

VLB ARRAY MEMO No. 288

National Radio Astronomy Observatory
Charlottesville, Virginia

Oct. 31, 1983

To: VLBA Configuration/Site Group
From: R. C. Walker
Subject: Possible change in the site near the VLA.

I have recently examined the u-v coverage provided by the VLBA station nearest the VLA when used with the VLA in somewhat greater detail than I had before. The sites recommended in VLBA Memos 205 and 250 were optimized for performance when the full VLBA, including the 3 additional stations that might eventually be built in New Mexico, was used with the VLA to obtain a very wide range of baselines. The sites found in that optimization left holes between the VLBA and the VLA that are comparable in terms of percent of uv distance with other holes in the uv coverage of the joint arrays. However those holes are large compared to holes in typical VLA coverage (The VLA covers a smaller range of spacings with many more antennas). My recent work shows that significant improvement in the performance of the VLA plus just the nearest antenna (which will be connected to the VLA by microwave link) of the original 10 element array can be obtained by using a somewhat different strategy than that suggested in Memos 205 and 250. The performance of the VLBA alone and of the full VLBA plus VLA combination are not significantly affected. The two most desirable options are:

1.) Use a site to the south of the VLA but somewhat closer to the VLA than the previously considered Winston site. The vicinity of Dusty is good. This does for the A array of the VLA what the long north arms of the hybrid configurations do for the more compact VLA configurations - provides much improved coverage of very low declination sources such as the galactic center and Cen A. There may be a problem with the availability of power near Dusty.

2.) Use the Pie Town site (of the 13 element array) in the original 10 stations instead of a site to the south of the VLA. This option provides very good coverage and significantly greater resolution than the Dusty site for a wide range of northern declination sources. It also is a site for which land is available and access is easy (on Rt 60 about an hour west of the VLA).

Both the Winston site and the alternate in the Rio Grande Valley leave fairly large holes (by VLA standards) and so are not as good as the above two. The Rio Grande site could be moved north to a spot on Rt 107 to obtain coverage very similar to Pie Town site. But if that is done and the additional stations are eventually built, the antenna that would have gone to Pie Town would have to go further south and the Bernardo antenna would need to be north of the VLA, in a region with very poor access.

If it is considered desirable to have an antenna very near the headquarters and if the headquarters is put in Socorro, the Bernardo site (of the 13 station configuration) could be used. The Bernardo site is about 20 miles north of Socorro. The coverage of neither Bernardo plus the VLA nor of the VLBA alone would be as good as with one of the above options. However the coverage of the 10 station VLBA, with Bernardo, plus the VLA is competitive with the other options.

A couple of reminders about possible future additions to the VLBA: If the 3 additional stations are built in New Mexico to close the gap between the VLBA and the VLA, Pie Town, Bernardo, and one of Winston, Dusty, or the Rio Grande site will all have antennas. Also I note that all of the talk of the 13 station array has made some people forget that there is another very attractive possible addition to the array (probably as the 14 th antenna) in the form of a station in South America, probably Ecuador. Such a southern extension would greatly improve the coverage on southern sources.

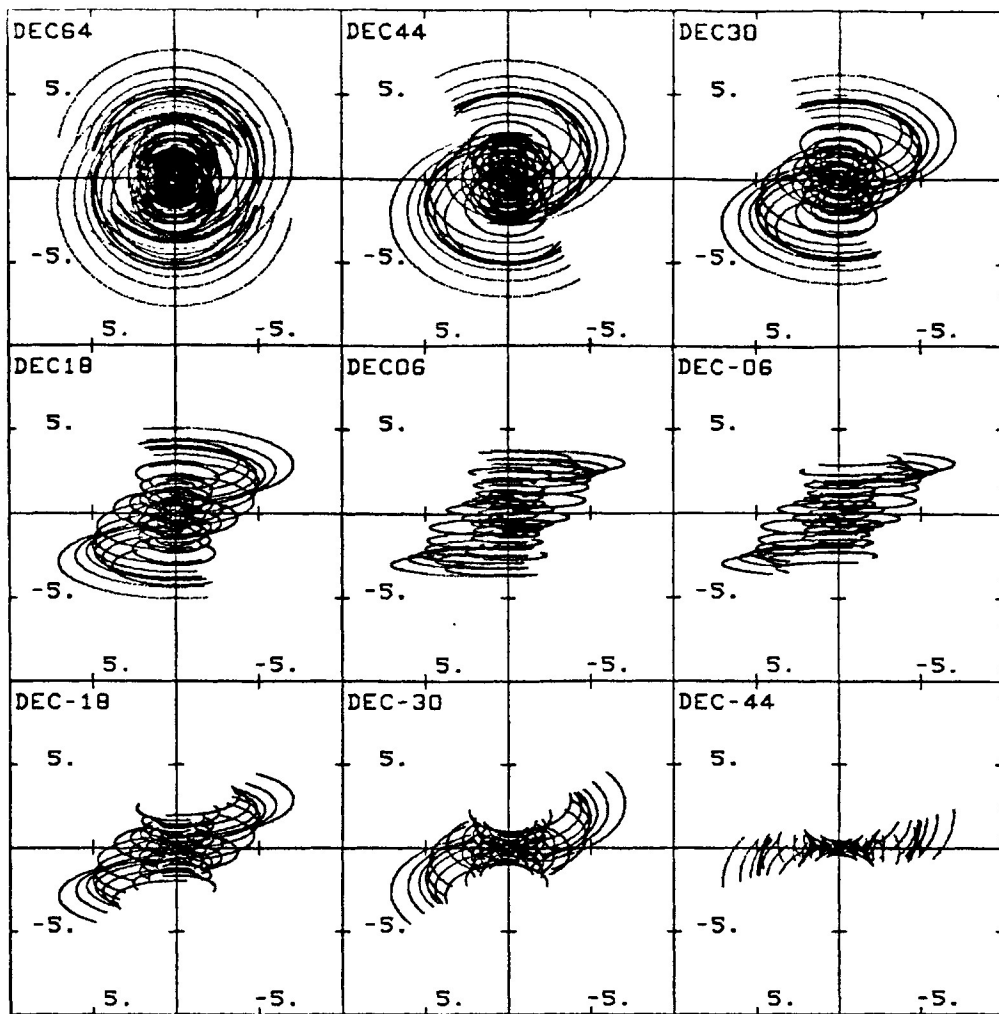
Attached are a selection of u-v plots showing the coverage provided by the various possible options for the site near the VLA. For each of Winston, Dusty, Pie Town, and Bernardo, three different plots are given: 1) the site plus nine antennas of the VLA (every 3 ed down each arm) on a scale showing coverage out to 100 km, 2) the inner 2000 km of the coverage of the VLBA alone using the site, and 3) the inner 500 km of the coverage of 4 antennas of the VLA plus the VLBA (10 station) using the site. Plots of the VLA plus the Rio Grande Valley site, of the VLA plus Pie Town, Bernardo, and Dusty, of the VLA plus Pie Town, Bernardo, and Winston, and of the VLA plus the 13 station VLBA using Winston and using Dusty are also included. In the larger scale plots, the only significant changes are near the center of the u-v plane so concentrate attention on the inner few tracks. Please excuse the smallness of the figures - it saves paper.

AE3	34.07	107.59
AE6	34.04	107.52
AE9	34.00	107.41
AW3	34.06	107.64
AW6	34.03	107.71
AW9	33.97	107.81
AN3	34.11	107.62
AN6	34.16	107.62
AN9	34.24	107.63
PIETOWN	34.33	108.14

Scale in km
(kilometers $\times 10^1$)

100 km scale

Pie Town + VLA

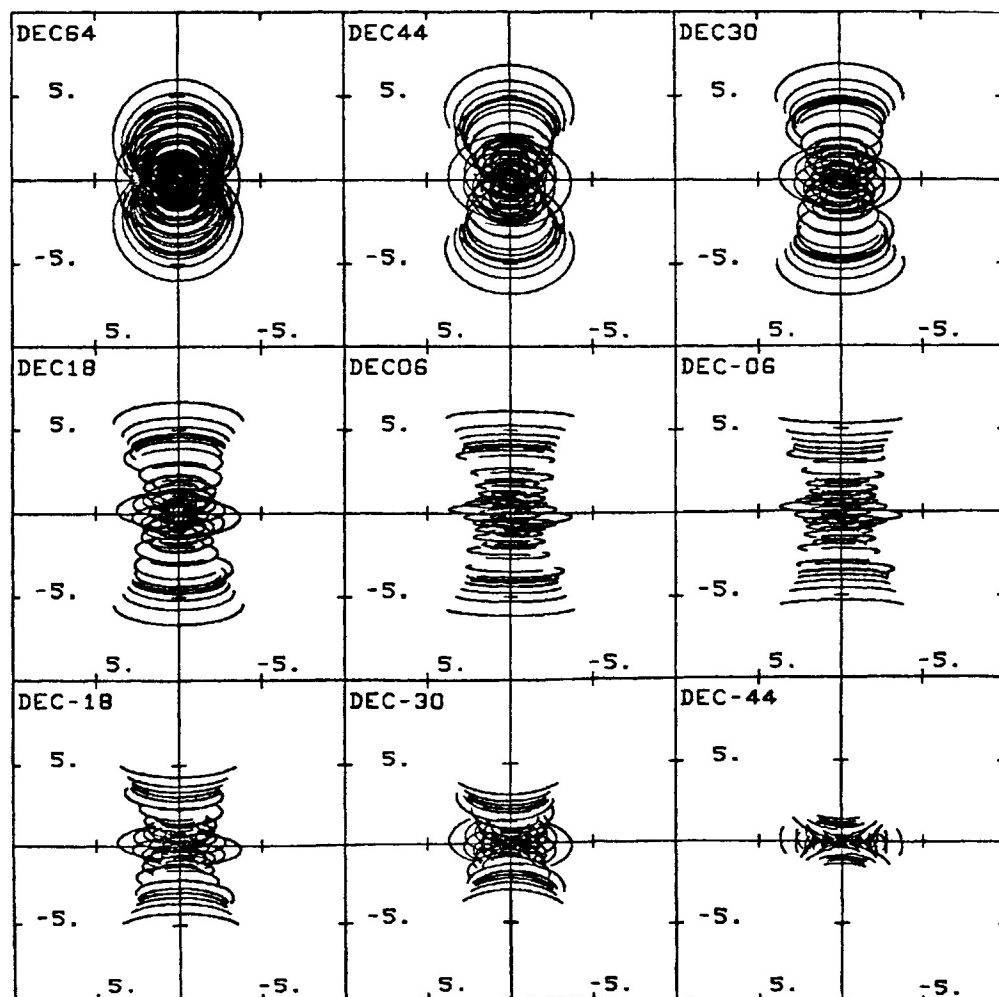


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AN3	34.11	107.62
AN6	34.16	107.62
AN9	34.24	107.63
DUSTY	33.62	107.65

Scale in km
(kilometers $\times 10^1$)

100 km Scale

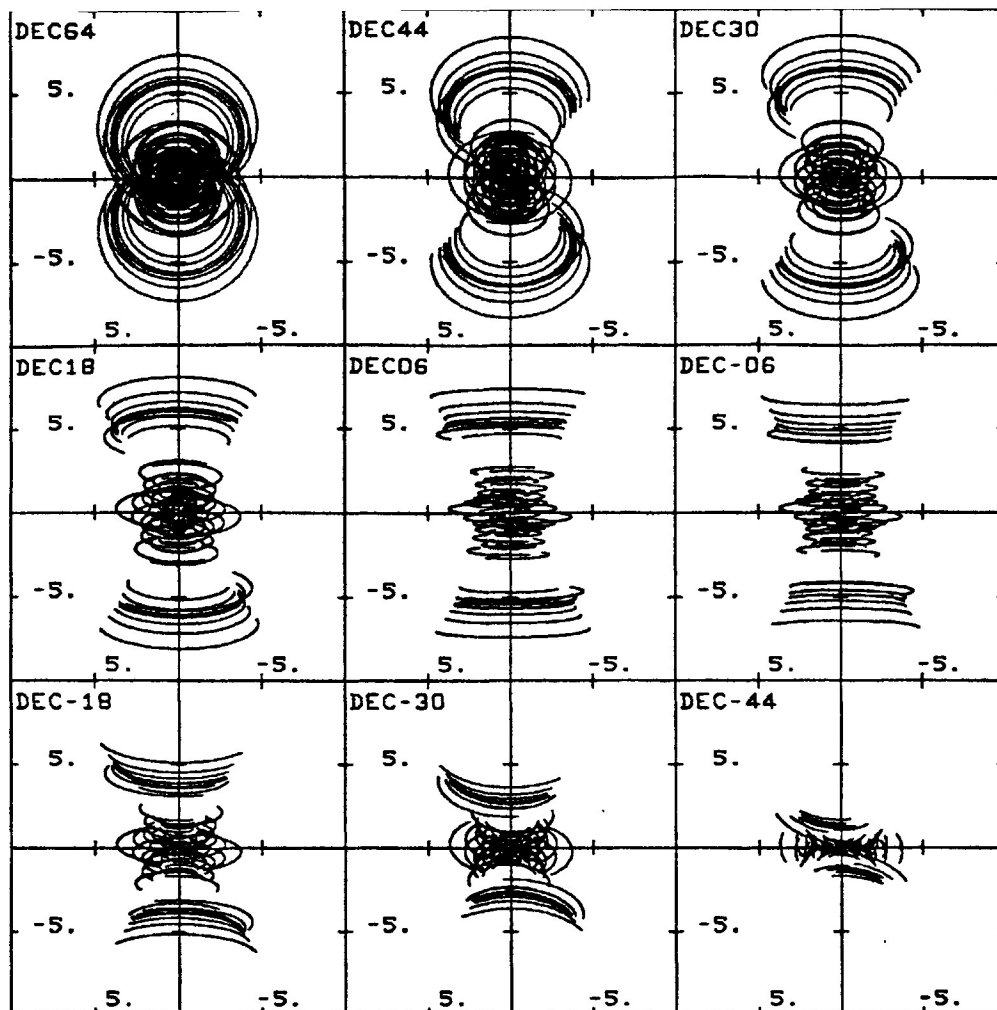
Dusty + VLA



AE3	34.07	107.59
AE6	34.04	107.52
AE9	34.00	107.41
AW3	34.06	107.64
AW6	34.03	107.71
AW9	33.97	107.81
AN3	34.11	107.62
AN6	34.16	107.62
AN9	34.24	107.63
WINSTON	33.49	107.74

Scale in km
(kilometers $\times 10^1$)

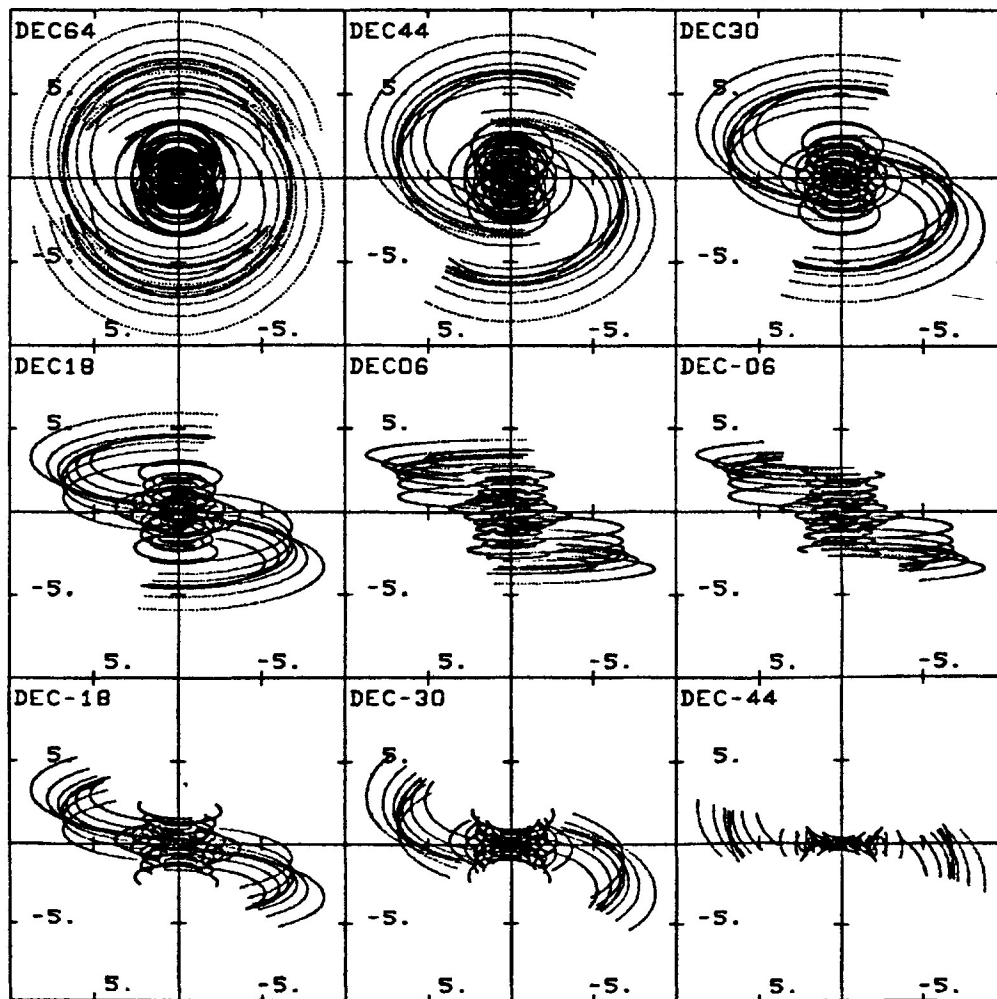
100 km Scale
Winston + VLA



AE3	34.07	107.59
AE6	34.04	107.52
AE9	34.00	107.41
AW3	34.06	107.64
AW6	34.03	107.71
AW9	33.97	107.81
AN3	34.11	107.62
AN6	34.16	107.62
AN9	34.24	107.63
BERNARDO	34.35	106.90

Scale in km
(kilometers $\times 10^1$)

100 km Scale
Bernardo + VLA



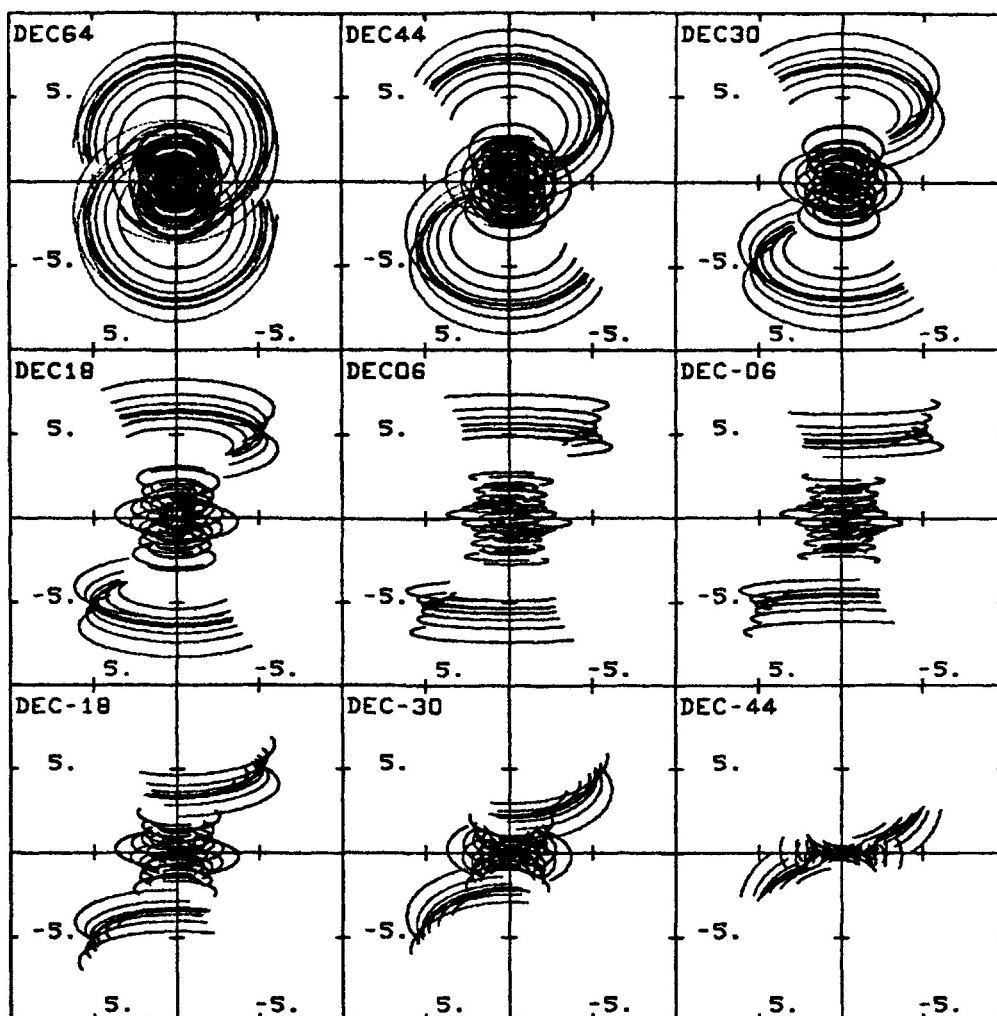
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AW9	33.97	107.81
AN3	34.11	107.62
AN6	34.16	107.62
AN9	34.24	107.63
RIOGRAND	33.51	107.22

Scale in km
(kilometers x 10¹)

100 km Scale

Rio Grande Valley
(North of Truth
or Consequences)

+ VLA

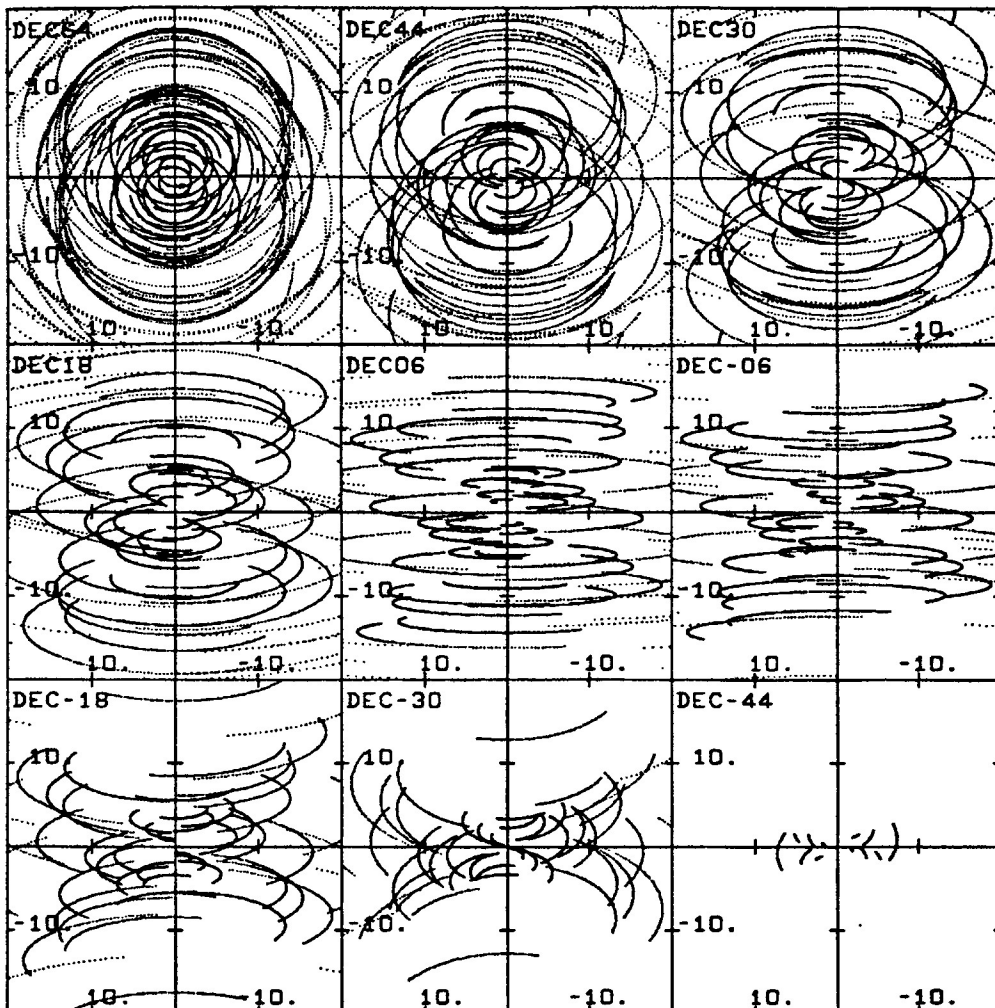


ARECIBO	18.34	66.75
HSTK	42.43	71.49
IOWA	41.58	91.57
FDUSNEW	30.47	103.95
LASL2	35.81	106.27
PIETOWN	34.33	108.14
KITT	31.96	111.60
WENATCH	47.40	120.30
OURO	37.05	118.28
HAWAII	19.80	155.50

Scale in km
(kilometers $\times 10^2$)

2000 km Scale

VLBA with
Pie Town

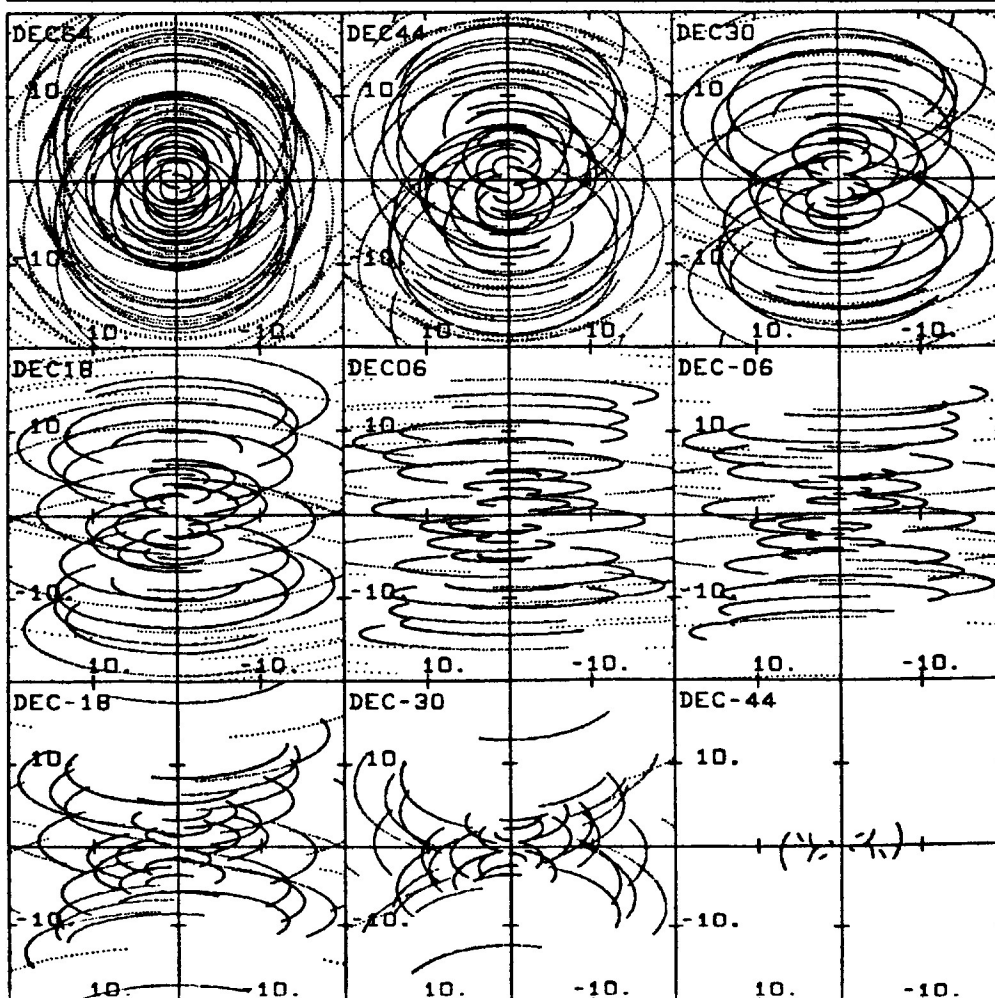


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Scale in km
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2000 km Scale

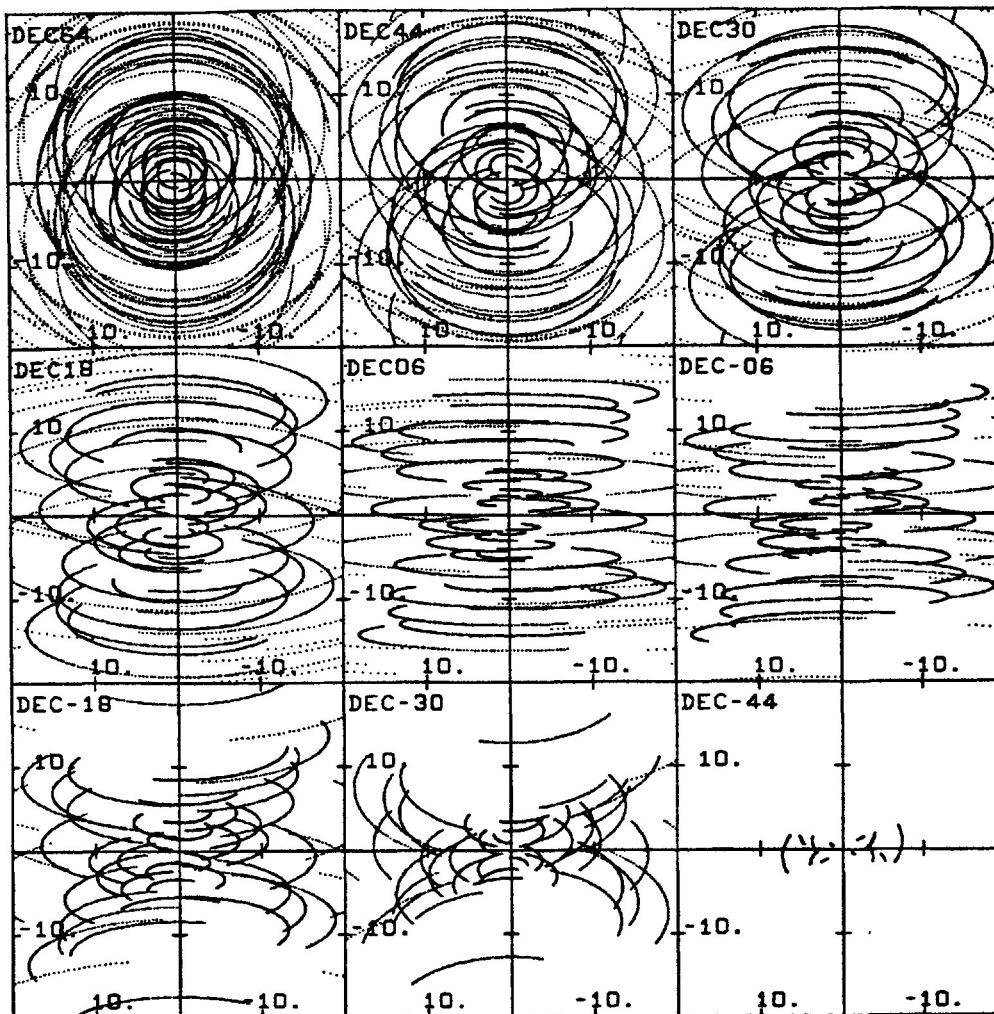
VLBA with
Dusty



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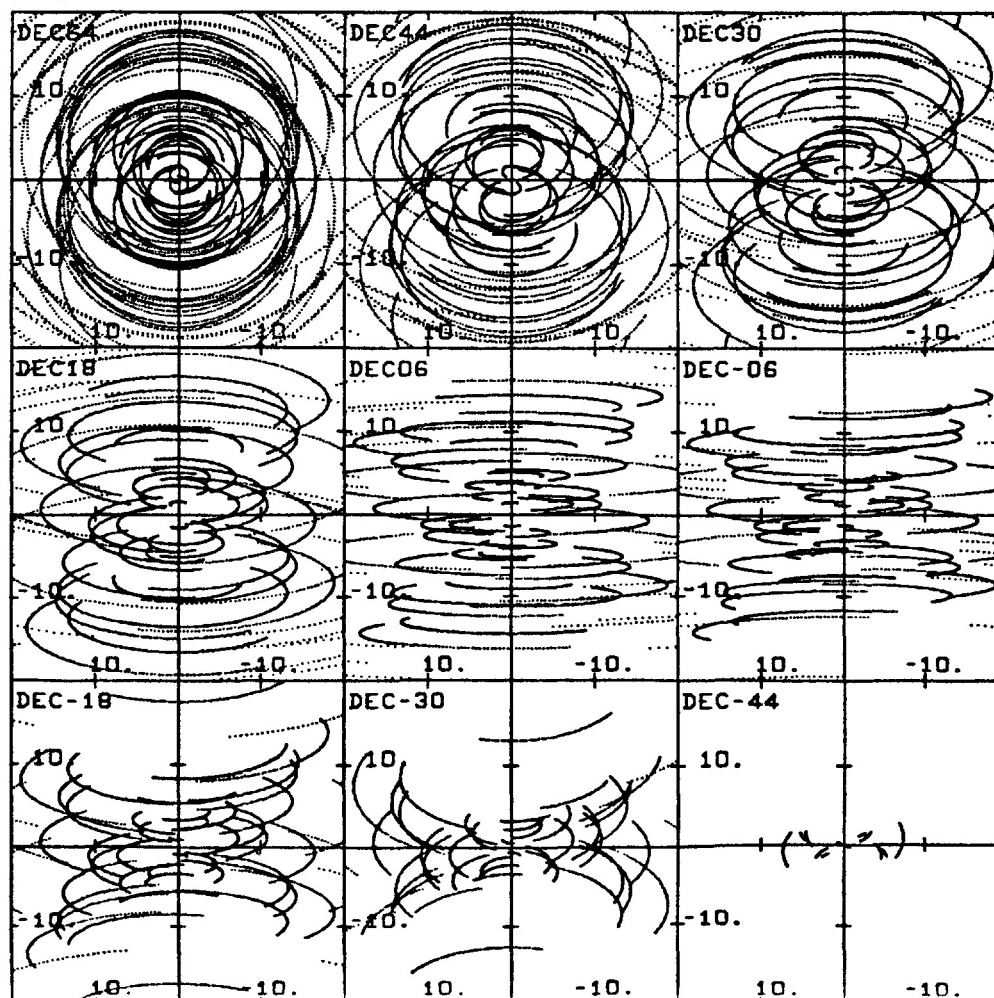
2000 km Scale
VLBA with
Winston



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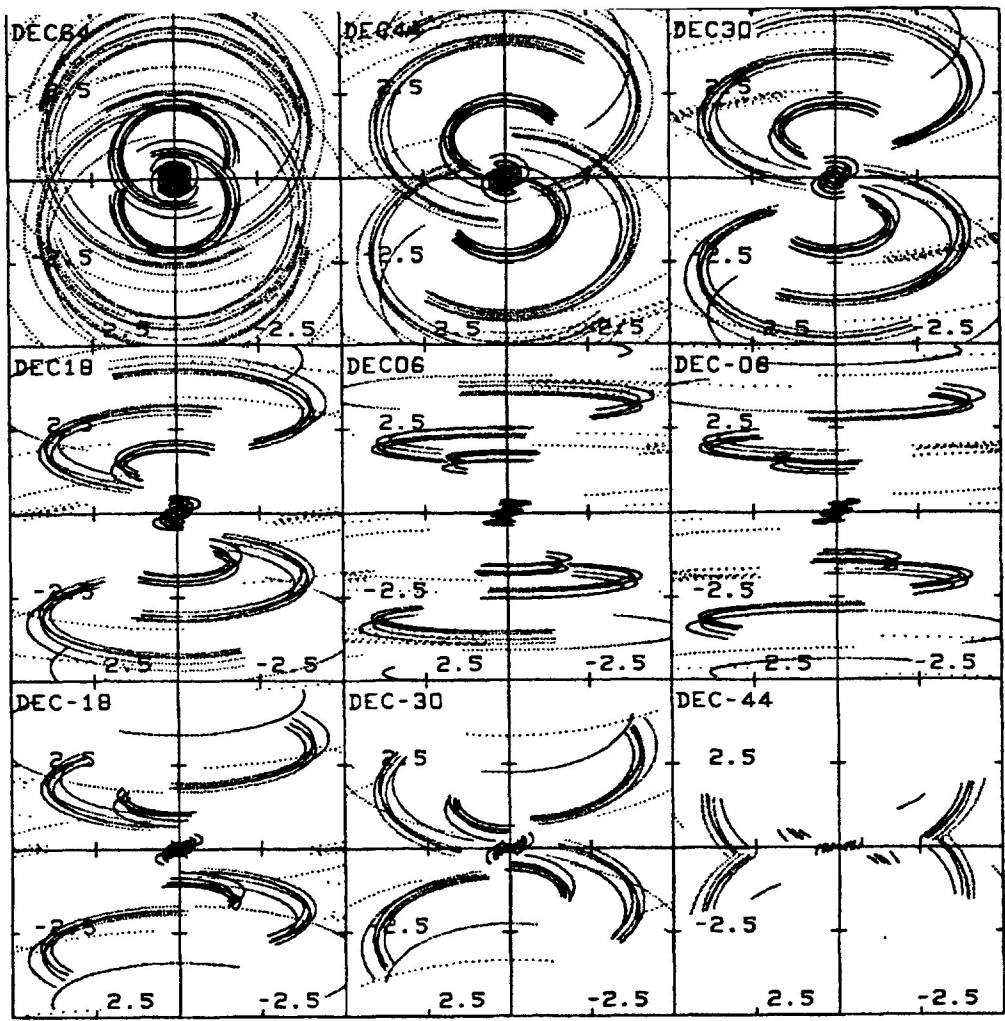
2000 km Scale
VLBA with
Bernardo



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Scale in km
(kilometers x 10²)

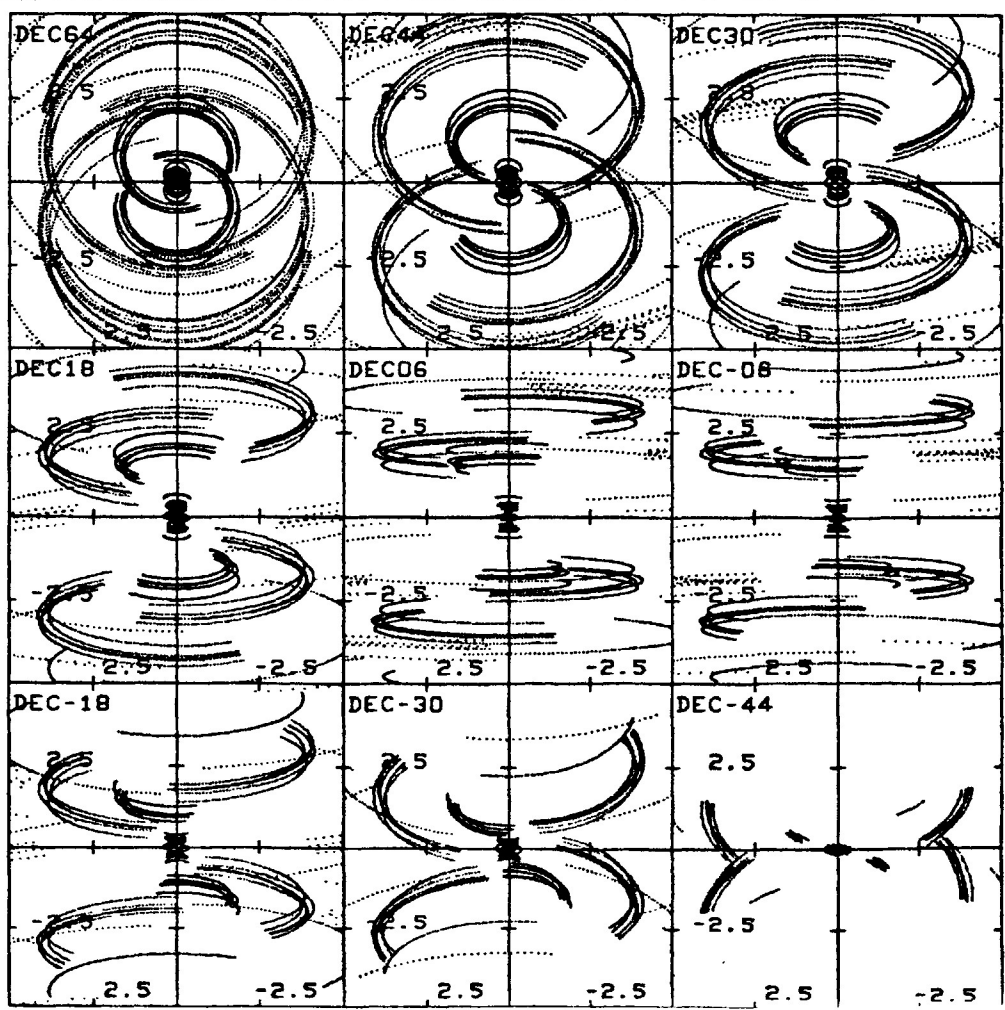
500 km Scale
VLA + VLBA
with Pie Town



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Scale in km
(kilometers x 10²)

500 km Scale
VLA + VLBA
with Dusty

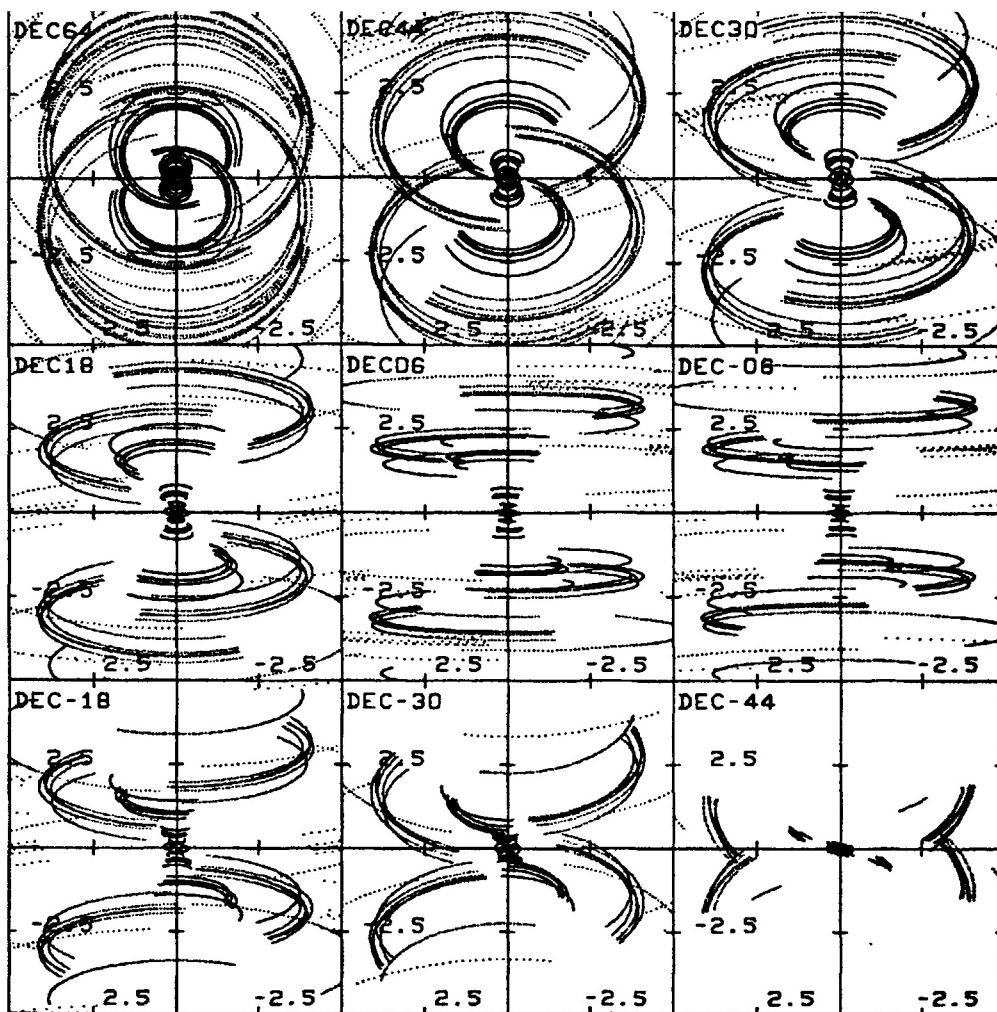


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Scale in km
(kilometers x 10²)

500 km Scale

VLA + VLBA
with Winston

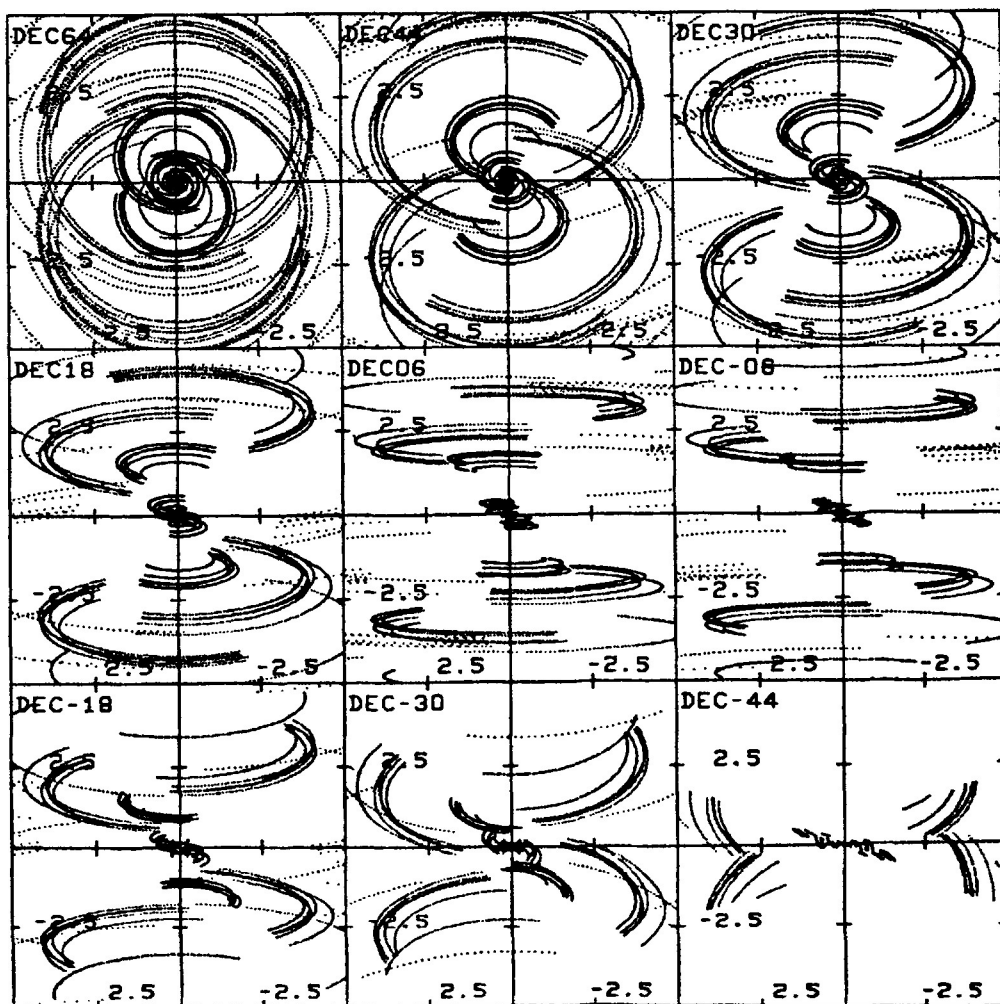


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Scale in km
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500 km Scale

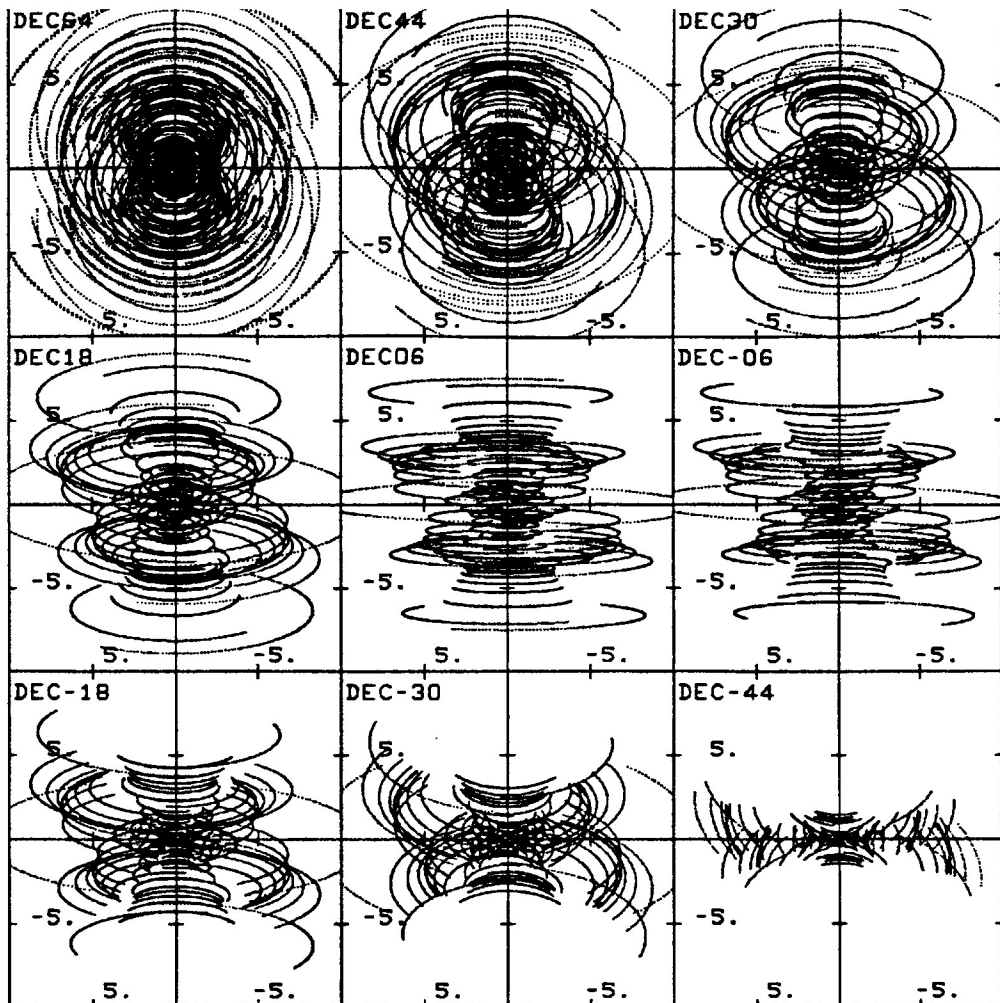
VLA + VLBA
with Bernardo



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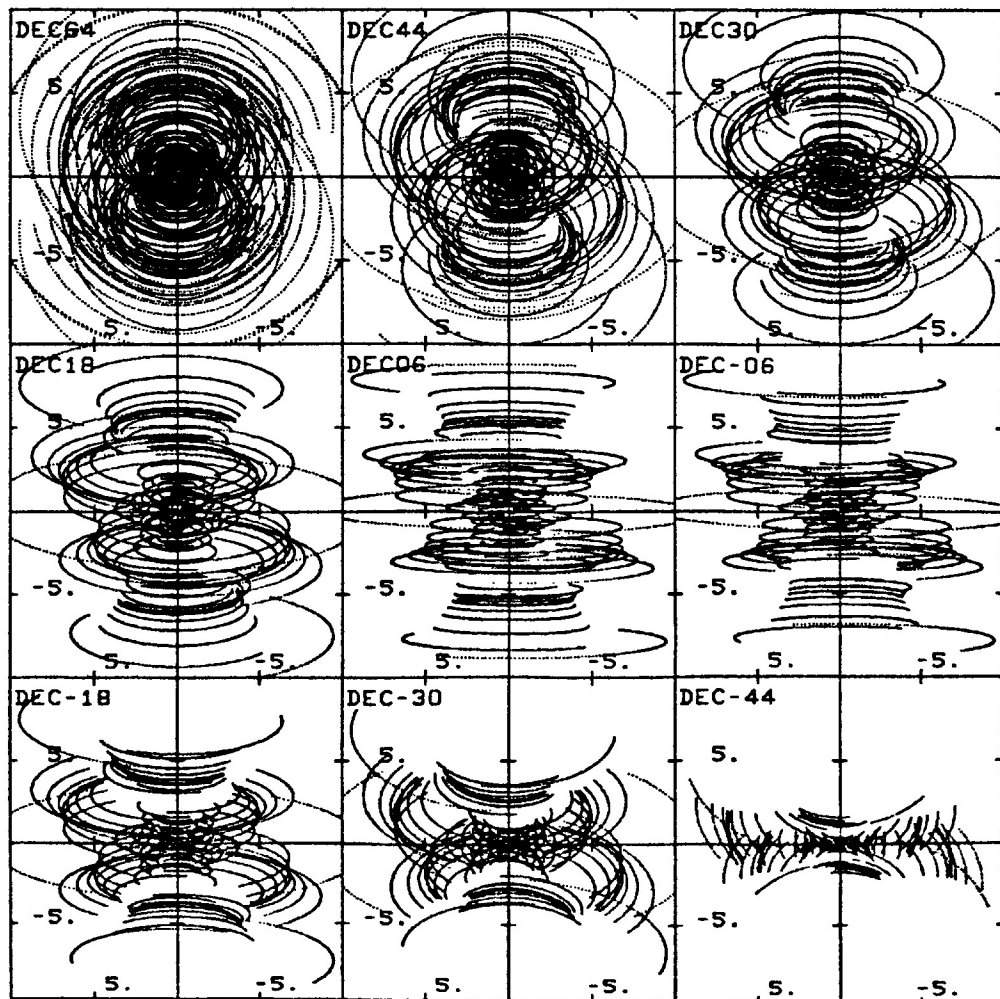
100 km Scale
VLA with
Dusty
Pie Town
Bernardo



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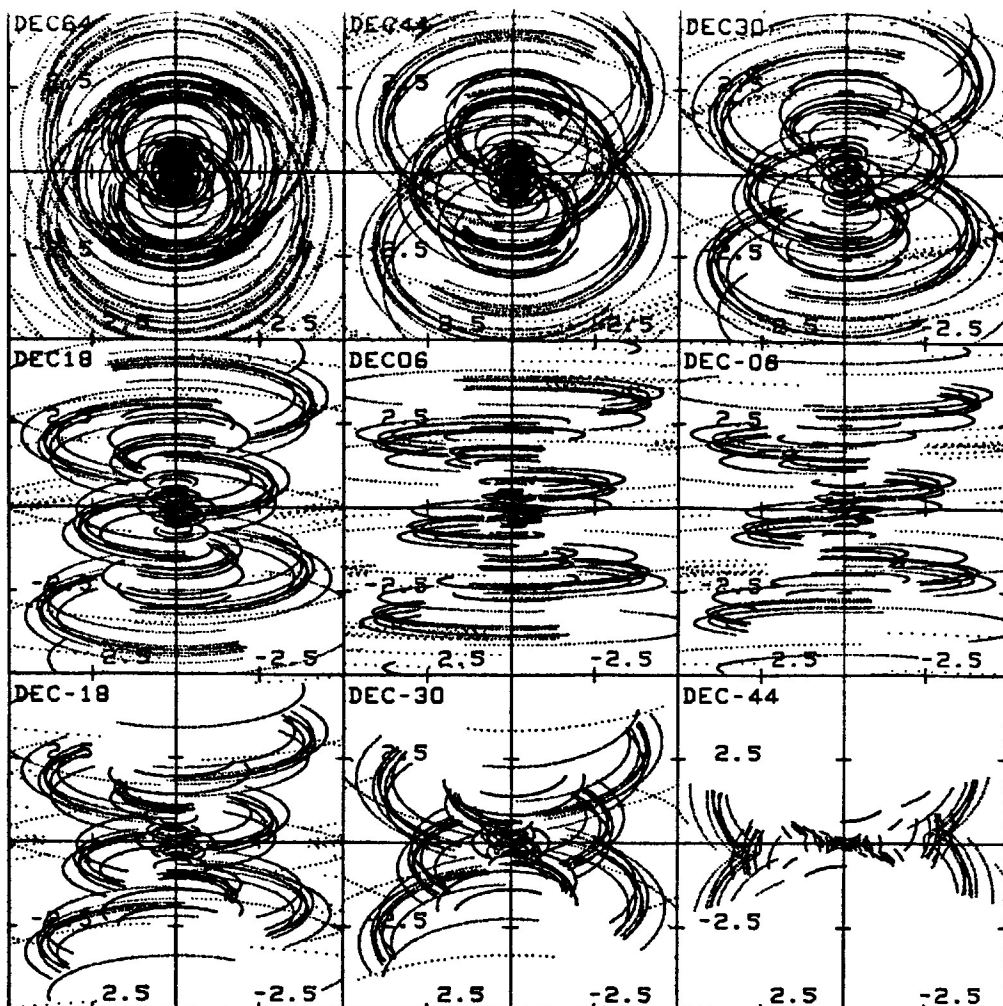
100 km Scale
VLA with
Winston
Pie Town
Bernardo



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WENATCH	47.40	120.30
OURO	37.05	118.28
HAWAII	19.80	155.50
PIETOWN	34.33	108.14
BERNARDO	34.35	106.90
ROSWELL	33.40	104.55
AW3	34.06	107.64
AW9	33.97	107.81
AE9	34.00	107.41
AN9	34.24	107.63

Scale in km
(kilometers $\times 10^2$)

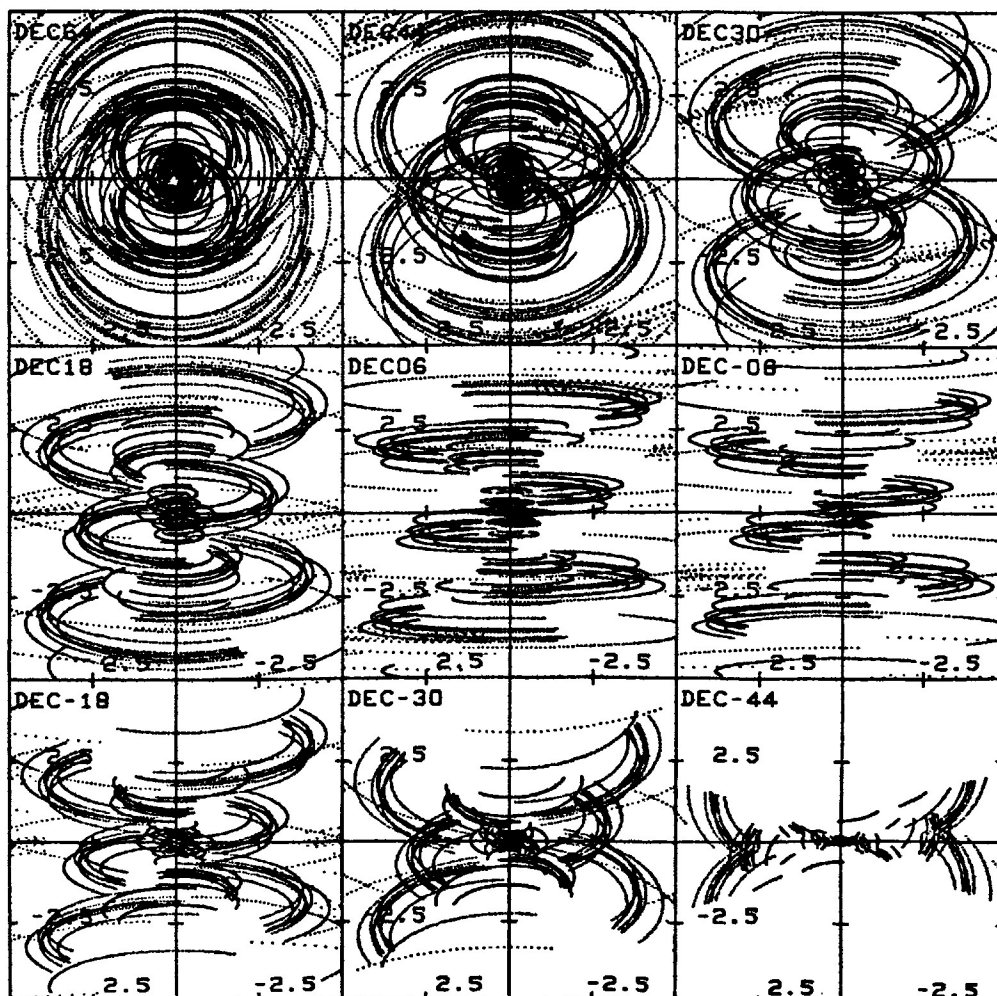
500 km Scale
4 VLA telescopes
13 Station VLBA
with Winston



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IOWA	41.58	91.57
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Scale in km
(kilometers $\times 10^2$)

500 km Scale
4 VLA telescopes
13 Station VLBA
with Dusty



Small differences
at ~ 100 km N-S.