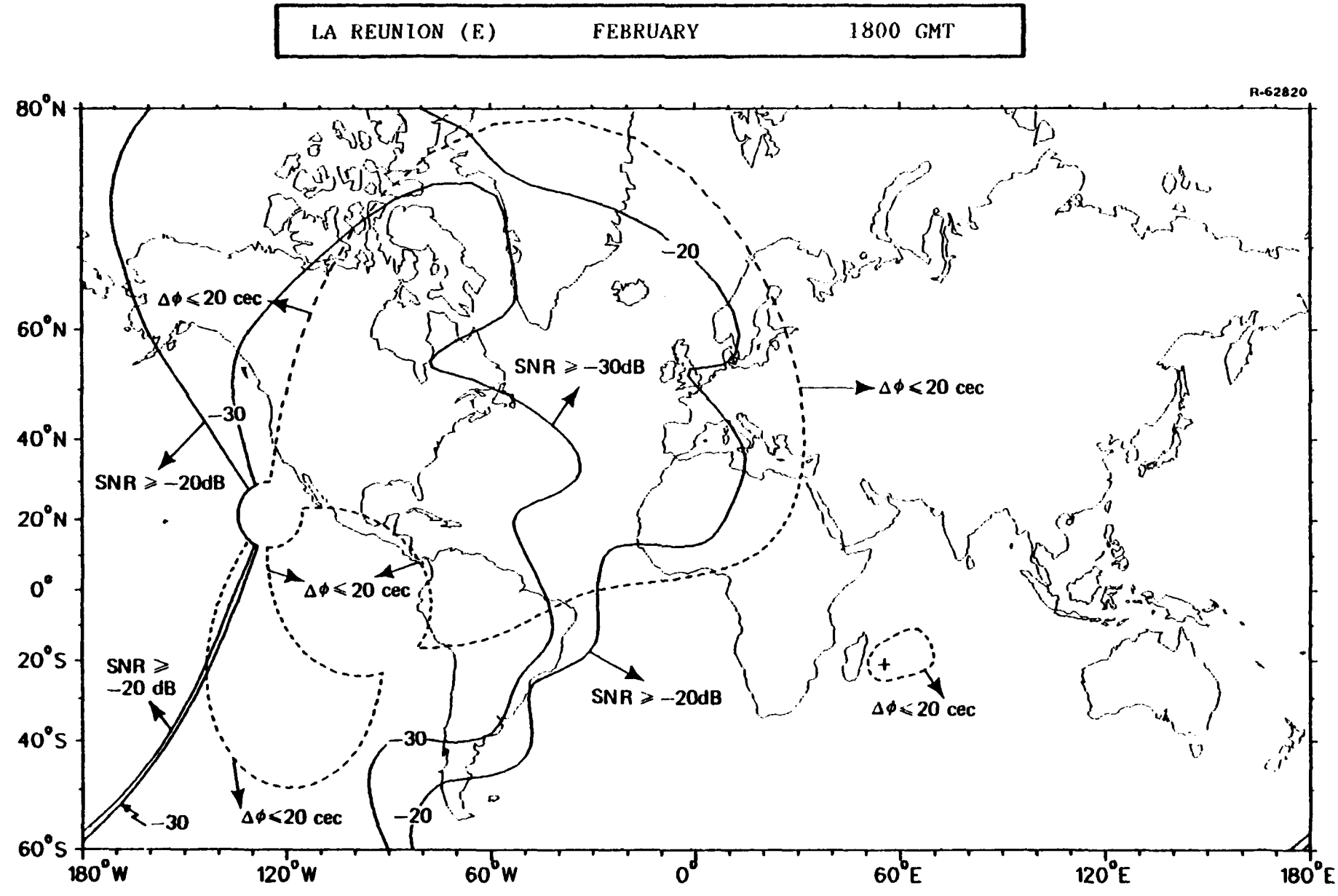
NORTH DAKOTA (D) NOVEMBER 0600 GMT

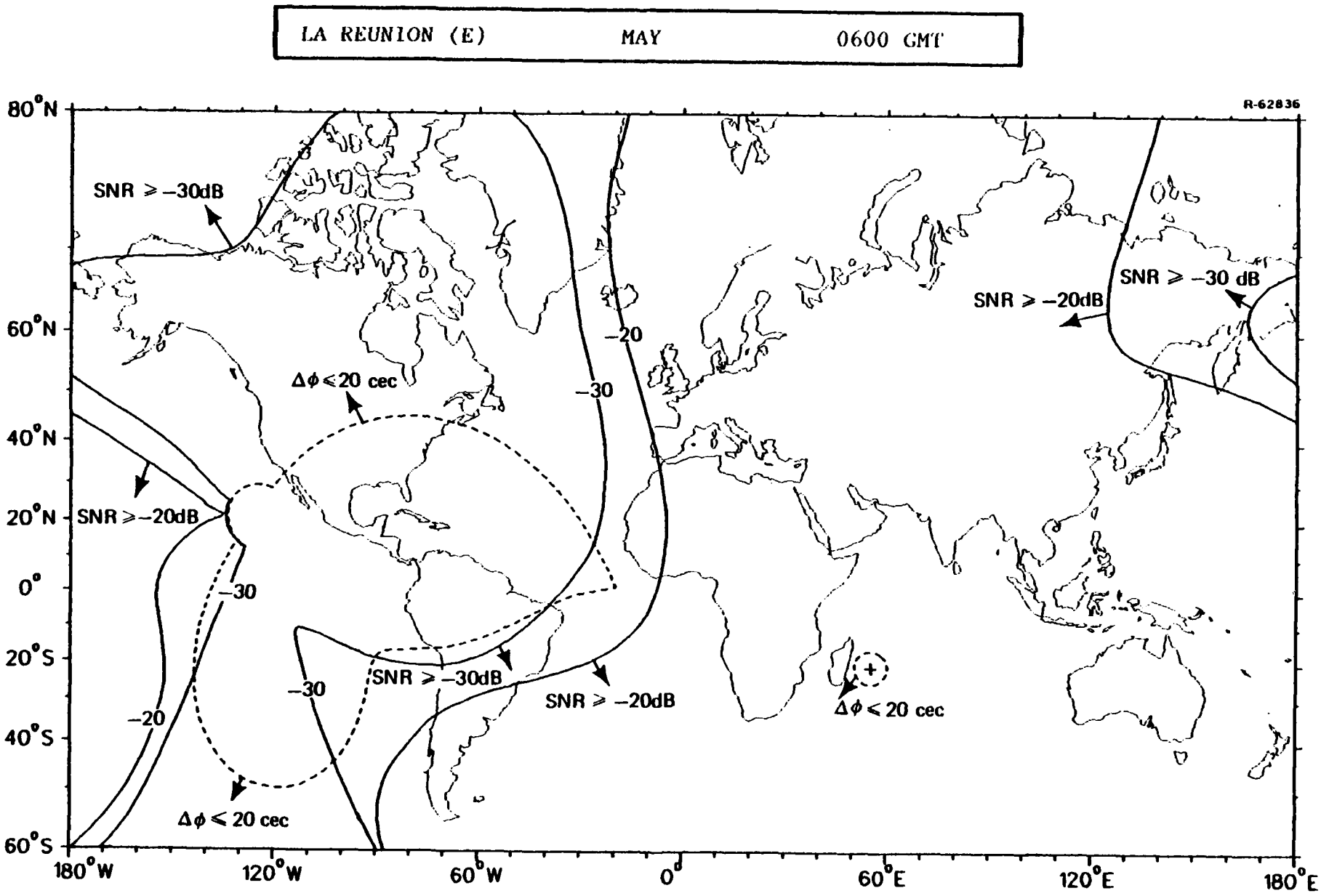


NORTH DAKOTA (D) NOVEMBER 1800 GMT

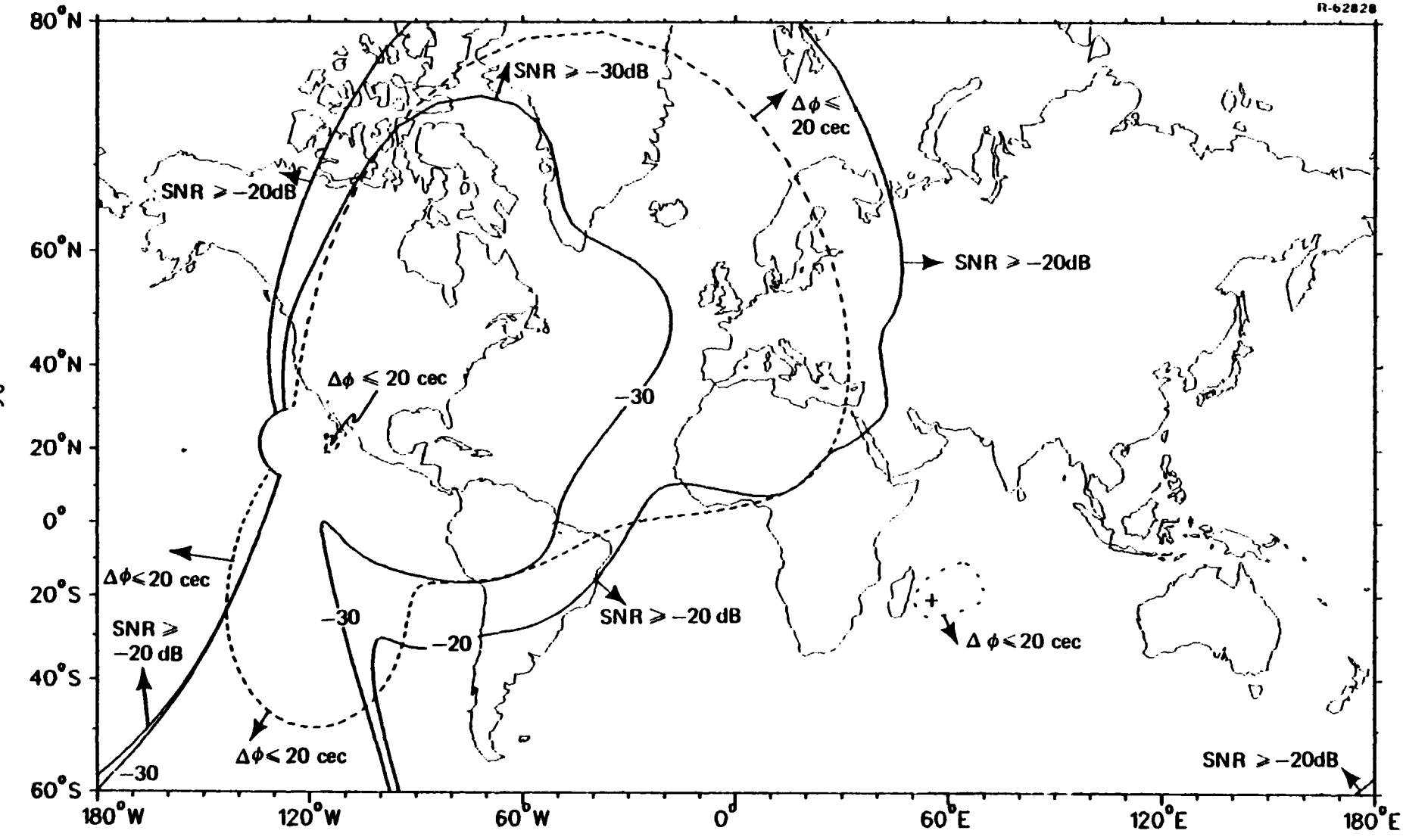


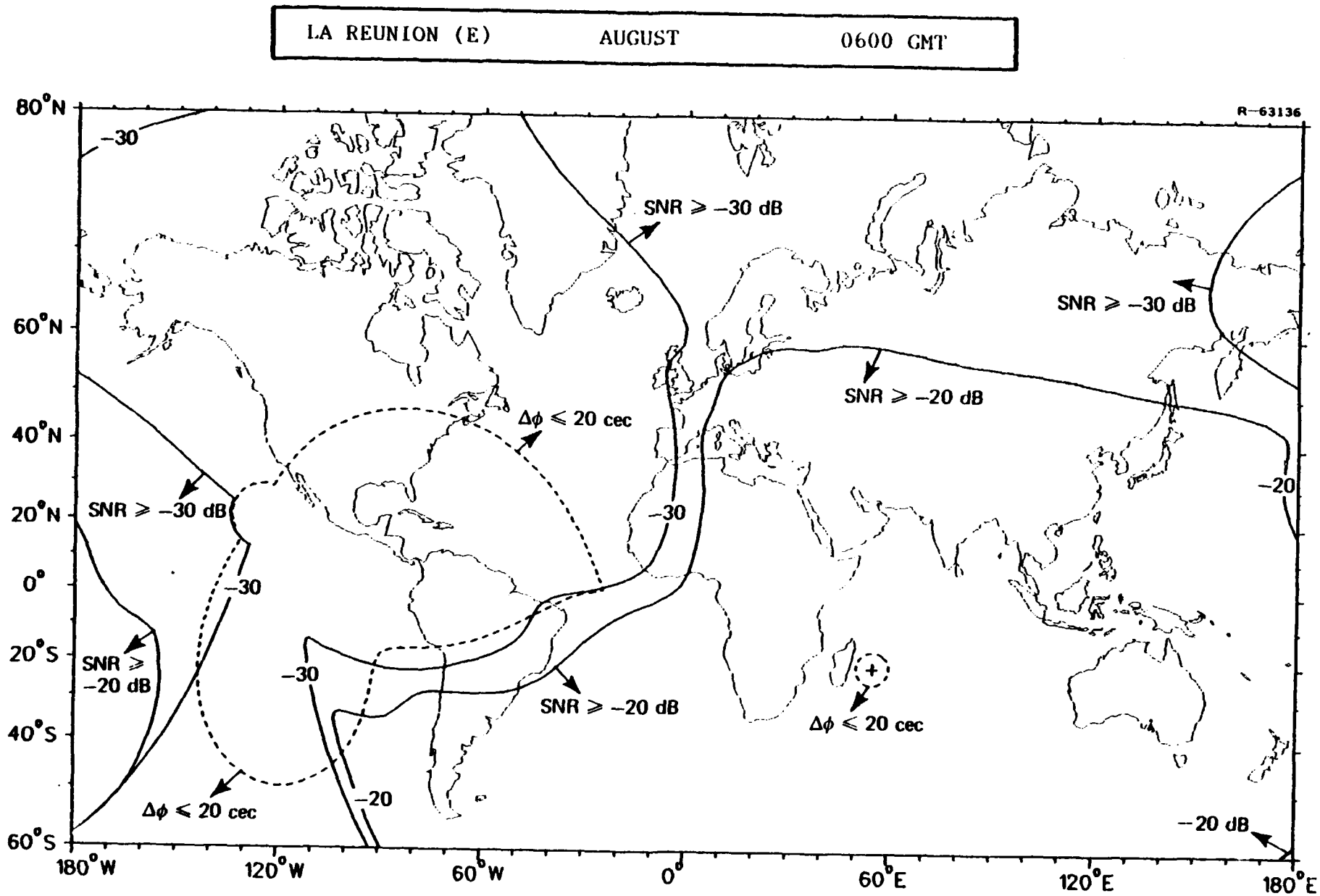

LA REUNION (E) FEBRUARY 0600 GMT
R-62844
80°N
60°N
40°N
20°N
0°
20°S
40°S
60°S
180°W
120°W
60°W
0°
60°E
120°E
180°E
SNR ≥ −20dB
SNR ≥ −30dB
SNR ≥ −20dB
SNR ≥ −30 dB
SNR ≥ −20dB
−30
Δφ ≤ 20 cec
−20
−30
SNR ≥ −20dB
−30
−20
SNR ≥ −30dB
SNR ≥ −20dB
Δφ ≤ 20 cec
Δφ ≤ 20 cec
−30
−20
SNR ≥ −20 dB

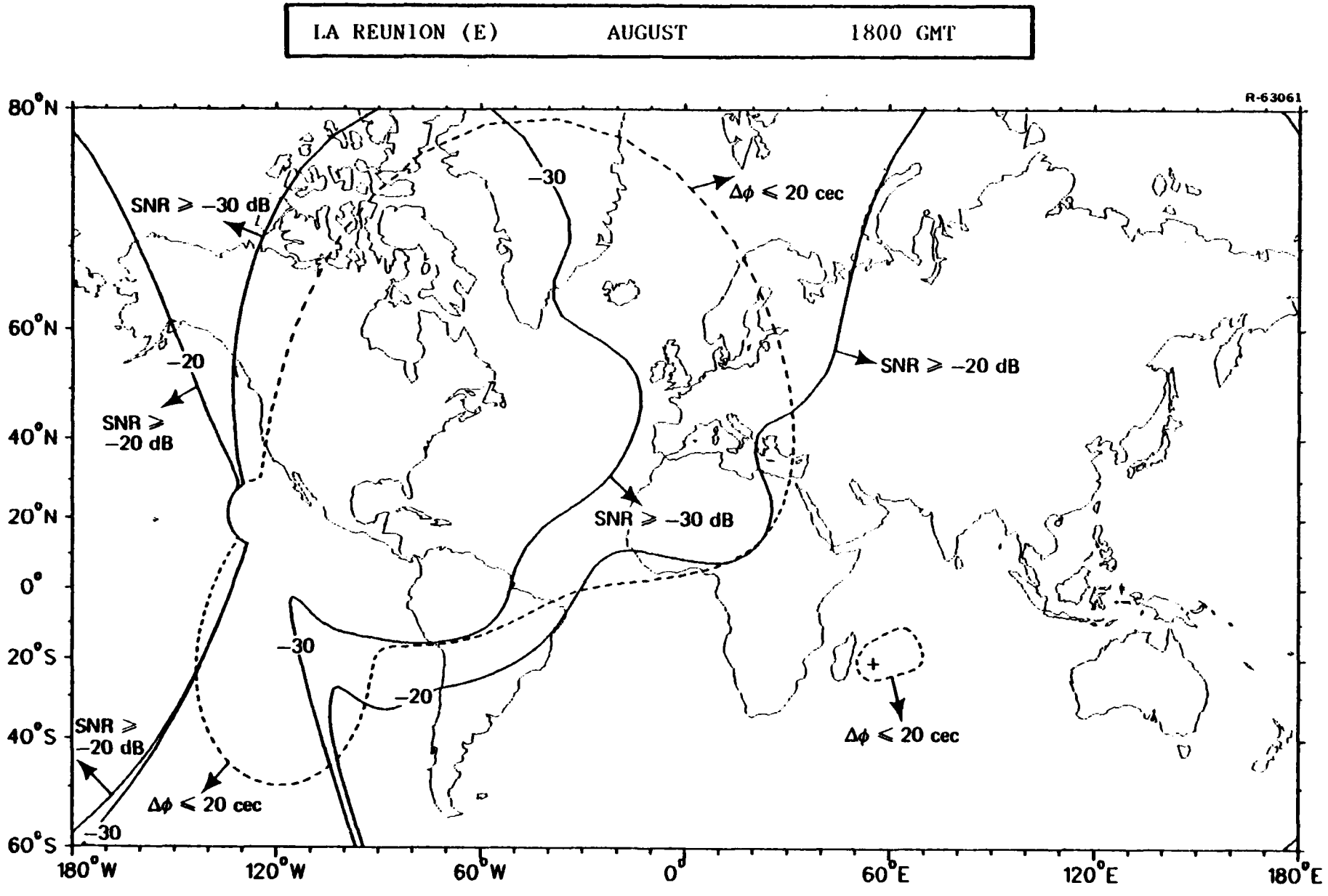

LA REUNION (E) FEBRUARY 1800 GMT
R-62820
80°N
60°N
40°N
20°N
0°
20°S
40°S
60°S
180°W
120°W
60°W
0°
60°E
120°E
180°E
Δφ ≤ 20 cec
SNR ≥ −30dB
Δφ ≤ 20 cec
SNR ≥ −20dB
Δφ ≤ 20 cec
SNR ≥ −20 dB
SNR ≥ −20dB
Δφ ≤ 20 cec
Δφ ≤ 20 cec
−20
−30
−30
−20
−30


LA REUNION (E) MAY 0600 GMT
R-62836
80°N
60°N
40°N
20°N
0°
20°S
40°S
60°S
180°W
120°W
60°W
0°
60°E
120°E
180°E
SNR ≥ −30dB
SNR ≥ −20dB
SNR ≥ −30 dB
SNR ≥ −20dB
Δφ ≤ 20 cec
−30
−20
−30
−30
−20
SNR ≥ −30dB
SNR ≥ −20dB
Δφ ≤ 20 cec
Δφ ≤ 20 cec

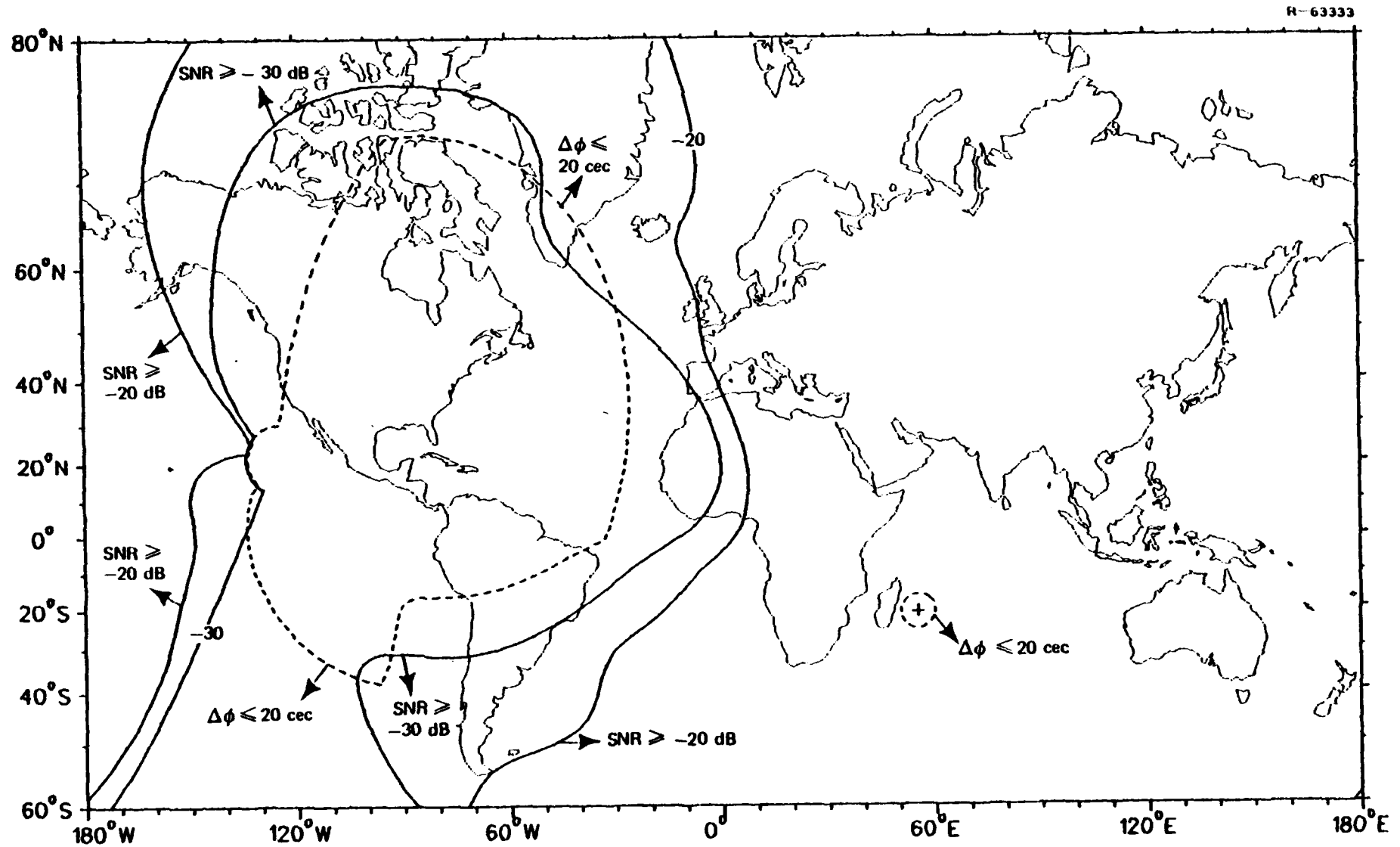
LA REUNION (E) MAY 1800 GMT



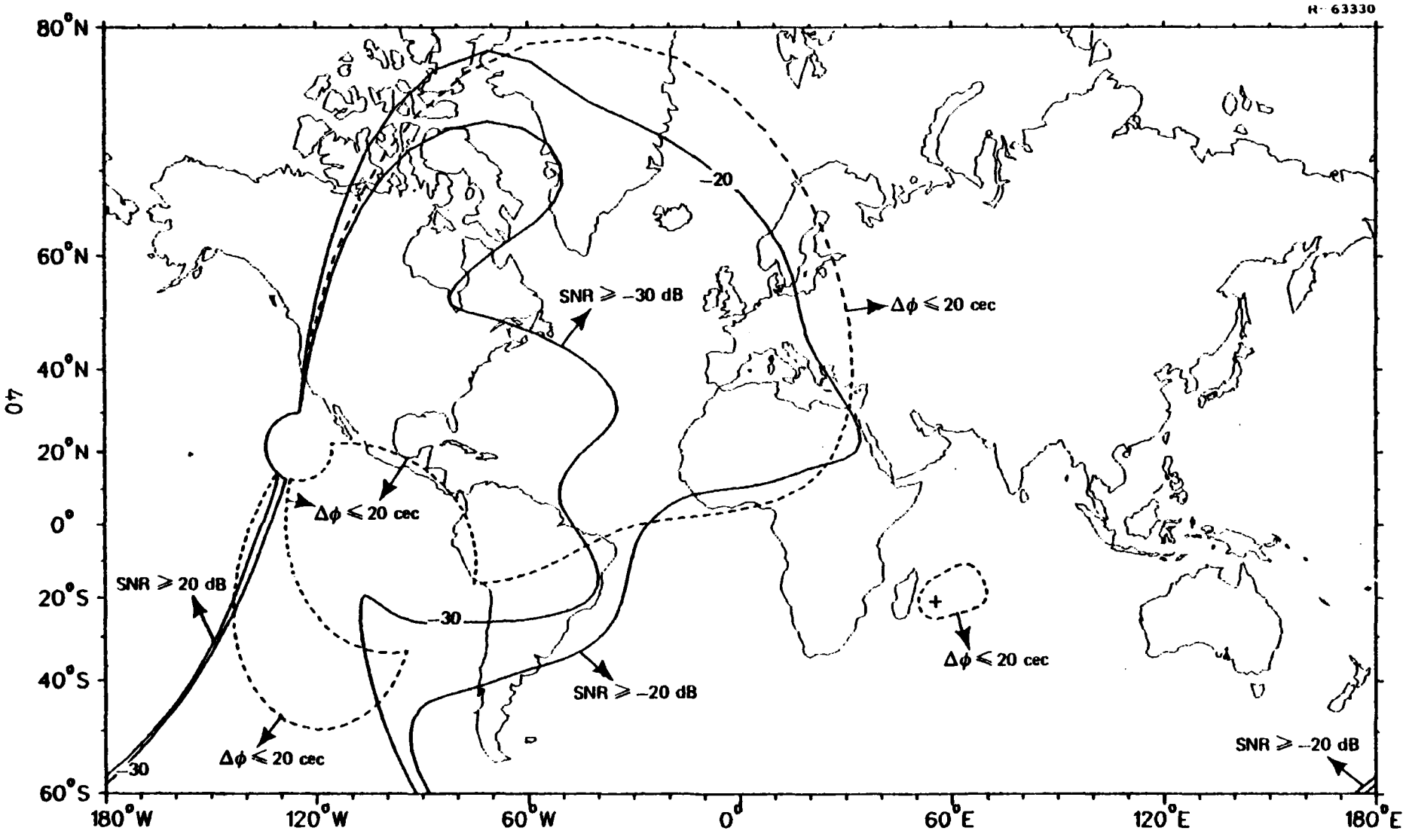

LA REUNION (E) AUGUST 0600 GMT
R-63136
80°N
60°N
40°N
20°N
0°
20°S
40°S
60°S
180°W
120°W
60°W
0°
60°E
120°E
180°E
-30
SNR ≥ -30 dB
SNR ≥ -20 dB
Δφ ≤ 20 cec
-20
-20 dB


LA REUNION (E) AUGUST 1800 GMT
R-63061
80°N
60°N
40°N
20°N
0°
20°S
40°S
60°S
180°W
120°W
60°W
0°
60°E
120°E
180°E
SNR ≥ −30 dB
−30
Δφ ≤ 20 cec
SNR ≥ −20 dB
−20
SNR ≥ −20 dB
SNR ≥ −30 dB
−30
−20
SNR ≥ −20 dB
Δφ ≤ 20 cec
−30
Δφ ≤ 20 cec

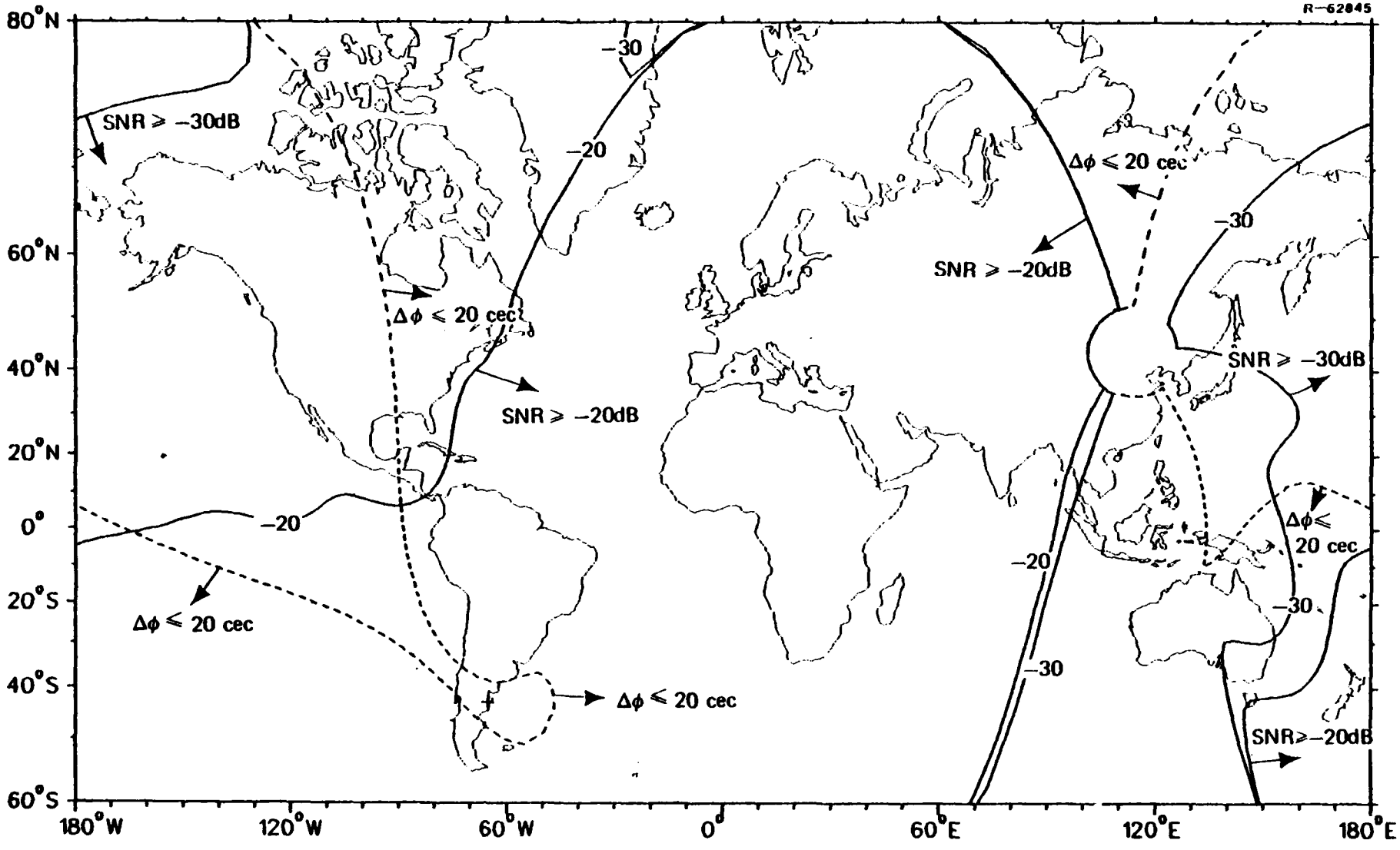
LA REUNION (E) NOVEMBER 0600 GMT



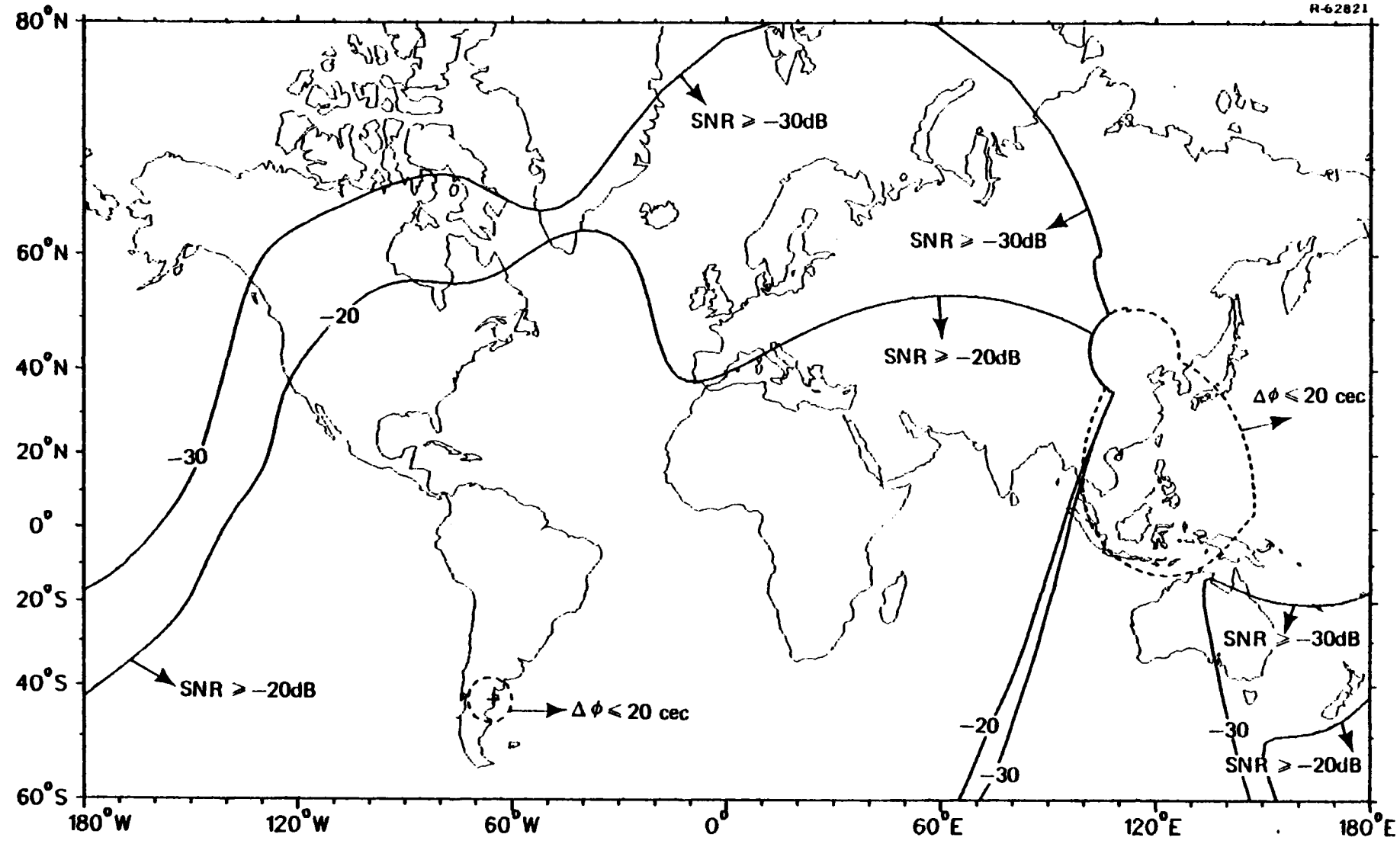
LA REUNION (E) NOVEMBER 1800 GMT

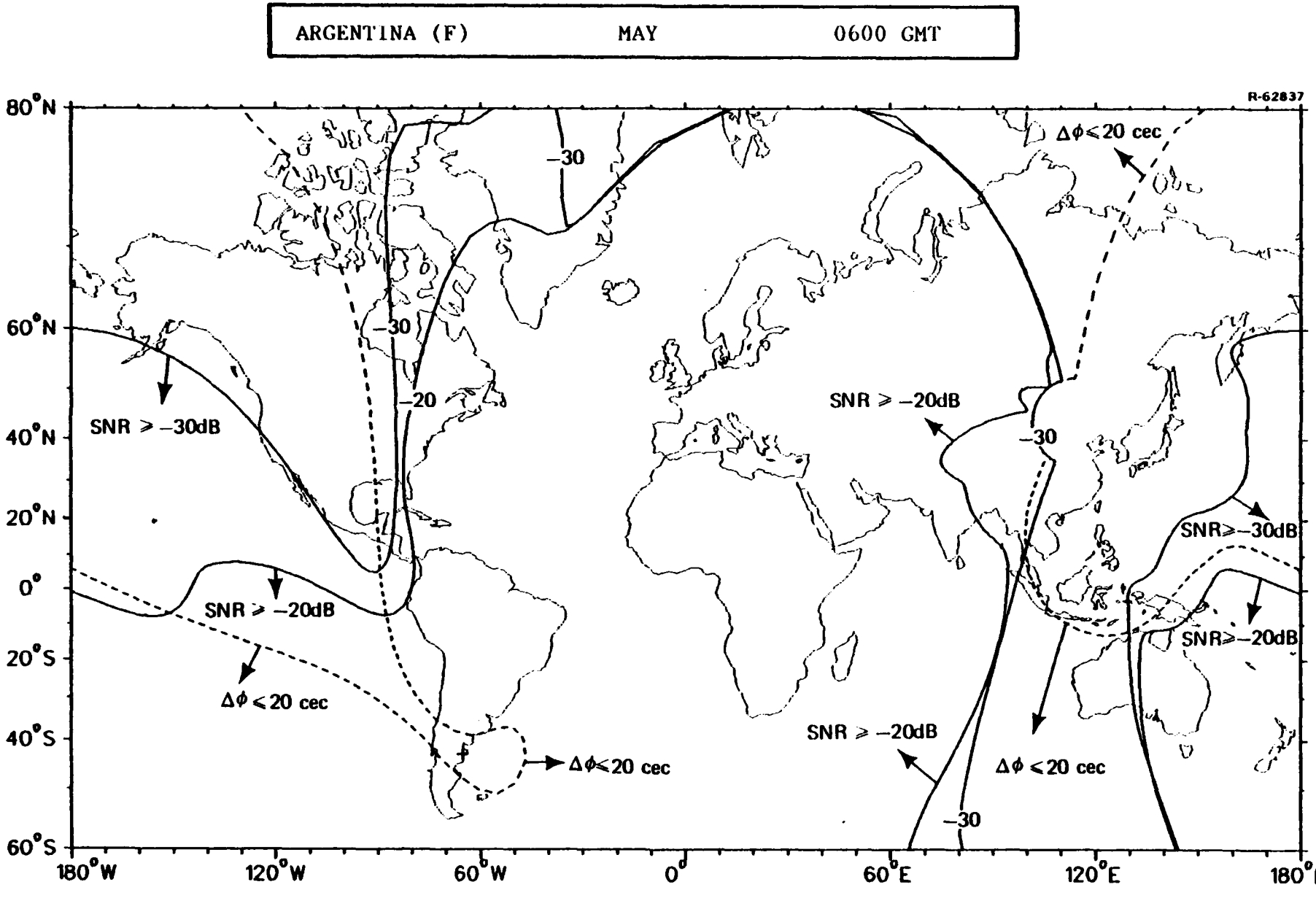


ARGENTINA (F)	FEBRUARY	0600 GMT

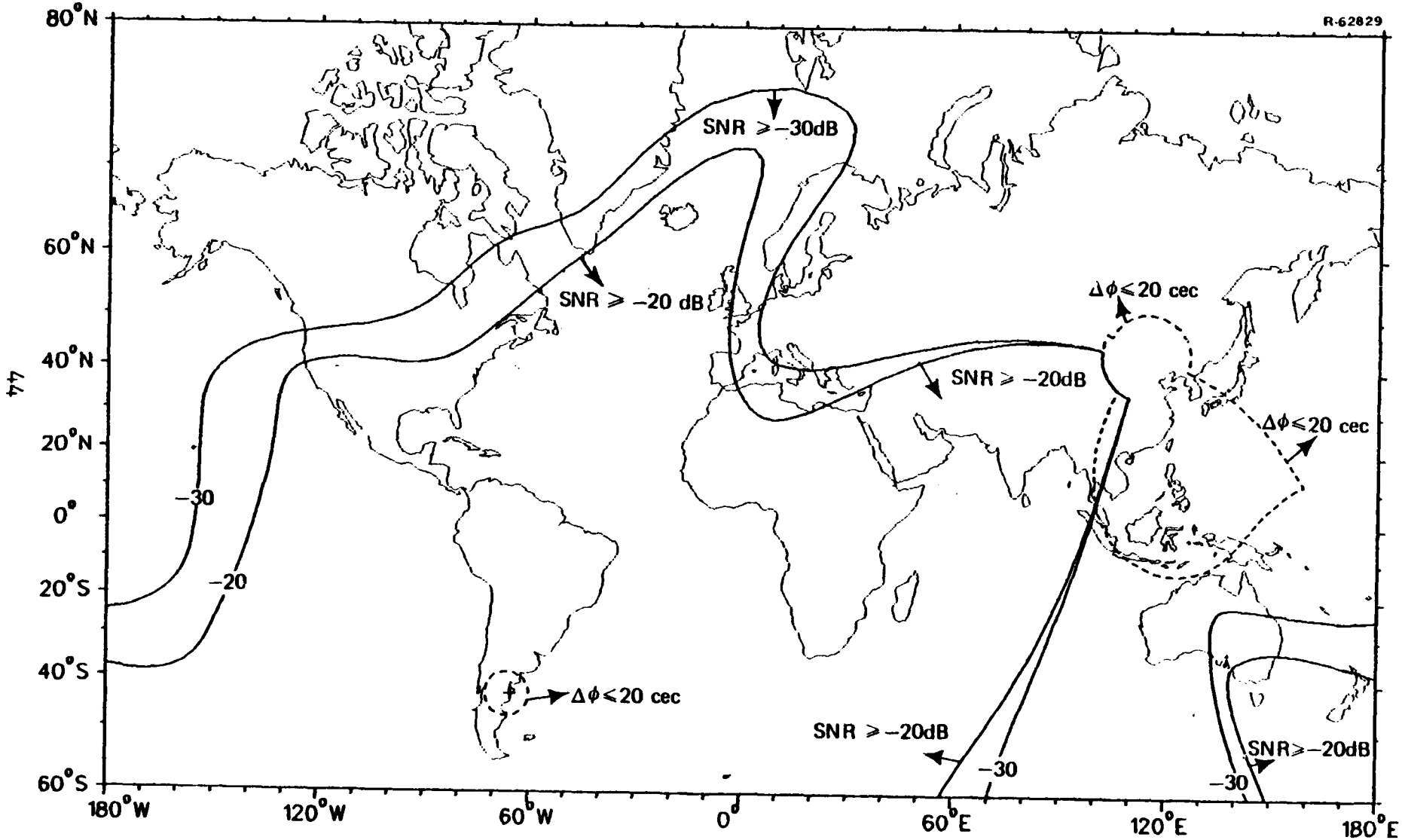


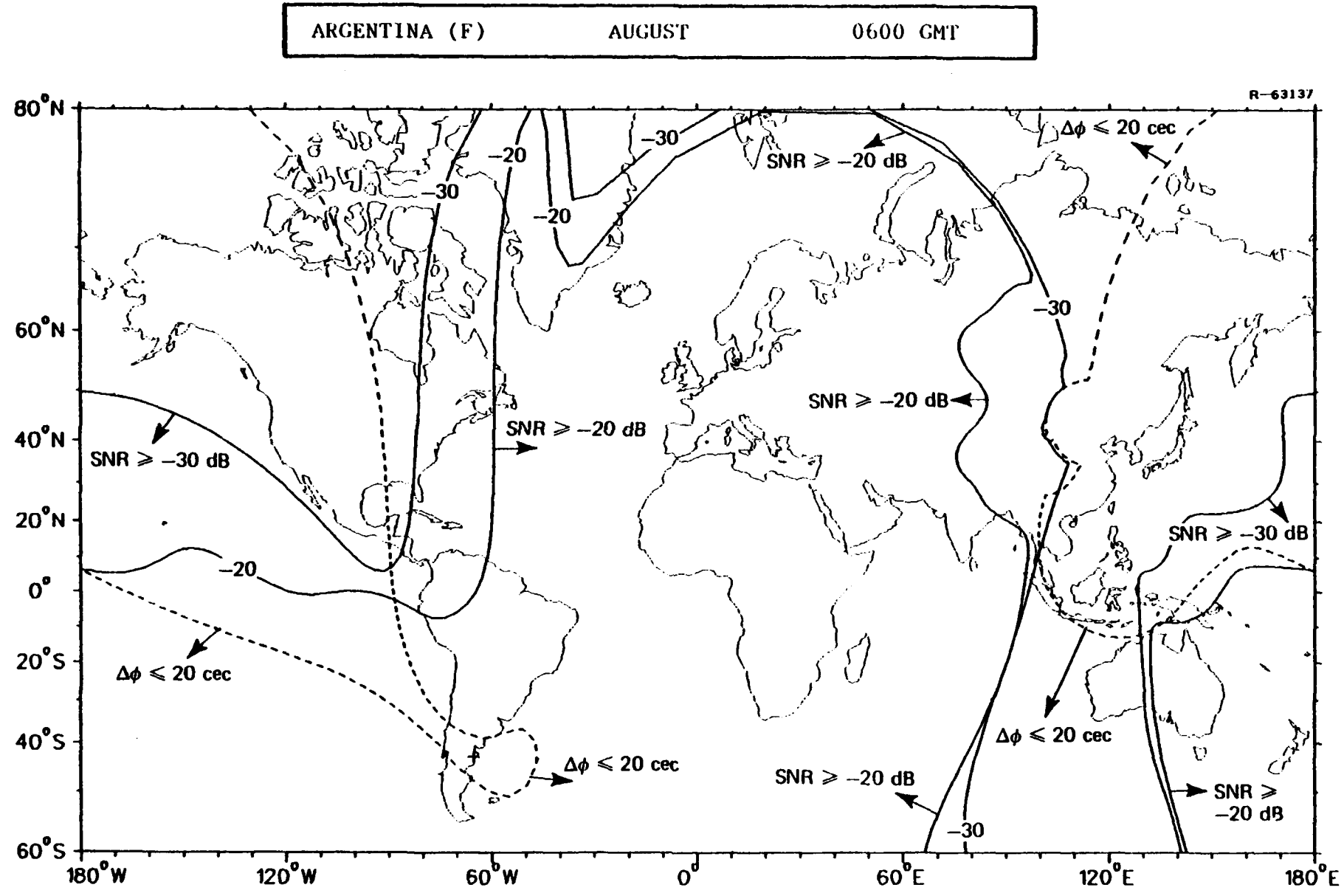
ARGENTINA (F)	FEBRUARY	1800 GMT



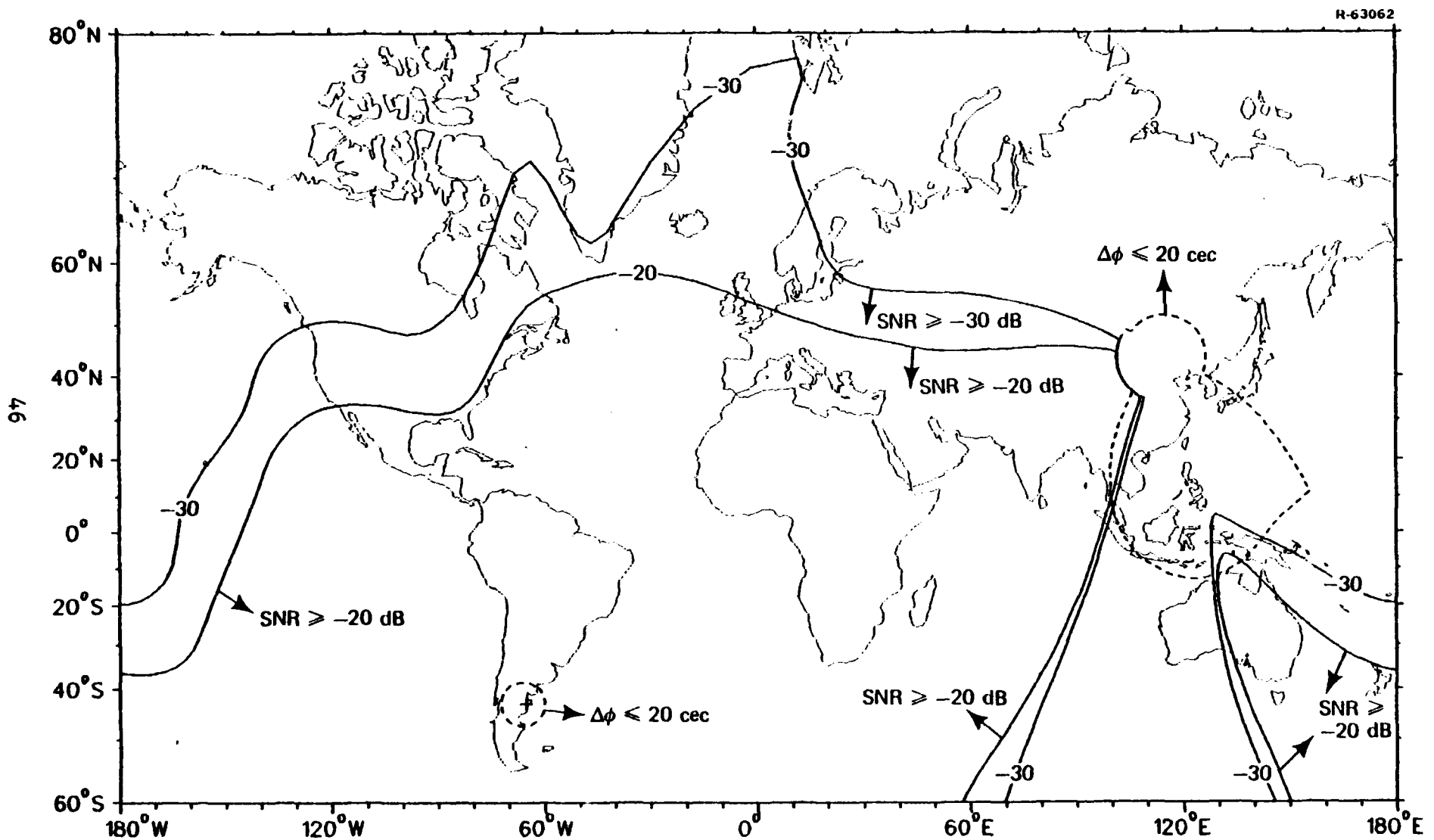

ARGENTINA (F)
MAY
0600 GMT
R-62837
80°N
60°N
40°N
20°N
0°
20°S
40°S
60°S
180°W
120°W
60°W
0°
60°E
120°E
180°E
-30
-30
-20
-30
-30
SNR ≥ -30dB
SNR ≥ -20dB
Δφ < 20 cec
Δφ<20 cec
SNR ≥ -20dB
Δφ<20 cec
SNR ≥ -20dB
Δφ < 20 cec
SNR≥-30dB
SNR≥-20dB

ARGENTINA (F)	MAY	1800 GMT

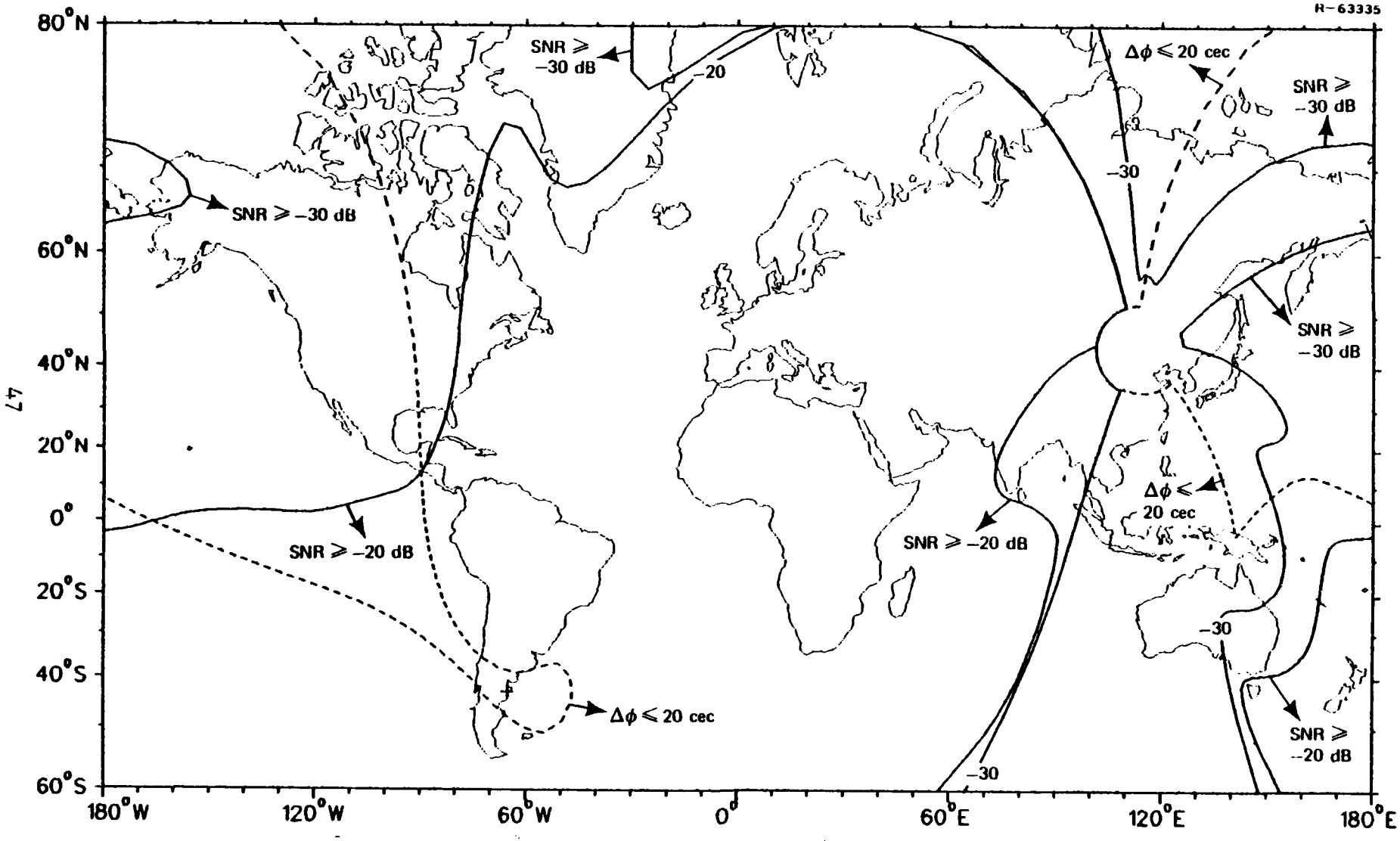



ARGENTINA (F) AUGUST 0600 GMT
R-63137
80°N
60°N
40°N
20°N
0°
20°S
40°S
60°S
180°W
120°W
60°W
0°
60°E
120°E
180°E
-20
-30
SNR ≥ -20 dB
SNR ≥ -30 dB
Δφ ≤ 20 cec

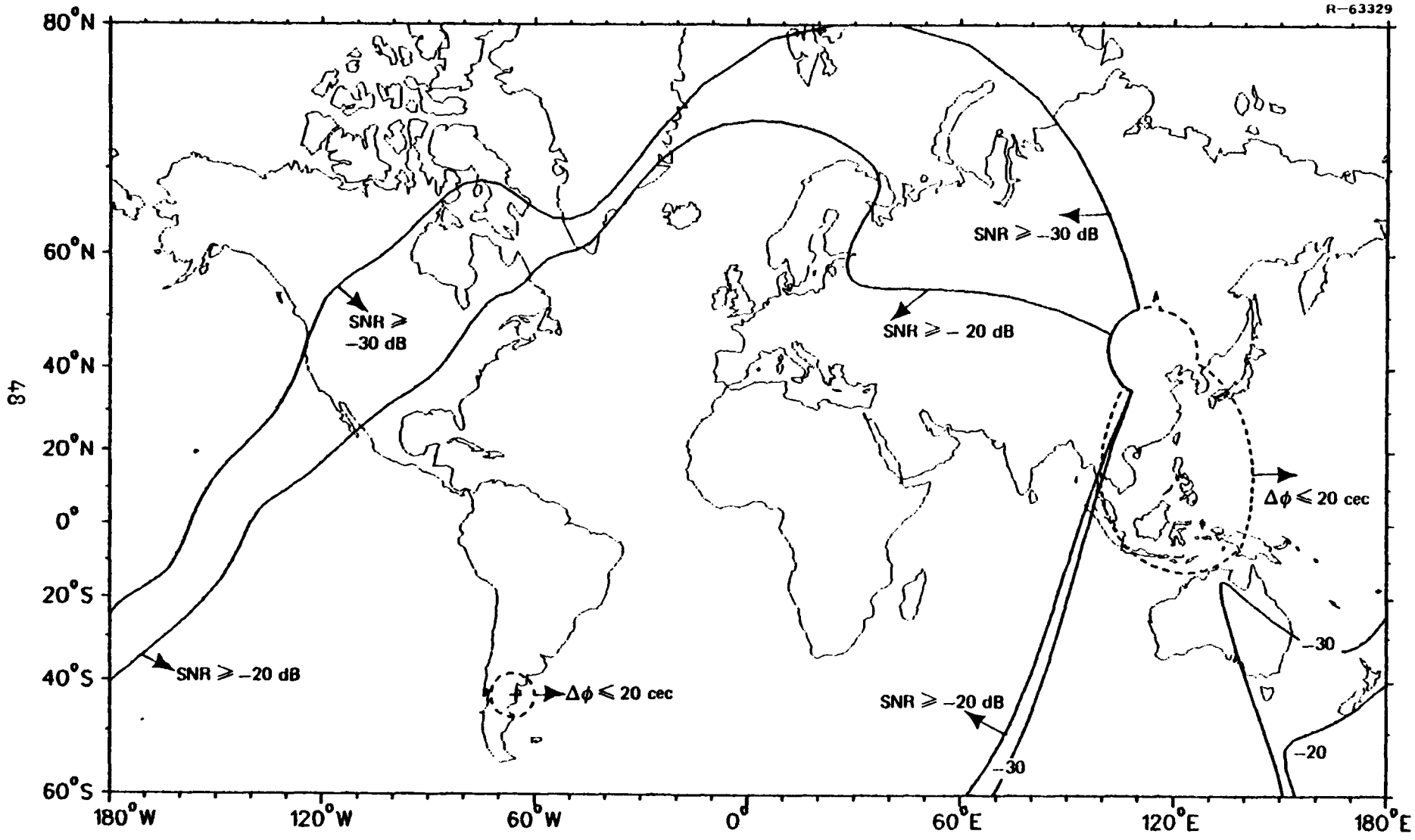
ARGENTINA (F)	AUGUST	1800 GMT



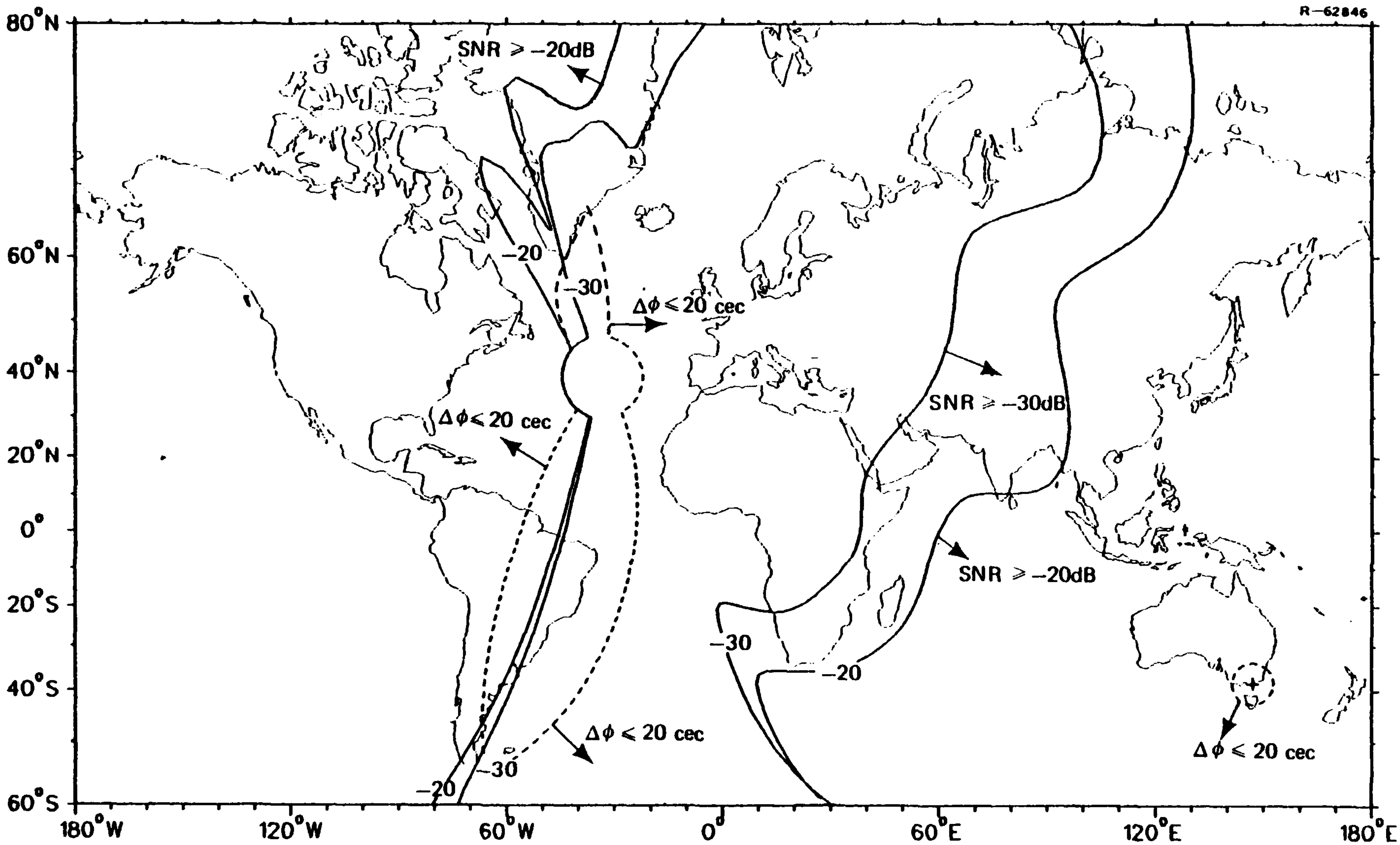
ARGENTINA (F)	NOVEMBER	0600 GMT



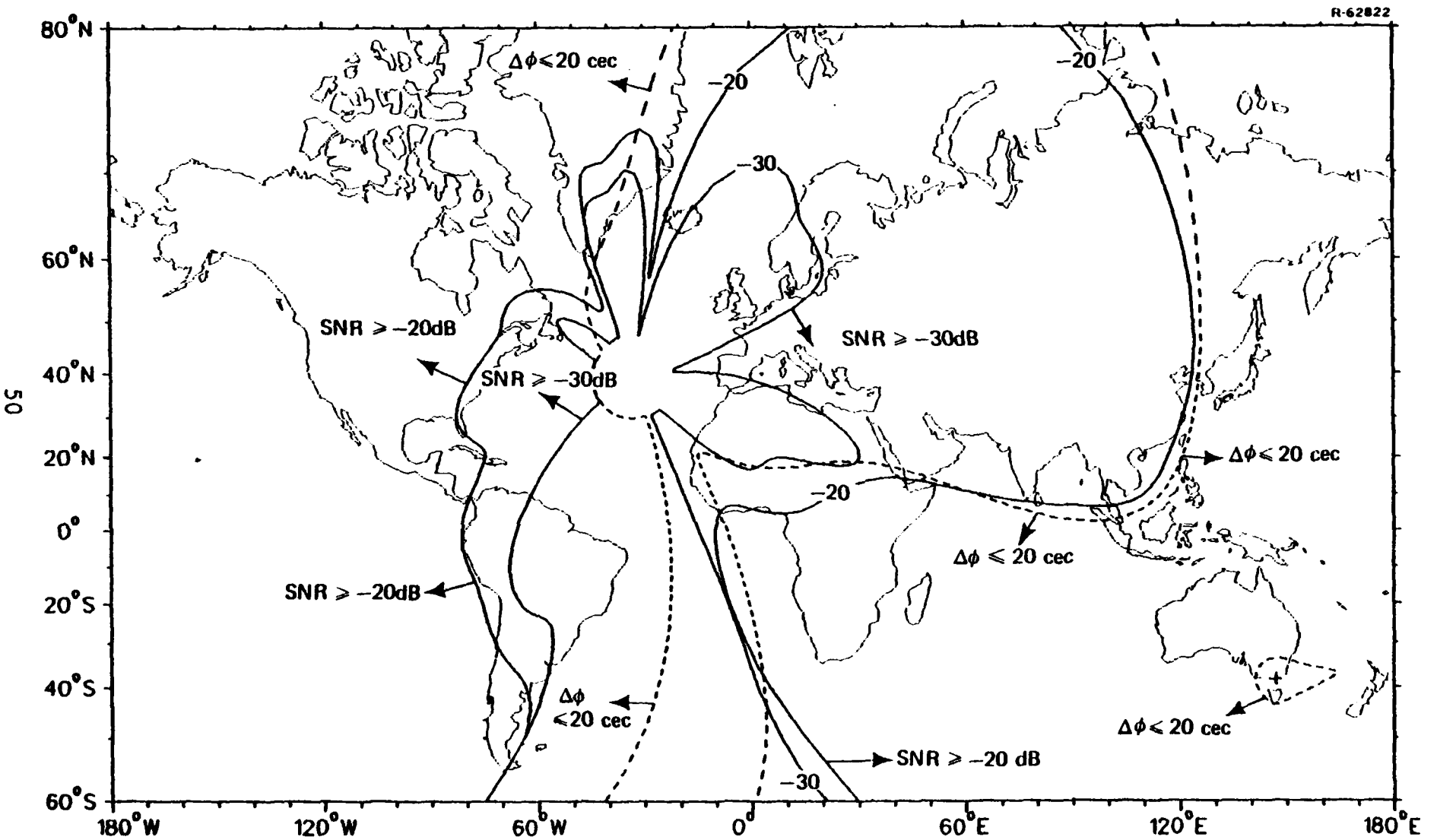
ARGENTINA (F) NOVEMBER 1800 GMT



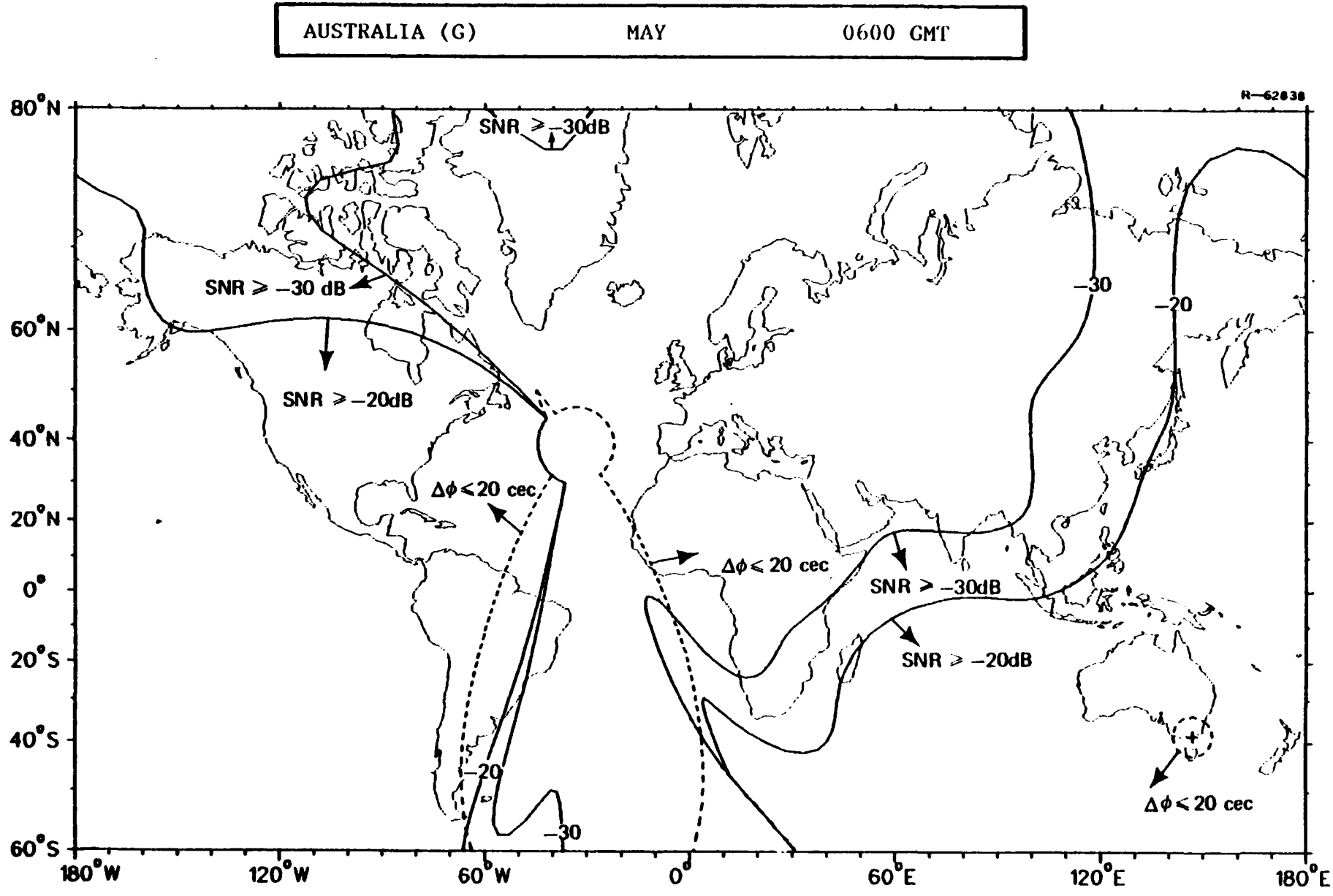
AUSTRALIA (G) FEBRUARY 0600 GMT



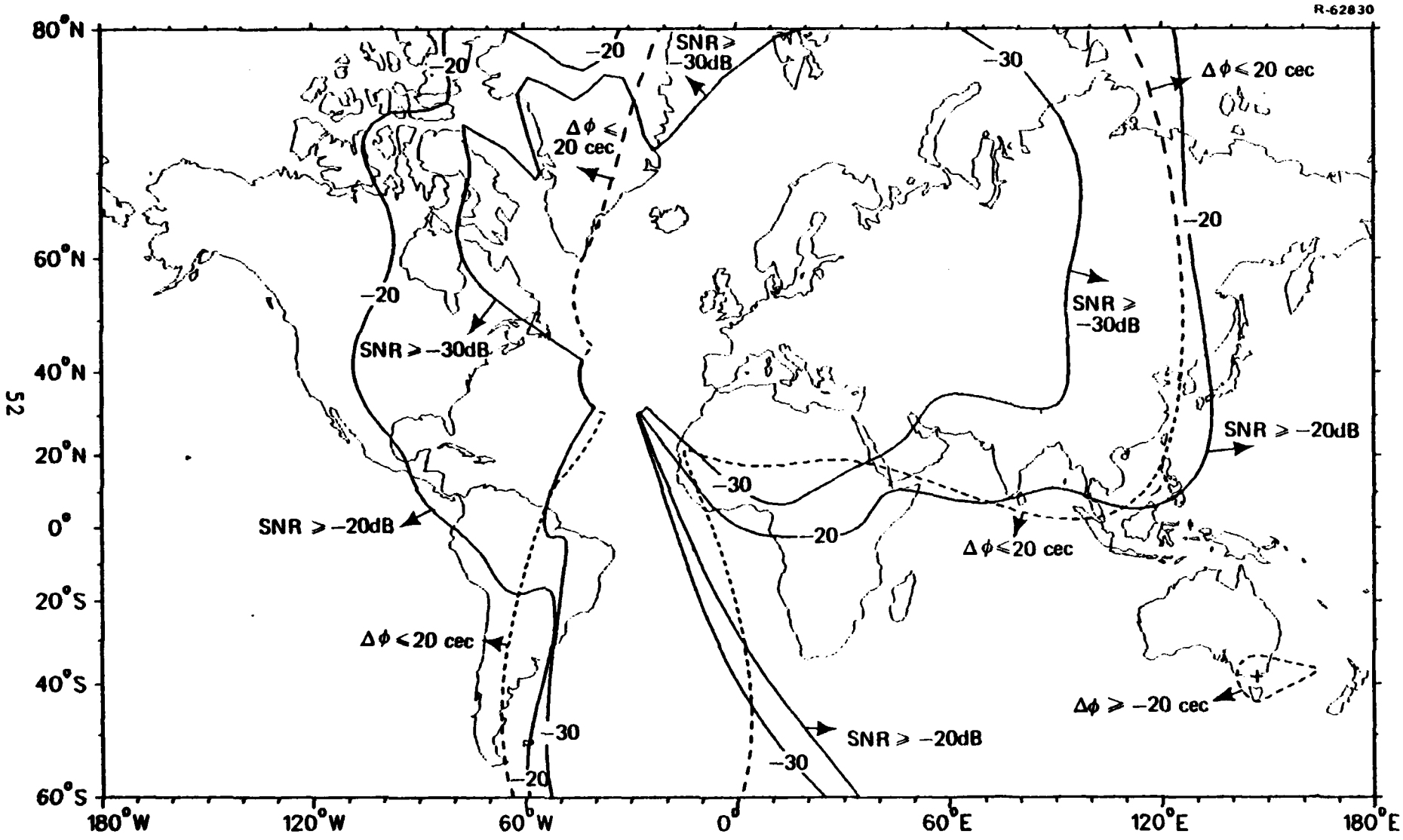
AUSTRALIA (G) FEBRUARY 1800 GMT

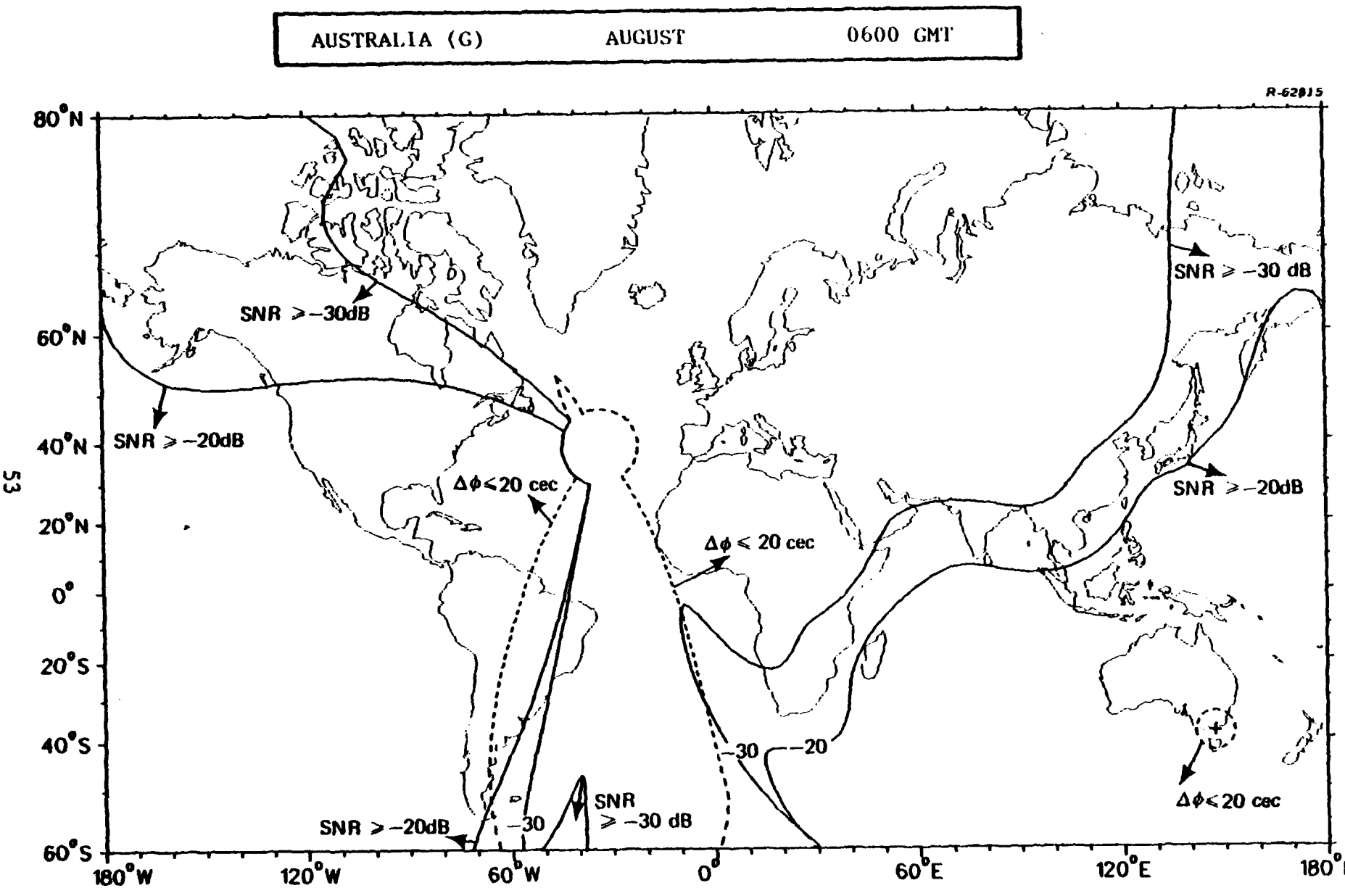


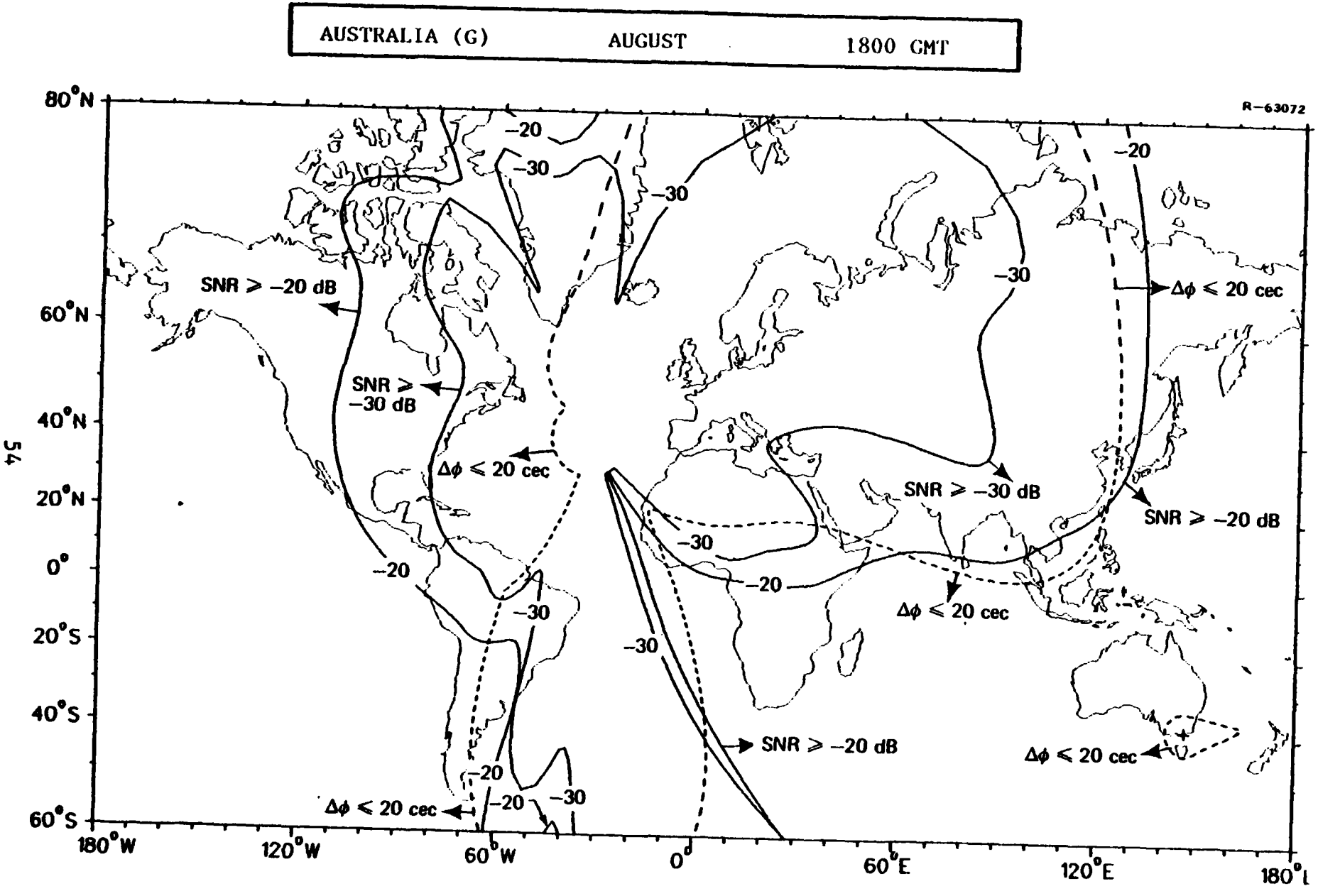
50


AUSTRALIA (G)
MAY
0600 GMT
R-62838
80°N
60°N
40°N
20°N
0°
20°S
40°S
60°S
180°W
120°W
60°W
0°
60°E
120°E
180°E
SNR ≥ −30dB
SNR ≥ −30 dB
SNR ≥ −20dB
Δϕ ≤ 20 cec
Δϕ ≤ 20 cec
SNR ≥ −30dB
SNR ≥ −20dB
Δϕ ≤ 20 cec
−30
−20
−20
−30

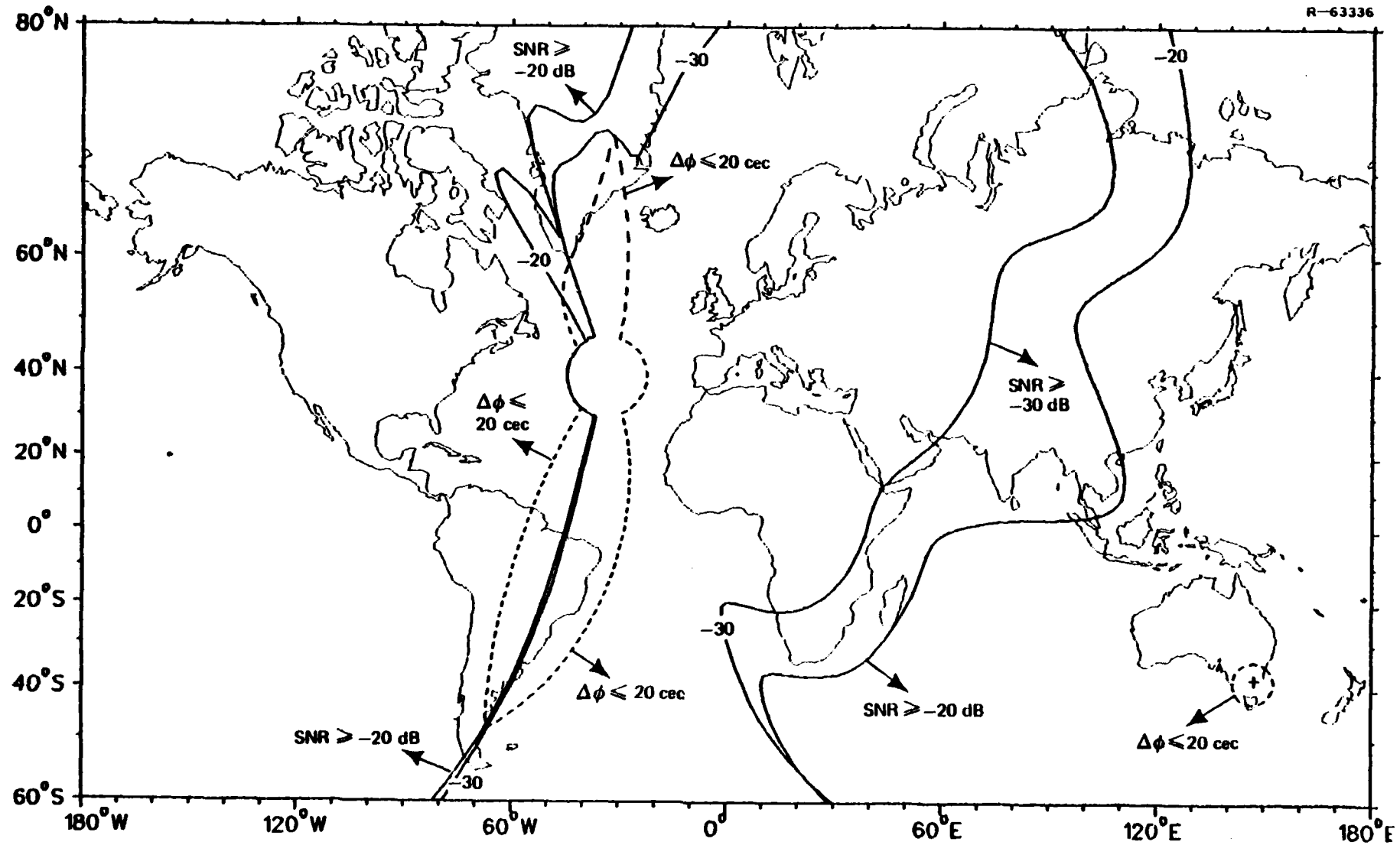
AUSTRALIA (G)	MAY	1800 GMT



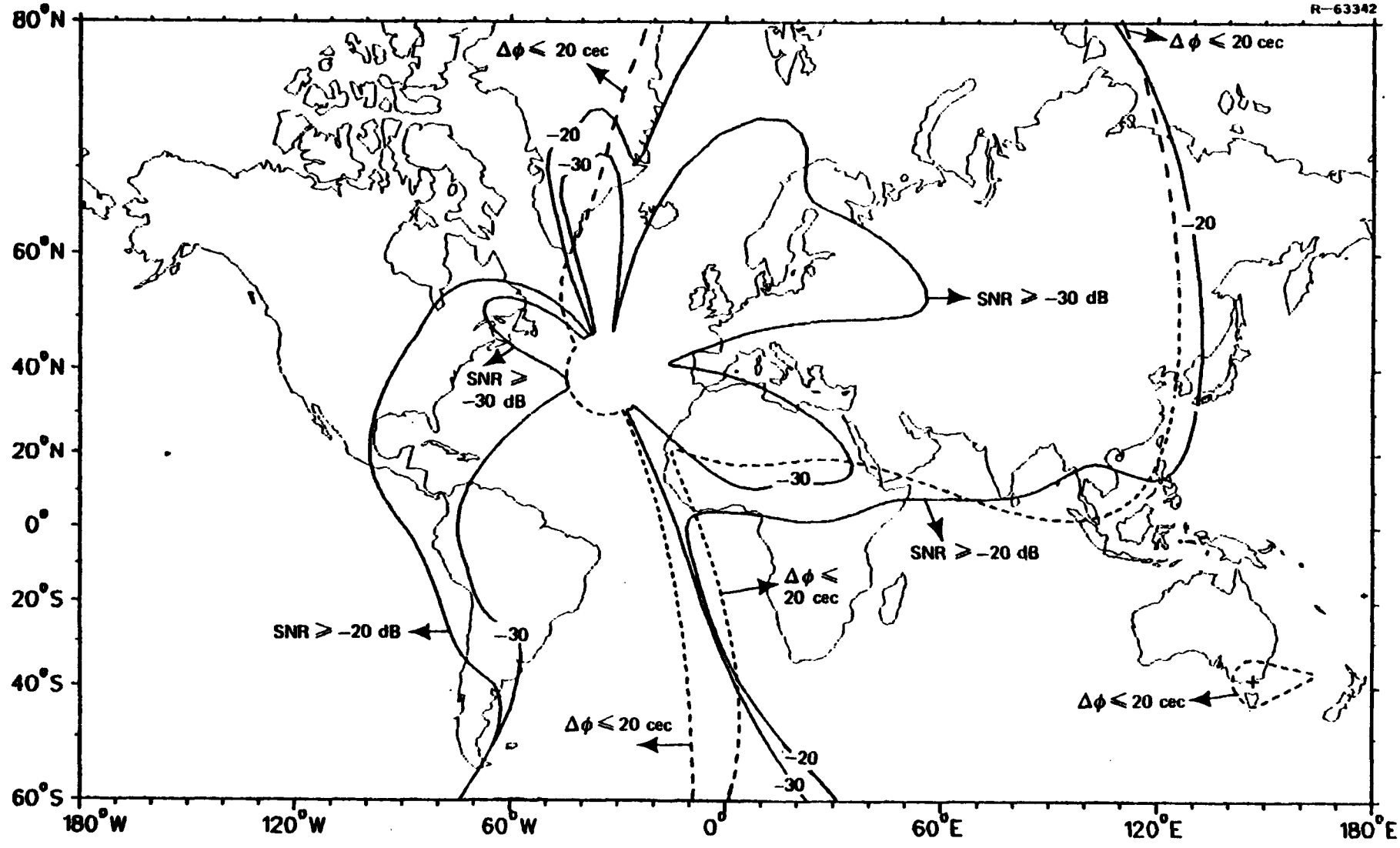

AUSTRALIA (G)
AUGUST
0600 GMT
R-62815
80°N
60°N
40°N
20°N
0°
20°S
40°S
60°S
180°W
120°W
60°W
0°
60°E
120°E
180°E
SNR ≥ −30dB
SNR ≥ −20dB
Δϕ<20 cec
Δϕ ≤ 20 cec
SNR ≥ −30 dB
SNR ≥ −20dB
−30
−20
SNR ≥ −20dB
−30
SNR ≥ −30 dB
Δϕ<20 cec


AUSTRALIA (G)
AUGUST
1800 GMT
R-63072
80°N
60°N
40°N
20°N
0°
20°S
40°S
60°S
180°W
120°W
60°W
0°
60°E
120°E
180°E
SNR ≥ −20 dB
SNR ≥ −30 dB
Δφ ≤ 20 cec
−20
−30

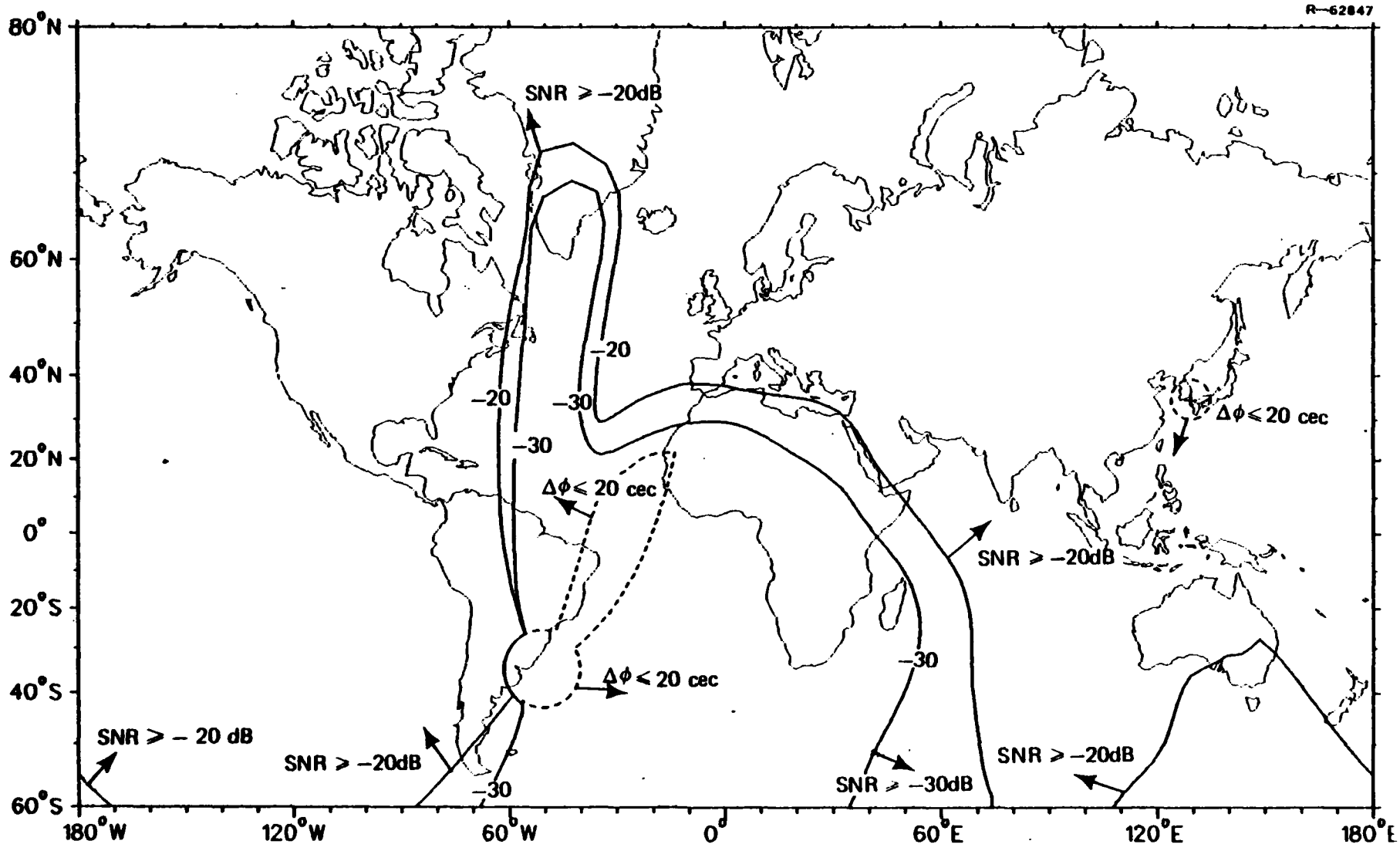
AUSTRALIA (G) NOVEMBER 0600 GMT



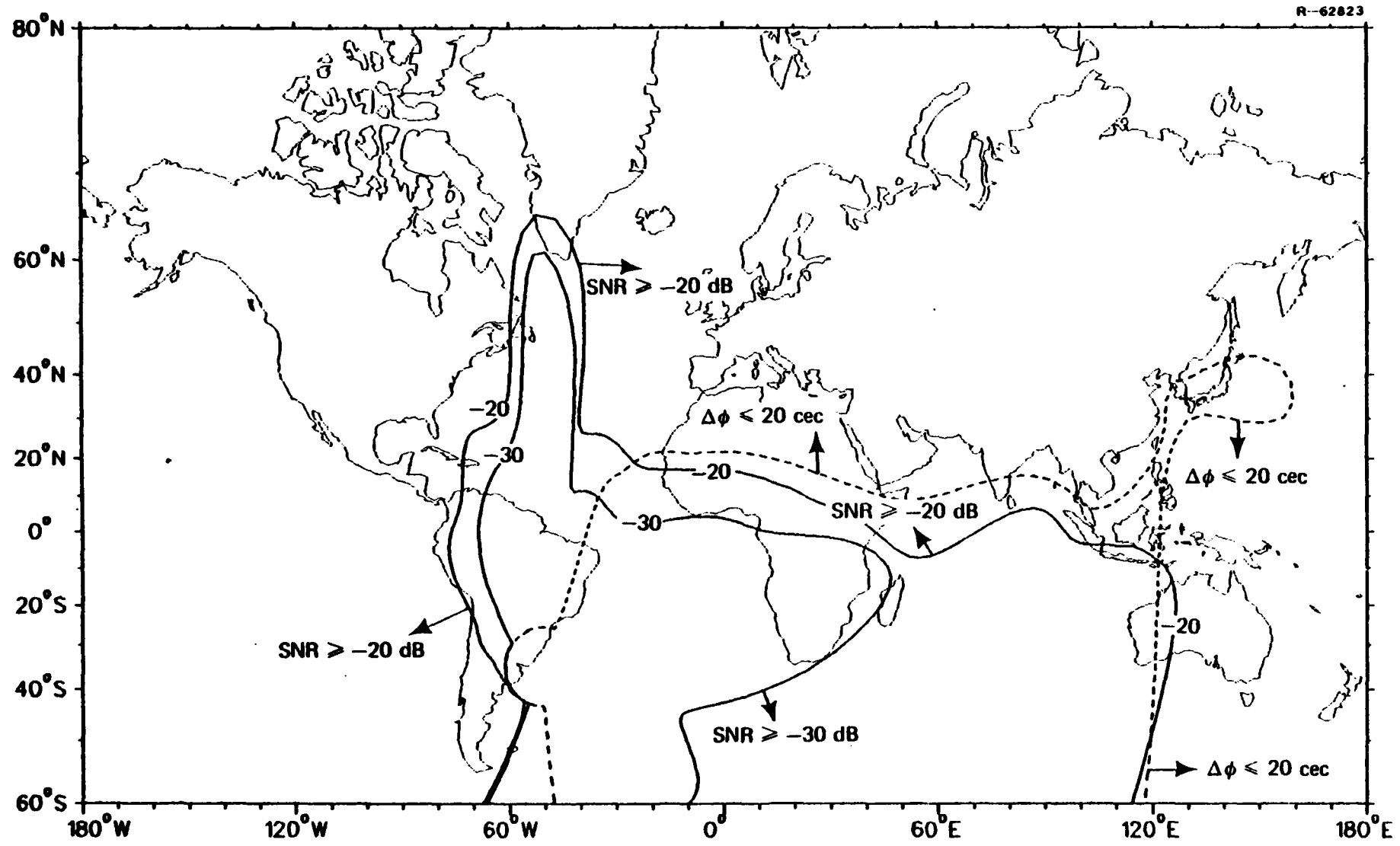
AUSTRALIA (G)	NOVEMBER	1800 GMT



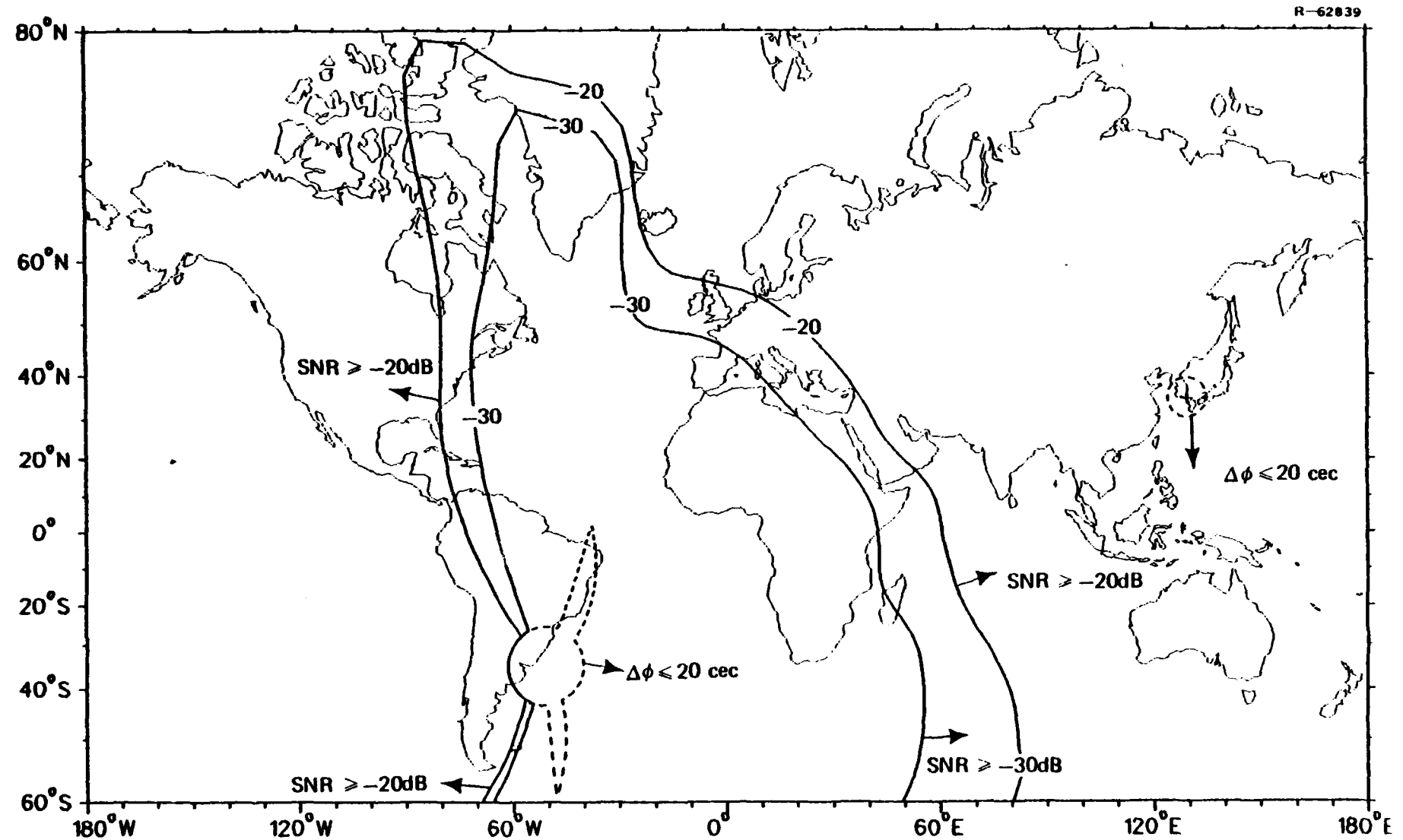
JAPAN (H) FEBRUARY 0600 GMT

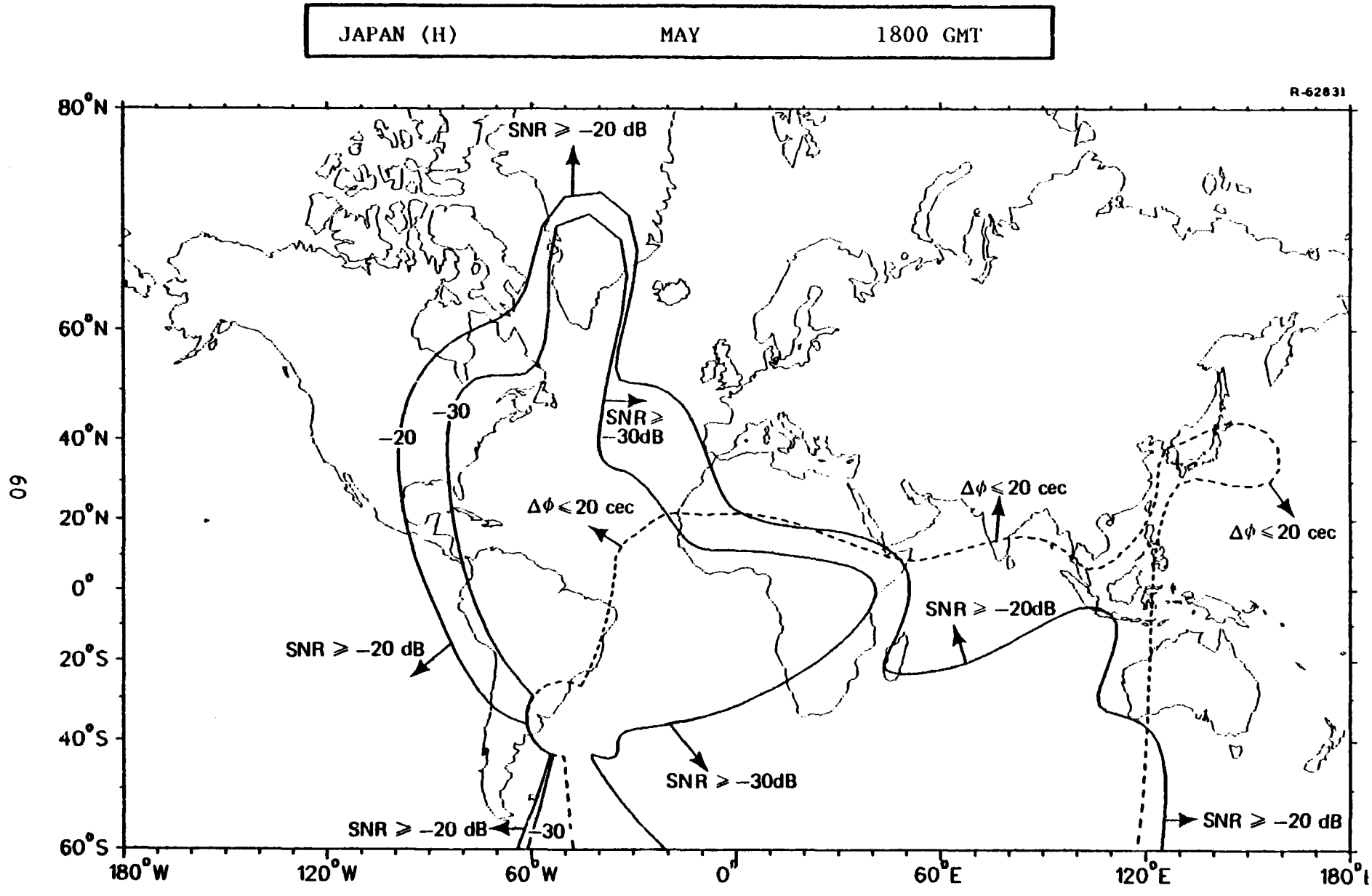


JAPAN (H)	FEBRUARY	1800 GMT

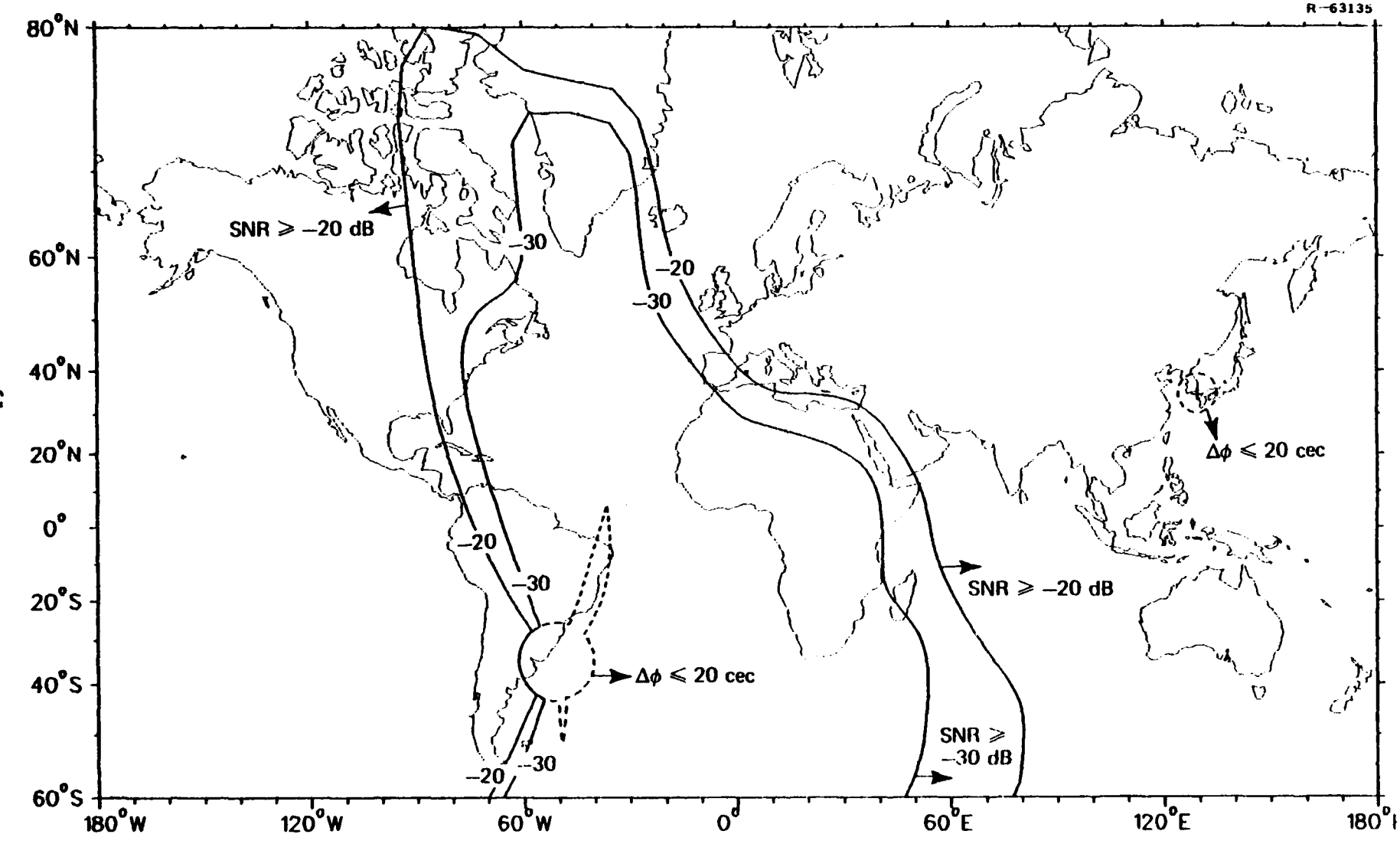


JAPAN (H) MAY 0600 GMT

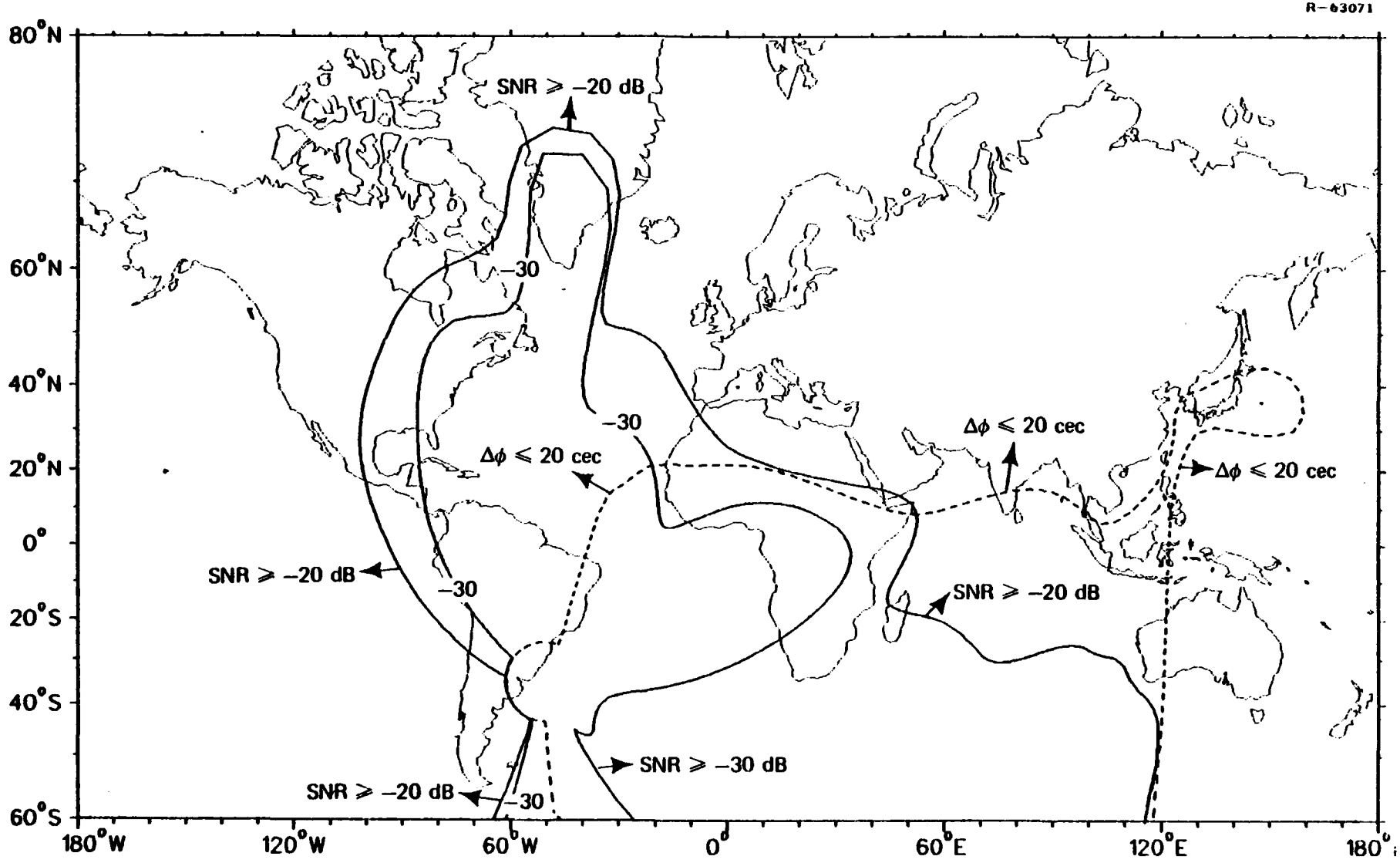


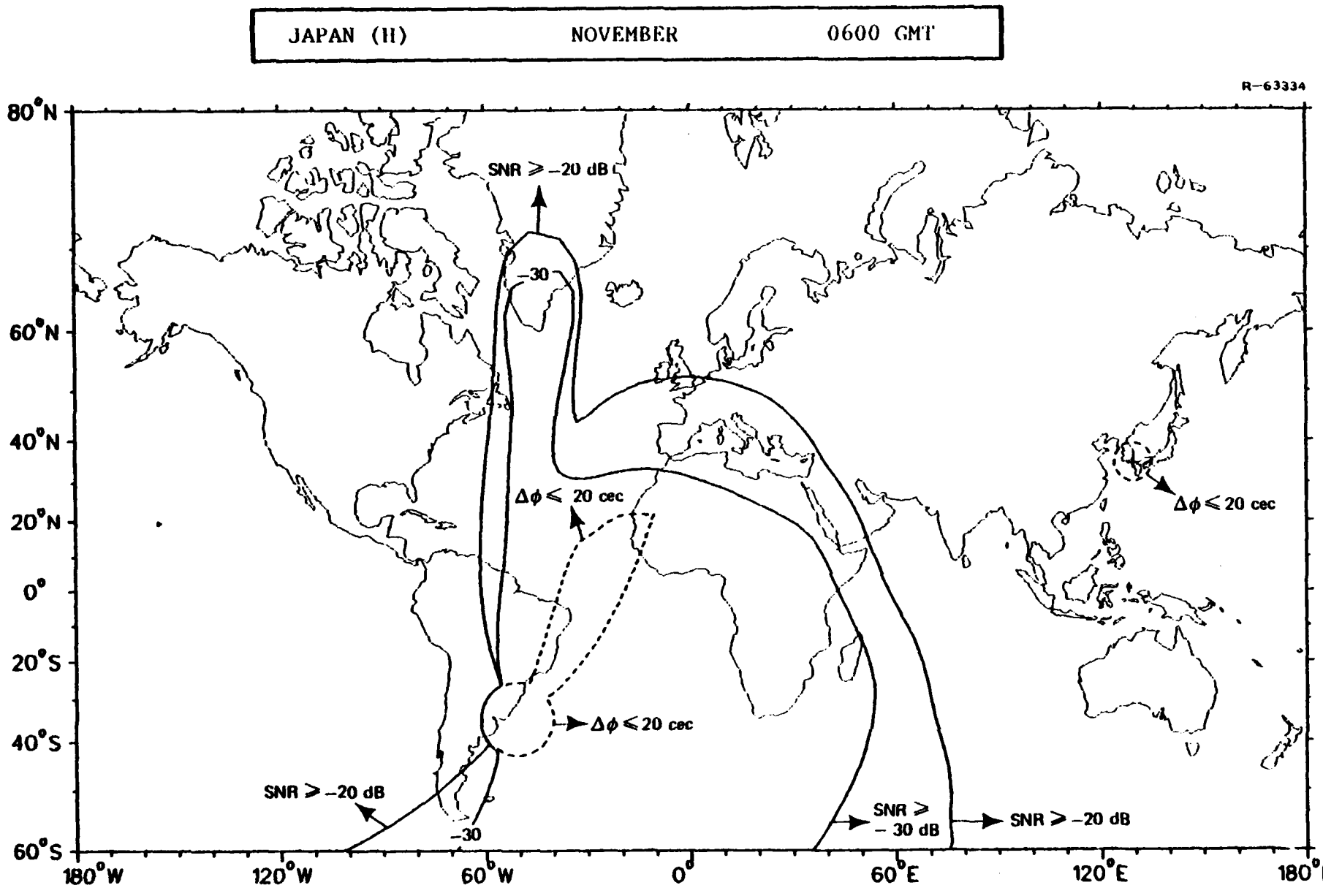

JAPAN (H)
MAY
1800 GMT
R-62831
80°N
60°N
40°N
20°N
0°
20°S
40°S
60°S
180°W
120°W
60°W
0°
60°E
120°E
180°E
SNR ≥ −20 dB
−30
−20
SNR ≥ −30dB
Δφ ≤ 20 cec
Δφ ≤ 20 cec
Δφ ≤ 20 cec
SNR ≥ −20dB
SNR ≥ −20 dB
SNR ≥ −30dB
SNR ≥ −20 dB
−30
SNR ≥ −20 dB

JAPAN (H) AUGUST 0600 GMT



JAPAN (H)	AUGUST	1800 GMT




JAPAN (H)
NOVEMBER
0600 GMT
R-63334
80°N
60°N
40°N
20°N
0°
20°S
40°S
60°S
180°W
120°W
60°W
0°
60°E
120°E
180°E
SNR ≥ −20 dB
−30
Δφ ≤ 20 cec
Δφ ≤ 20 cec
Δφ ≤ 20 cec
SNR ≥ −20 dB
−30
SNR ≥ − 30 dB
SNR ≥ −20 dB

JAPAN (H) NOVEMBER 1800 GMT