4.0 CONCLUSIONS

Significant CO emissions in the Lynwood area are added to an urban air mass with already elevated CO concentrations. A tendency toward more stable meteorological conditions at Lynwood than at other areas exacerbates the CO air quality problem there.

The specific causes for higher concentrations of CO in the Lynwood vicinity than at other locations can be stated as follows:

1) Under the appropriate meteorological conditions, a strong, surface-based, surface inversion sets up soon after sunset and persists until sunrise. This occurs at about the same time throughout the SoCAB but the inversion strength appears to be stronger near Lynwood than at other locations (at least as shown by the limited number of measurement locations of the field study). The stronger inversion would suppress vertical mixing more near Lynwood than at other locations.

2) The gradient of terrain is smaller near LYNN than at most other locations in the SoCAB. This relatively flat terrain within 5 km of LYNN results in a smaller slope-induced component for the nocturnal winds.

3) The combination of stronger inversions and relatively flatter terrain (consequently weaker drainage winds) results in lower wind speeds and reduced dispersion of pollutants during the nighttime at LYNN than at other locations.

4) Low nocturnal wind speeds lead to weak transport of air during evening hours, particularly when wind directions change from westerly to northerly. Air arriving at LYNN during the time of nighttime peak CO concentrations, between 2200 and 0100 PST, had been 10 to 15 km to the west of LYNN several hours earlier at the time of higher emissions associated with the evening rush hour. The air arriving at LYNN at peak CO periods appears to have missed the downtown Los Angeles area and its major freeways by about 5 km.

5) Early morning wind speeds are higher than evening wind speeds. Air arriving at LYNN during the time of morning peak CO concentrations, about 0800 PST, is near possible regional sources at the start of the morning rush hour several hours earlier. Emissions generated during rush hour near downtown Los Angeles do not have time to reach LYNN before the morning inversion breaks and vertical mixing begins. Because of the time necessary for transport, emissions within 5 km of LYNN are large contributors to the elevated CO in the morning.

6) Vehicles in the vicinity of LYNN are older and have higher emissions than in some other areas of the SoCAB. It is reasonable to assume, however, that a similar vehicle mix extends several kilometers from LYNN although the full extent of the mix was not determined. Compared to other areas in the SoCAB,

the local vehicles in the vicinity of LYNN would provide a relatively large source of CO. With the low wind speeds and suppressed mixing, CO generated within 5 km of LYNN would be a major contributor to the total CO concentration at LYNN. Because specific data on vehicle age, vehicle emissions, and traffic counts are not available near other SCAQMD sites, the effect of the vehicle mix and traffic volume near the various sites cannot be quantified.

7) The EOF analysis indicated a possible CO source very near LYNN. While this source, possibly associated with operations of the U.S. Post Office just to the north of LYNN, is a contributor to the elevated CO concentrations at LYNN, it should not be singled out as the major influence on the CO concentration at LYNN. High CO concentrations occur in an area surrounding LYNN and the Post Office that cannot be determined from the collected data.

These causes of the elevated CO concentrations in the vicinity of Lynwood are expanded in following discussion of the five specific items listed in Section 1.1 for identification as part of this report.

4.1 Source Regions

Major source regions of CO associated with freeway traffic surround the Lynwood area. A heavy concentration of traffic passes through the region where the I-10, I-5, US 101, I-110, I-710, and CA 60 freeways converge to the north of Lynwood. Freeway I-405 to the west and south of Lynwood carries more traffic than any other single freeway.

There are also sources near LYNN, such as local traffic and nearby commercial and public operations. The mix of local vehicles has older, higher emitting vehicles than found in some other parts of the SoCAB. With a limited amount of data, the EOF analysis identifies the location of a source within 100 m of LYNN, possibly associated with the operations of the Post Office. This source may contribute a few ppm to the maximum CO concentration at LYNN. Other measurements show the area of high CO to extend to the north and to the south of LYNN and the Post Office. The maximum CO concentrations at the AQMD, CC, and HS sites show similarly high values in all directions within 4 km of LYNN (the HS sites). By 7 km from LYNN, the maximum values have decreased to about half the LYNN maximum. Other locations in the SoCAB have CO concentrations nearly as high as those at LYNN, possibly the result of the influence of local sources.

For evening hours when CO concentration increases, backward trajectories from Lynwood indicate that air from the vicinity of downtown Los Angeles (where several major freeways converge) does not reach Lynwood until several hours after the peak in CO concentration. As the CO level is increasing, the air from Los Angeles travels to the west and northwest of Lynwood. Even after the wind shifts to a northerly direction at about 1900 to 2000 PST, air arriving at Lynwood has been coming from the west of Lynwood for several hours. The air moves only a few kilometers each hour during the period of increasing CO levels, implying the

high CO concentrations are of local origin. One local source suggested by EOF analysis is associated with operations of the U.S. Post Office near the site. It is likely that the contribution of the Post Office may not be as great during evening hours as during morning hours since operations are reduced at that time. Backward trajectories at other sites show the air movement to have patterns similar to that for Lynwood. At CELA, the source of CO would likely be the general downtown Los Angeles area, including nearby freeways and local streets during the early evening hours. After the time of maximum CO, 2000 to 2100, air reaches CELA from areas north and west of downtown Los Angeles. For HAWT, the source of CO for the peak near 0000 would likely be the nearby I-405 freeway and other local traffic to the northeast.

For morning hours, backward trajectories from Lynwood show that 2 to 3 hours are required for air to reach Lynwood from the downtown Los Angeles area. The emissions in the downtown area at 0600 could contribute to the CO during the hours of maximum values at about 0800. The local sources also contribute to the increase in CO. The EOF analysis shows the existence of a source between LYNN and HS02/HS05 that may have been associated with operations at the Post Office. Analysis shows the contribution of this source to the maximum CO during the intensive to be 1 to 3 ppm while the contribution to the average CO is less than 1 ppm. The EOF also indicates that there are other unidentified local sources (probably associated with local traffic on nearby surface streets) to the north of LYNN.

A good portion of the CO concentrations at LYNN that exceed CO concentrations at other locations appears to originate in the local area. It is likely that the contribution is not a single source but rather a combination of numerous sources in the area.

4.2 Potential Transport Routes

The possible transport routes of CO to the Lynwood area have been alluded to in the previous discussion on regional sources. In the evening hours, the transport route to LYNN is initially from the west. When CO levels increase, the transport has developed a northerly component several hours after nightfall as the wind shifts from westerly to northwesterly to northerly. For at least a few hours after the wind shift, air continues to reach LYNN along a path that originated to the west of Lynwood. Eventually, the transport route is contained in the north-to-northeast sector.

In the morning hours, air reaches LYNN from regions in the north-to-northeast sector. Transport routes extend to the northern edge of the SoCAB. These routes show the effect of a fairly steady downslope wind in the early morning hours.

4.3 Topographic Factors

The terrain in the immediate vicinity of LYNN has less slope than is found at any other CO monitoring site in the SCAQMD network. Nearly flat to moderately flat terrain extends to more than 5 km from LYNN in all directions; that is a larger area of relatively flat terrain than found around any other site.

The small gradient in terrain elevation near LYNN provides less reinforcement to the nocturnal winds and consequently keeps wind speeds at LYNN are often lower than at other sites. The light winds allow a stronger thermal stability to develop, which in turn limits mixing and reduces the dispersion of CO emissions. The effect of slope can be seen in the difference in stability and wind speeds at LTS and VTS.

4.4 Meteorological Factors

Meteorological conditions in the SoCAB are often conducive to high CO concentrations. These occur when synoptic scale features are weak and local effects dominate the meteorology.

Under these conditions, a surface-based inversion sets up soon after sunset. The onset of this inversion occurs at about the same time throughout the SoCAB but the inversion strength appears to stronger at some locations, such as Lynwood, where it is 5 times as strong as at Vernon. This stronger inversion suppresses vertical mixing and nocturnal wind speeds in areas of flat terrain are lower. The switch of wind direction from southwesterly to northerly in the evening contributes to the decreased wind speeds during the late evening and reduces the transport and dispersion of pollutants.

As the sun rises, the surface-base inversion begins to erode from the ground upward as the atmosphere becomes unstable near the ground. Pollutants are then vertically mixed throughout an increasing depth and their concentration decreases. An increase in horizontal wind speed around noontime contributes to the dilution of pollutants.

4.5 Sub-periods

There are at least three and possibly four distinct sub-periods in the diurnal variation of CO concentrations in the South Coast Air Basin and in other urban areas. Two sub-periods are associated with the morning and evening maxima; one sub-period is associated with the daytime minimum. A fourth sub-period could be associated with the minimum between the evening and morning maxima.

The sub-period associated with the morning maximum in CO levels coincides with the morning rush hour. Its start is defined by the increase in CO levels at about 0500 PST and is sometimes marked by an increase in thermal stability. The sub-period ends as the atmosphere near the ground becomes unstable shortly after sunrise, mixing increases, and CO concentrations decrease.

The sub-period associated with the daytime minimum results from the mixing that occurs during the day. While traffic counts during the middle of the day decrease by 10 to 20% from their peaks, the CO concentrations at all sites decrease to near zero as the enhanced vertical mixing disperses the pollutant through a larger and larger volume. There is a slight increase in pollutant concentration in the late afternoon as the mixing depth decreases and as emissions increase.

Defined meteorologically, the sub-period associated with the evening maximum in CO concentrations starts as stable atmospheric conditions begin to develop at about 1800 PST. This time is 1 to 2 hours after both the peak in rush hour traffic and the initial increase in CO concentrations. The period extends through the evening maximum in CO levels that occurs between 2000 and 0000 PST. Its end may be associated with the slight decrease in stability accompanied by an increase in wind speed that sometimes occurs after midnight.

The decrease in CO concentrations between the evening and morning maxima may indicate a fourth sub-period although its cause may be associated only with the minimum in emissions.

5.0 REFERENCES

AeroVironment, Inc. (1991). "Determination of Source Contributions to High Ambient Carbon Monoxide Concentrations and Categorization of Carbon Monoxide Potential." Final Report prepared under Contract No. A832-135 for California Air Resources Board, Sacramento, CA, by AeroVironment, Inc., Monrovia, CA.

Cassmassi, J., B. Selik, and J. Arnold (1988). "Exposure of the Wind Monitoring Stations of the South Coast Air Quality Management District." Report by South Coast Air Quality Management District, El Monte, CA, May, 1988.

Douglas, S.G., R.C. Kessler, and E.L. Carr (1990). "User's Guide for the Urban Airshed Model. Vol III: User's Manual for the Diagnostic Wind Model." Report No. EPA-450/4-90-007C (NTIS No. PB91-131243), USPEA/OAQPS, Research Triangle Park, NC.

Douglas, S.G., R.C. Kessler, C.A. Emery, and J.L. Burtt (1991): "Diagnostic Analysis of Wind Observations Collected during the Southern California Air Quality Study." Final Report prepared under Contract No. A832-133 for California Air Resources Board, Sacramento, CA, by Systems Applications International, San Rafael, CA.

Henry, R.C., Y.-J. Wang, and K.A. Gebhart (1991). "The Relationship Between Empirical Orthogonal Functions and Sources of Air Pollution." *Atmos. Environ.*, 25A(2), 503-509.

Kunz, K.S. (1957). Numerical Analysis. McGraw-Hill, Inc., New York, NY, pp. 381.

Morris, R.E., and T.C. Myers (1990). "User's Guide for the Urban Airshed Model. Volume I: User's Manual for UAM(CB-IV)." Report No. EPA-450/4-90-007A (NTIS No. PB91-131243), USEPA/OAQPS, Research Triangle Park, NC.

Stedman, D.H.,G.A. Bishop, J.E. Peterson, and P.L. Guenther (1991). "On-Road CO Remote Sensing in the Los Angeles Basin." Final Report prepared under Contract No. A932-189 for California Air Resources Board, Sacramento, CA, by University of Denver, Denver, CO.

APPENDIX A

GM ROVER VEHICLE DATA

Comparison Tables
Pontiac Average CO
Oldsmobile Average CO

Table A-1

LYNWOOD AQMD AND PONTIAC CO DATA COLLECTED FROM OUTSIDE VEHICLE

LOOP	SECTOR	DATE	HOUR	CO CONCENTRATION, PPM PONTIAC	CO CONCENTRATION, PPM LYNWOOD
6	SW	891202	1500	13.6	4
7	NW	891202	1500	13.8	4
10	NE	891203	1700	13.3	6
11	SW	891203	1700	9.3	6
13	SE	891204	800	10.7	7
15	SW	891205	1400	11.0	4
16	NW	891205	1500	10.4	4
17	SE	891205	1500	12.9	4
18	NE	891205	1600	15.5	5
20	SE	891206	100	2.4	1
23	SE	891206	800	17.1	14
24	NW	891206	800	16.5	14
25	SW	891206	1000	9.8	10
26	NE	891206	1000	9.4	10
29	NE	891208	700	30.0	20
30	SW	891208	800	29.7	18
31	SE	891208	800	24.1	18
32	NW	891208	900	14.6	18
33	NE	891208	1000	12.0	5
36	SW	891208	1800	15.3	15
37	NW	891208	1900	15.0	10
38	SE	891208	1900	17.7	11
39	NE	891208	1900	24.3	11
42	NE	891209	900	11.9	6

Table A-1 (continued)

LYNWOOD AQMD AND PONTIAC CO DATA COLLECTED FROM OUTSIDE VEHICLE

LOOP	SECTOR	DATE	HOUR	CO CONCENTRATION, PPM PONTIAC	LYNWOOD
44	SW	891210	1700	8.8	4
45	NW	891210	1800	10.6	6
46	SE	891210	1800	8.6	6
47	NE	891210	1800	12.2	6
50	NE	891211	600	21.7	12
51	SW	891211	700	19.1	12
52	NW	891211	700	20.3	12
53	SE	891211	800	19.4	11
56	NE	891211	1700	12.1	2
60	NE	891212	1700	12.8	4
61	SW	891212	1700	11.8	5
62	SE	891212	1700	9.5	5
74	SE	891214	1600	8.9	4
75	NE	891214	1600	14.7	4
76	NW	891214	1700	15.4	7
77	SW	891214	1700	13.7	7
81	NE	891216	1000	11.4	5
82	SW	891216	1000	10.0	3
85	SE	891218	1500	9.9	3
86	NW	891218	1600	9.3	4
87	NE	891218	1700	12.4	5
88	SW	891218	1700	12.9	5

Table A-2
LYNWOOD AQMD AND PONTIAC CO DATA COLLECTED FROM INSIDE VEHICLE

LOOP	SECTOR	DATE	HOUR	CO CONCENTRATION, PPM PONTIAC	CO CONCENTRATION, PPM LYNWOOD
91	NE	891219	800	14.8	12
92	SW	891219	800	12.0	7
95	NE	891219	2000	17.8	9
96	SW	891219	2100	16.1	13
97	SE	891219	2200	14.3	14
98	NW	891219	2200	16.2	14
99	BOX[a]	891219	2300	17.4	16
100	BOX[a]	891220	0	16.0	12

[a] Loops around outside legs of sectors.

Table A-3

LYNWOOD AQMD AND OLDSMOBILE CO DATA

LOOP	SECTOR	DATE	HOUR	CO CONCENTRATION, PPM OLDSMOBILE	CO CONCENTRATION, PPM LYNWOOD
5	SE	891204	800	8.5	7
7	SW	891205	1400	13.1	4
8	NW	891205	1500	11.1	4
9	SE	891205	1500	13.3	4
10	NE	891205	1600	13.6	5
13	SW	891205	2100	7.4	4
14	NW	891205	2100	5.6	2
15	SE	891205	2200	5.5	1
16	NE	891205	2200	5.7	1
17	SW	891205	2200	4.3	1
18	NW	891205	2300	4.9	1
19	SE	891205	2300	5.5	1
20	NE	891205	2300	5.9	1
23	SE	891206	800	16.8	14
24	SW	891206	1000	11.3	9
25	NE	891206	1000	12.0	6
28	NW	891208	800	12.9	18
29	SW	891208	900	16.4	6
32	NE	891208	1800	14.1	10
33	SE	891208	1900	12.9	11
34	NW	891208	1900	14.6	11
35	SW	891208	1900	17.0	11
38	NE	891209	900	16.5	6
40	NE	891210	1700	10.9	6
41	SW	891210	1800	9.1	6
42	SE	891210	1800	10.6	6
43	NW	891210	1800	12.0	6
44	NE	891210	1900	13.6	10
46	NE	891211	1600	13.3	3
47	SW	891211	1700	13.4	2
50	NE	891212	900	14.6	3
51	SW	891212	900	14.6	3
52	NW	891212	1000	14.5	3
53	SE	891212	1000	14.7	3
54	NE	891212	1100	14.3	2

Table A-3 (continued)

LYNWOOD AQMD AND OLDSMOBILE CO DATA

LOOP	SECTOR	DATE	HOUR	CO CONCENTRATION, PPM OLDSMOBILE	CO CONCENTRATION, PPM LYNWOOD
61	NE	891213	800	24.4	16
62	SW	891213	800	25.3	16
63	NW	891213	900	22.7	7
64	SE	891213	900	20.6	7
67	NE	891213	1700	20.7	14
68	SW	891213	1800	14.8	13
69	NW	891213	1800	14.8	13
72	NE	891214	1500	7.5	3
73	SW	891214	1600	8.6	4
74	NW	891214	1600	8.6	4
75	SE	891214	1700	9.4	7
76	NE	891214	1700	9.9	7
81	SW	891218	700	17.2	8
82	NE	891218	700	19.4	5
83	SE	891218	800	12.9	5
84	NW	891218	800	12.2	5
87	NE	891218	1500	8.5	4
88	SW	891218	1600	7.9	4
89	NW	891218	1600	10.7	4
90	SE	891218	1700	12.3	5
91	NE	891218	1700	12.9	5
92	SW	891218	1800	15.1	9
93	NW	891218	1800	17.7	9
96	NW	891219	800	9.6	12
97	SE	891219	800	9.0	7
100	NE	891219	1600	6.9	3
101	SW	891219	1700	7.1	3
102	NW	891219	1700	6.3	3
103	SE	891219	1800	5.7	4
106	NE	891220	0	7.3	12
107	SW	891220	100	6.4	12
108	NW	891220	100	5.8	8
109	SE	891220	100	5.6	8

Table A-4

PONTIAC AND OLDSMOBILE DATA FROM CONCURRENT LEGS

DATE	START TIME	AVERAGE CO CONCENTRATION, PPM PONTIAC	OLDSMOBILE
891204	83146	10.4	8.5
891204	83726	9.3	7.8
891204	83946	10.9	12.4
891204	84334	11.6	7.8
891204	85202	12.5	9.5
891205	143032	8.8	9.4
891205	143544	13.7	22.5
891205	144112	12.1	10.5
891205	144534	9.6	10.1
891205	145202	8.3	8.6
891205	145844	11.6	11.3
891205	150416	9.4	7.0
891205	151034	11.9	16.2
891205	152202	9.4	24.3
891205	152934	14.9	12.6
891205	153316	12.7	8.9
891205	153540	13.5	8.3
891205	155506	9.2	11.1
891205	160100	12.7	12.6
891205	161026	14.3	14.5
891205	161442	27.1	16.4
891206	72801	20.4	19.3
891206	80101	19.0	23.8
891206	80701	16.6	14.5
891206	81031	15.7	14.7
891206	81353	16.8	15.1
891206	101131	8.9	9.0
891206	101551	8.6	11.6
891206	102107	9.6	10.6
891206	102447	12.0	14.1
891206	103431	9.6	14.2
891206	104123	9.8	12.5
891206	104839	10.7	11.0
891206	105121	7.6	10.1
891206	110431	10.1	11.1

Table A-4 (continued)

PONTIAC AND OLDSMOBILE DATA FROM CONCURRENT LEGS

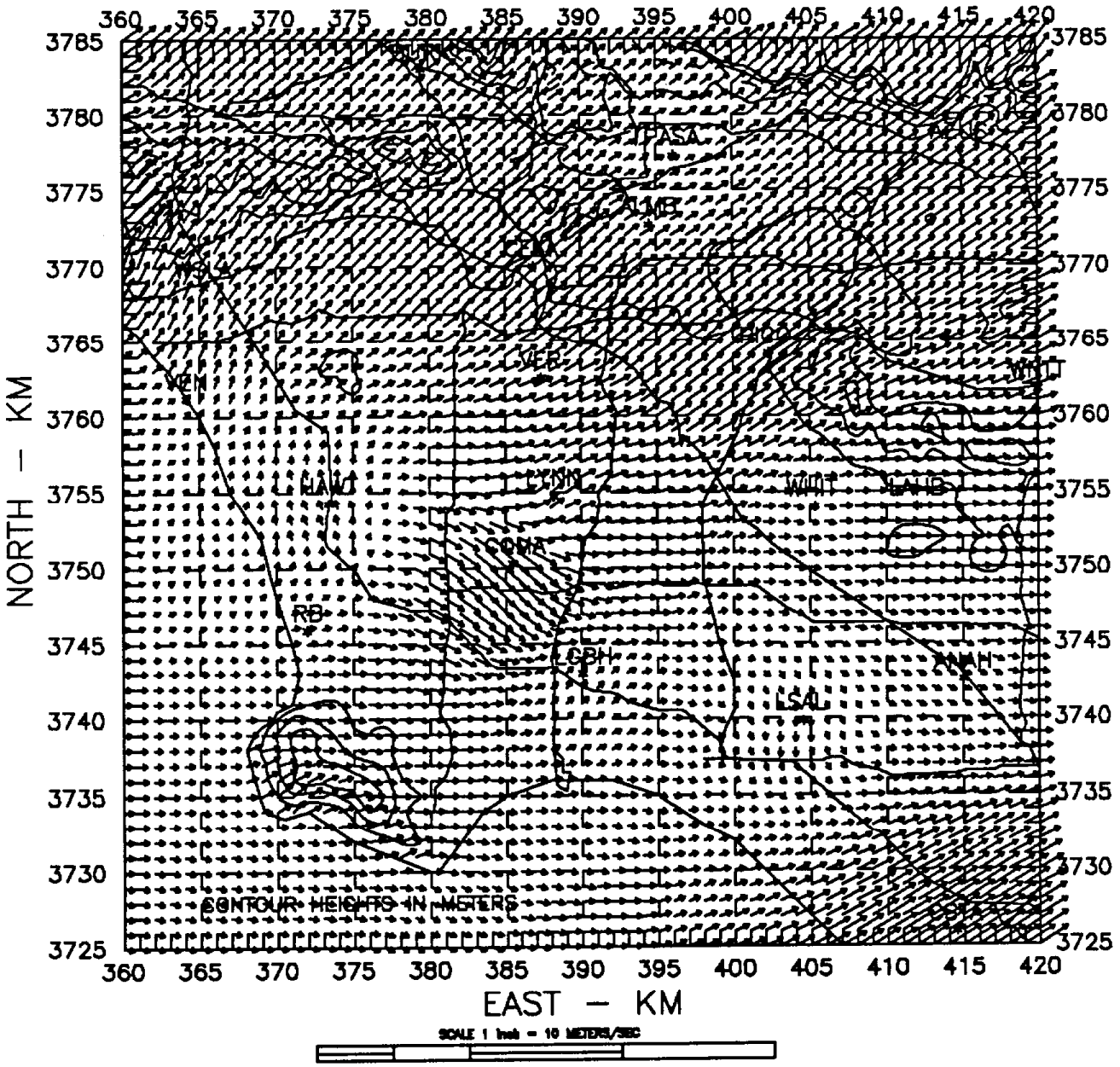
DATE	START TIME	AVERAGE CO CONCENTRATION, PPM PONTIAC	OLDSMOBILE
891208	140847	12.2	11.0
891208	174246	13.2	15.0
891208	200232	17.3	10.2
891209	90746	11.9	15.9
891210	165447	10.1	8.6
891210	181201	9.9	10.2
891210	181737	8.5	10.3
891210	182107	5.5	6.1
891210	182319	9.0	13.0
891210	192031	9.0	9.5
891211	151346	9.3	8.8
891211	175502	11.2	11.1
891212	85132	12.8	14.5
891214	181101	12.7	8.4
891218	63232	15.9	16.8
891218	150817	8.1	13.9
891219	72111	20.1	18.2
891219	83901	14.6	7.6

APPENDIX B

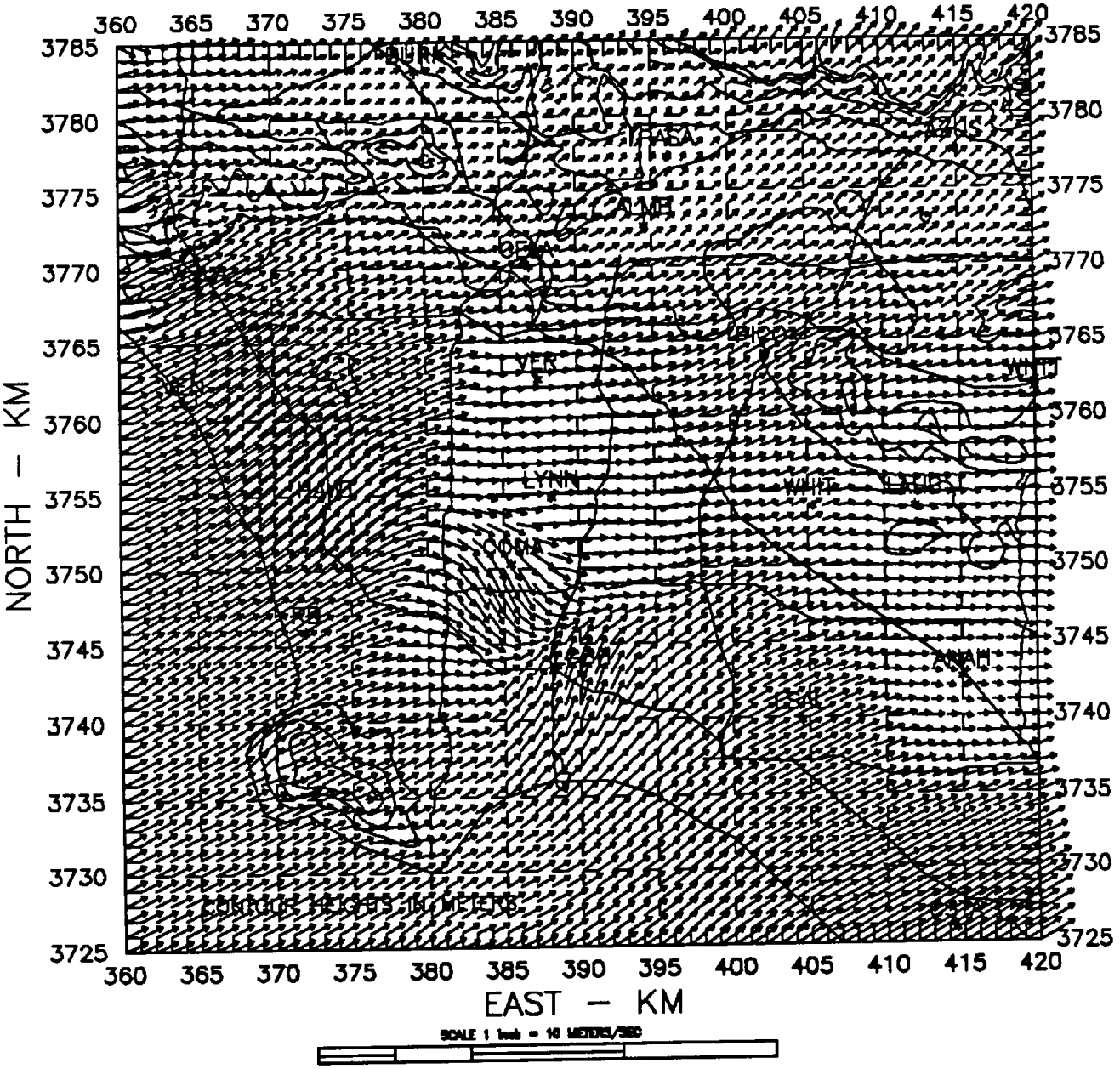
Hourly Surface Wind Fields Generated from Diagnostic Wind Model

Wind Fields for December, 1989 Intensive Period

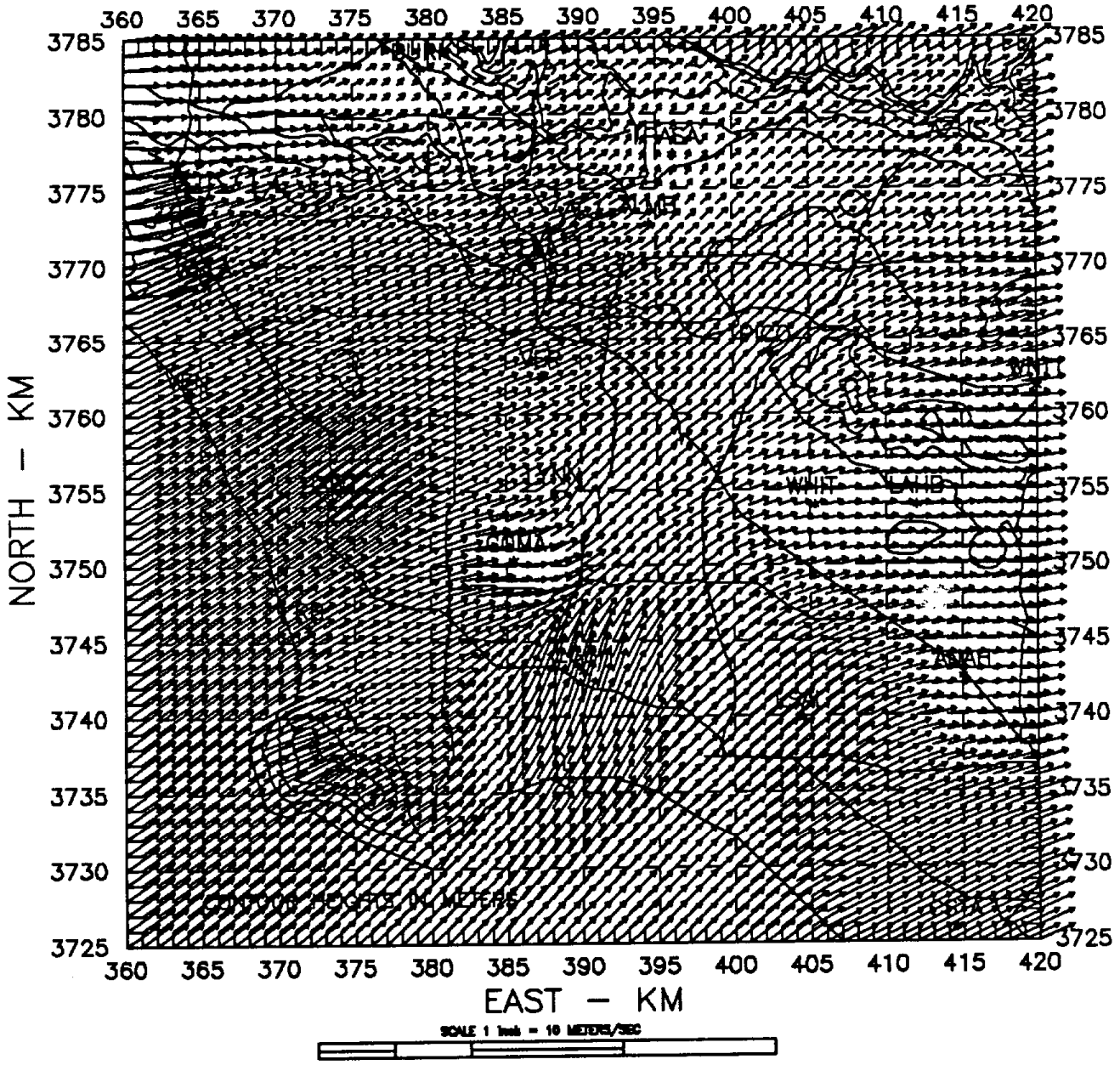
891219 HOUR 12 — LEVEL 1 WINDS



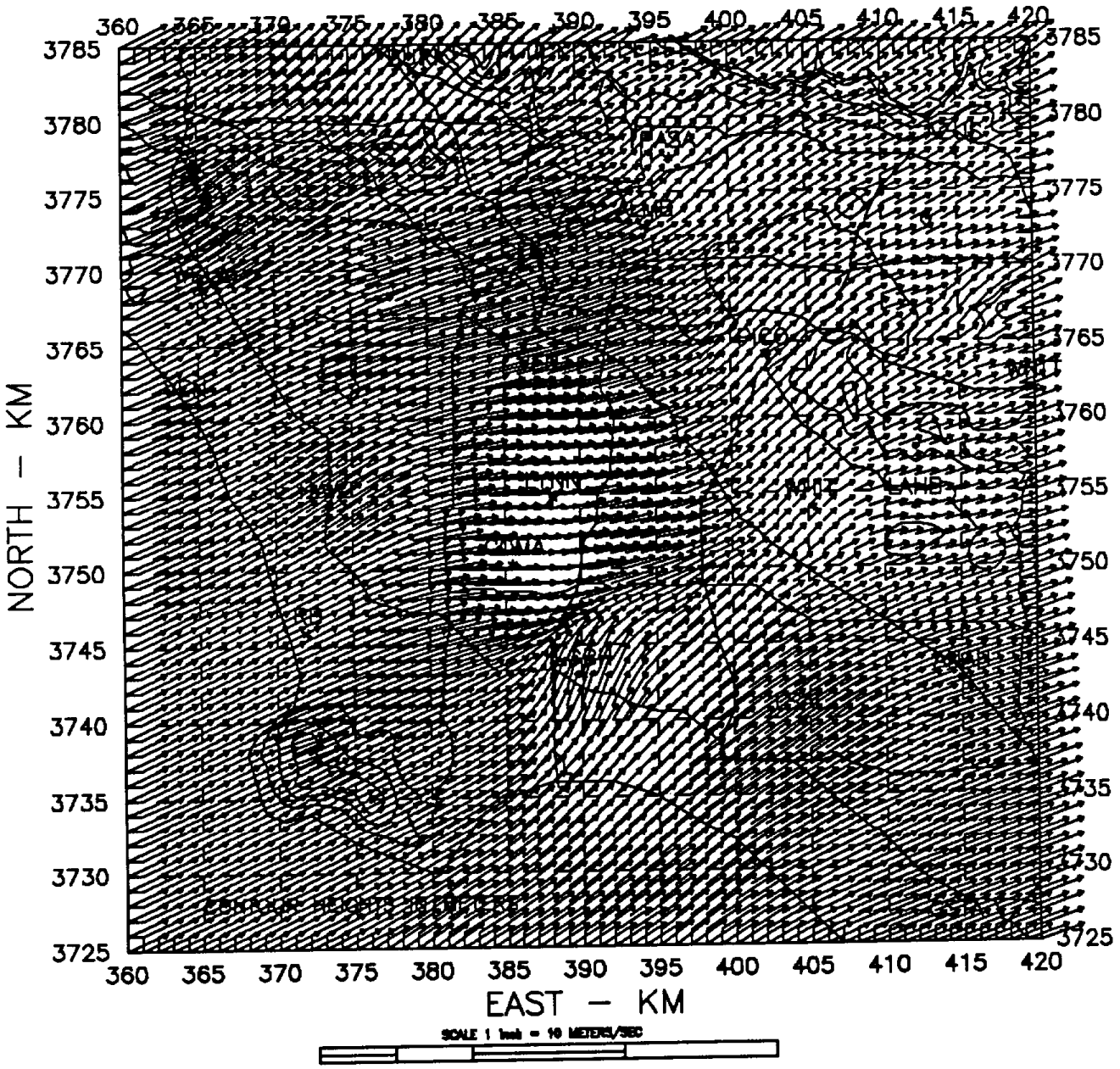
891219 HOUR 13 – LEVEL 1 WINDS



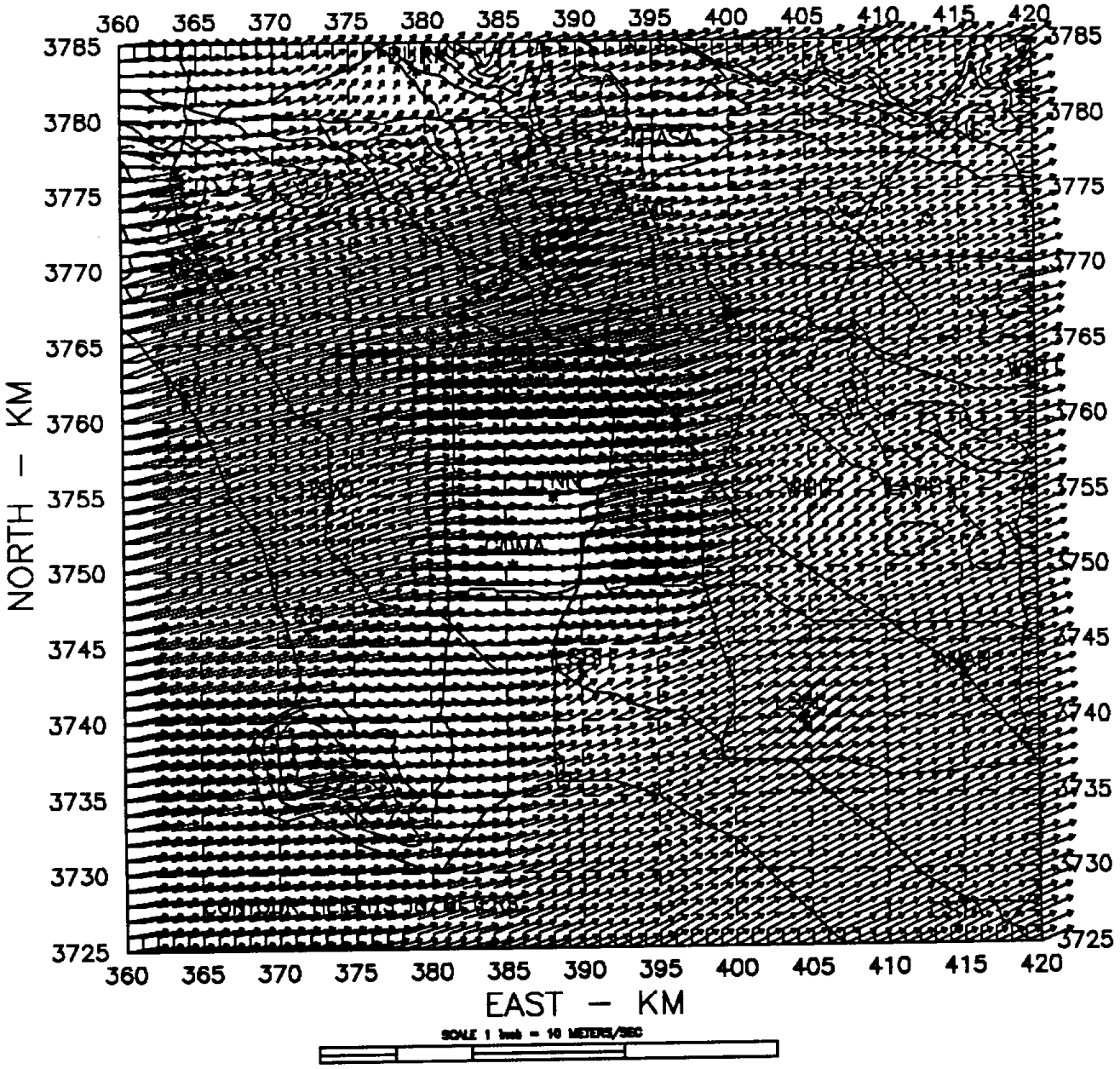
891219 HOUR 14 — LEVEL 1 WINDS



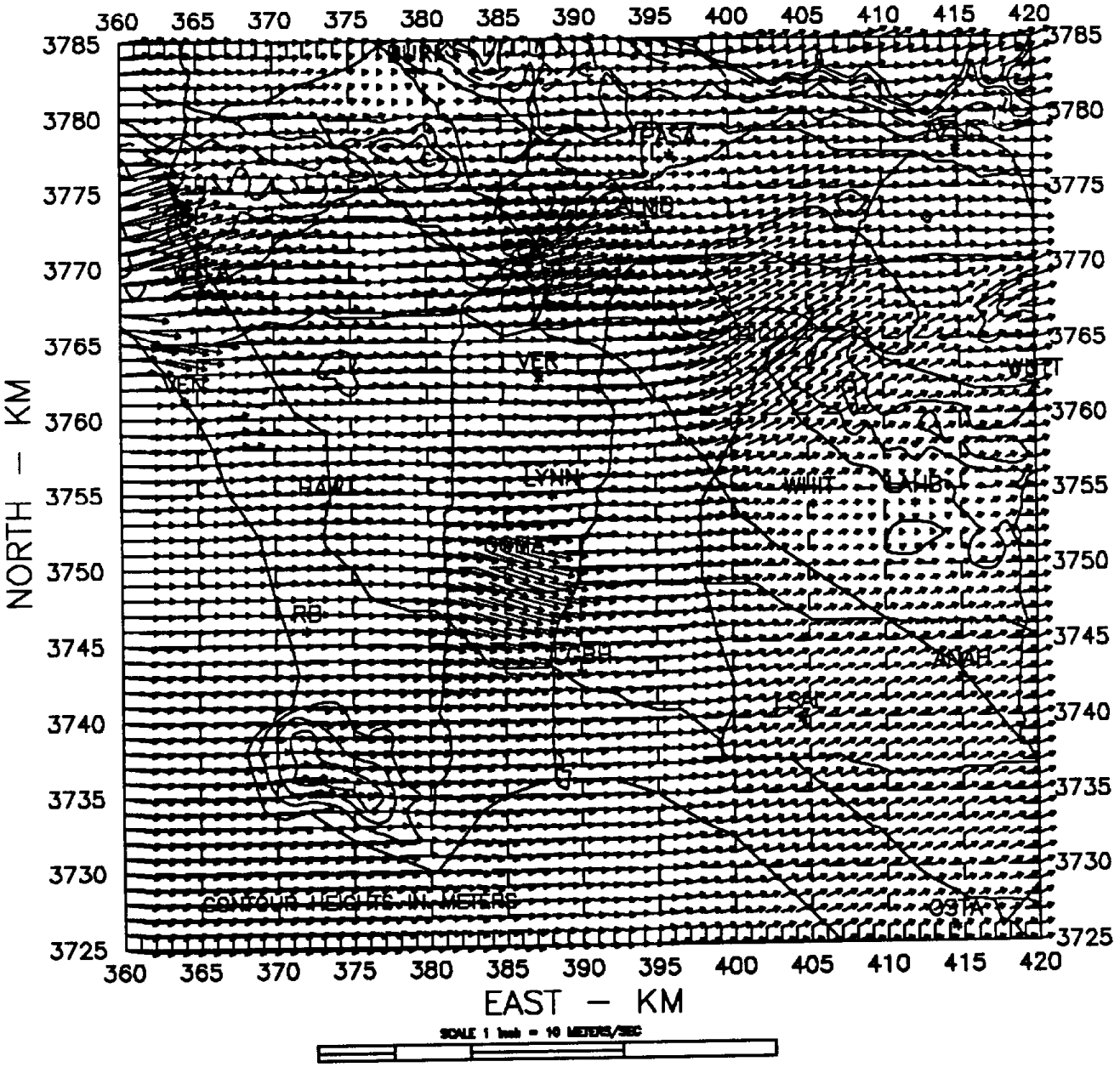
891219 HOUR 15 – LEVEL 1 WINDS



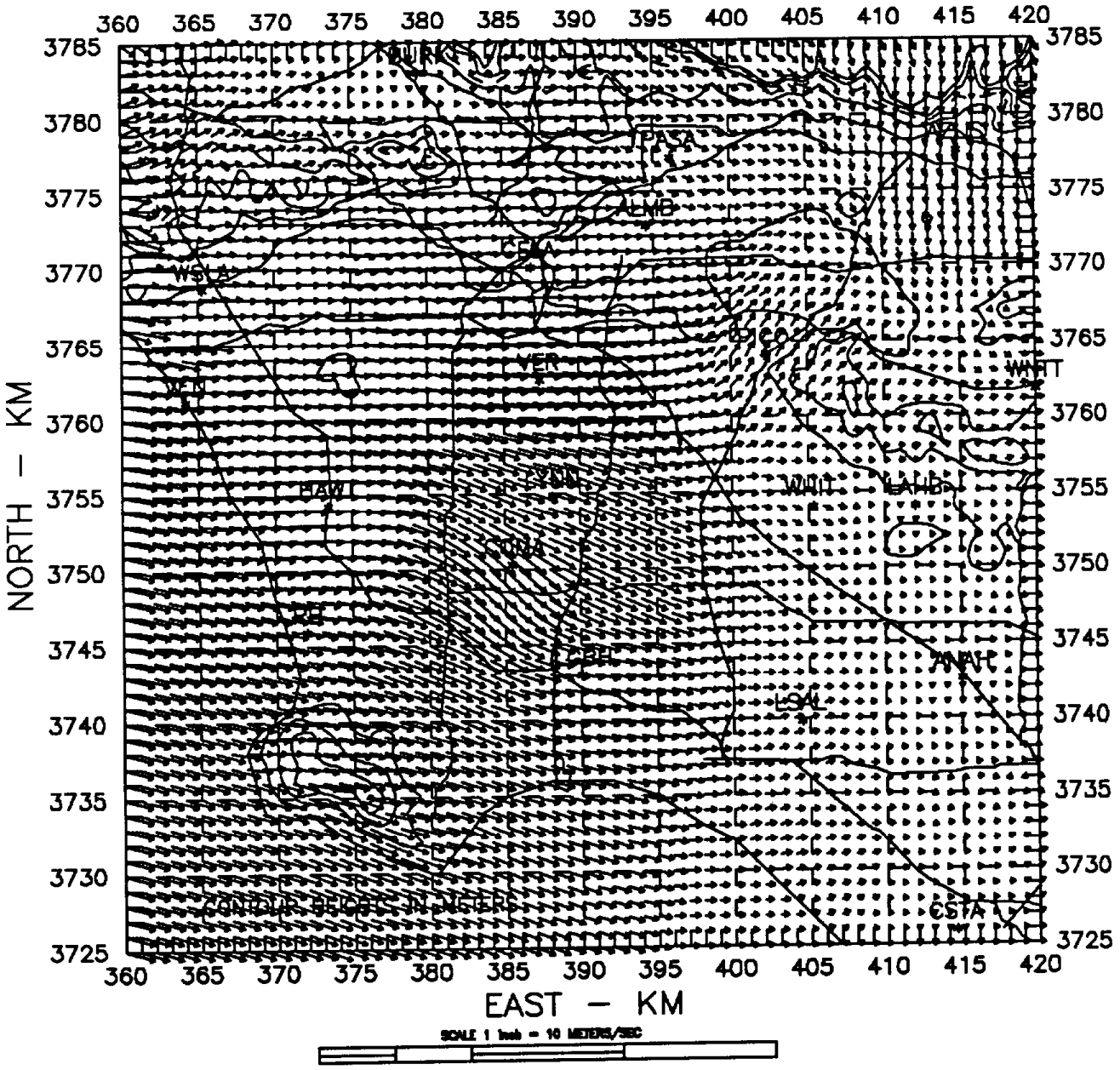
891219 HOUR 16 – LEVEL 1 WINDS



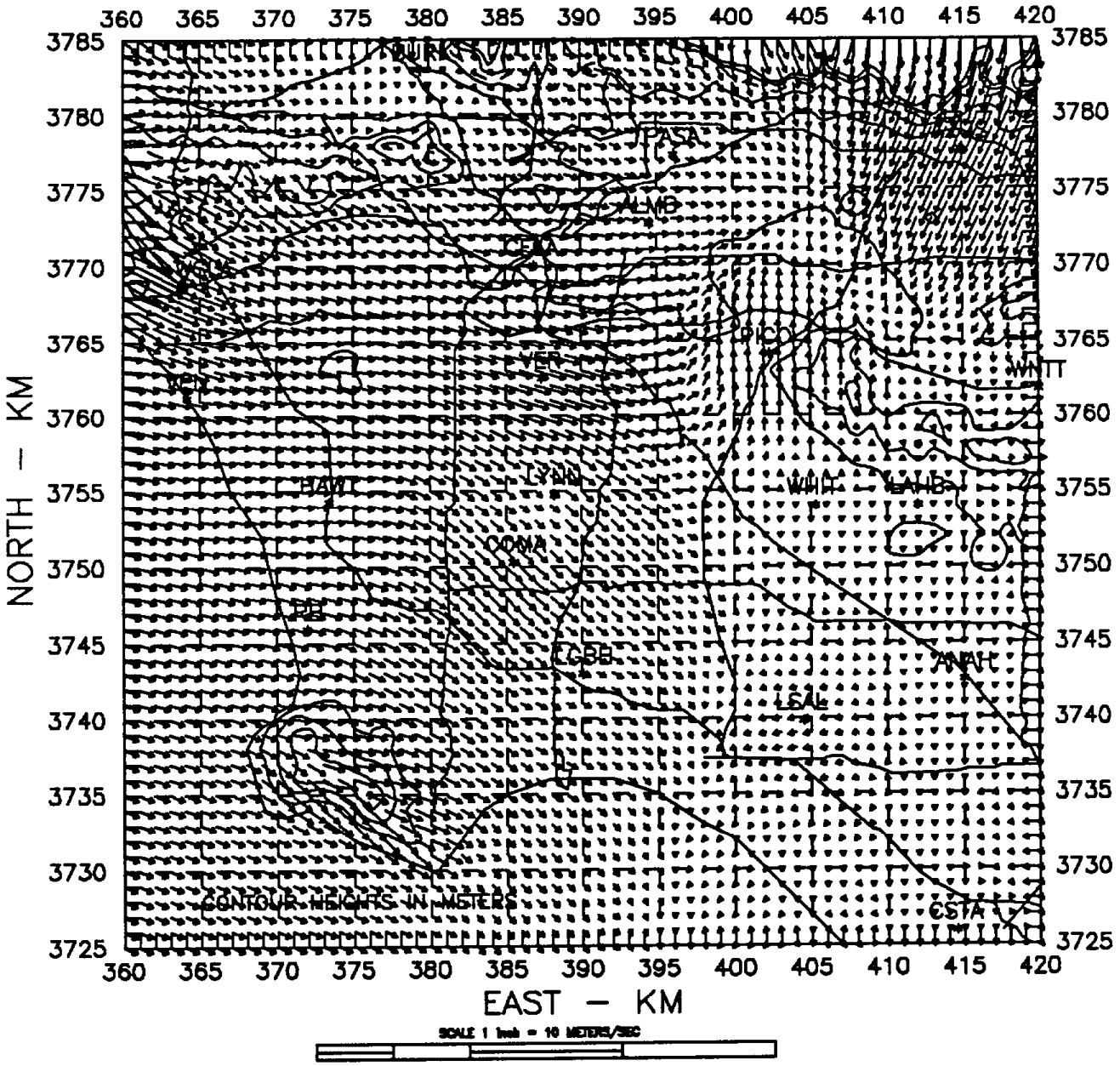
891219 HOUR 17 – LEVEL 1 WINDS



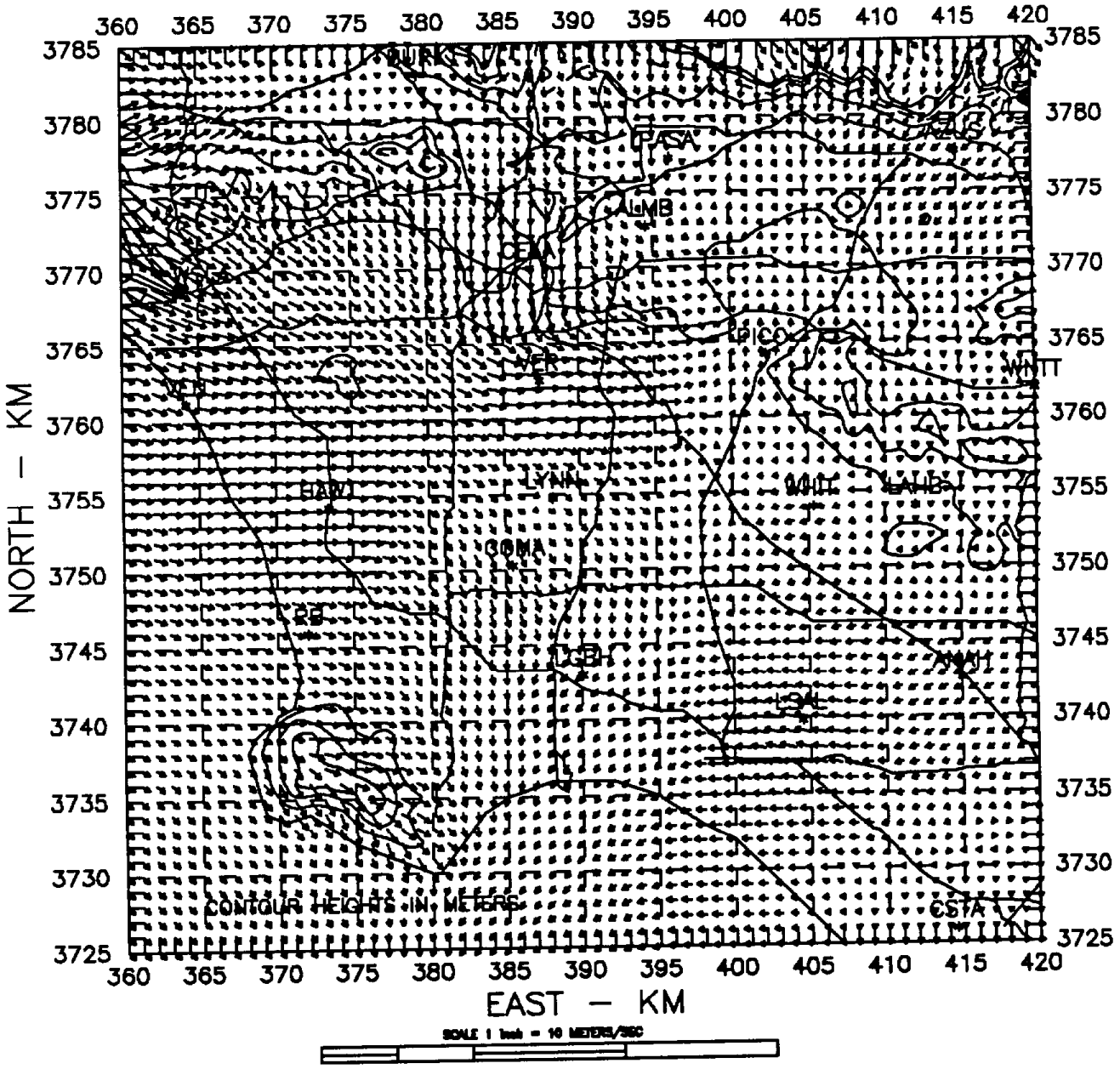
891219 HOUR 18 – LEVEL 1 WINDS



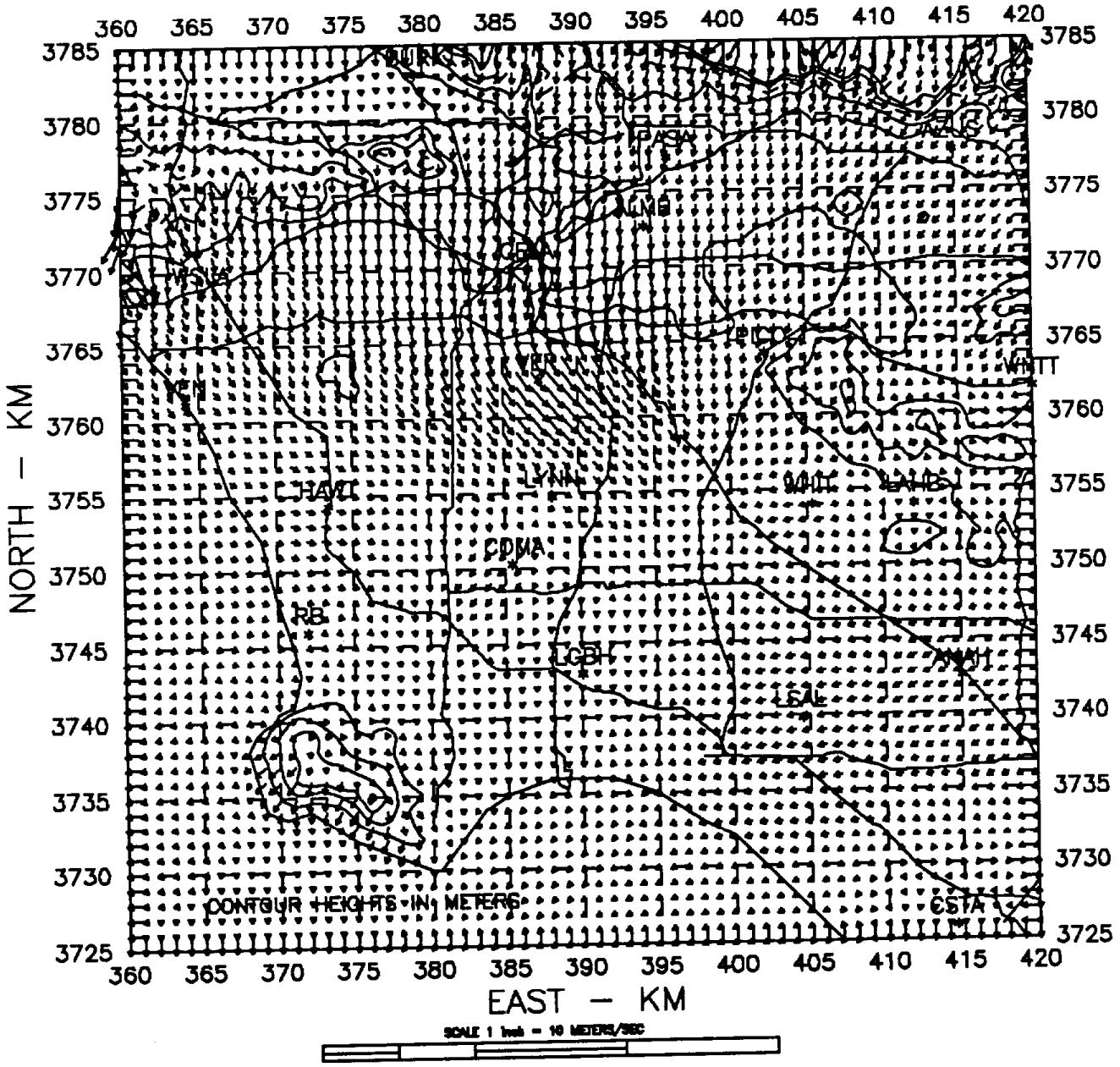
891219 HOUR 19 – LEVEL 1 WINDS



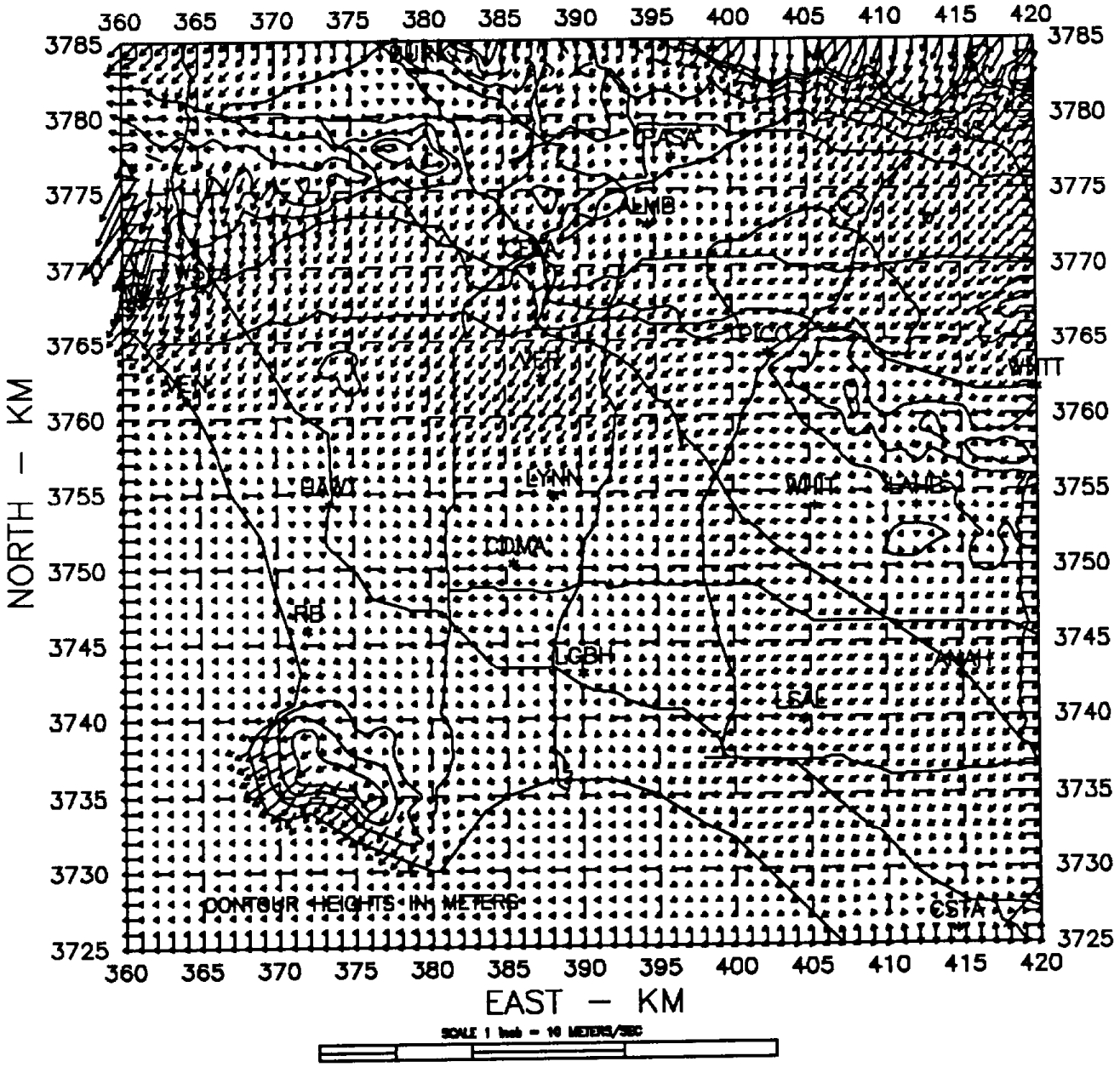
891219 HOUR 20 – LEVEL 1 WINDS



891219 HOUR 21 – LEVEL 1 WINDS



891219 HOUR 22 – LEVEL 1 WINDS



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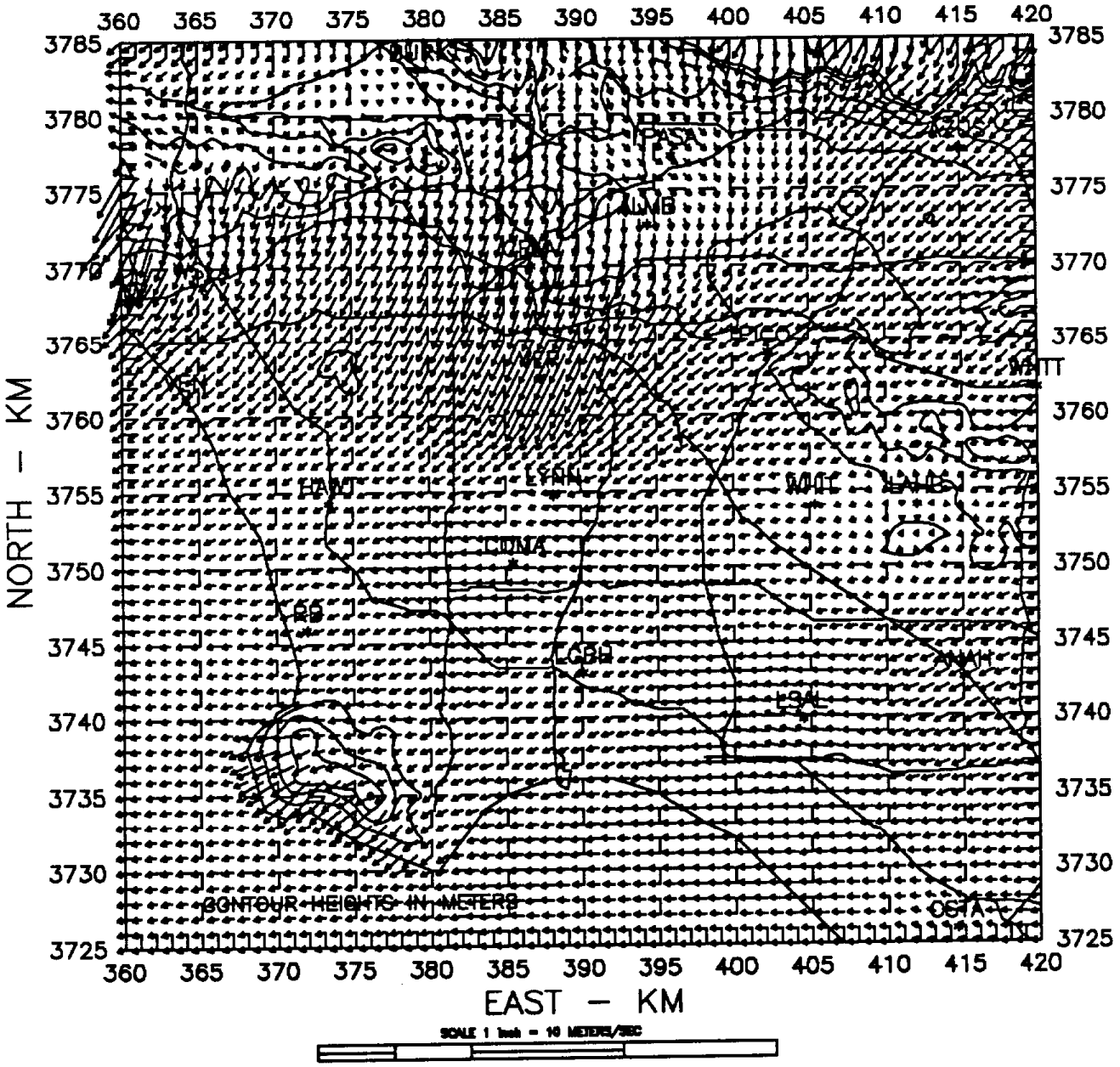

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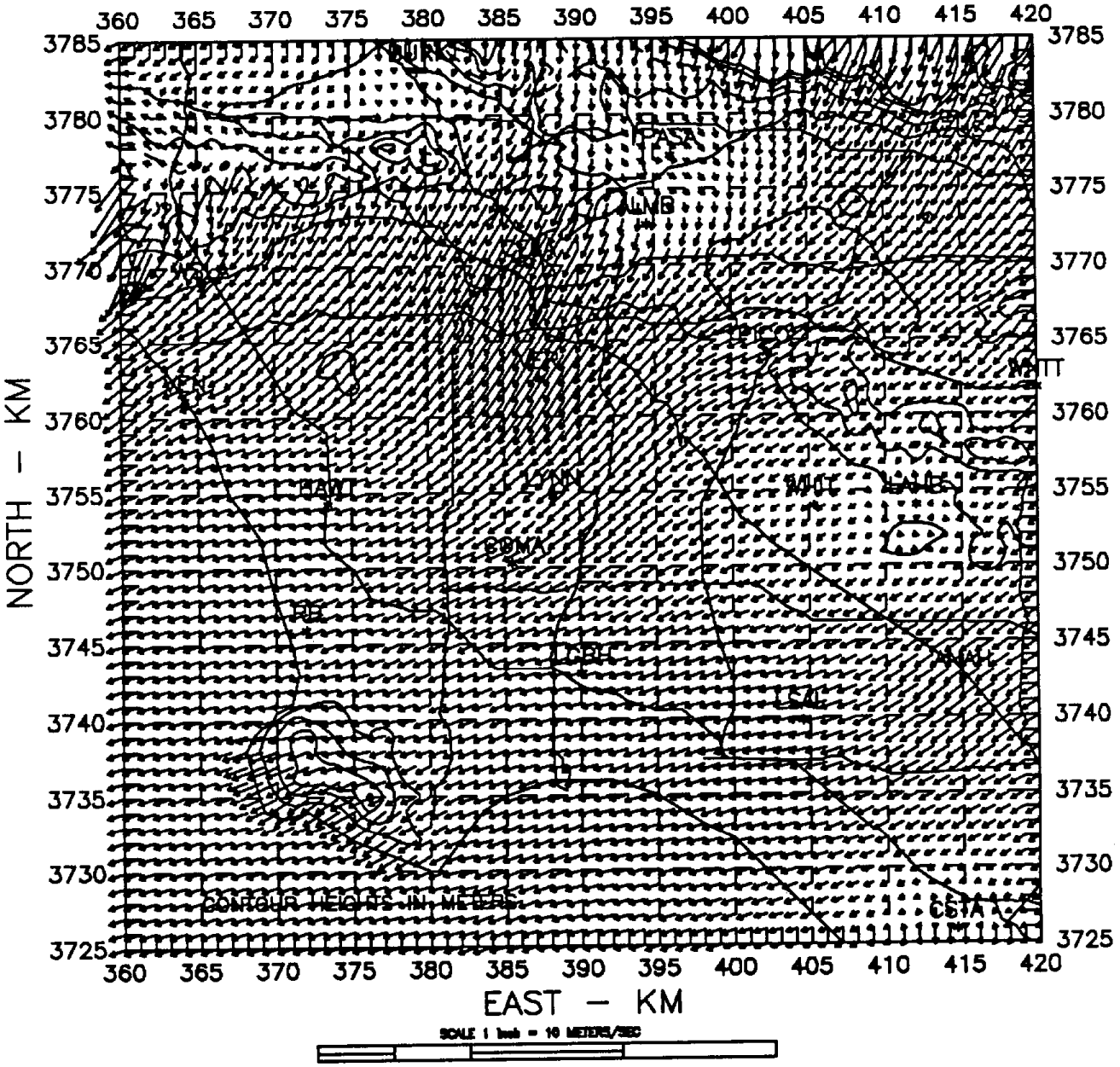

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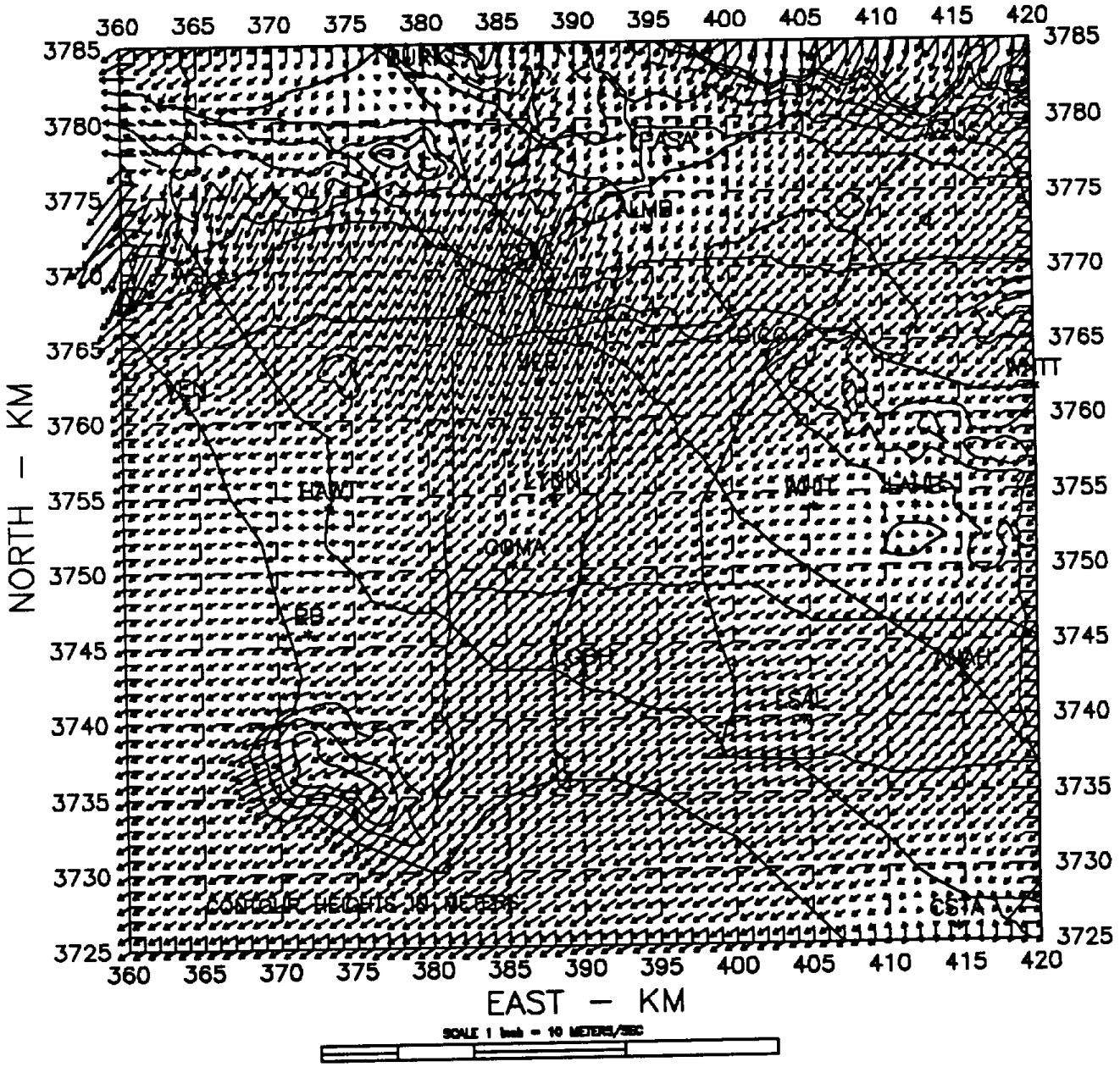

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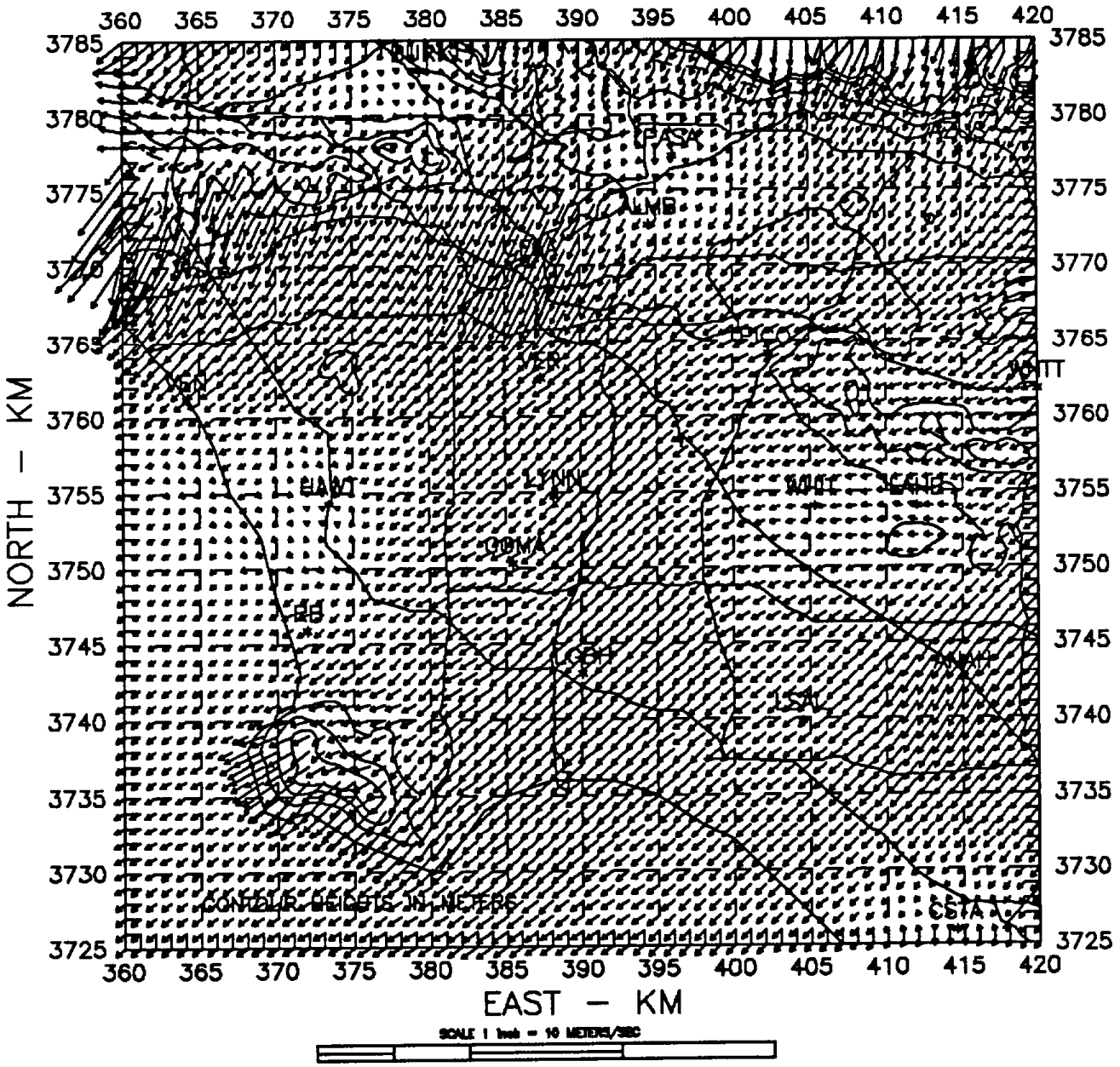

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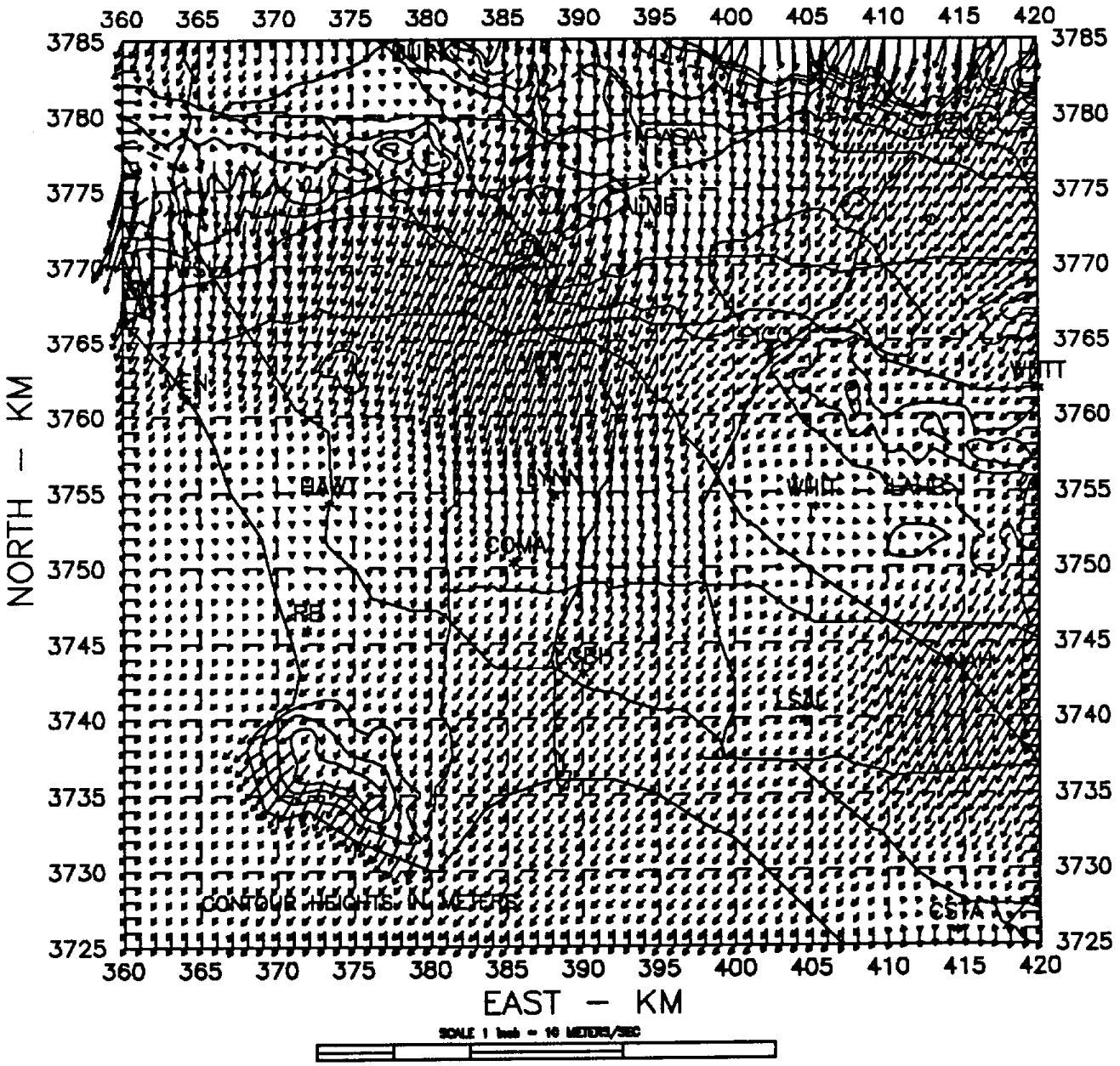

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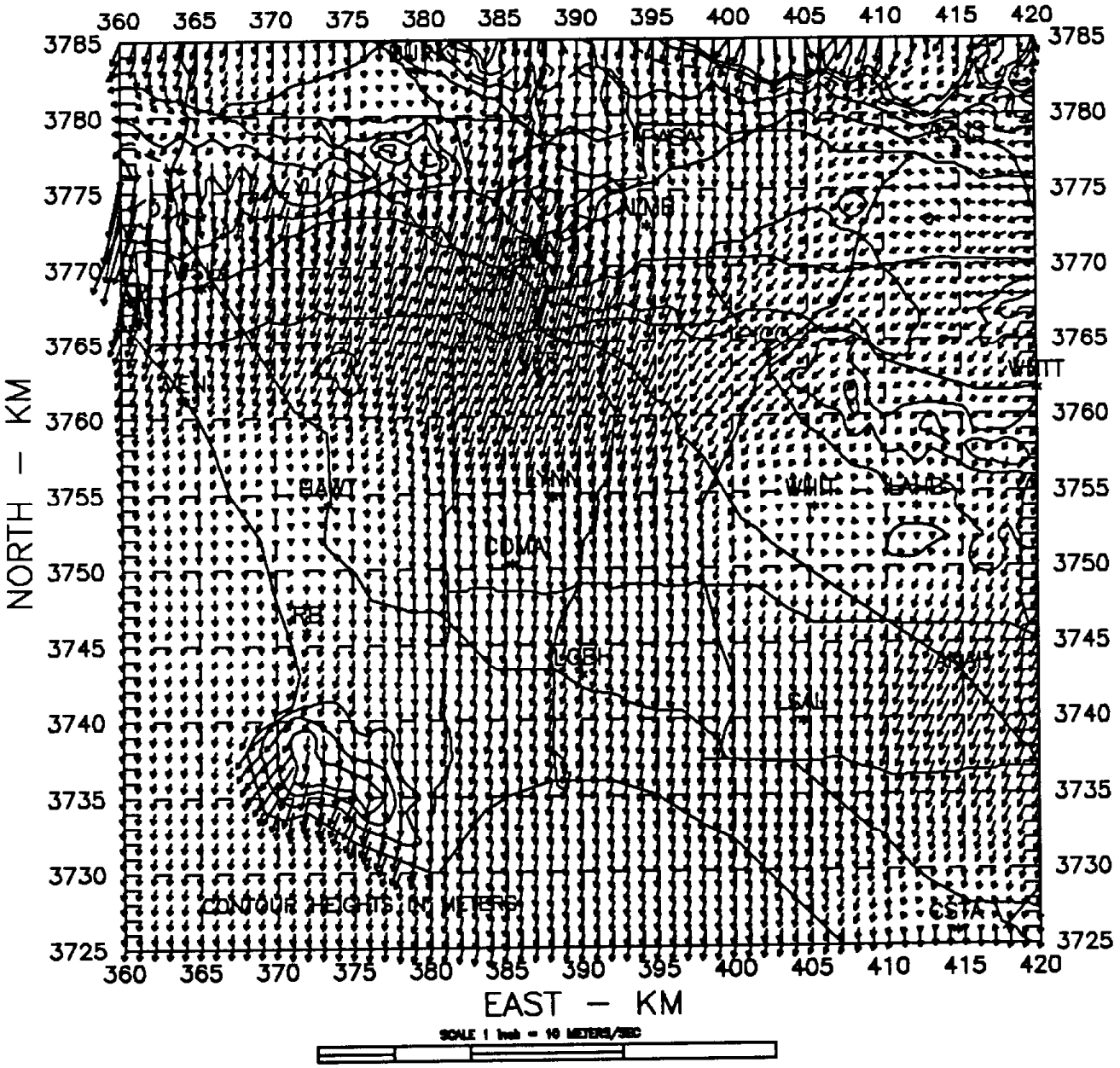

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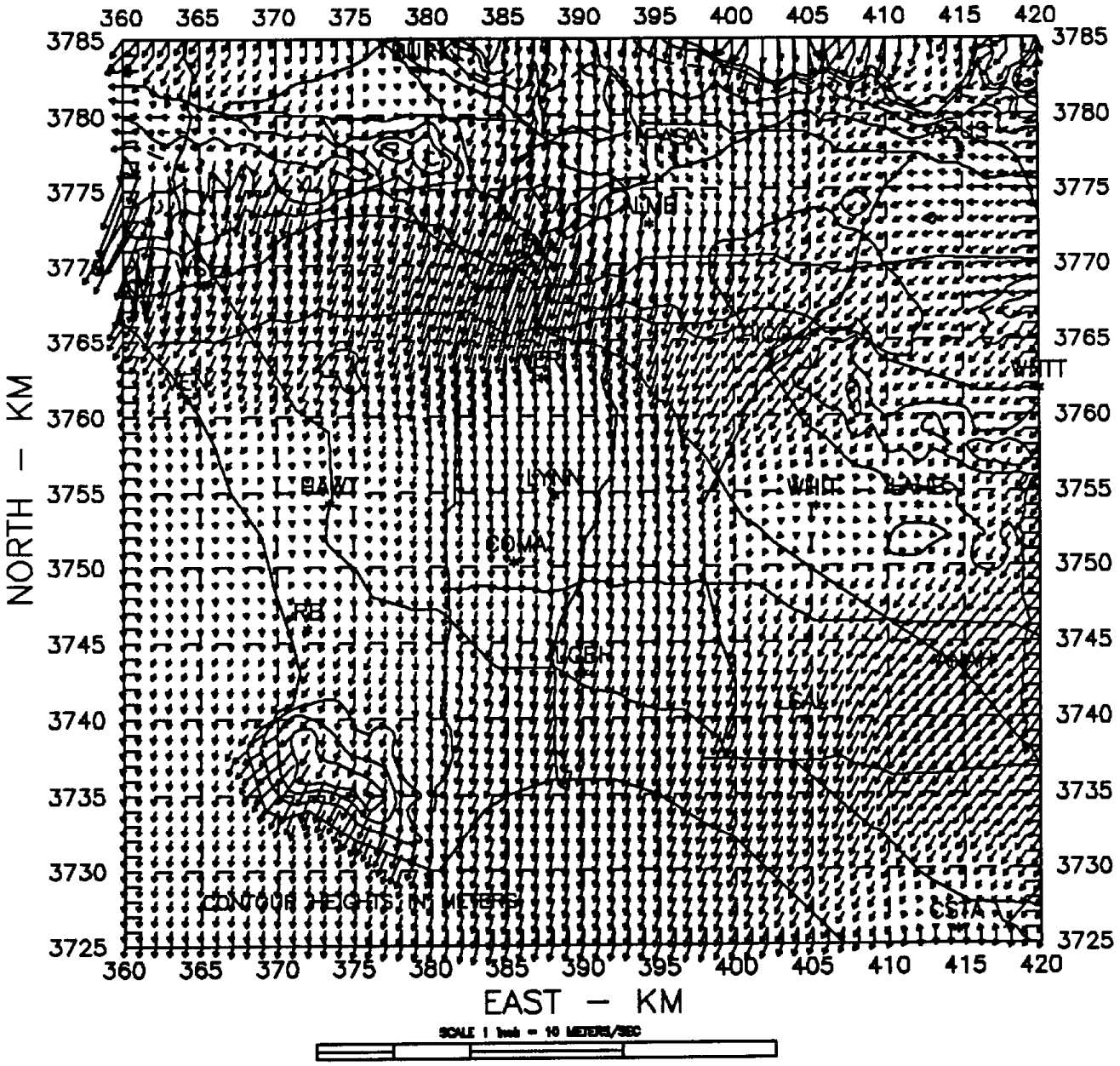

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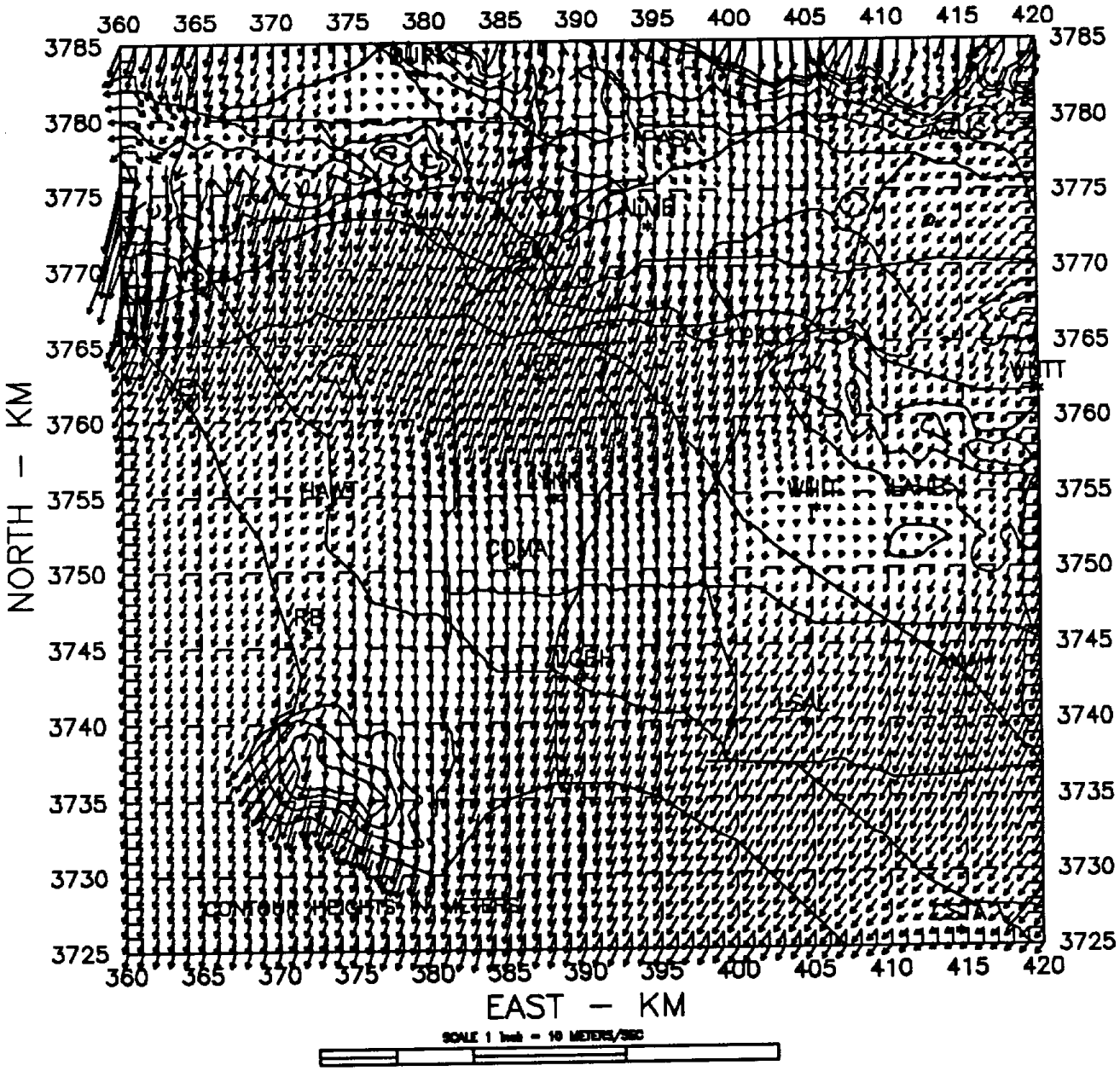

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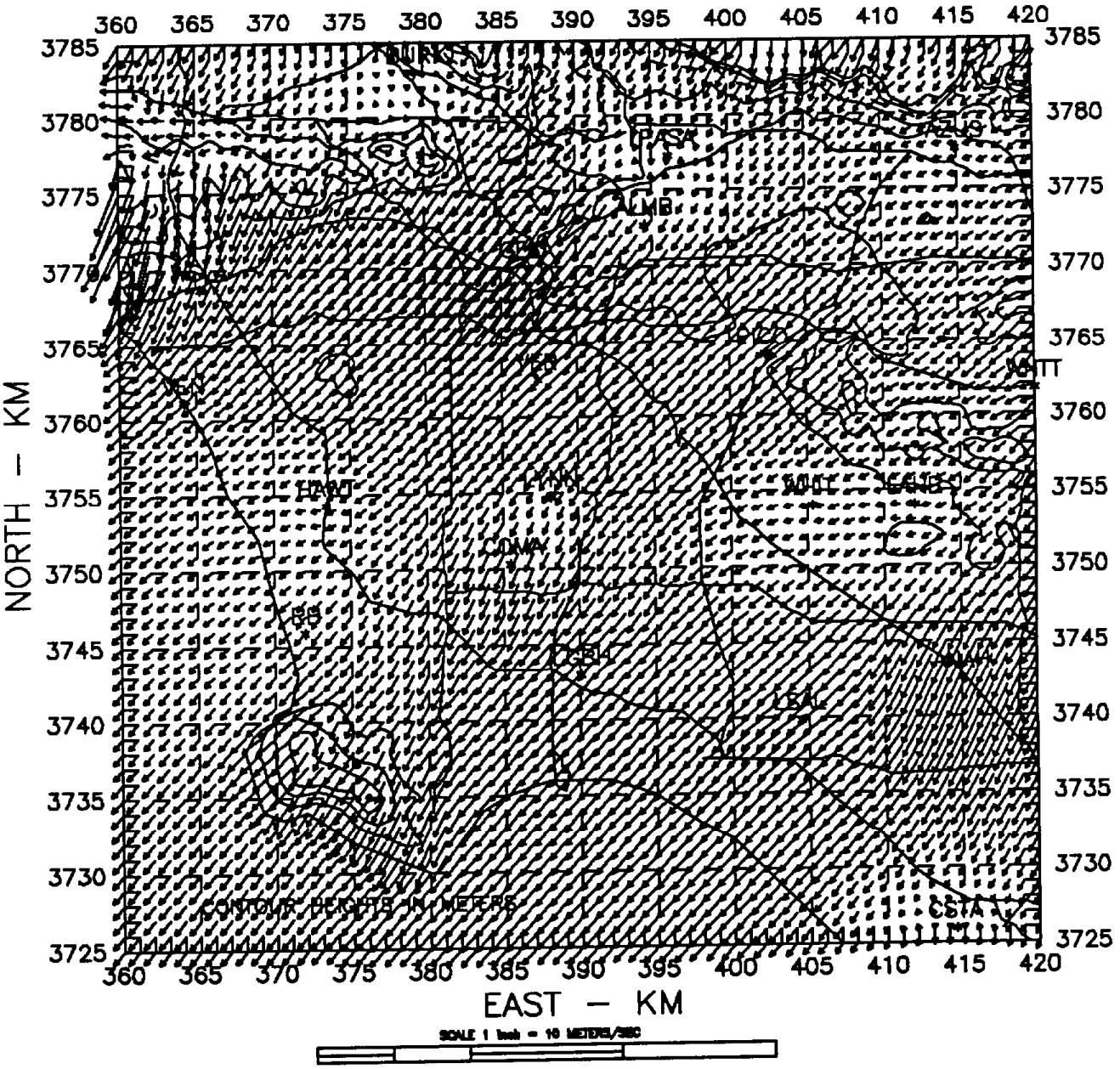

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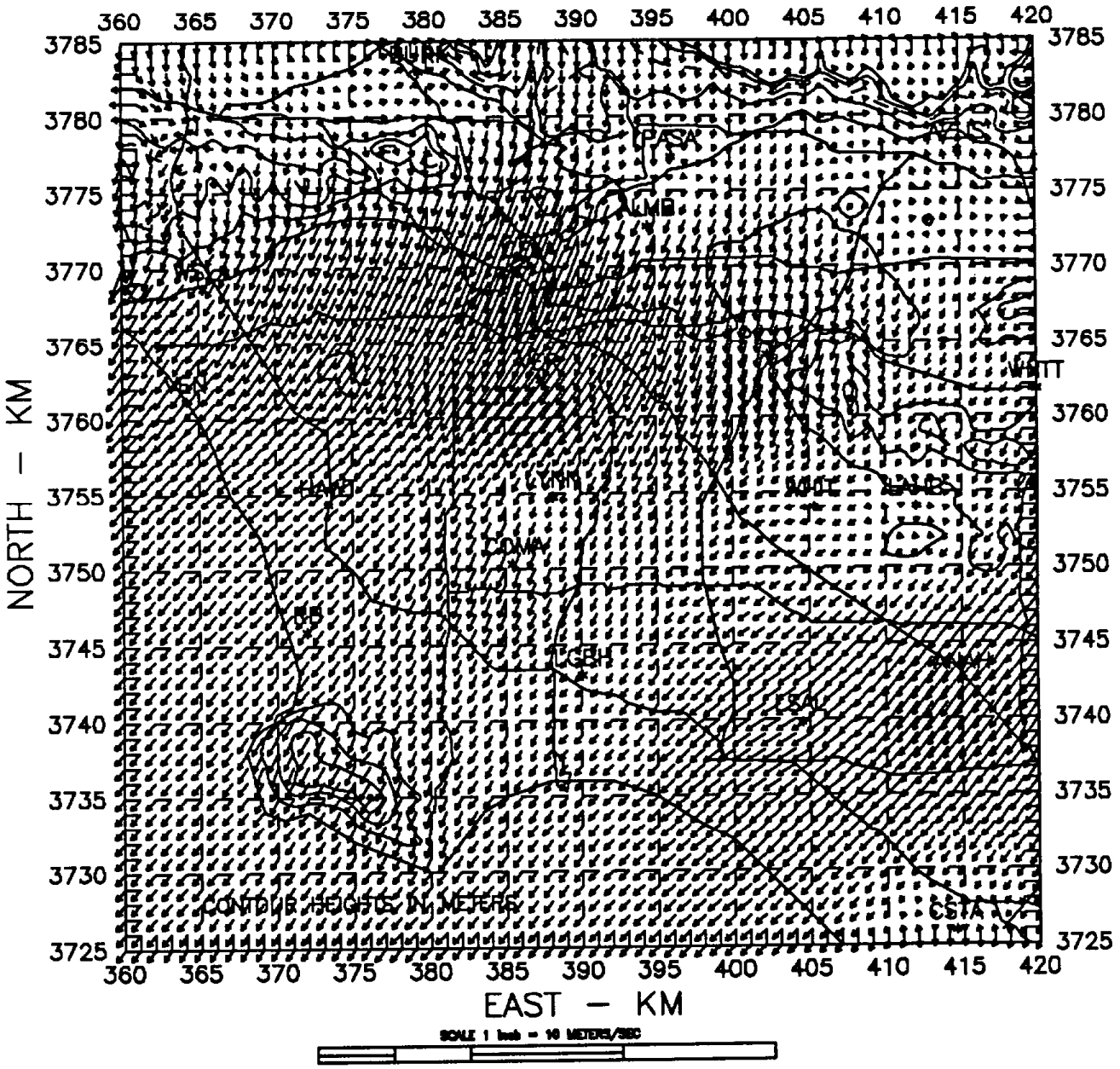

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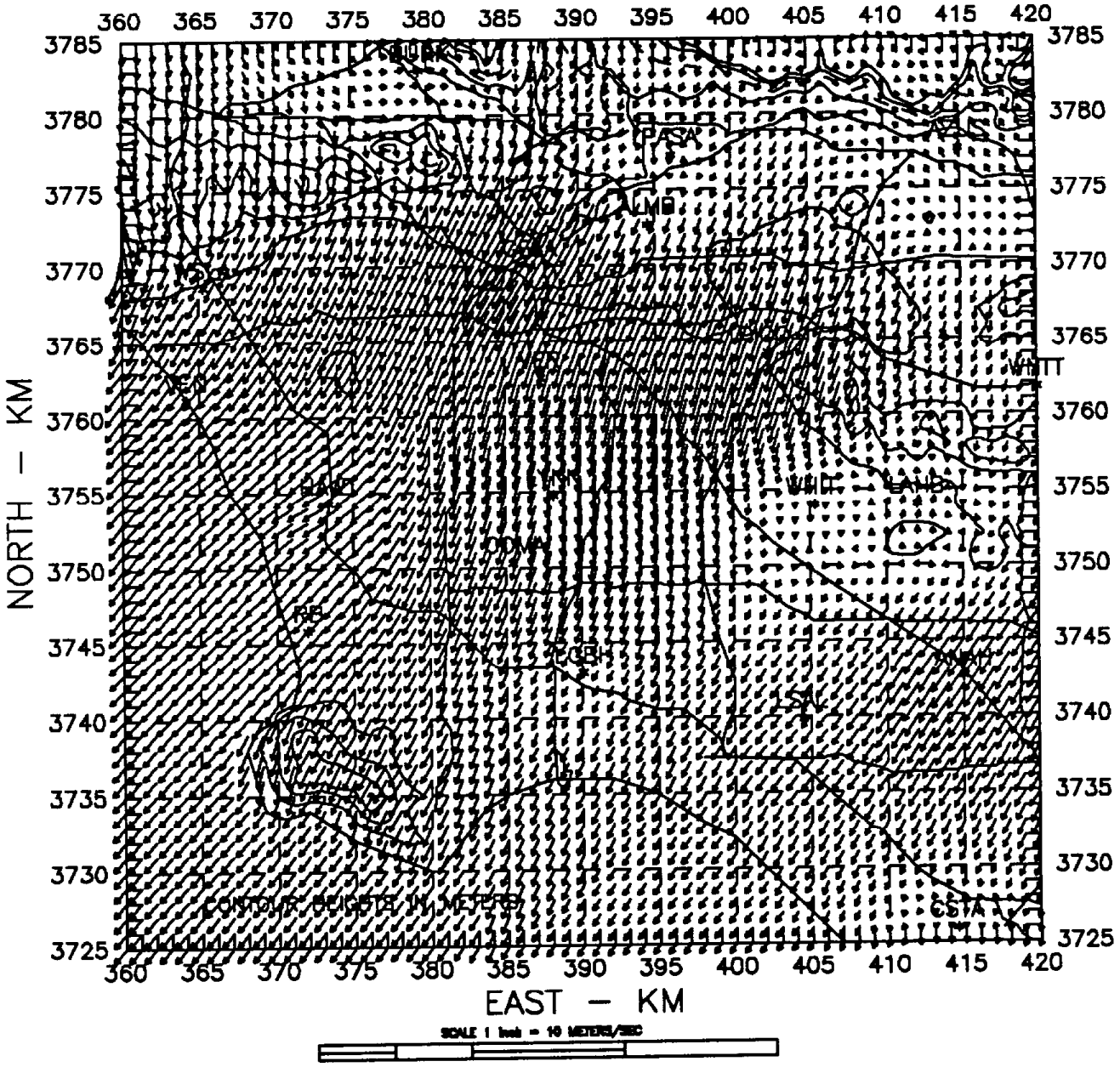

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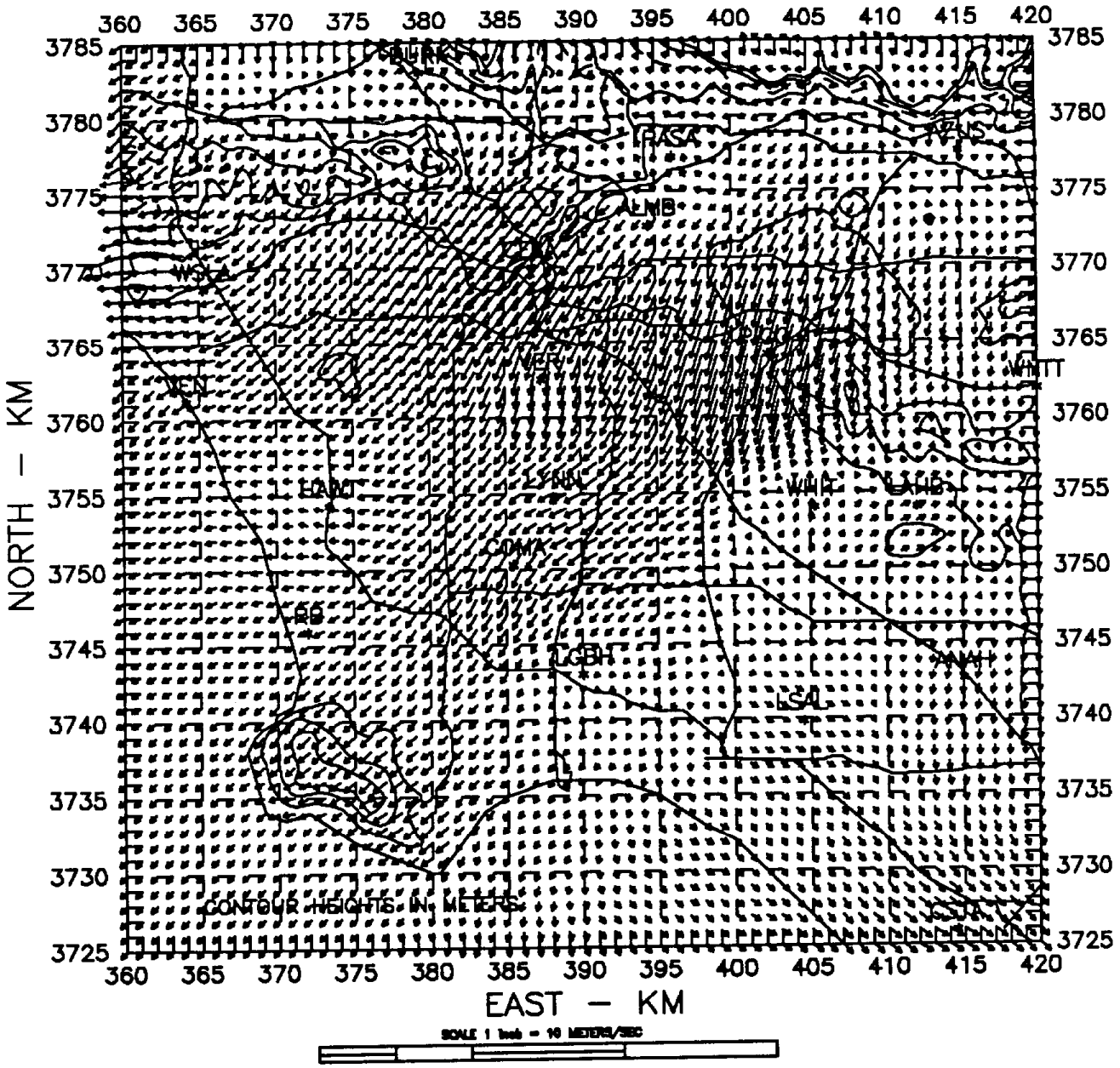

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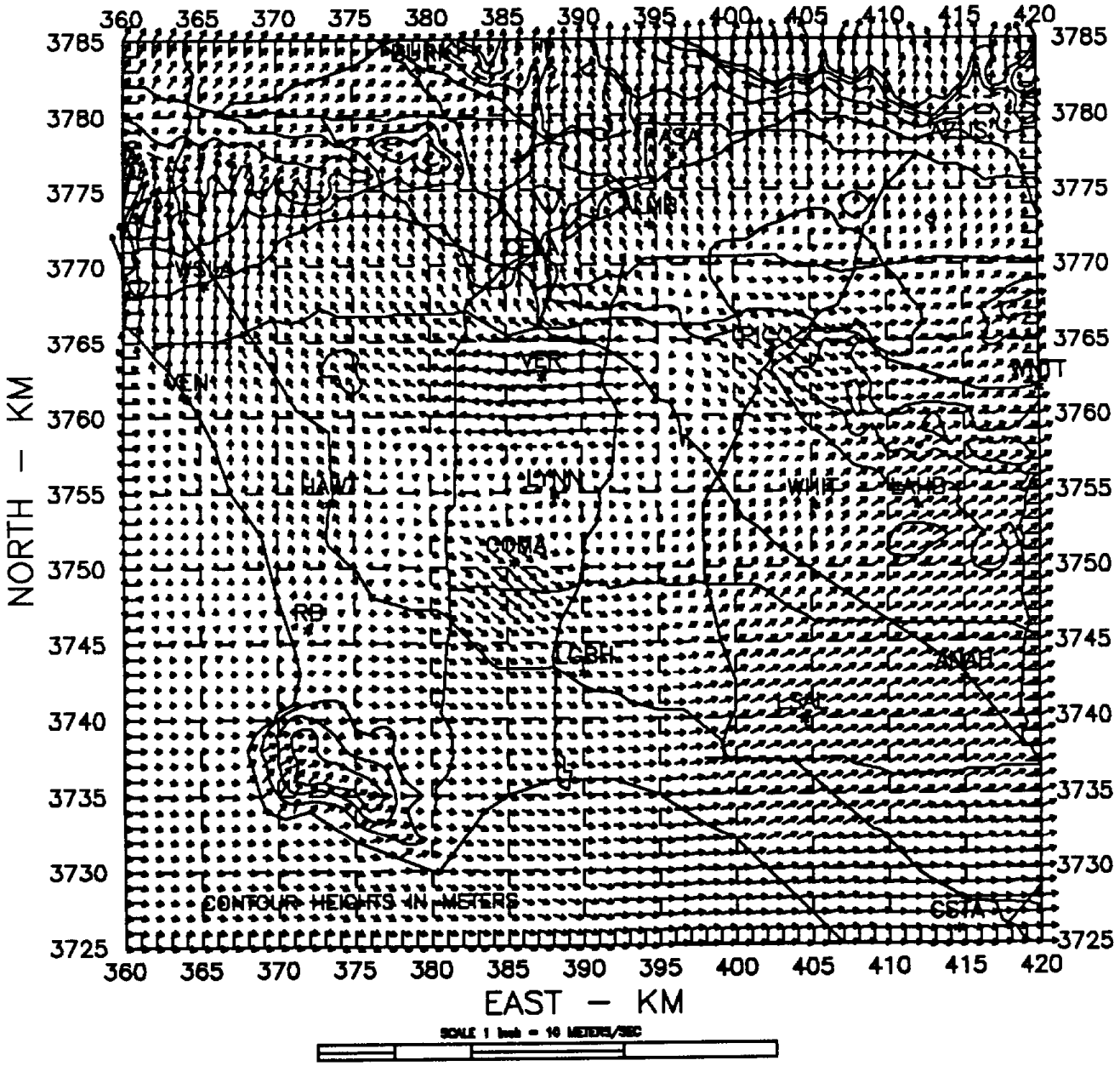
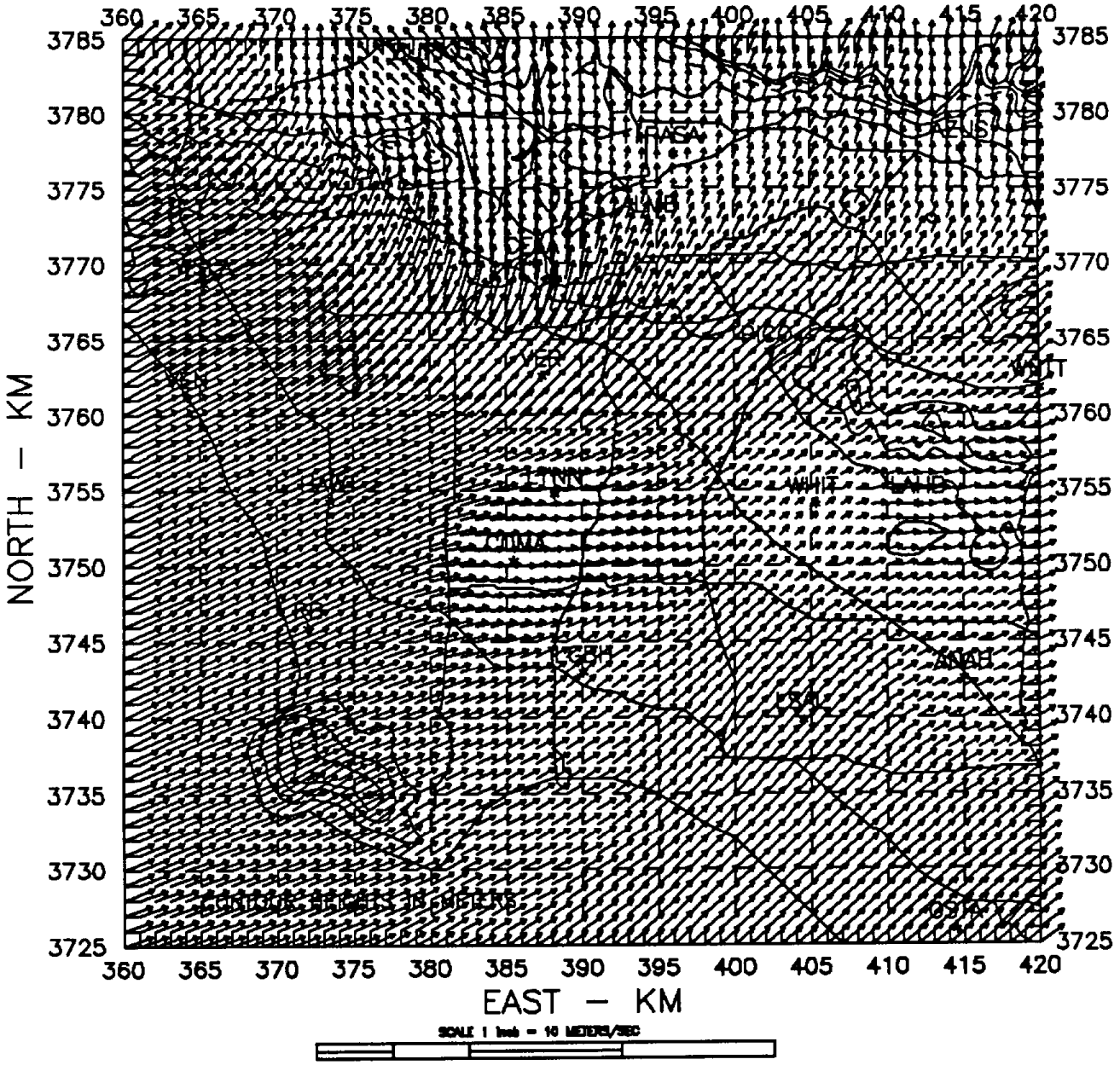


Wind Fields for January, 1990 Intensive Period

900108 HOUR 12 – LEVEL 1 WINDS



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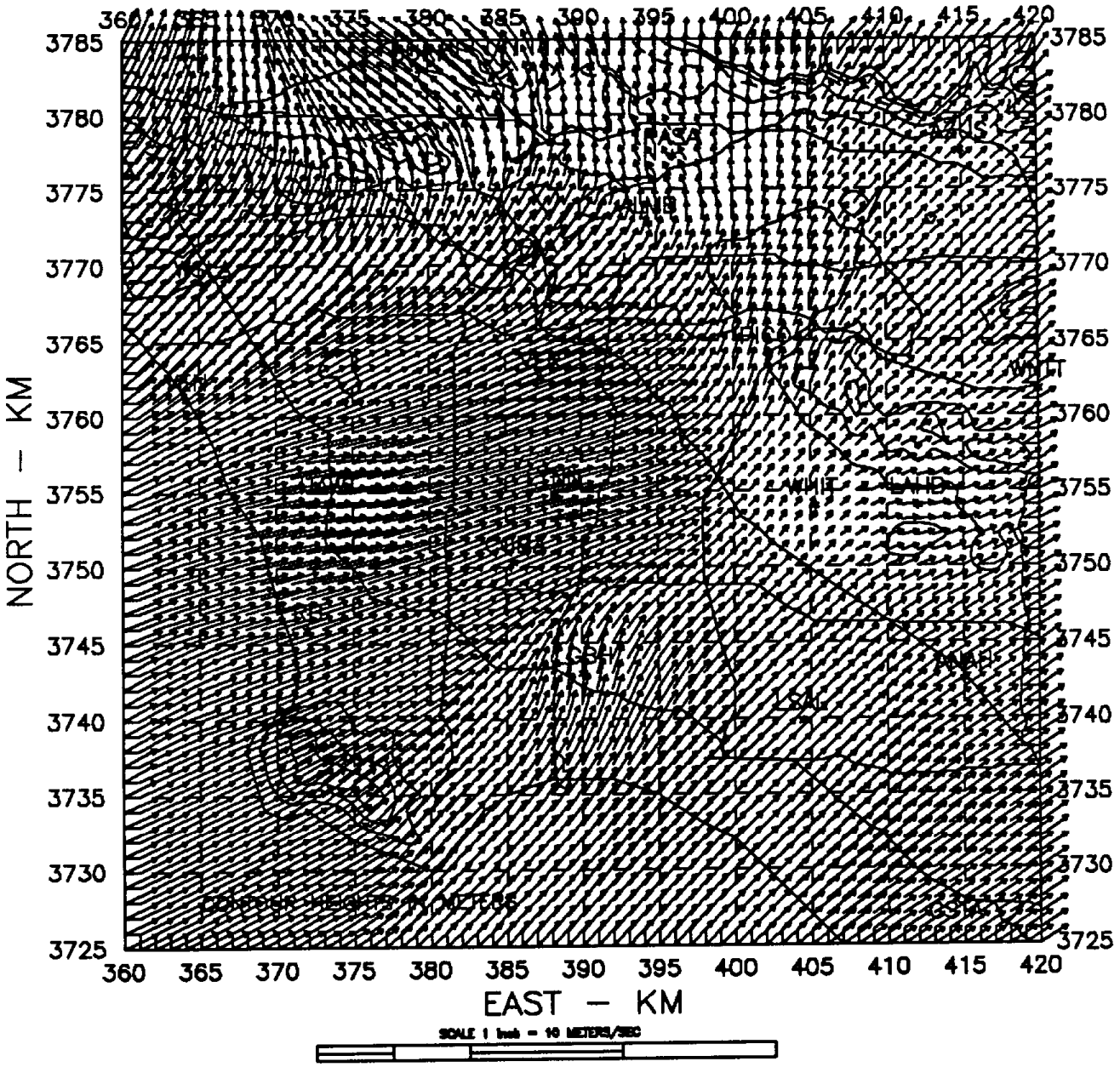
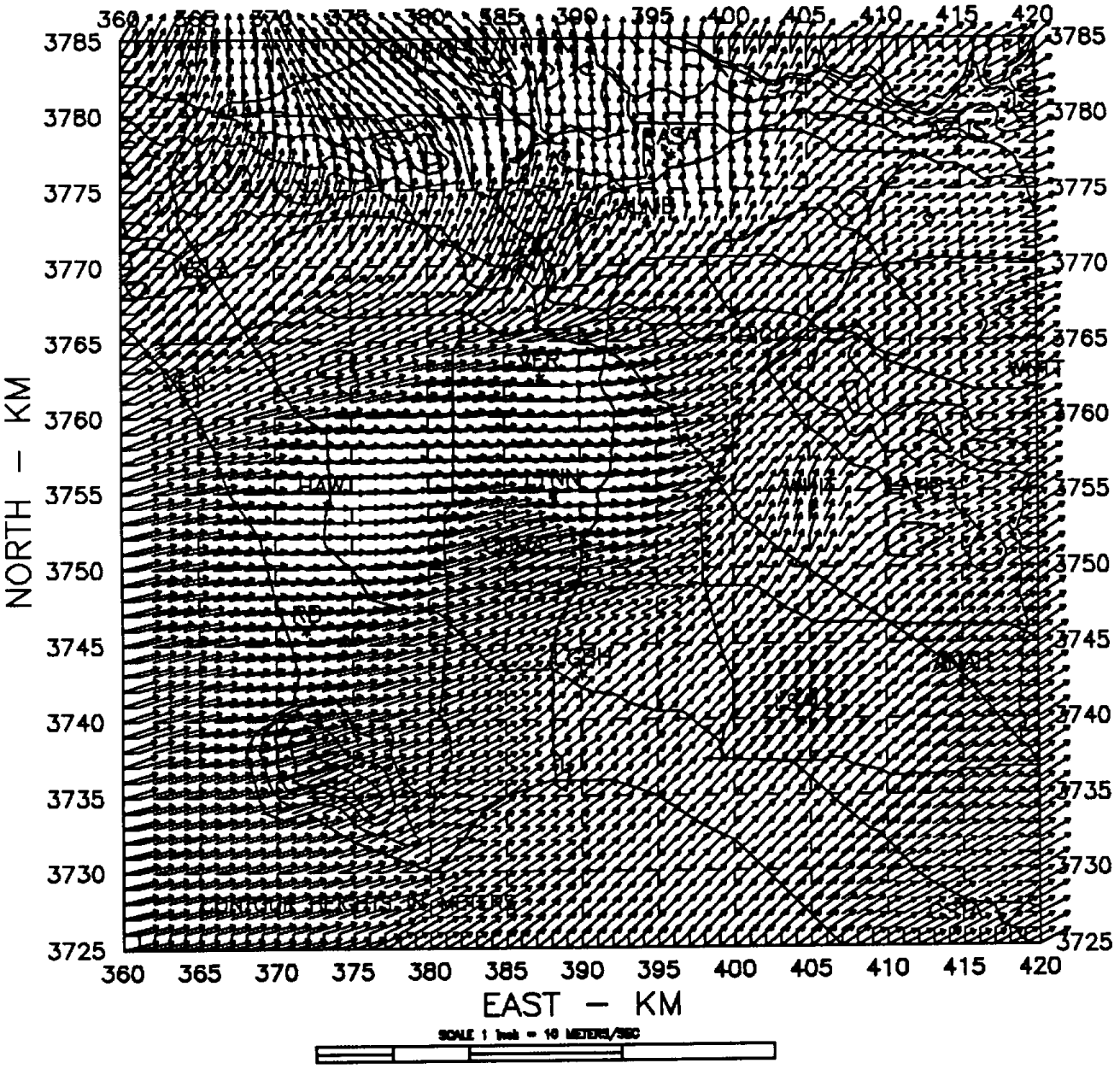


900108 HOUR 14 – LEVEL 1 WINDS



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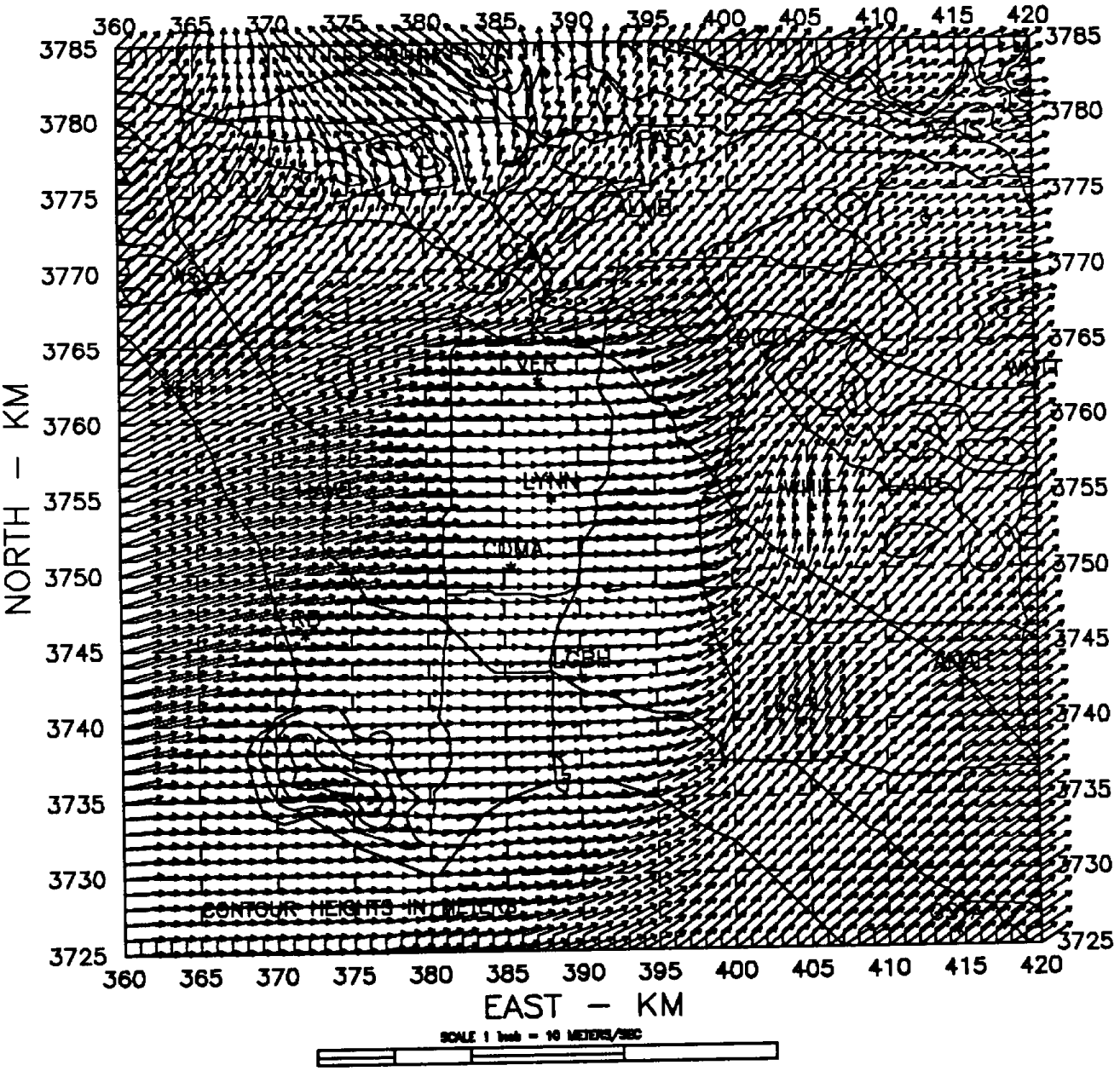

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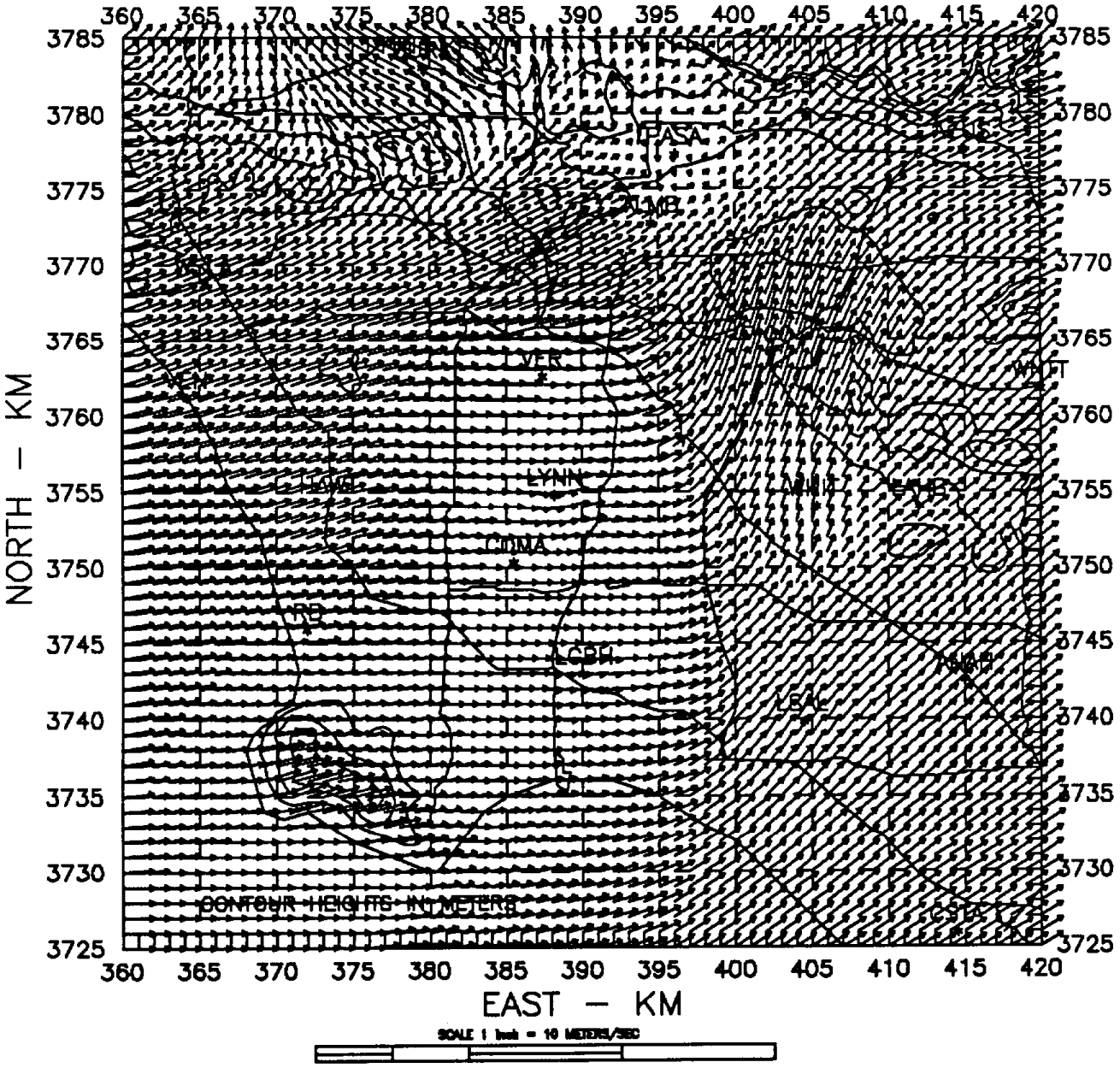

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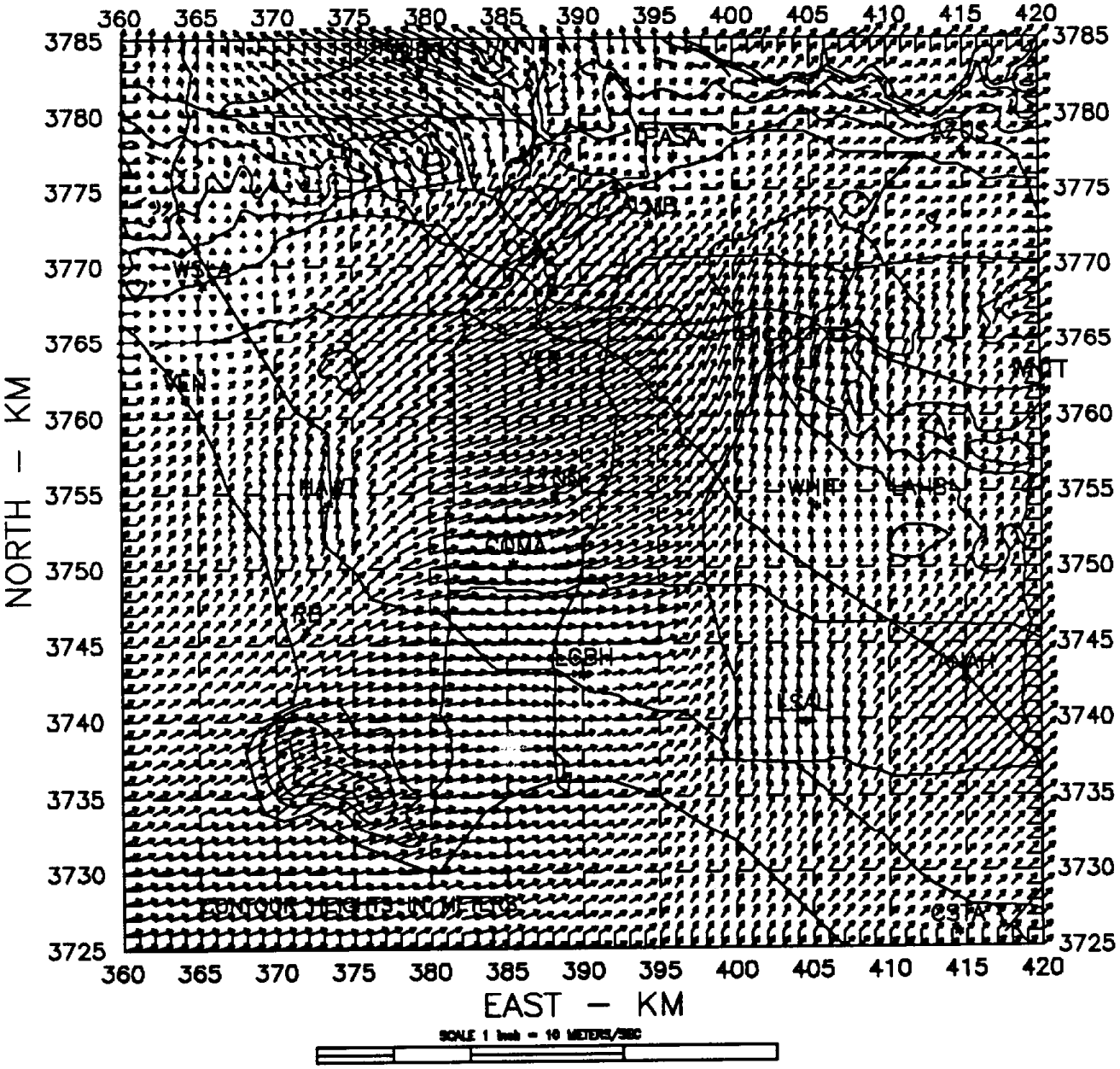
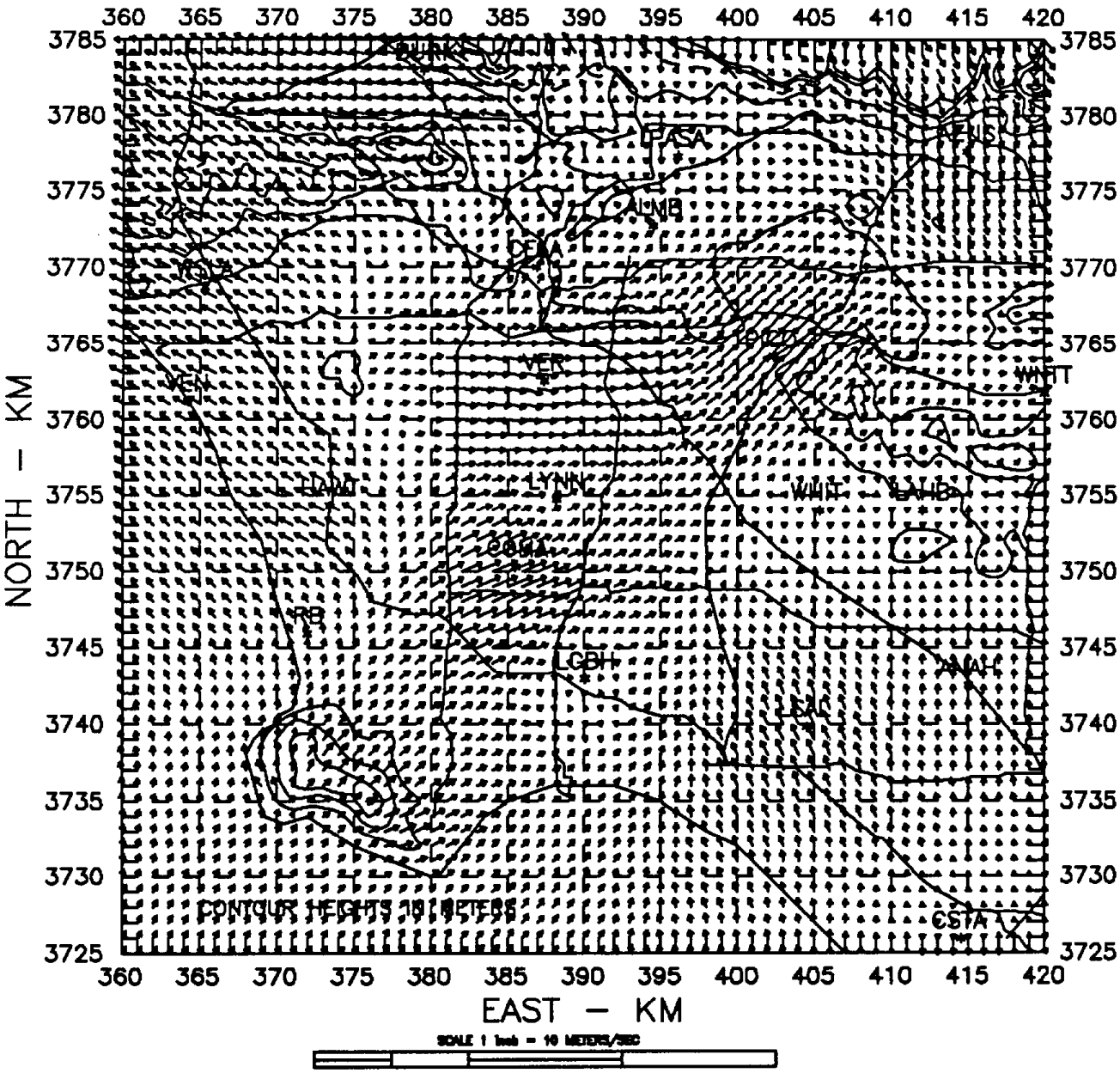
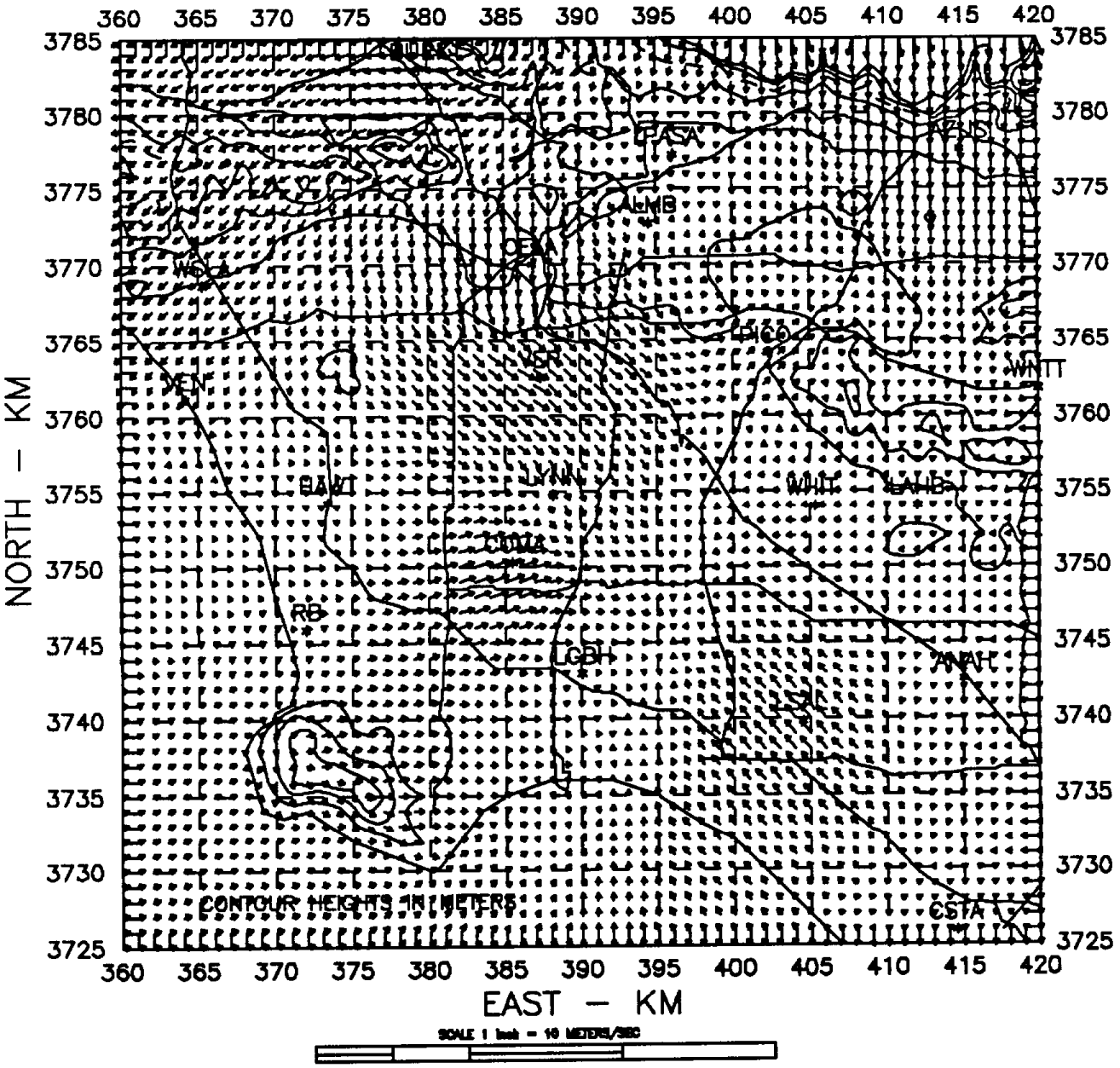


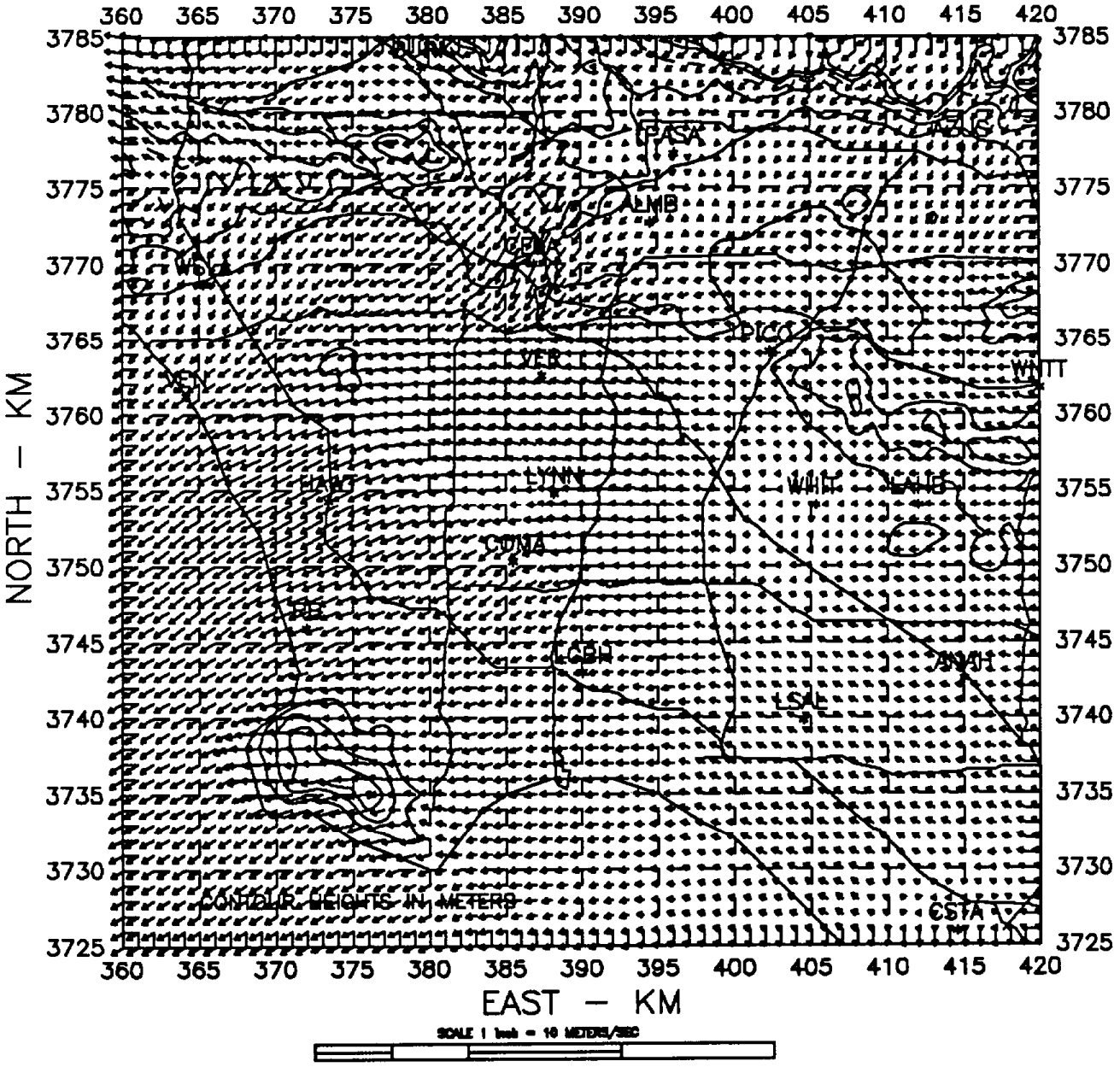
900108 HOUR 18 – LEVEL 1 WINDS



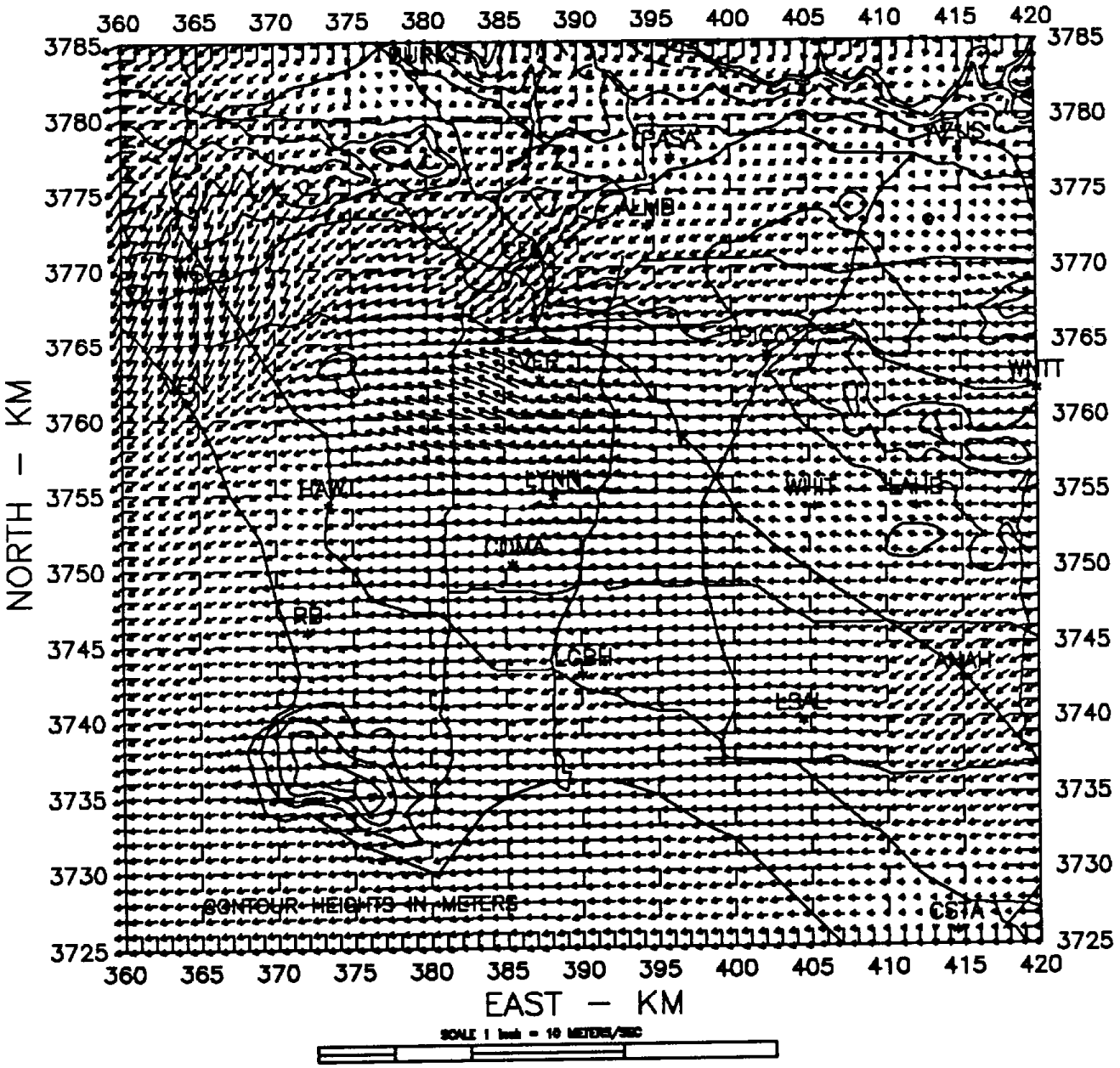
900108 HOUR 19 – LEVEL 1 WINDS



900108 HOUR 20 – LEVEL 1 WINDS



900108 HOUR 21 – LEVEL 1 WINDS



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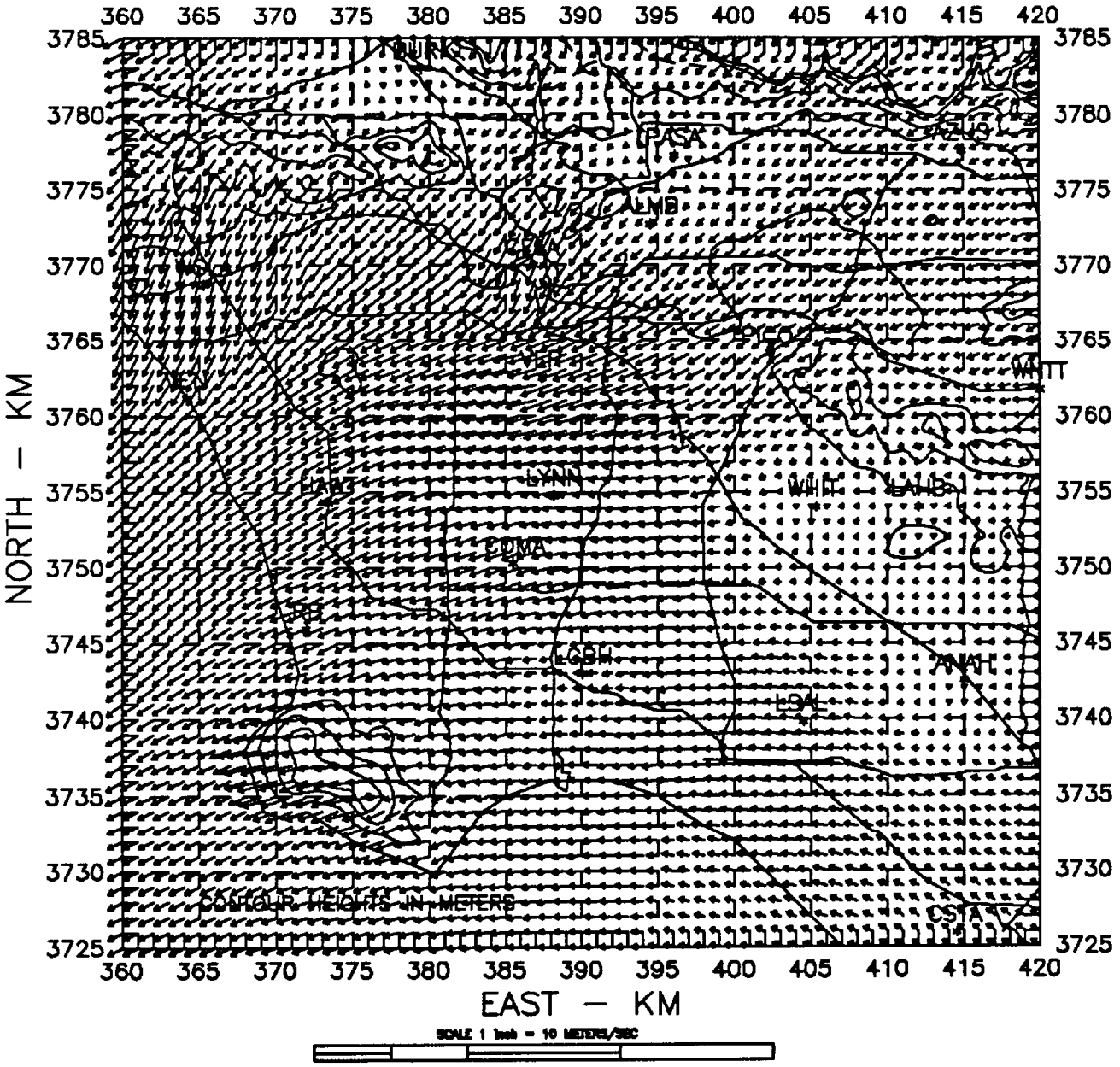

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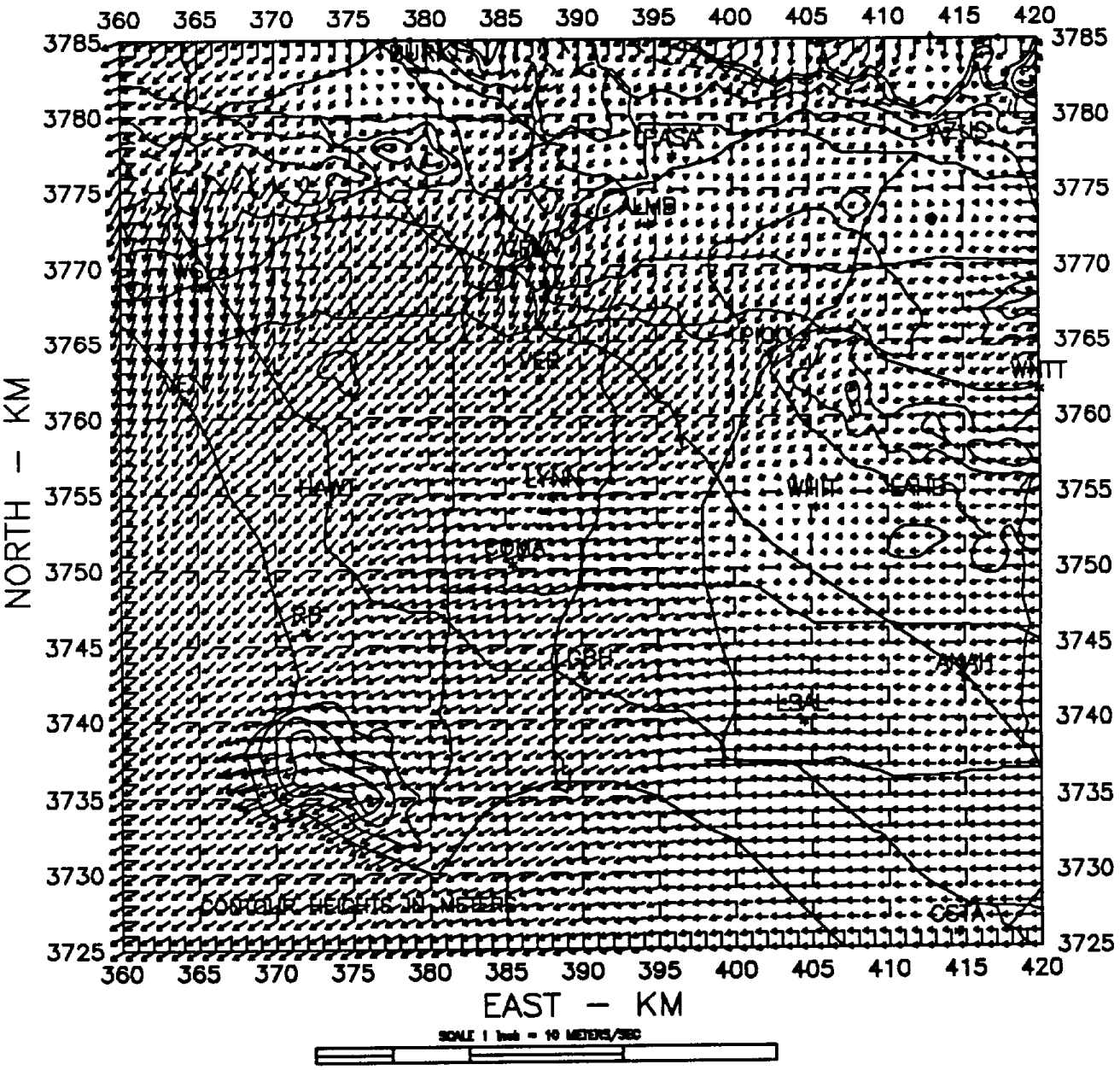

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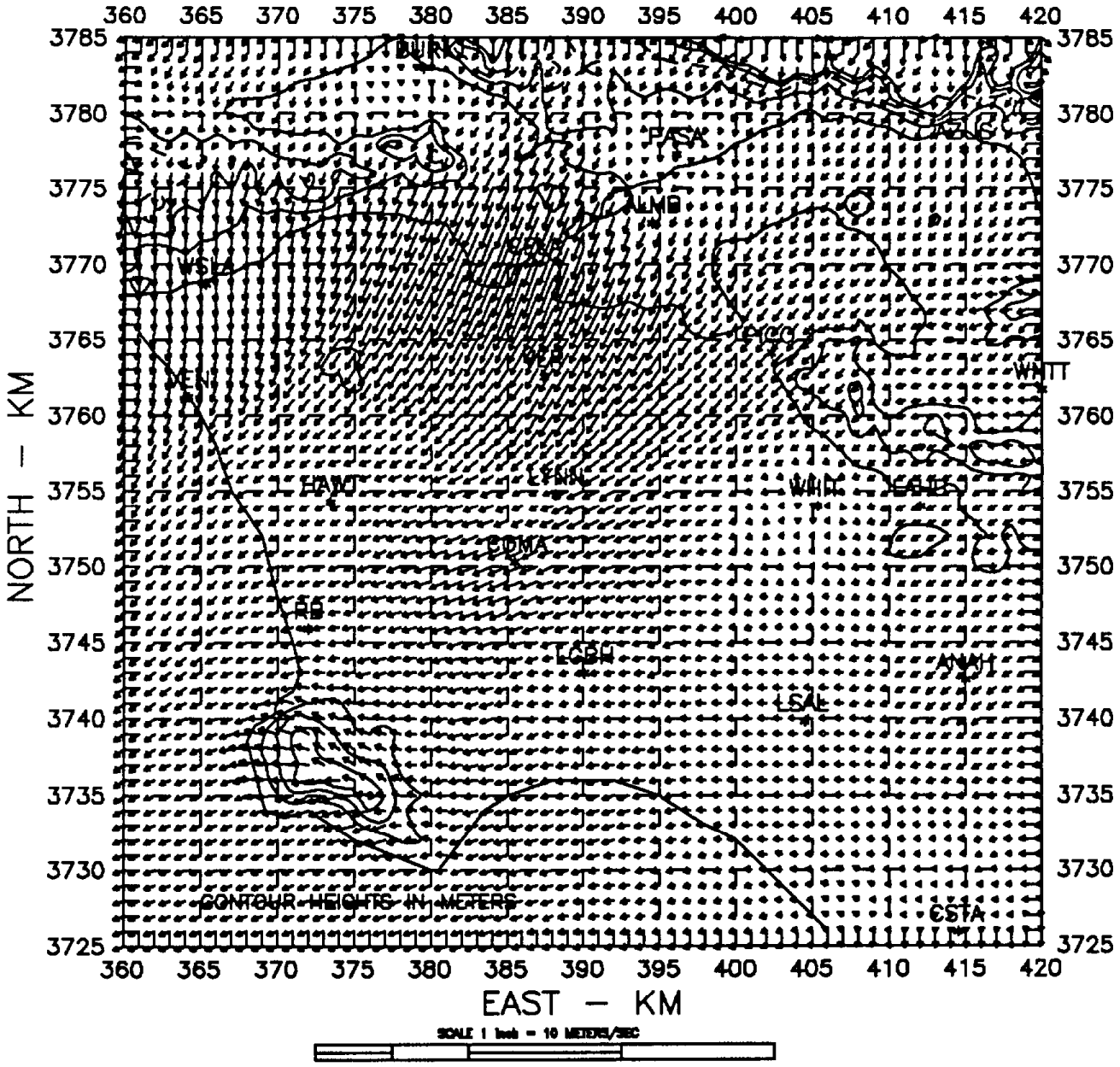

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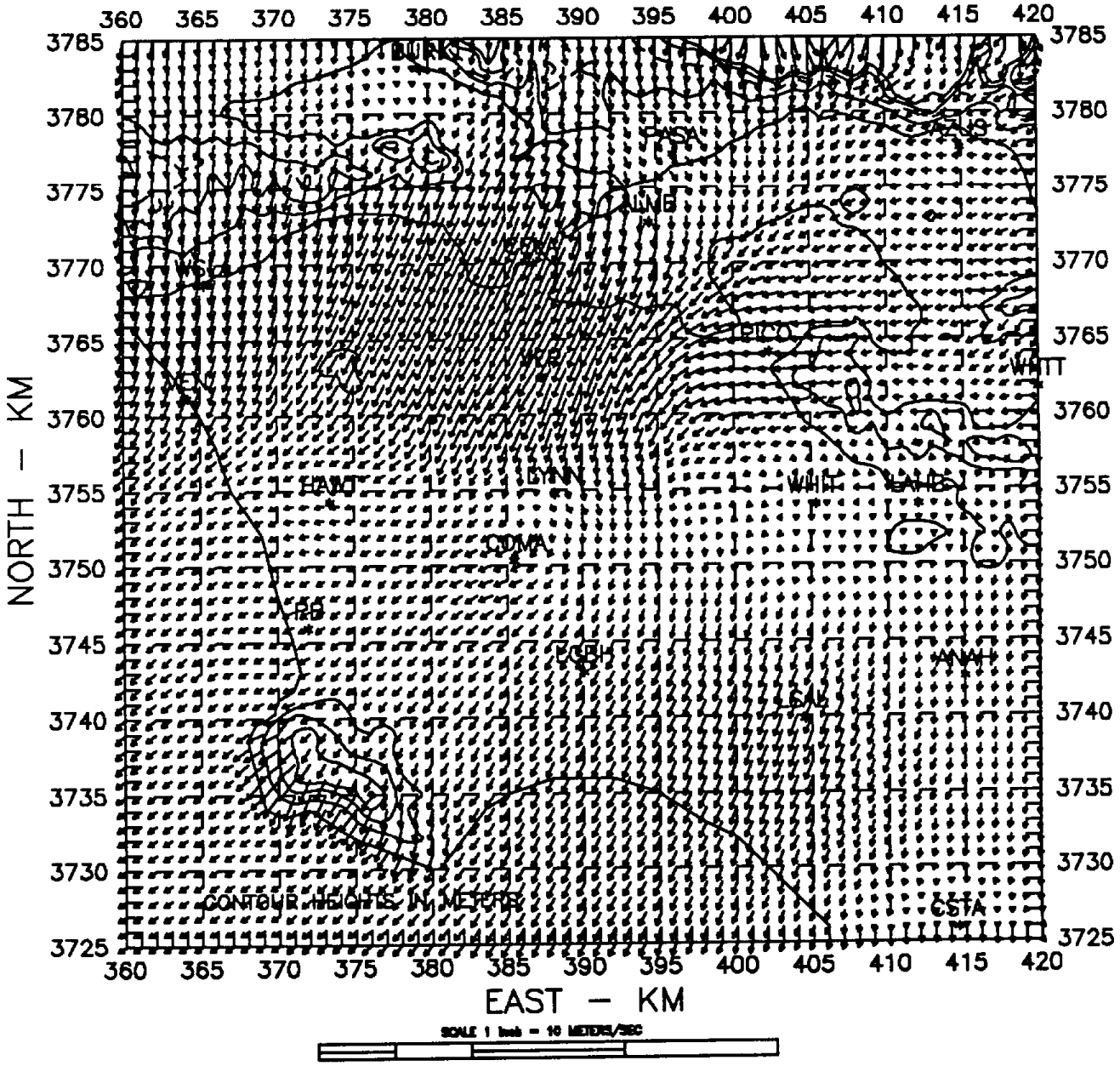

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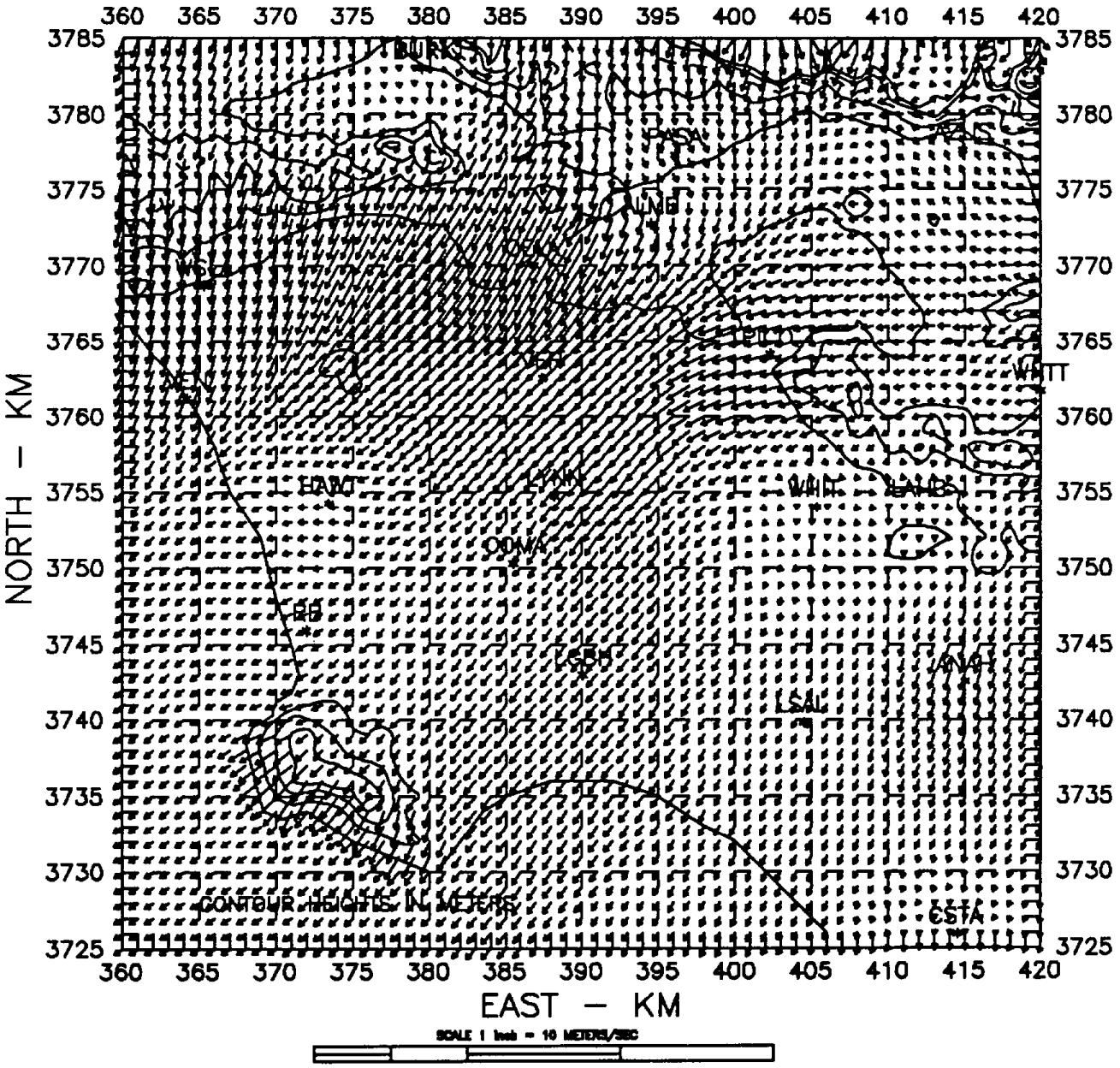

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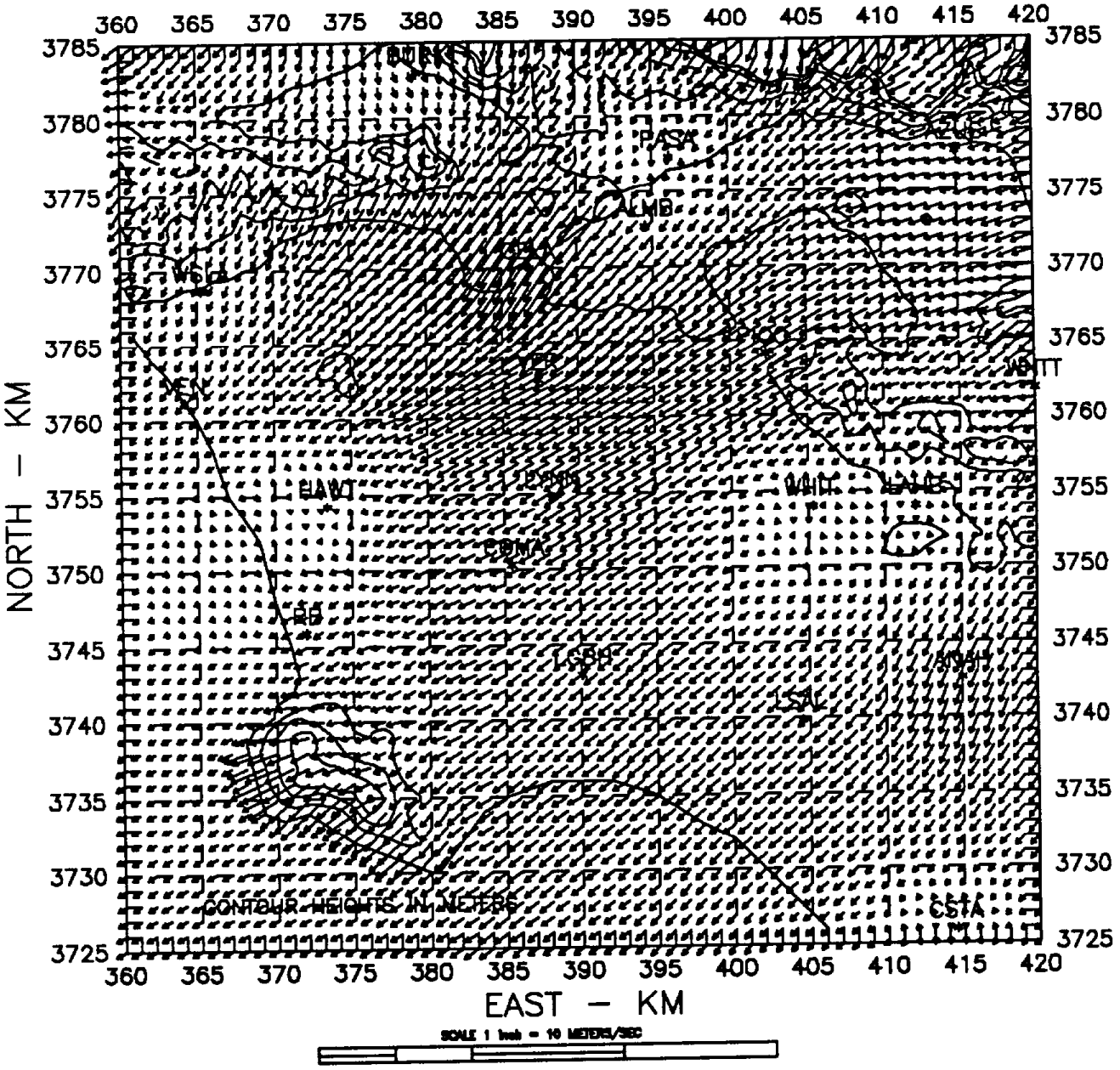

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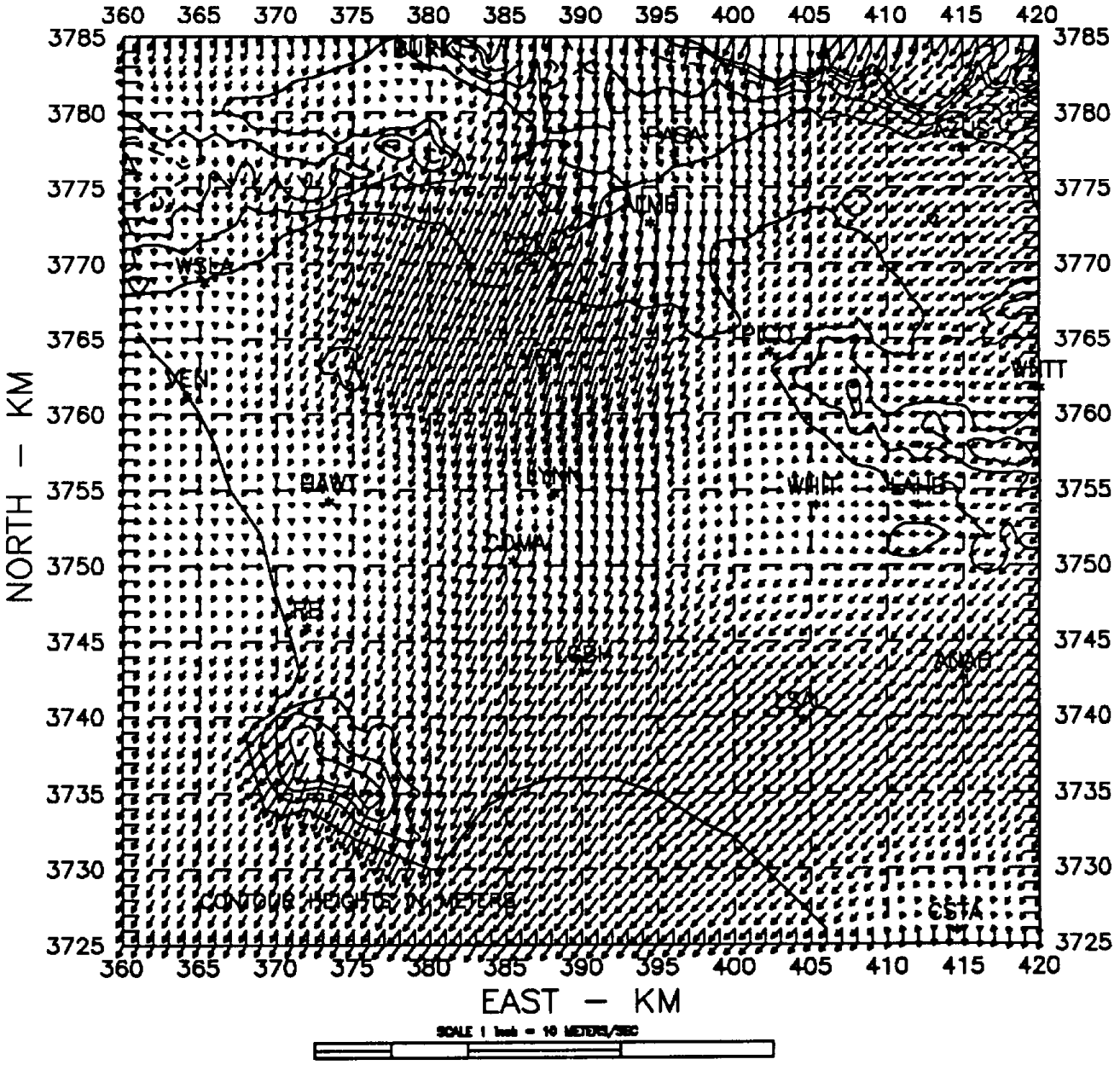

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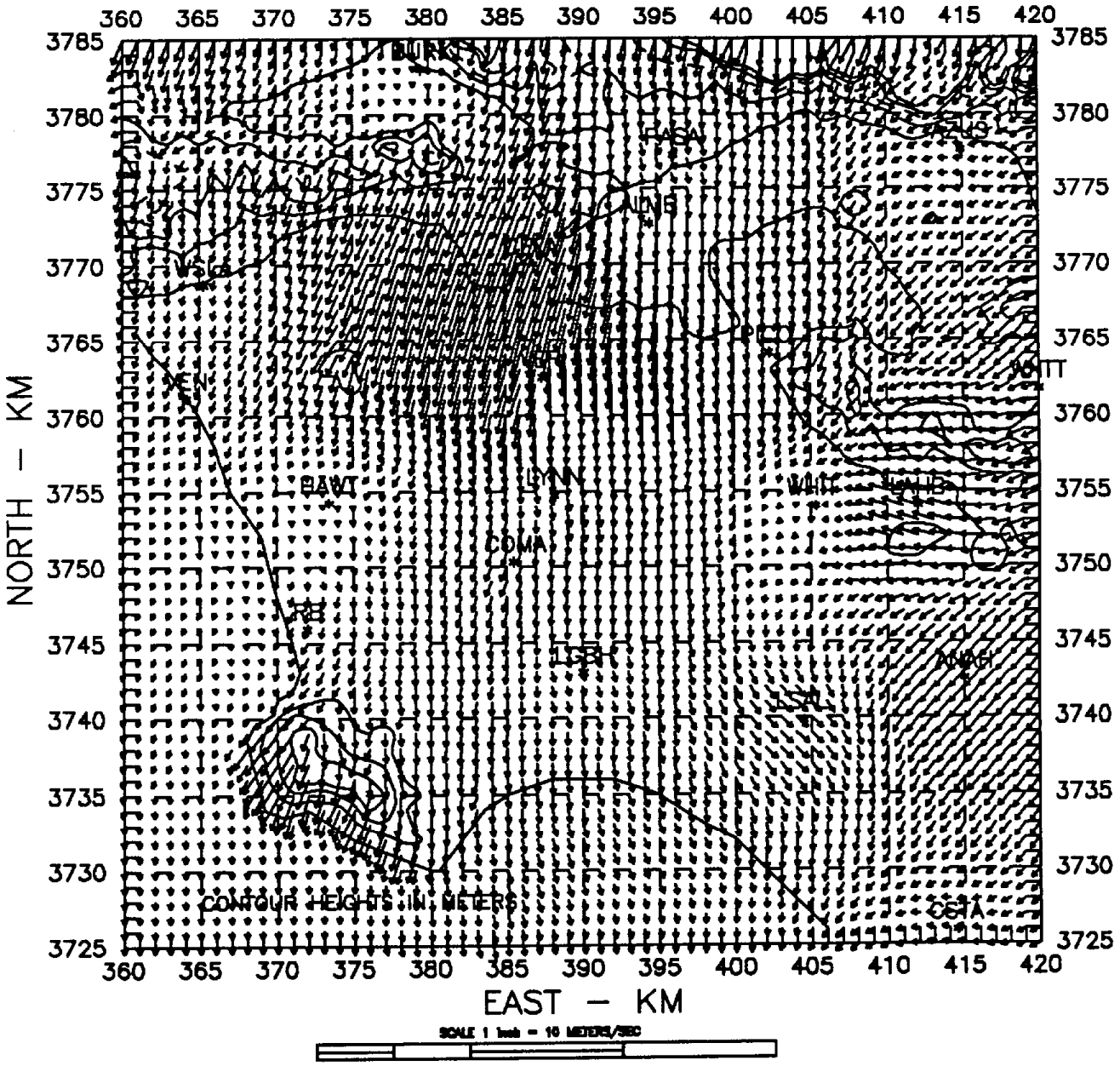

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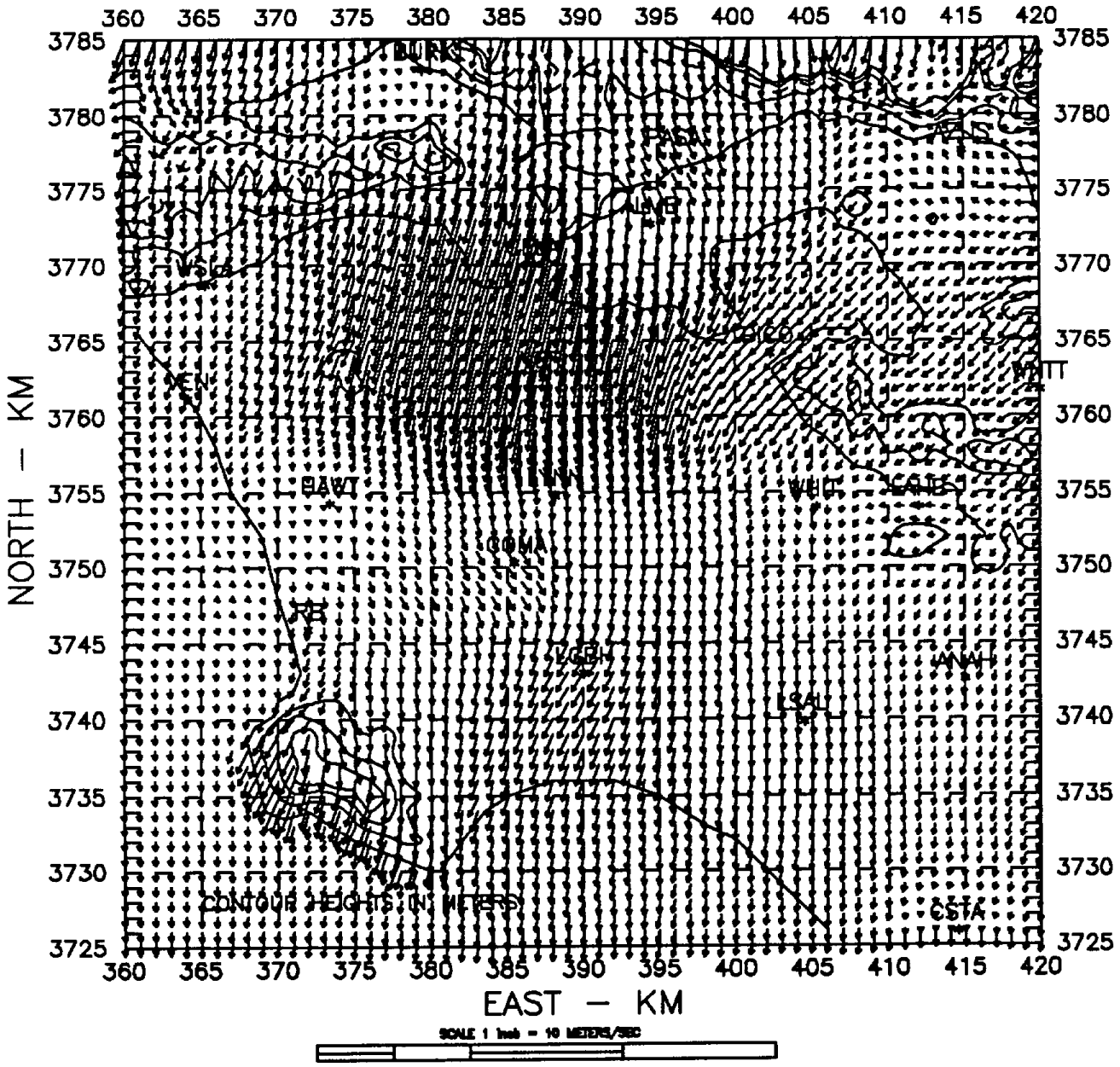

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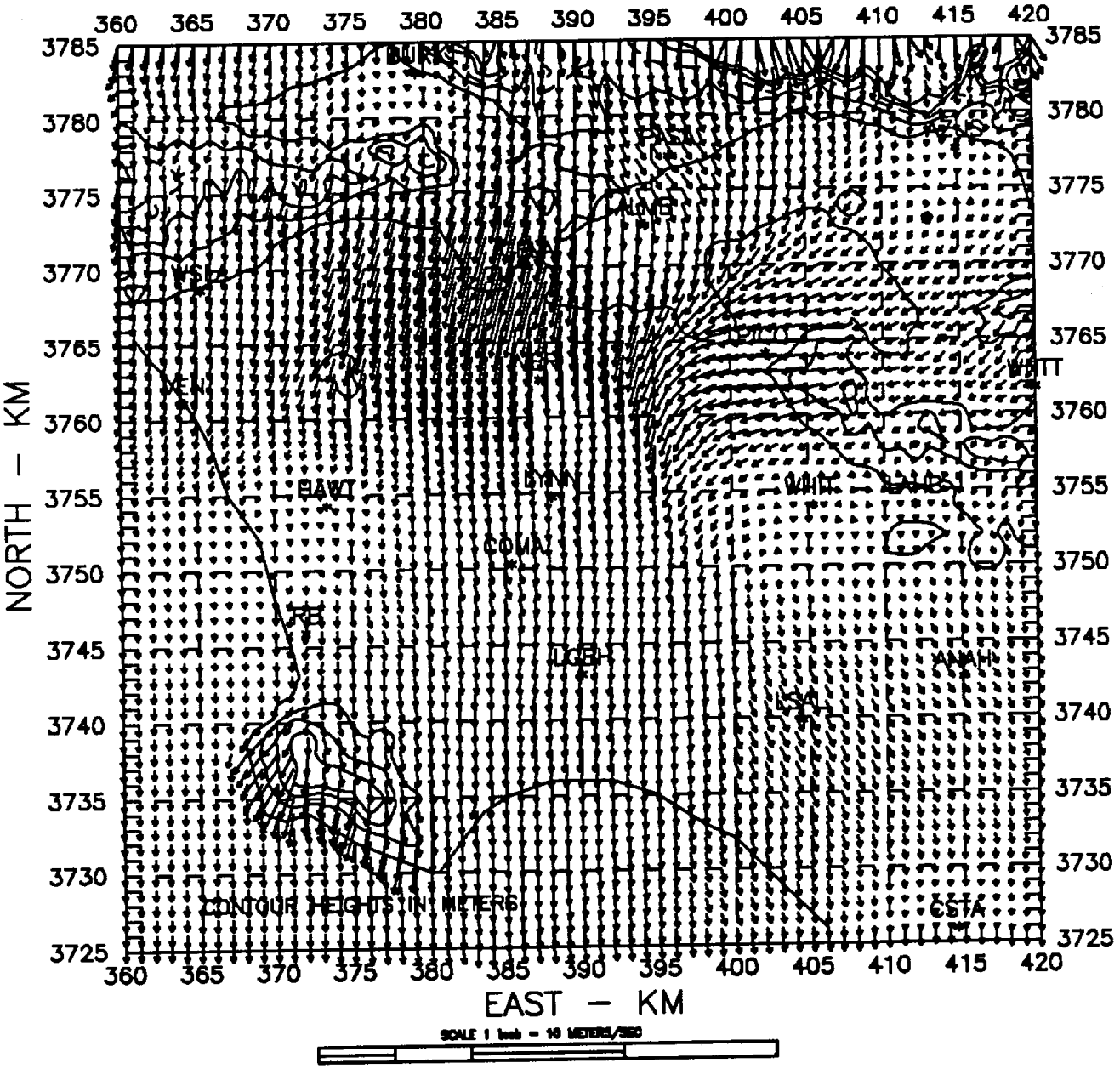

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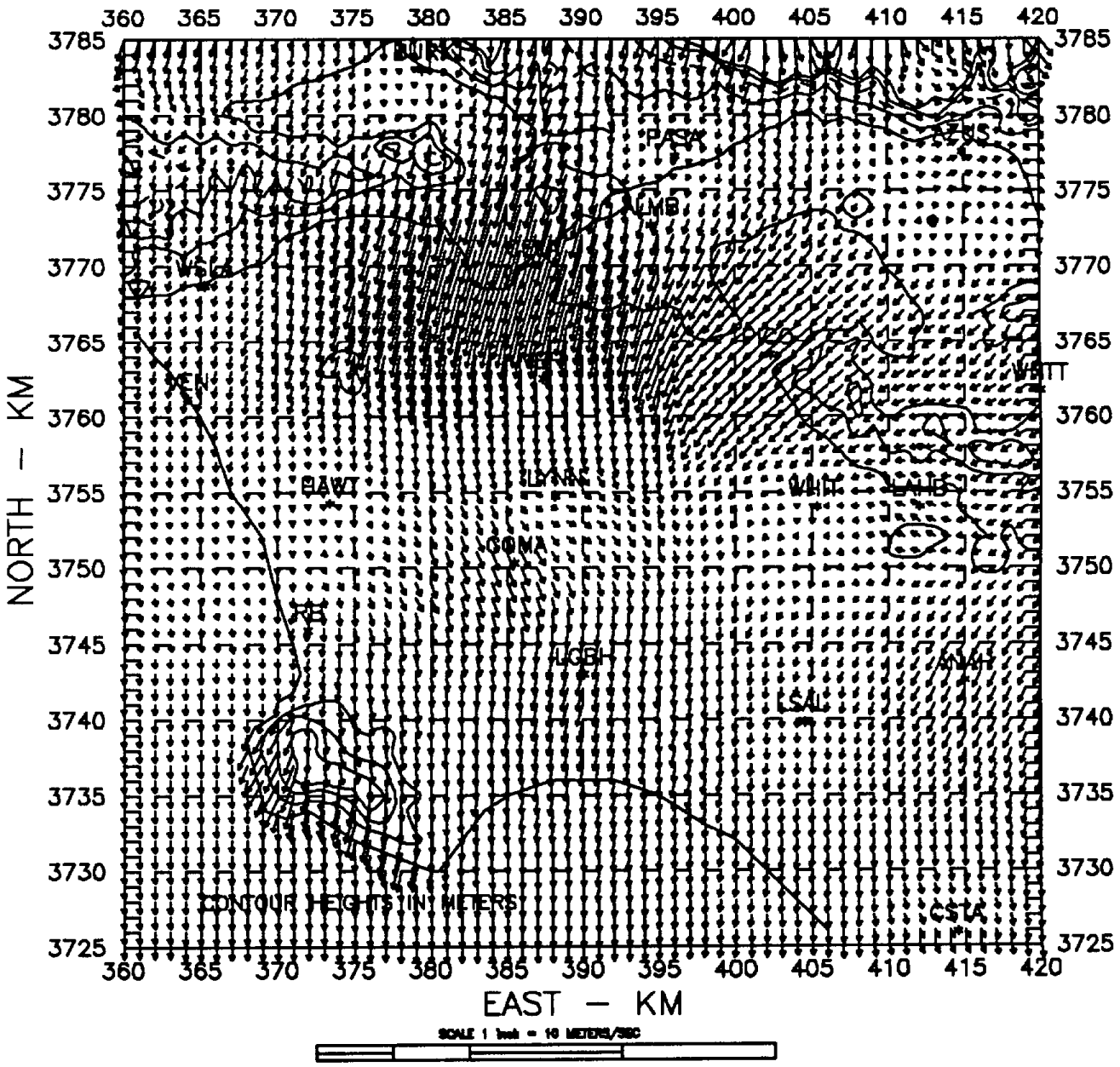

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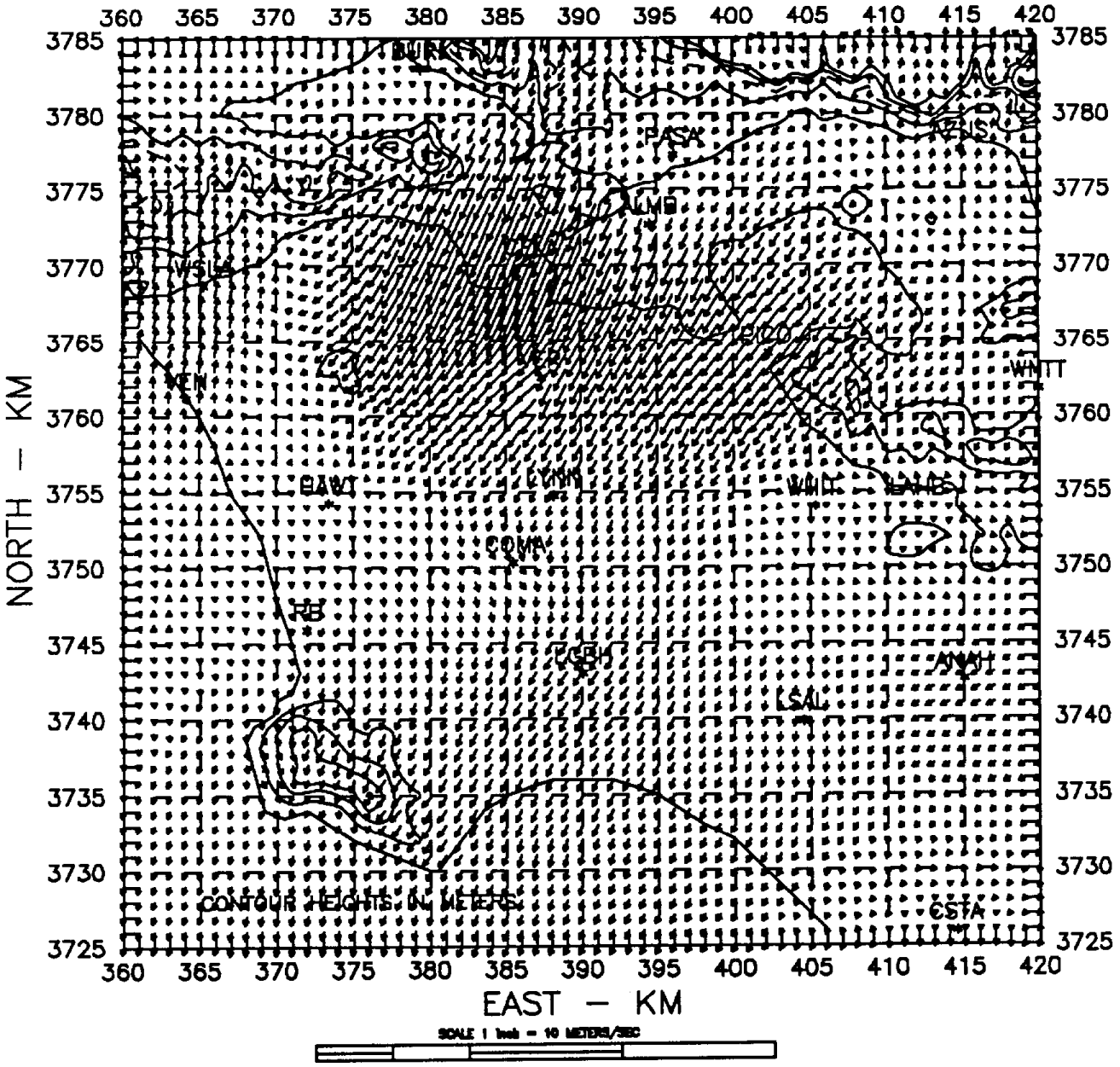

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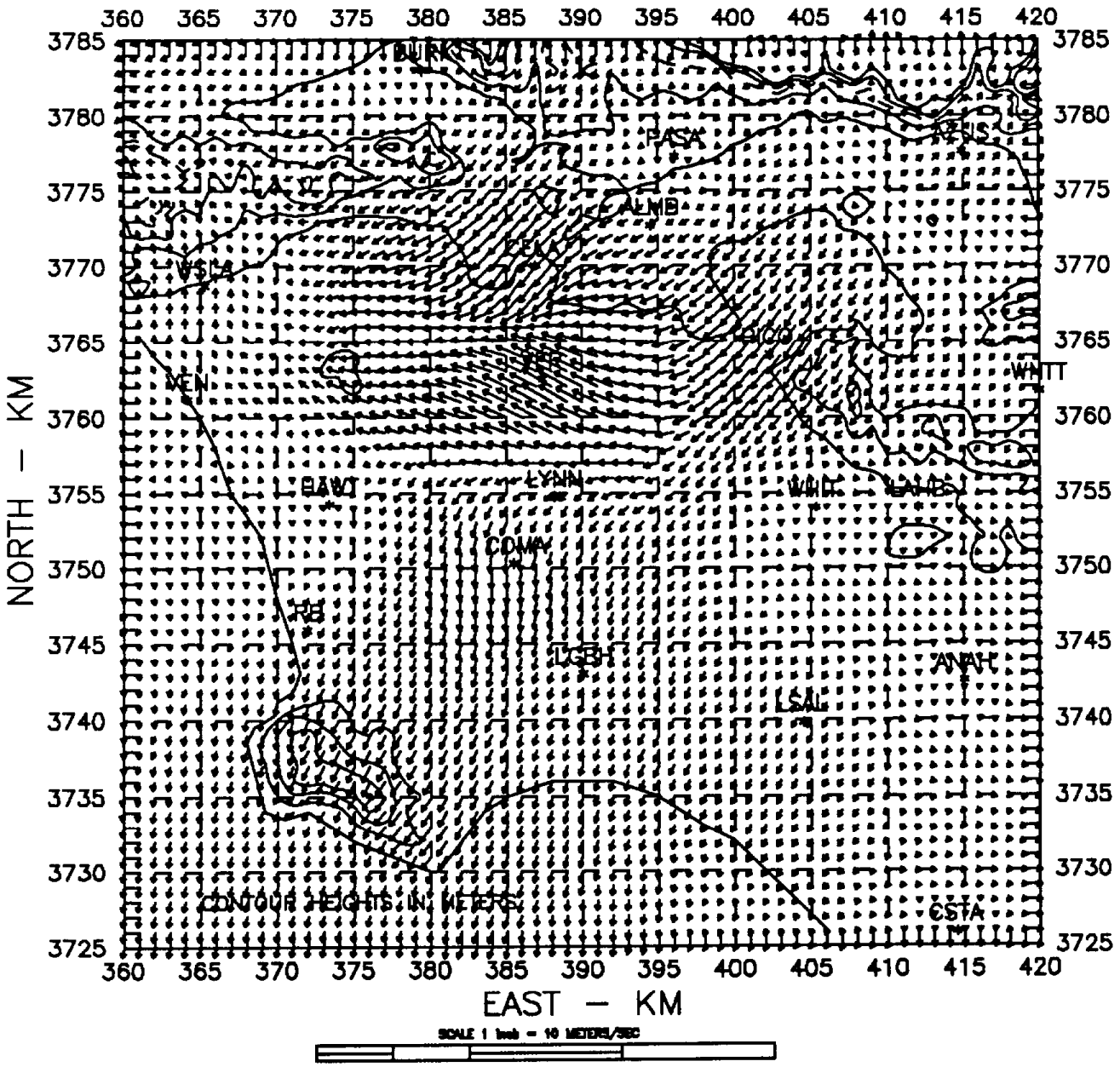
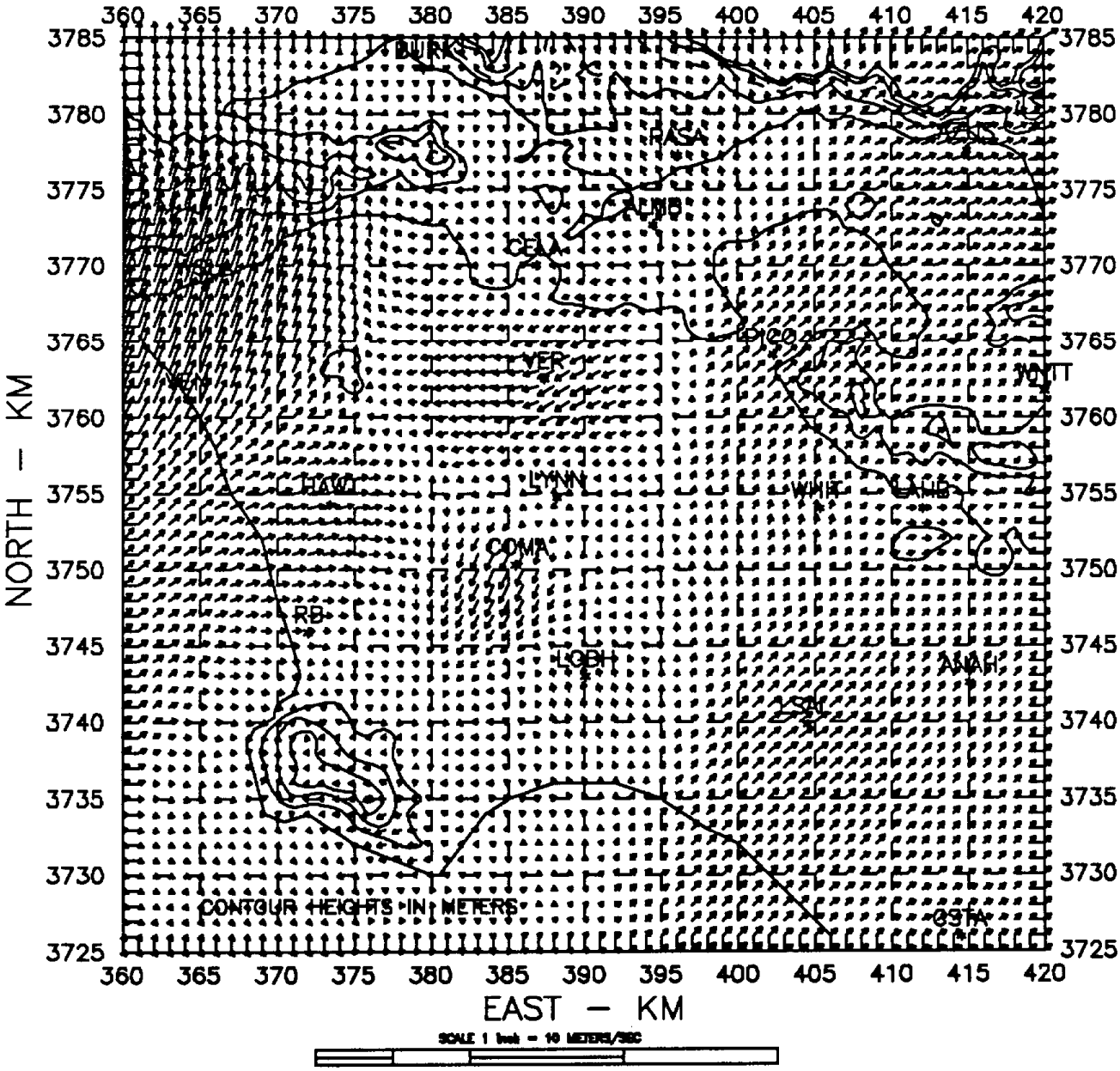


900109 HOUR 11 — LEVEL 1 WINDS



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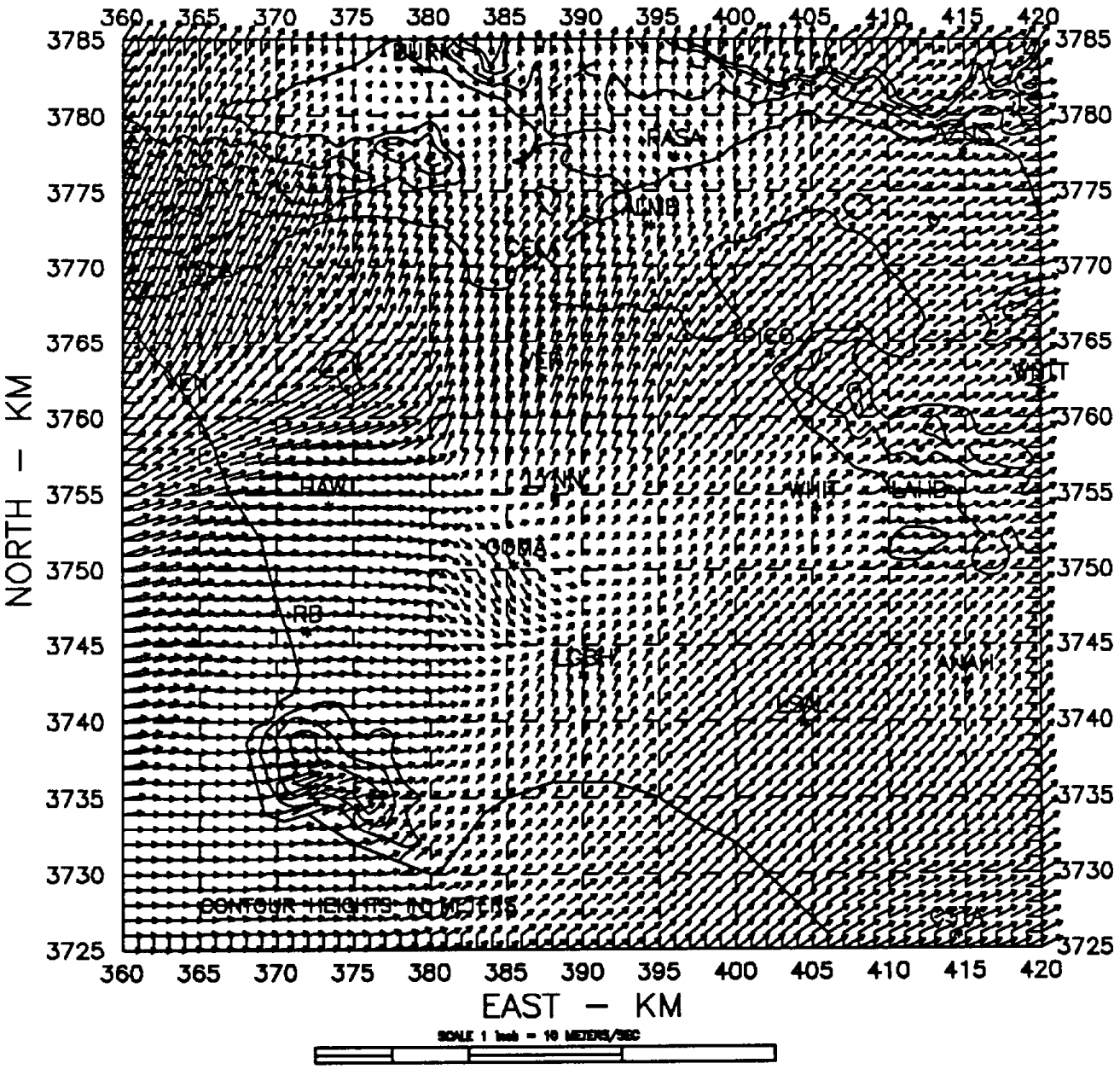

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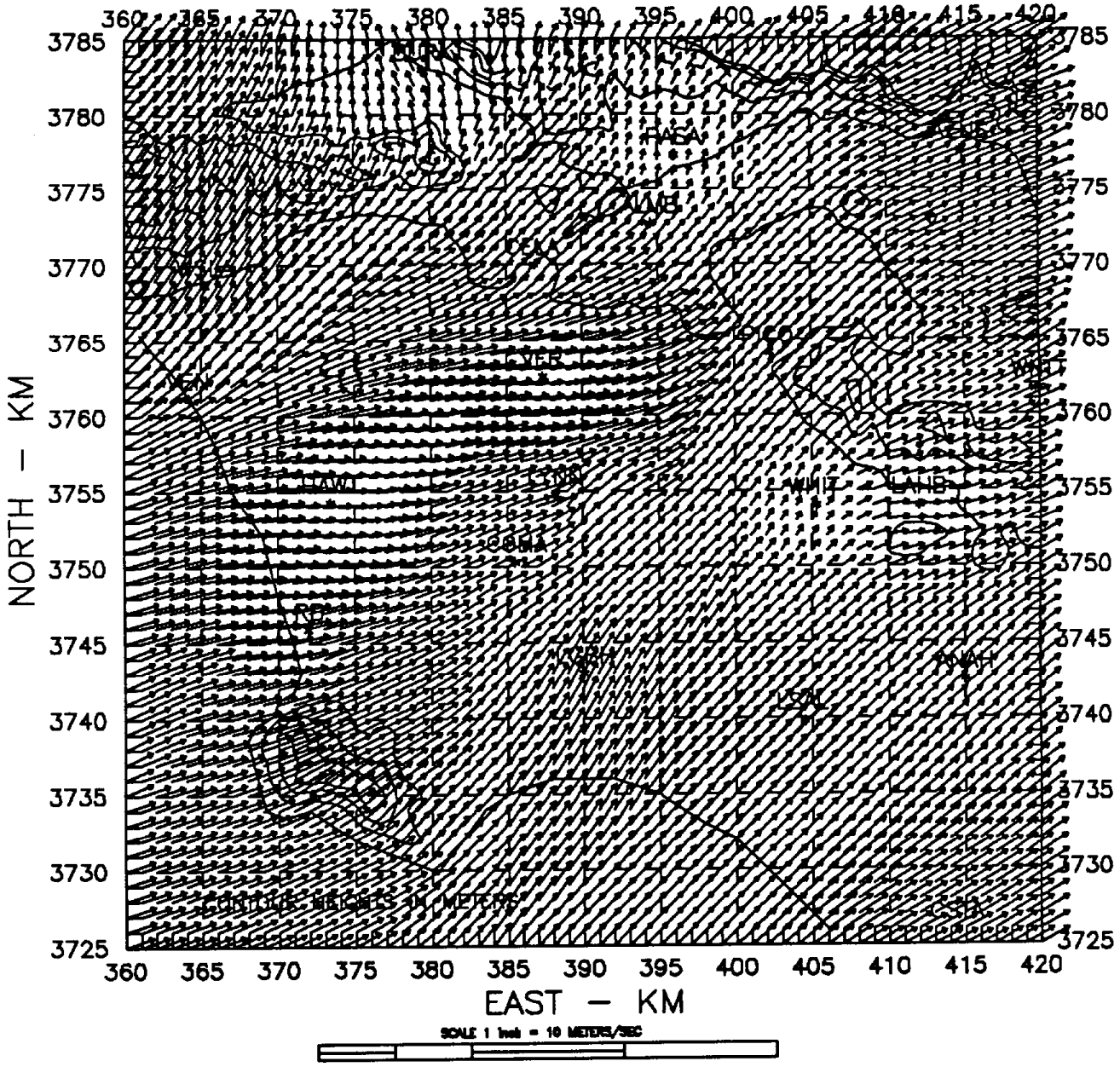
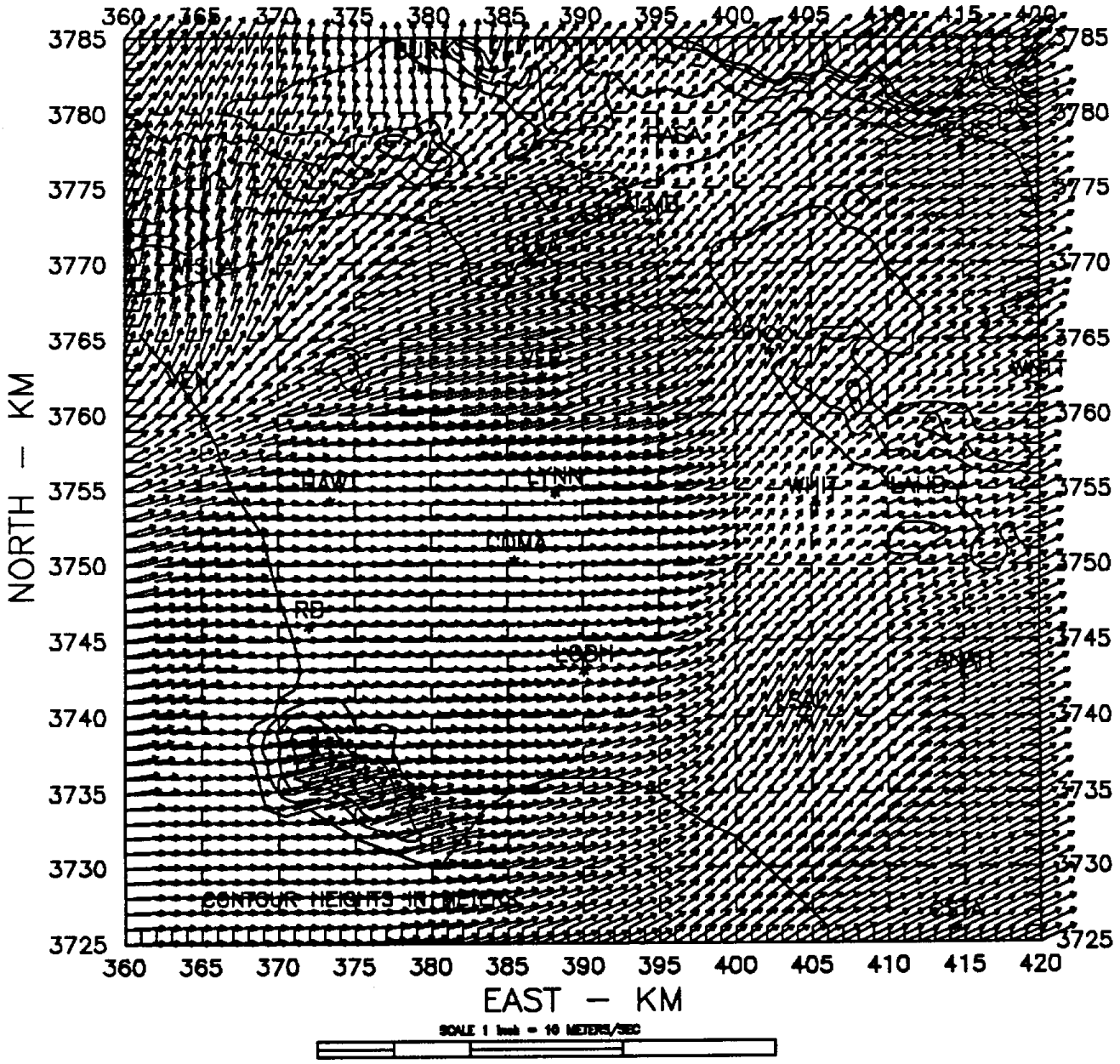


900109 HOUR 14 — LEVEL 1 WINDS



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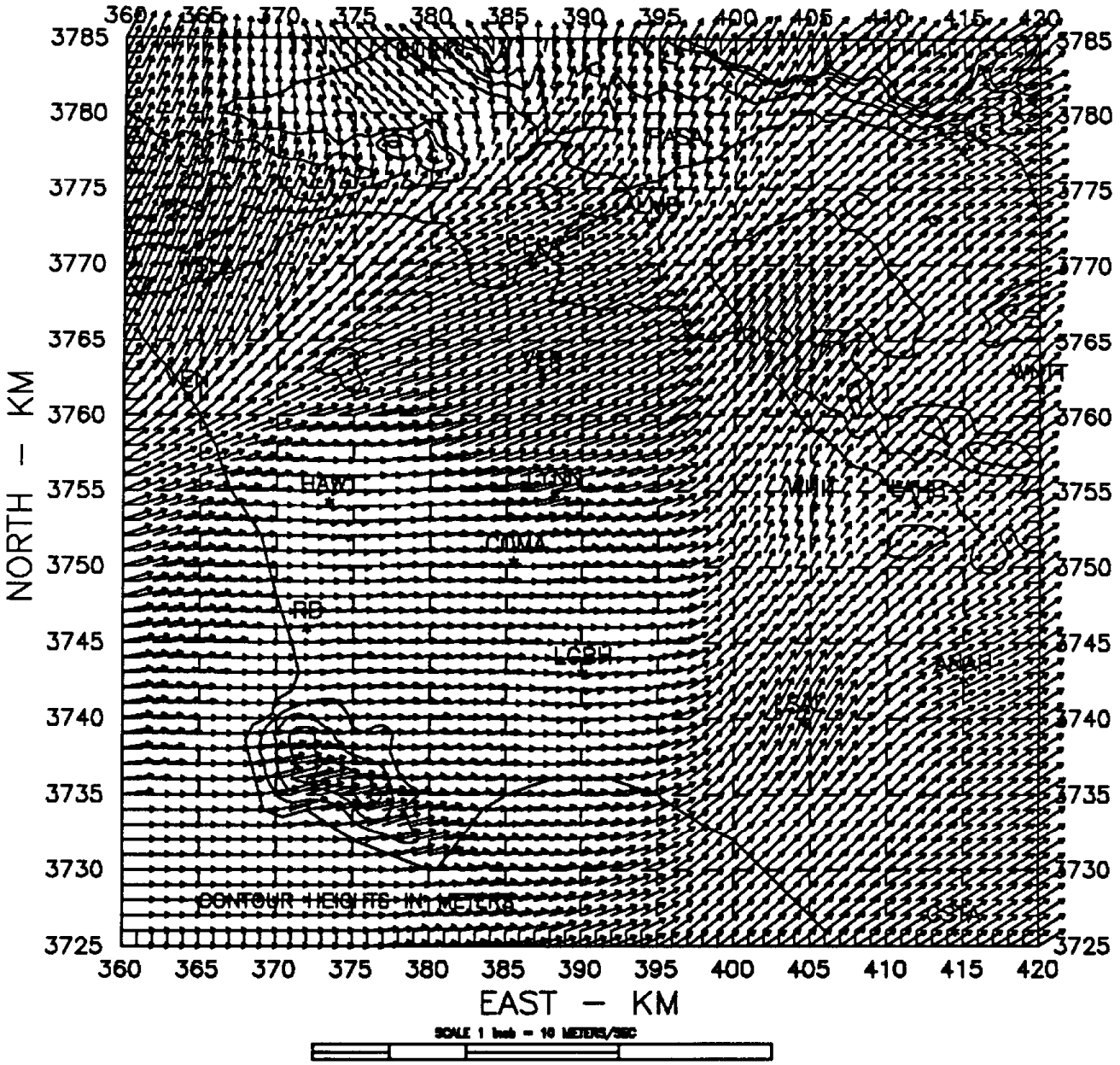

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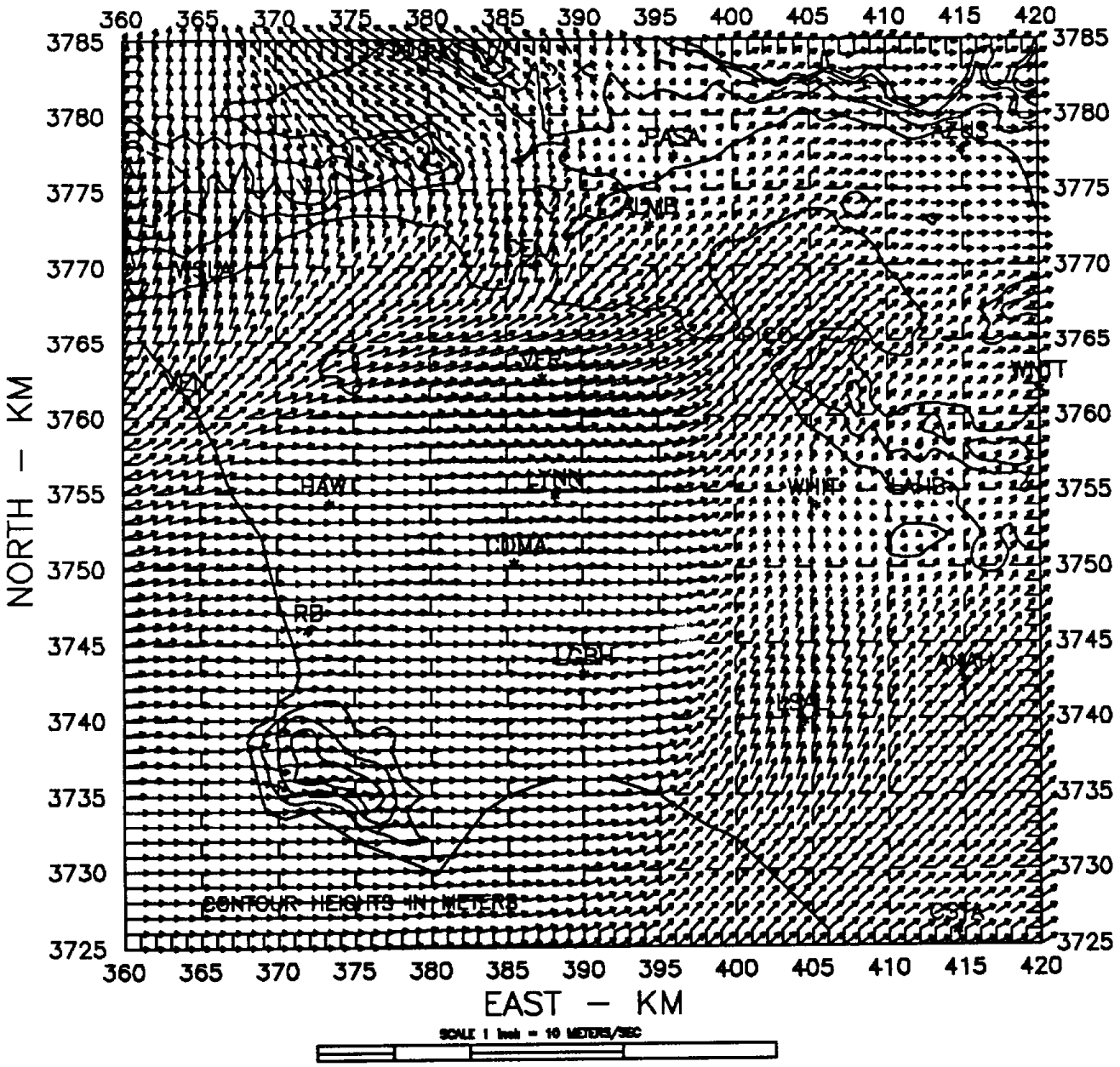

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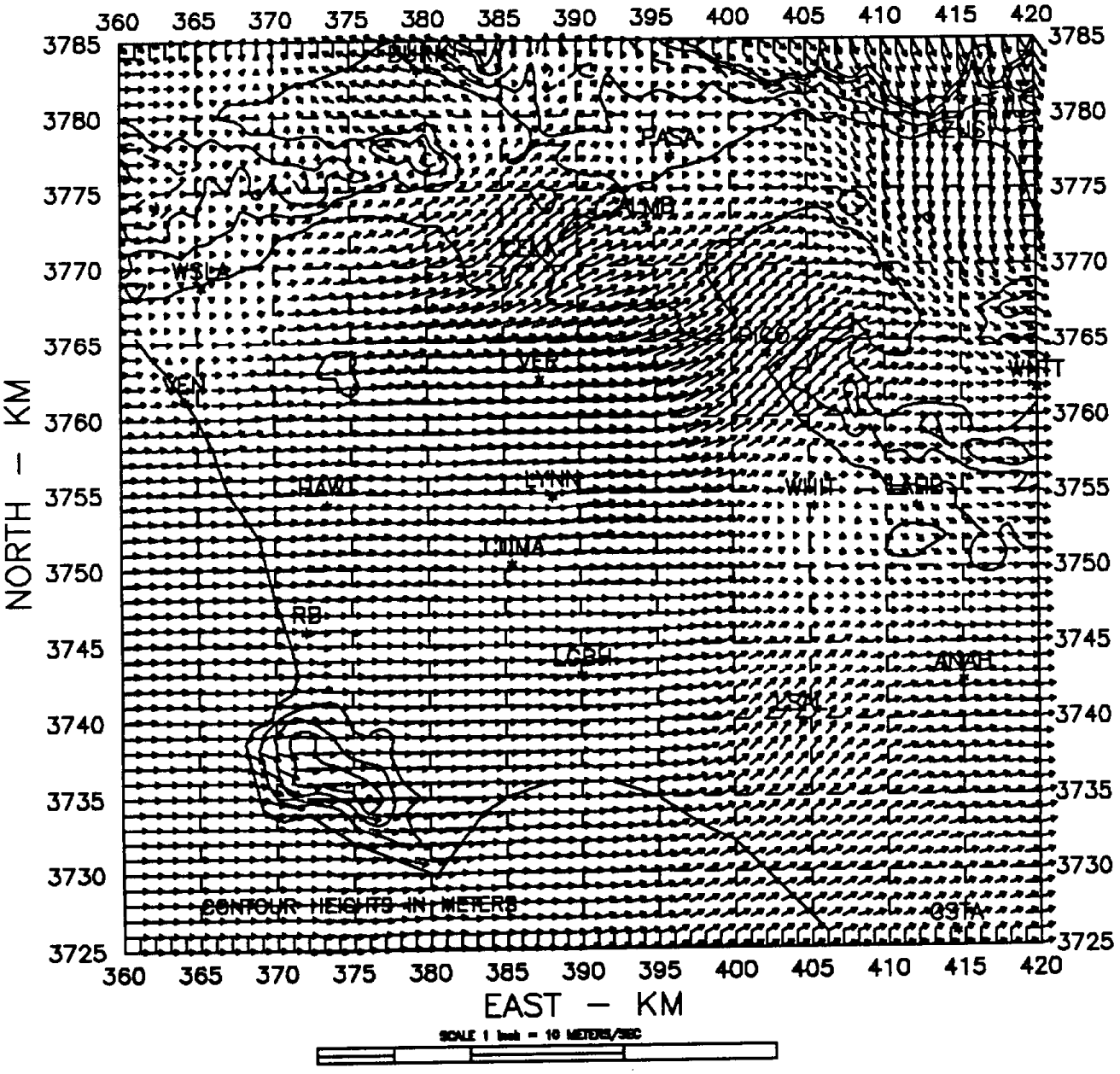

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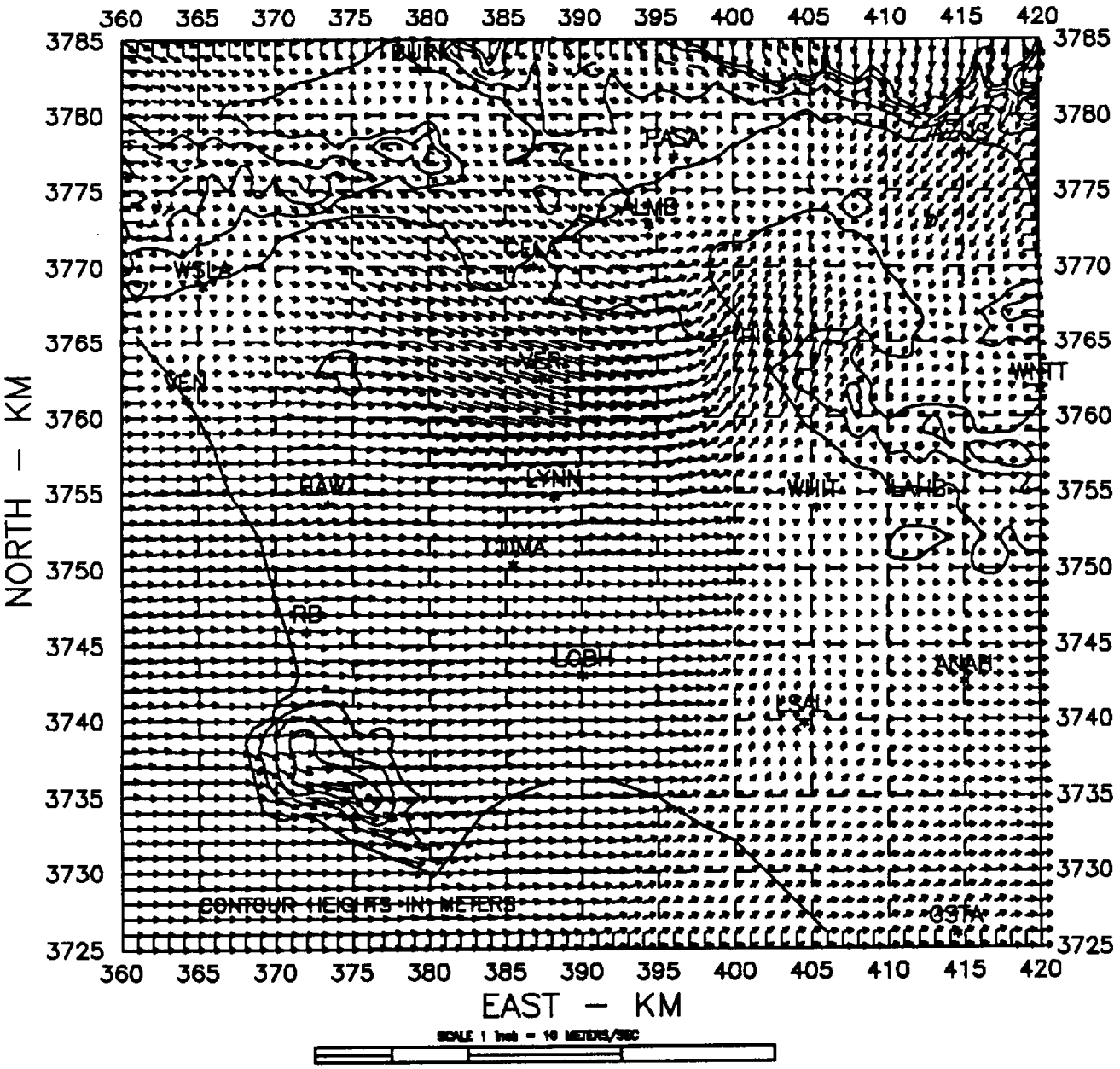

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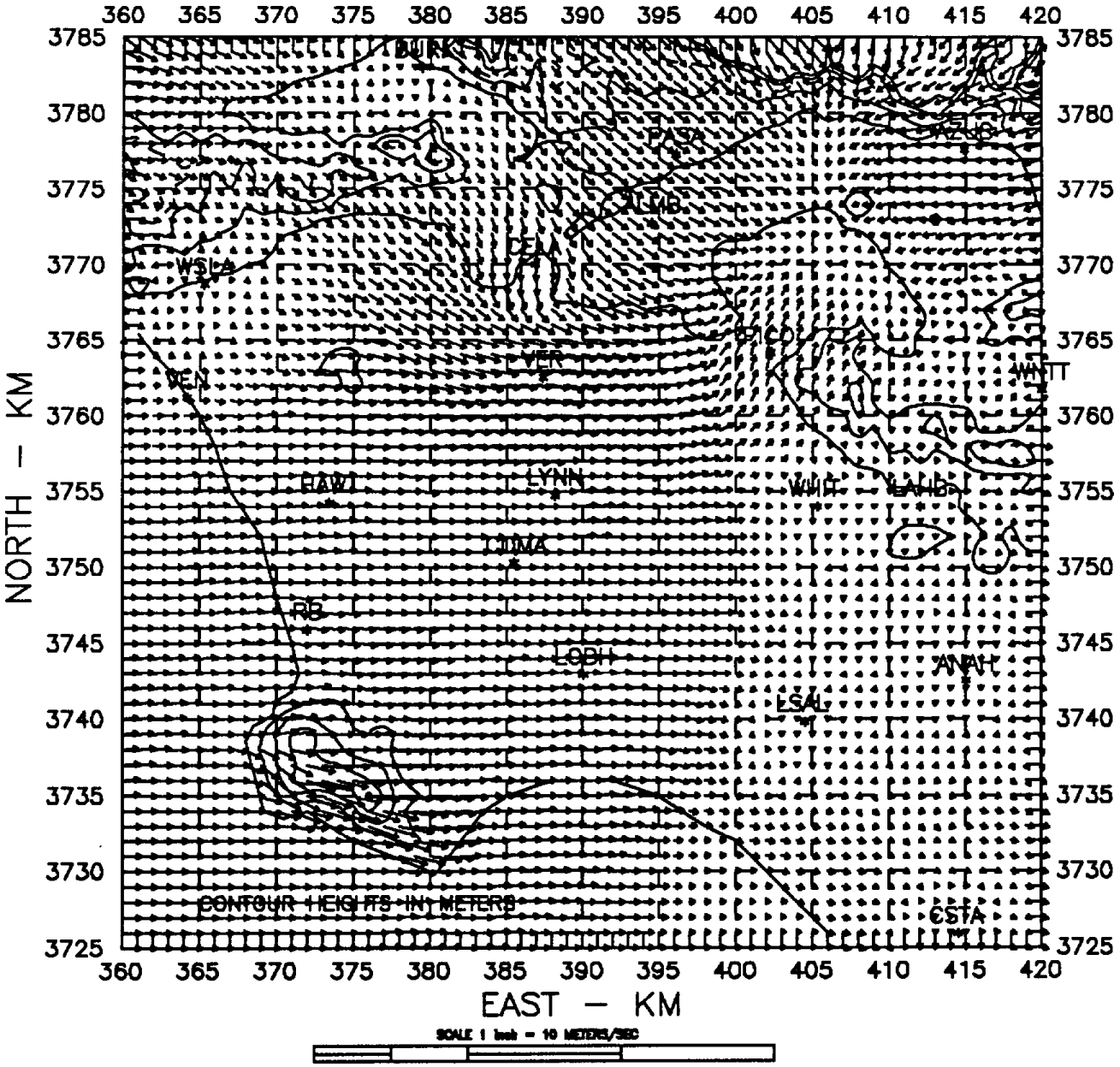

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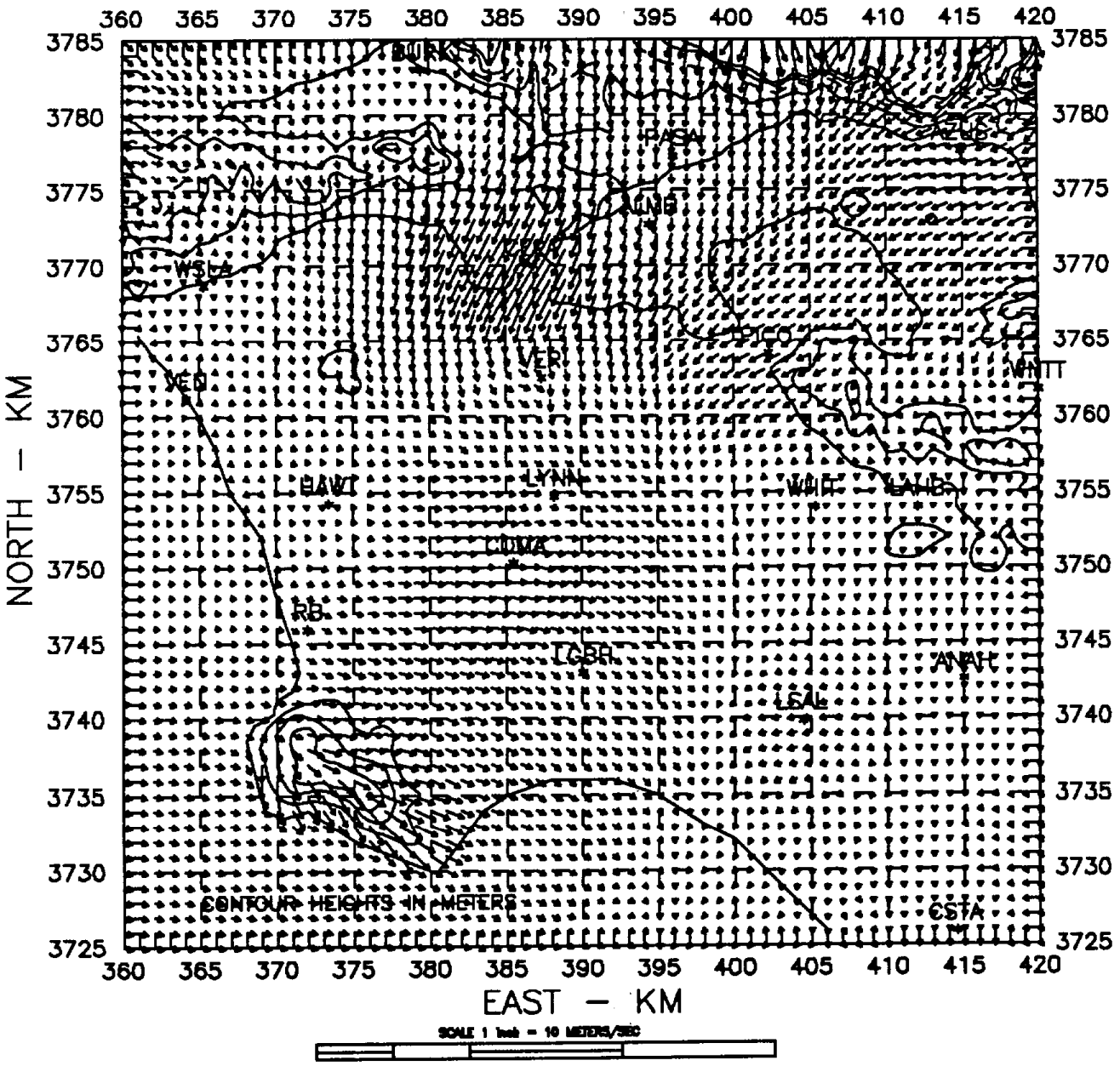
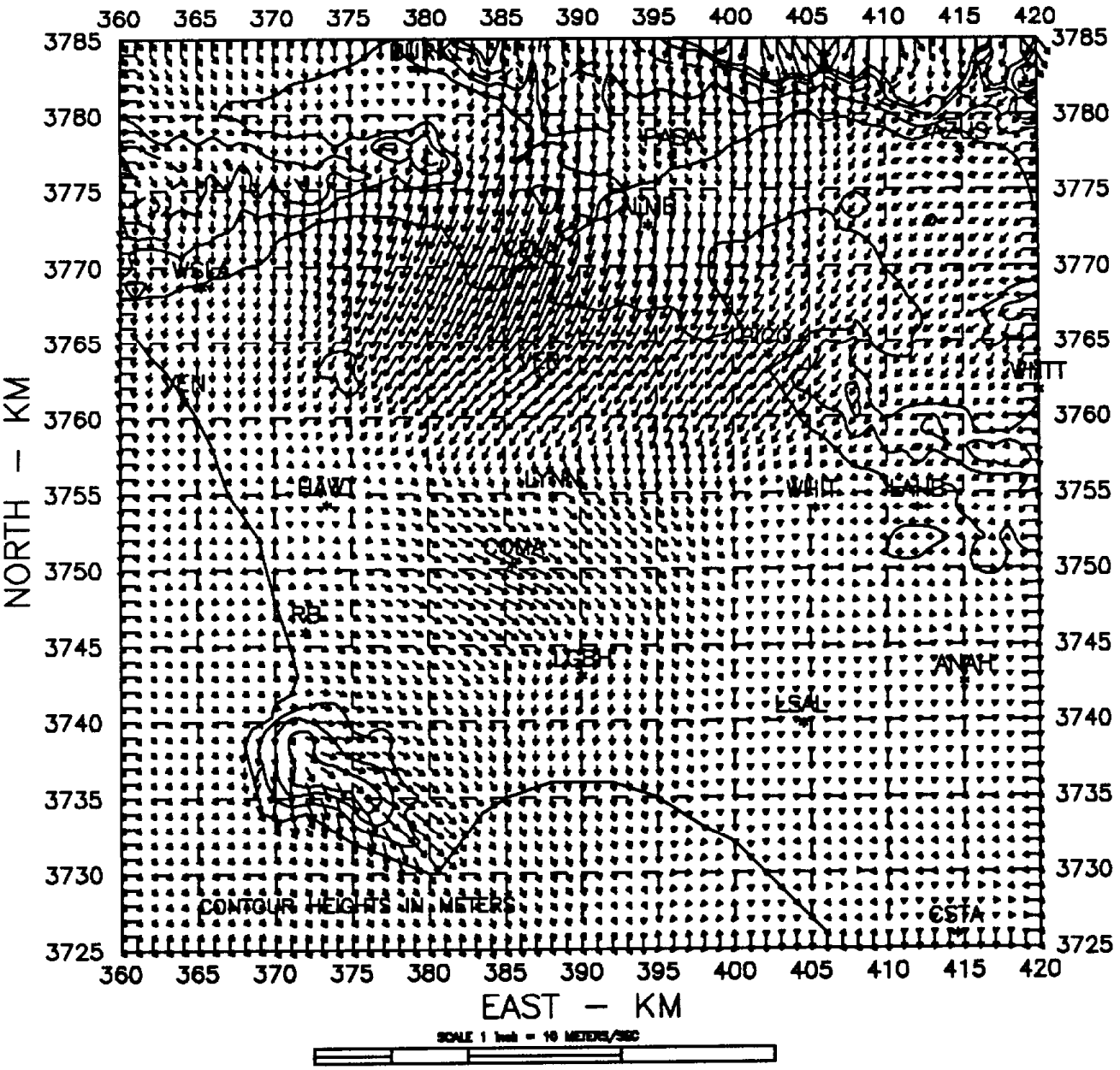


900109 HOUR 21 – LEVEL 1 WINDS



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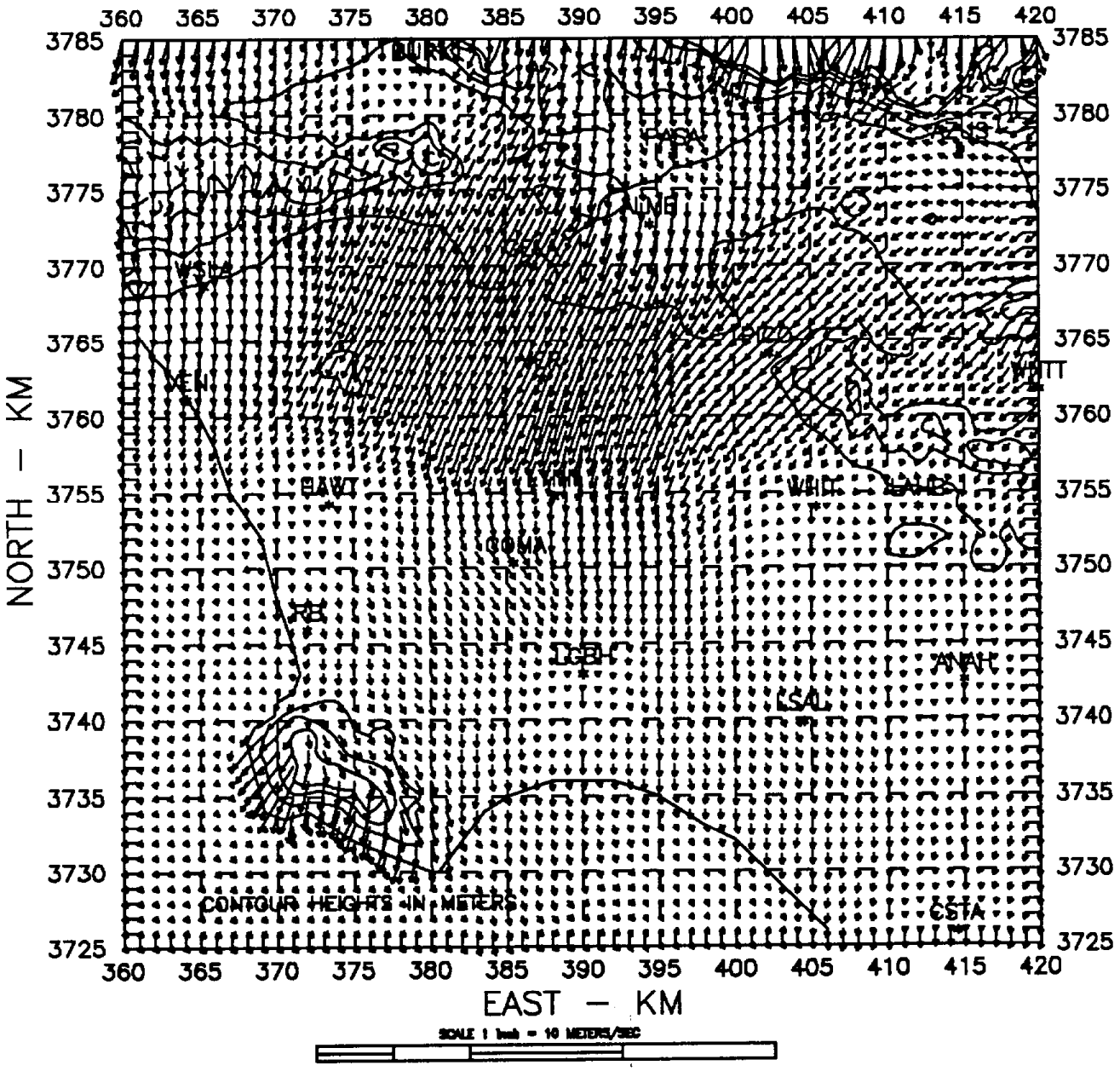

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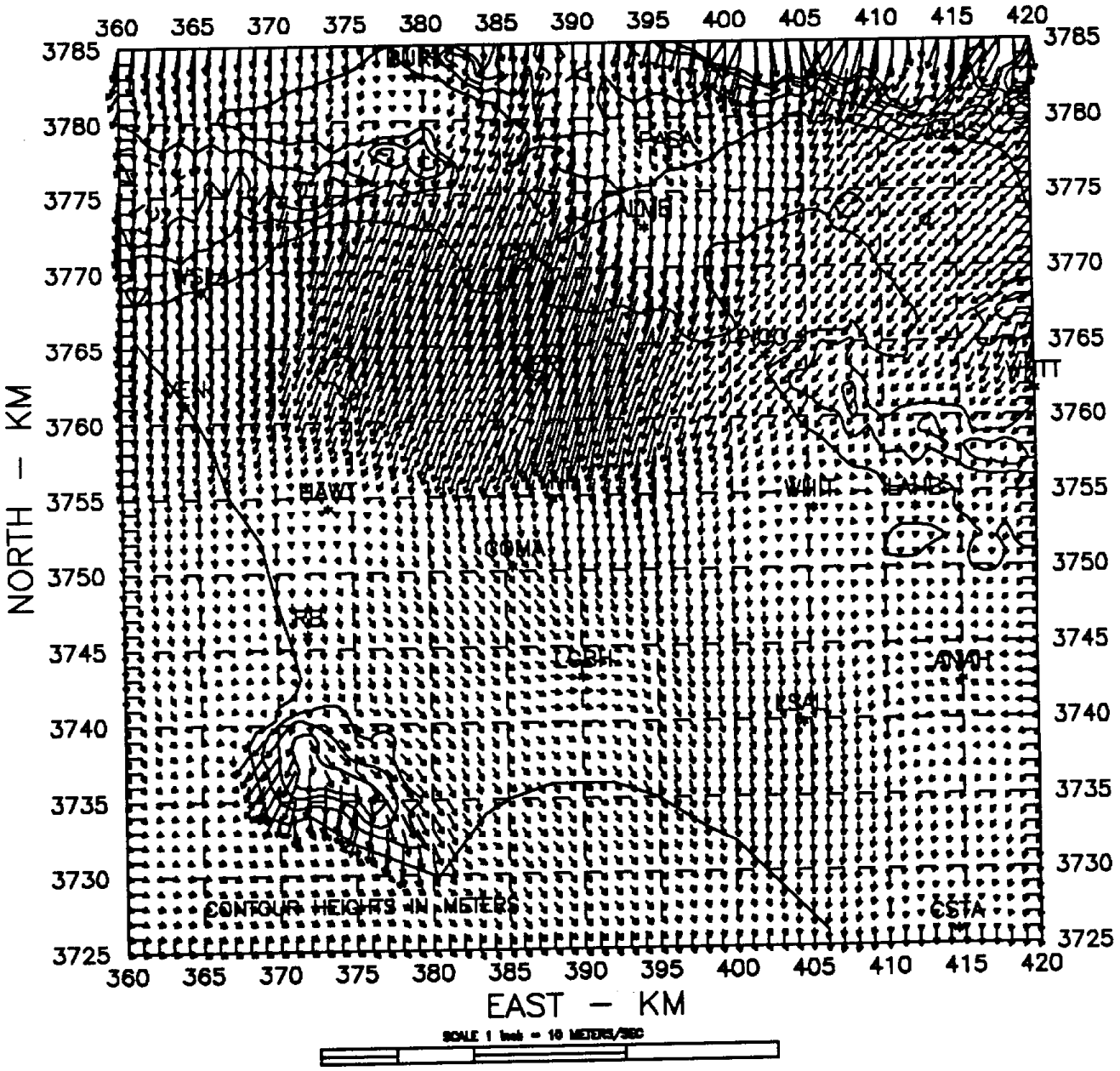

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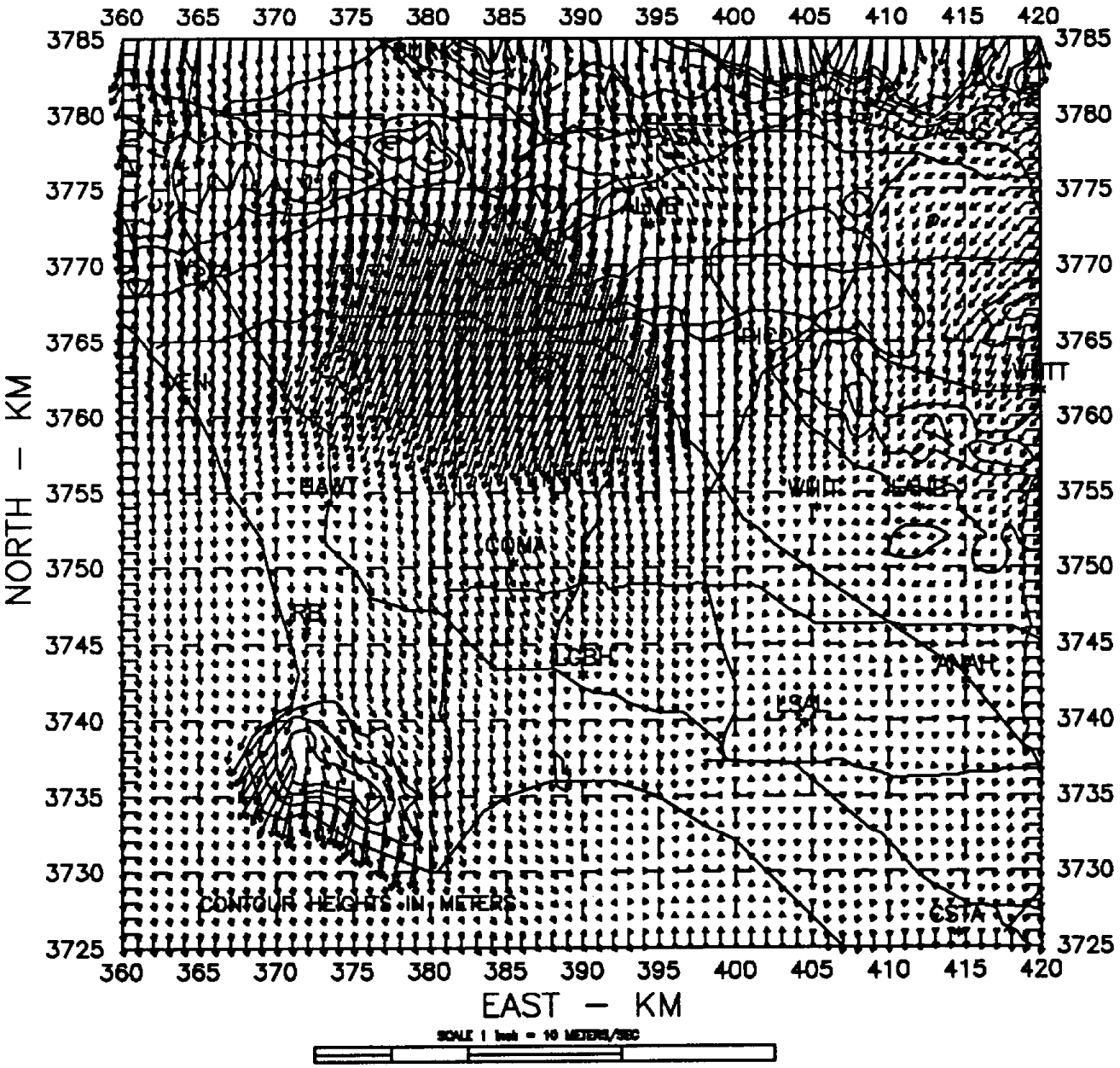
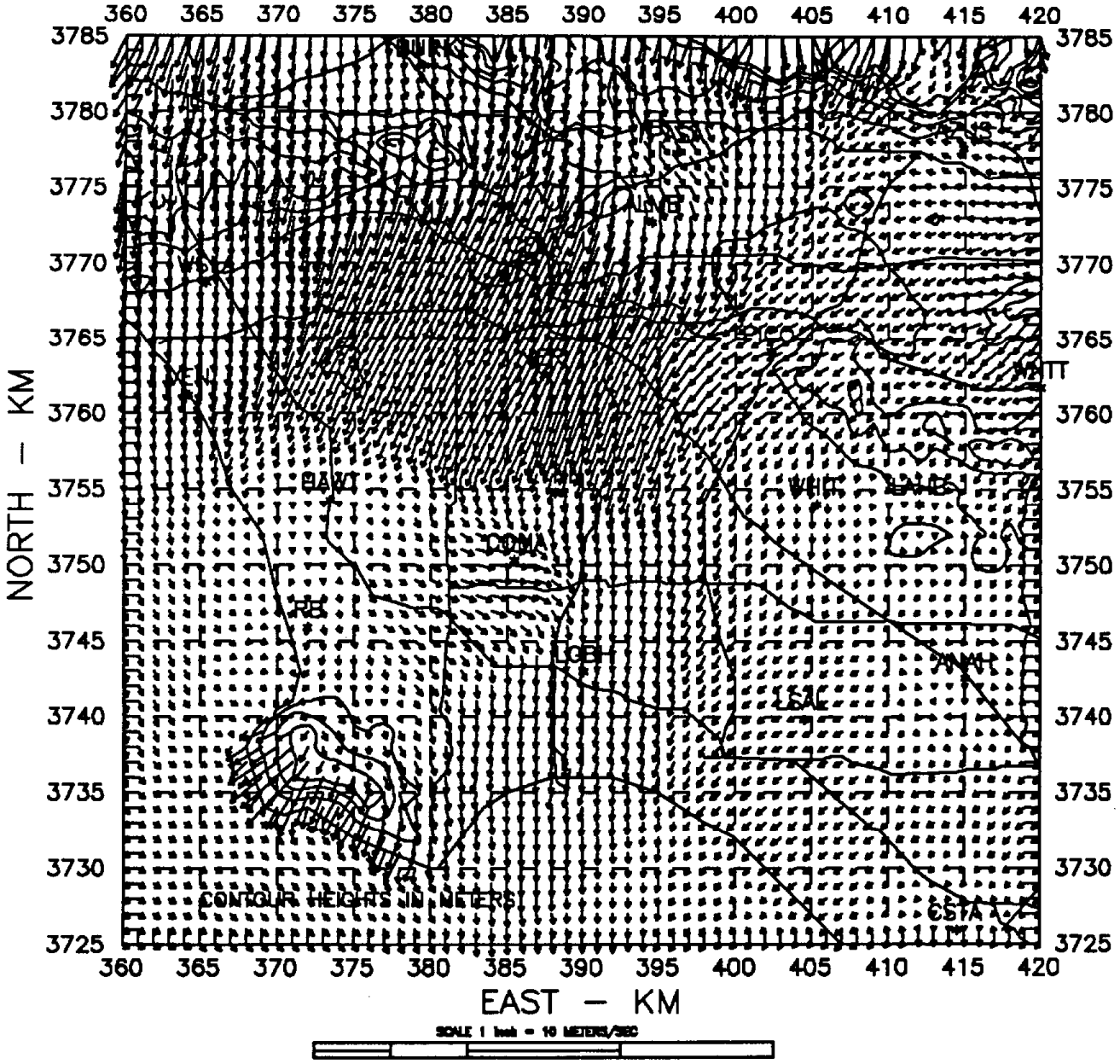


900110 HOUR 01 – LEVEL 1 WINDS



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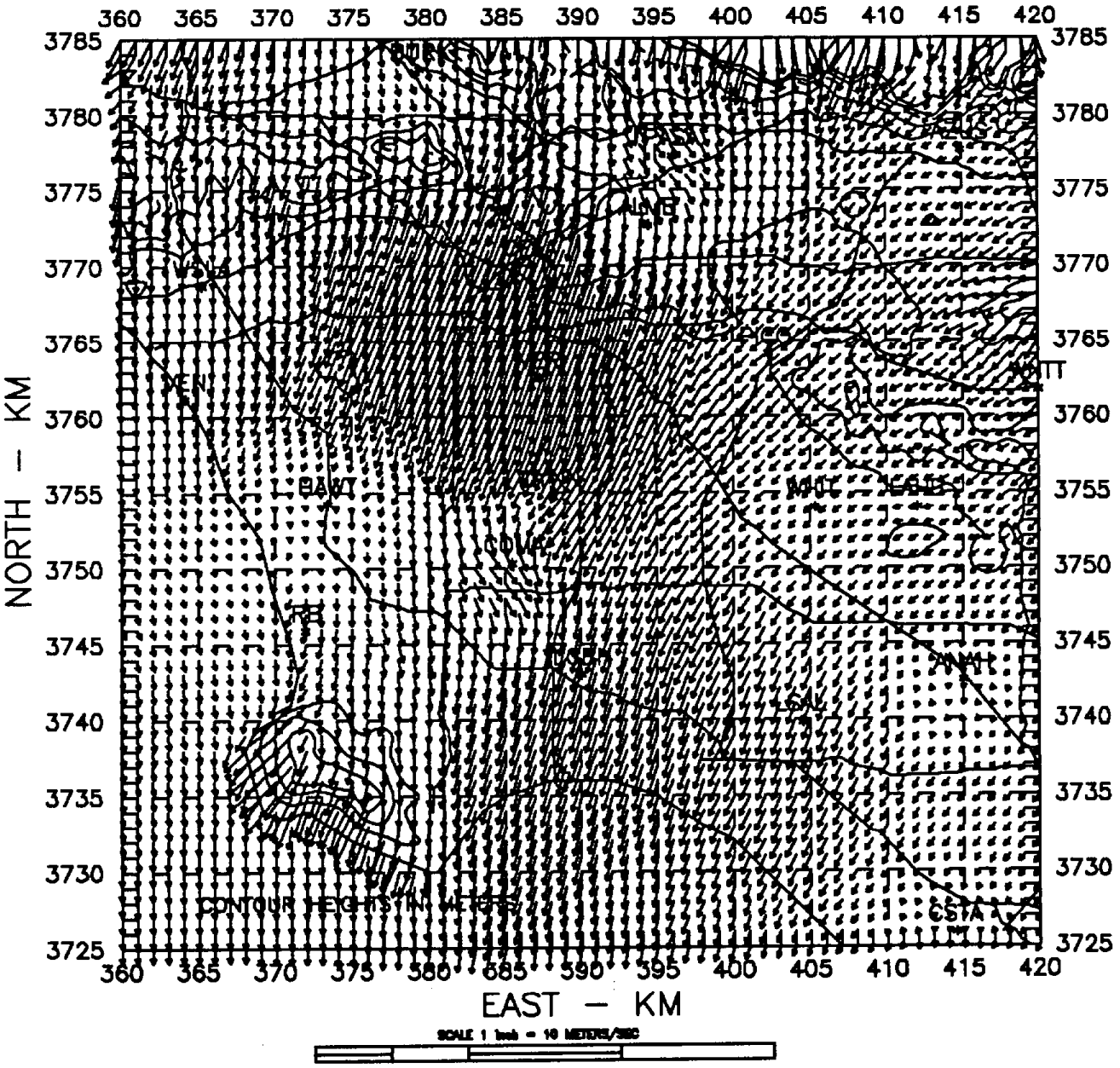
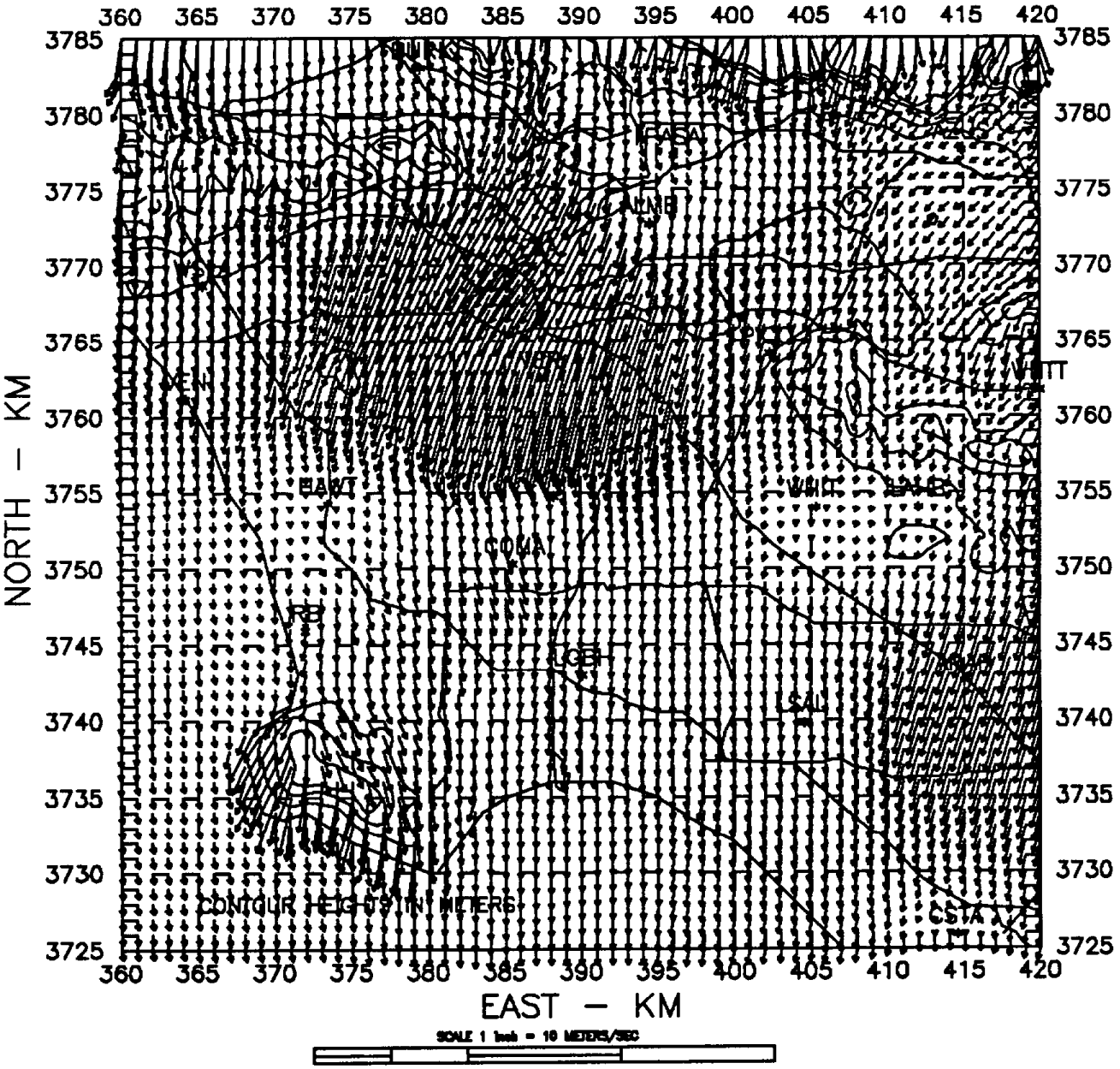


900110 HOUR 03 — LEVEL 1 WINDS



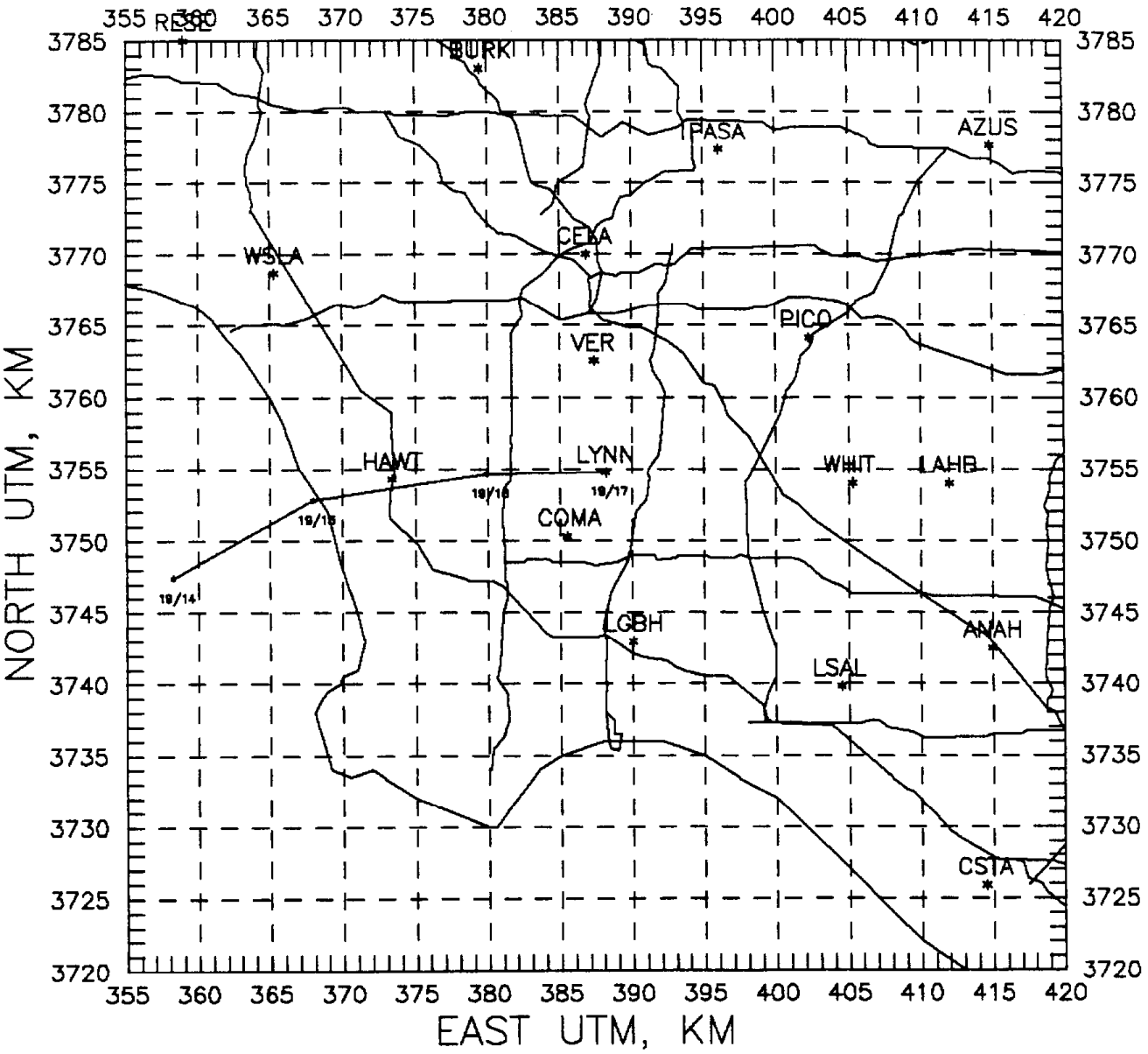
APPENDIX C

Trajectories of Air Arriving at:
LYNN for December, 1989
LYNN for January, 1990
CELA, HAWT, LGBH for December, 1989

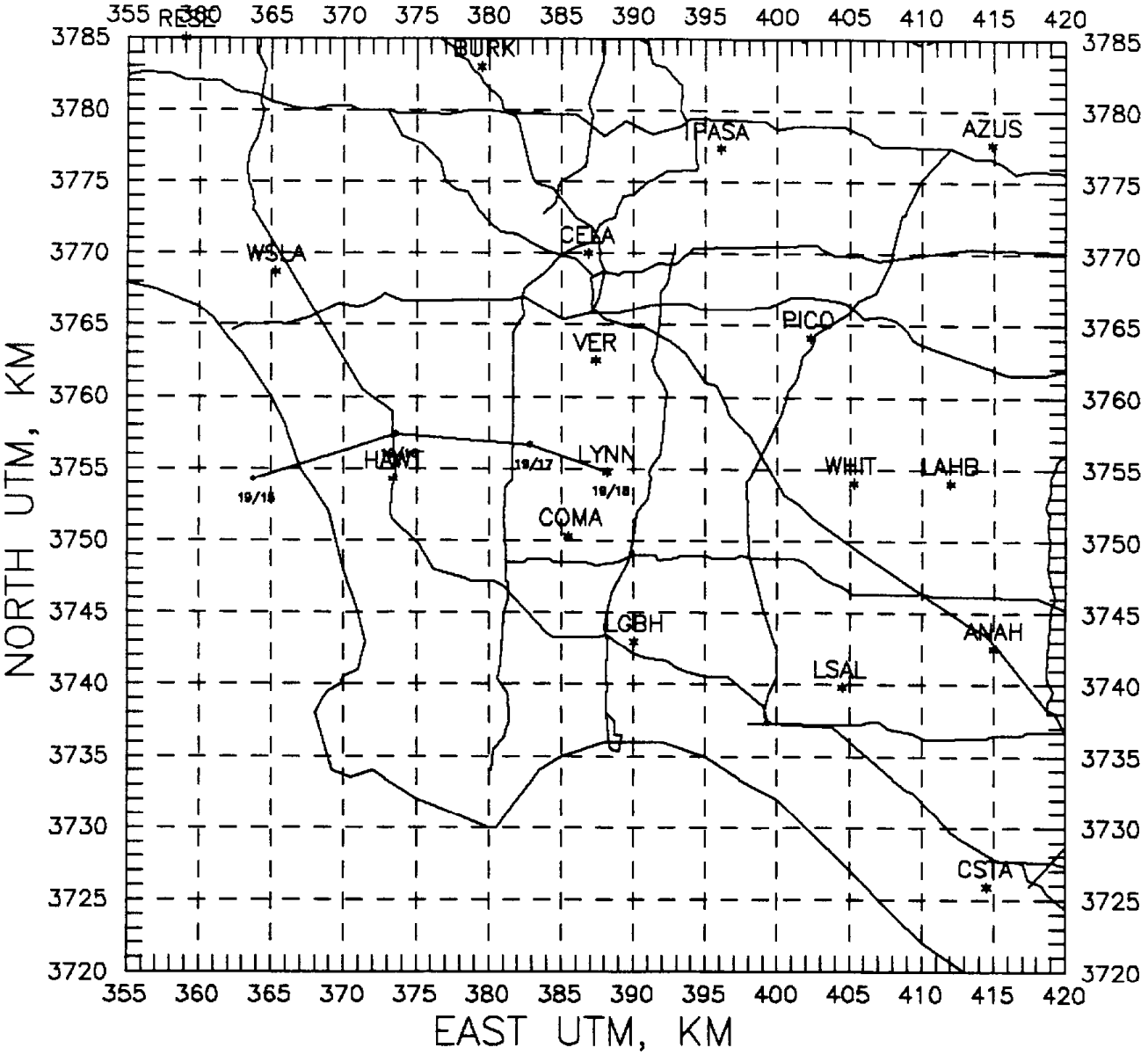
Trajectories of Tracer Releases for December 1989
Trajectories of Tracer Releases for January 1990

Trajectories of Air Arriving at LYNN
for December, 1989

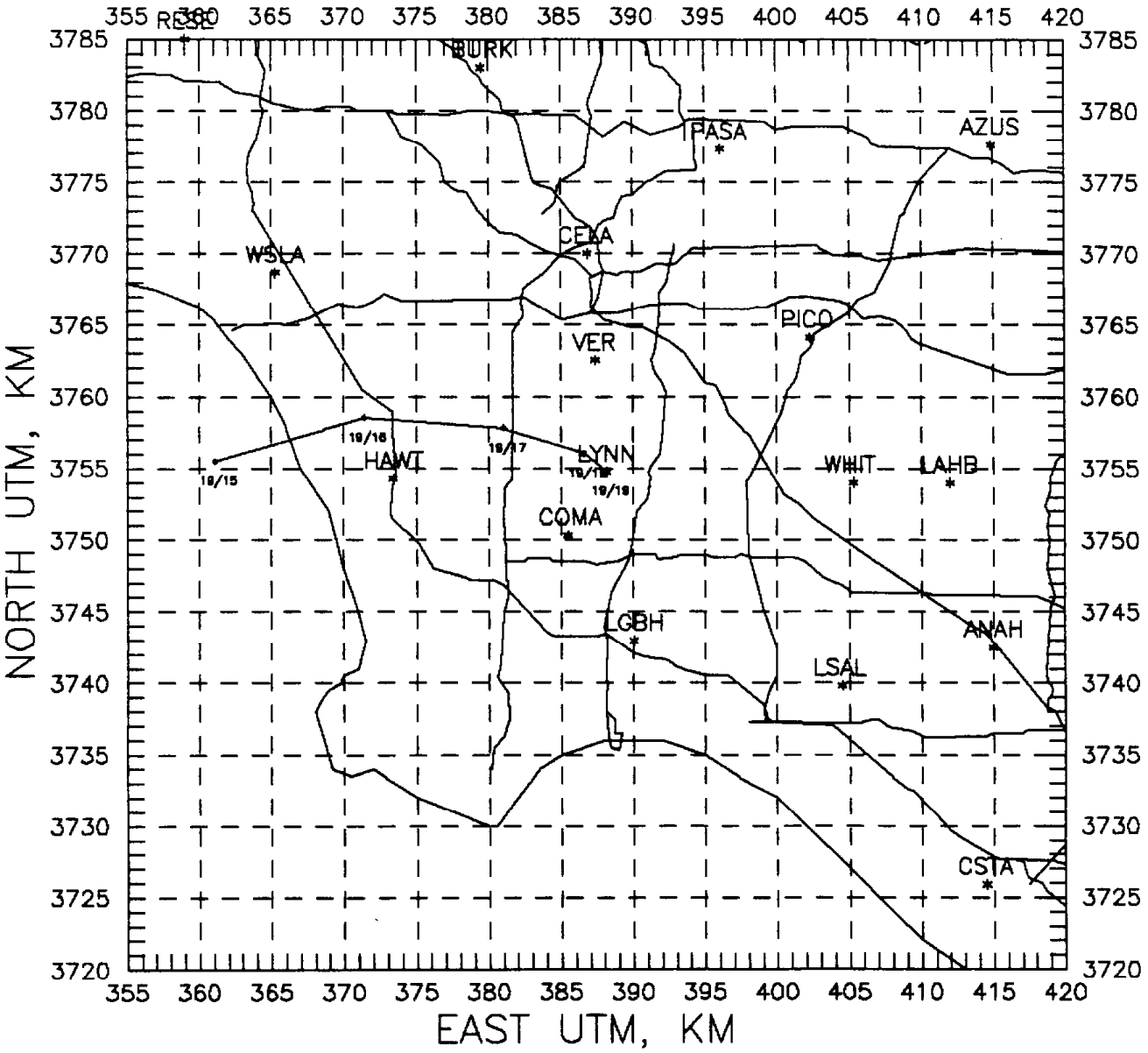
TRAJECTORY – ARRIVE LYNN – 1219/17



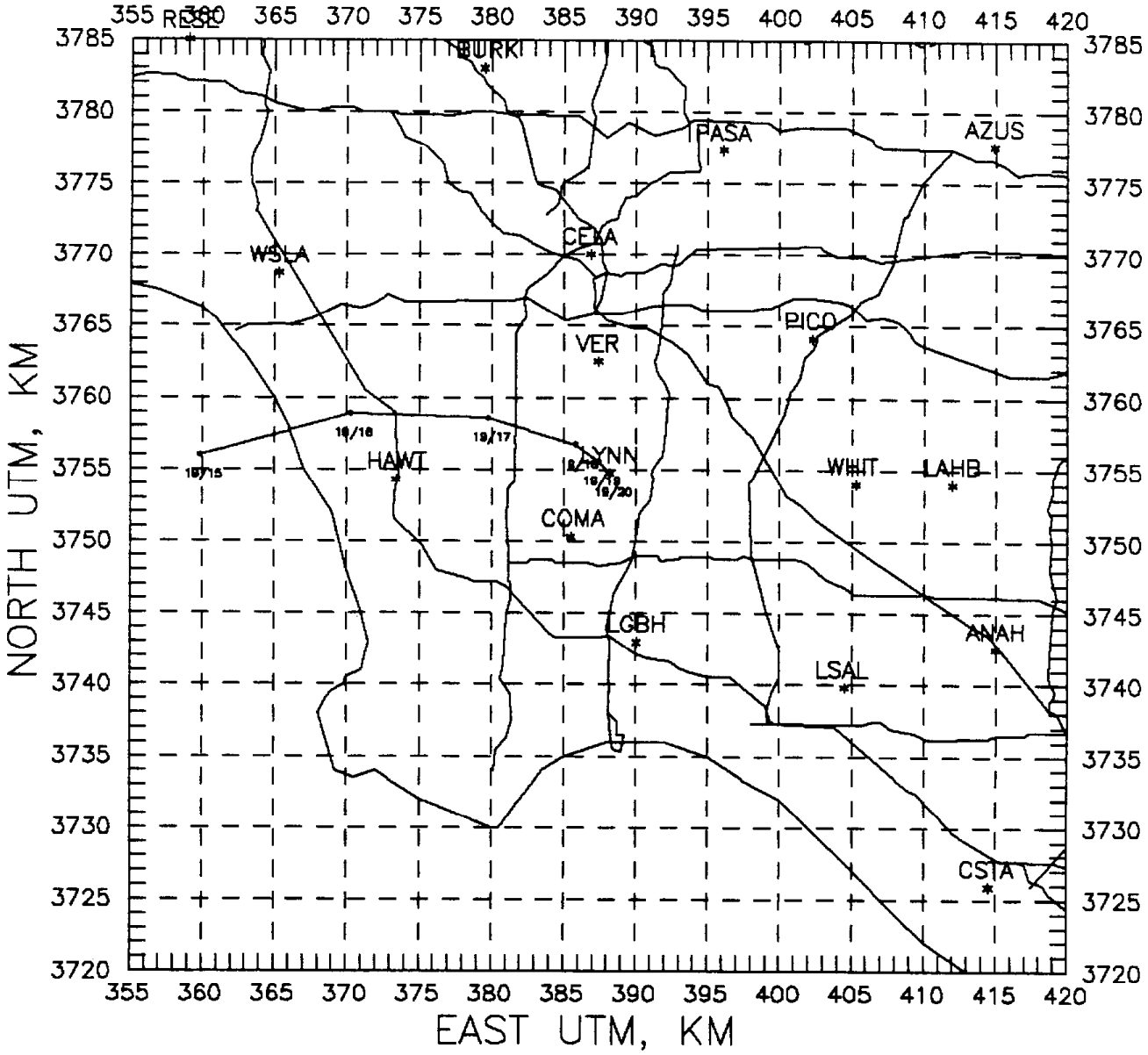
TRAJECTORY – ARRIVE LYNN – 1219/18



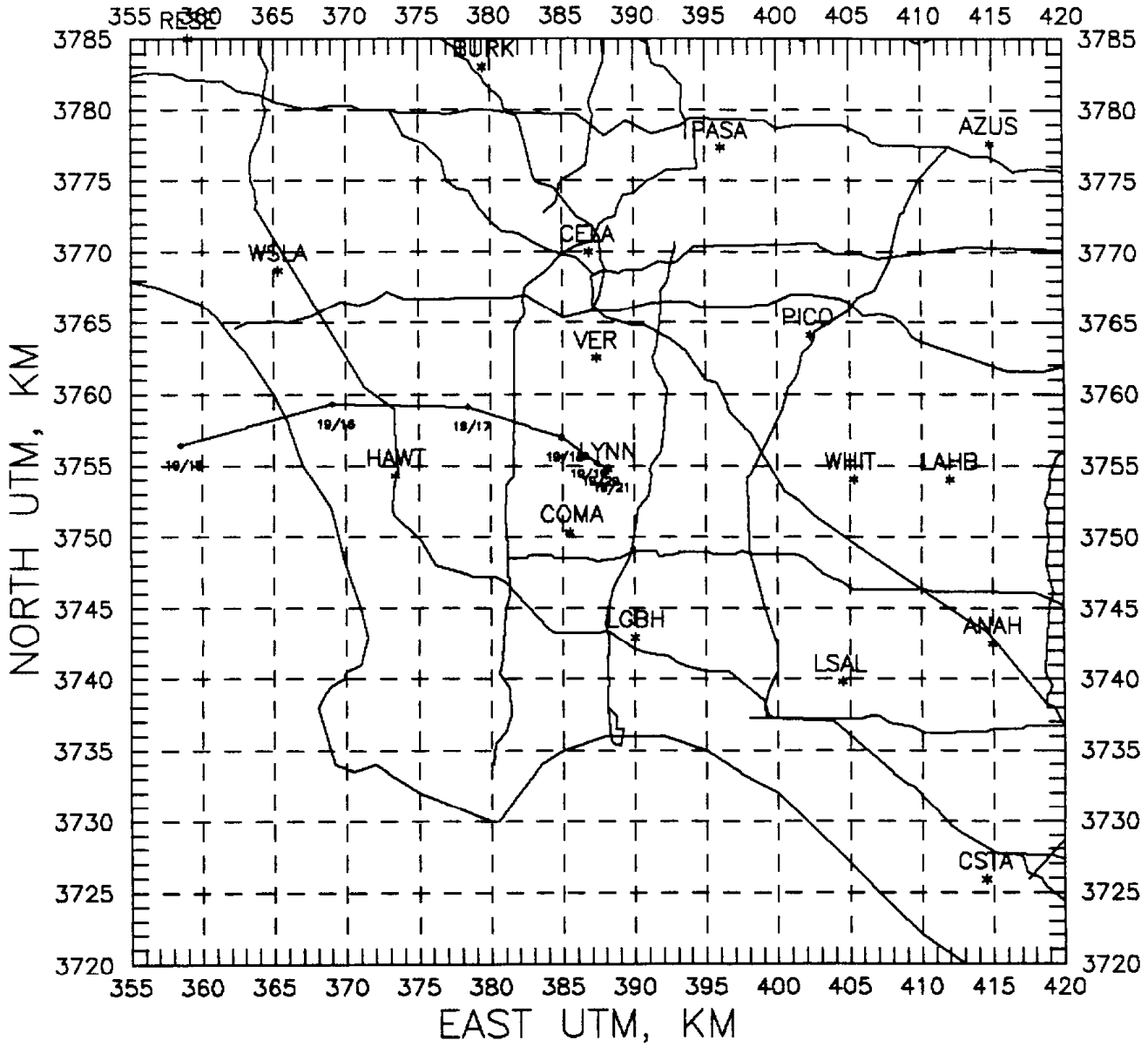
TRAJECTORY – ARRIVE LYNN – 1219/19



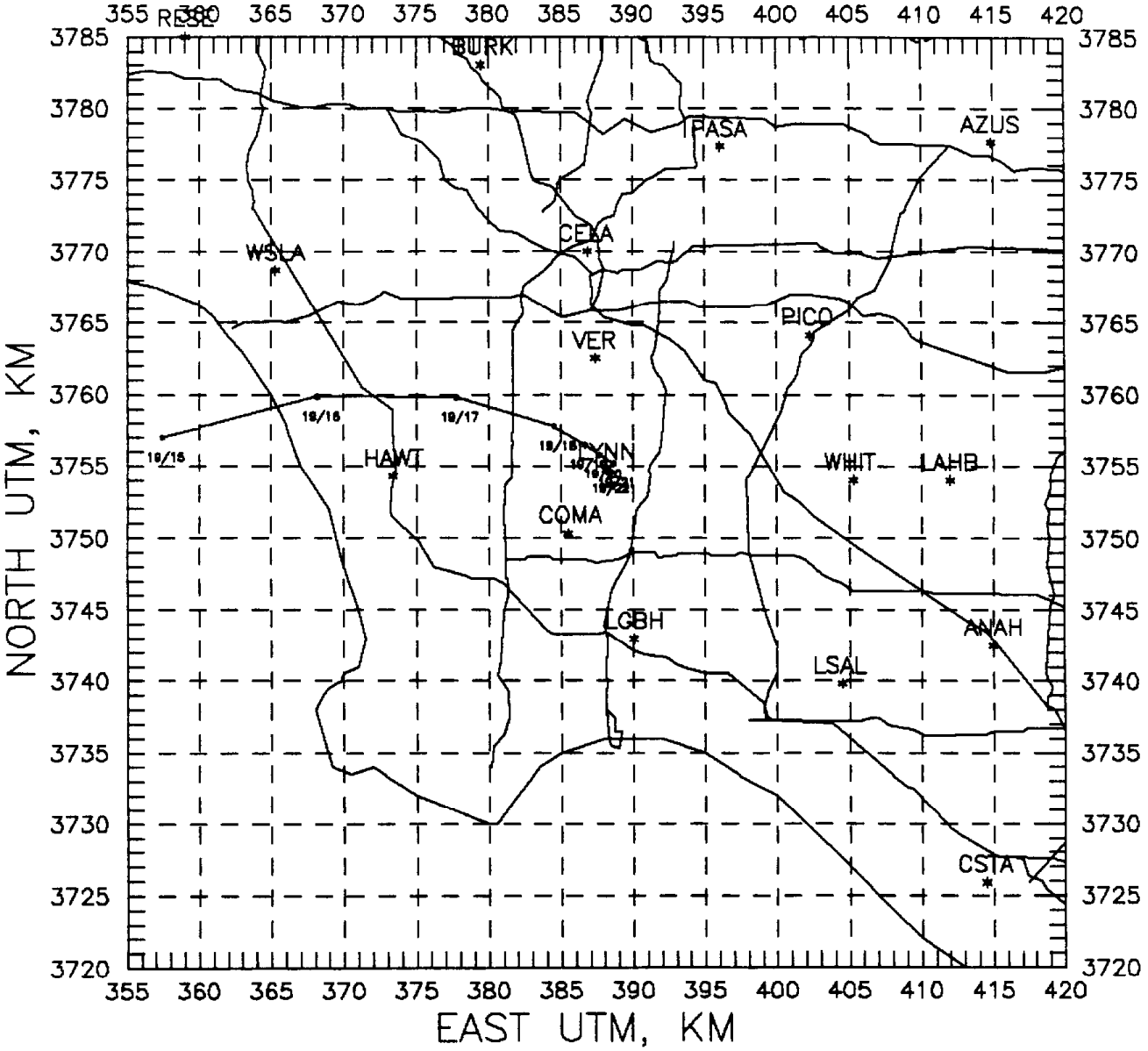
TRAJECTORY – ARRIVE LYNN – 1219/20



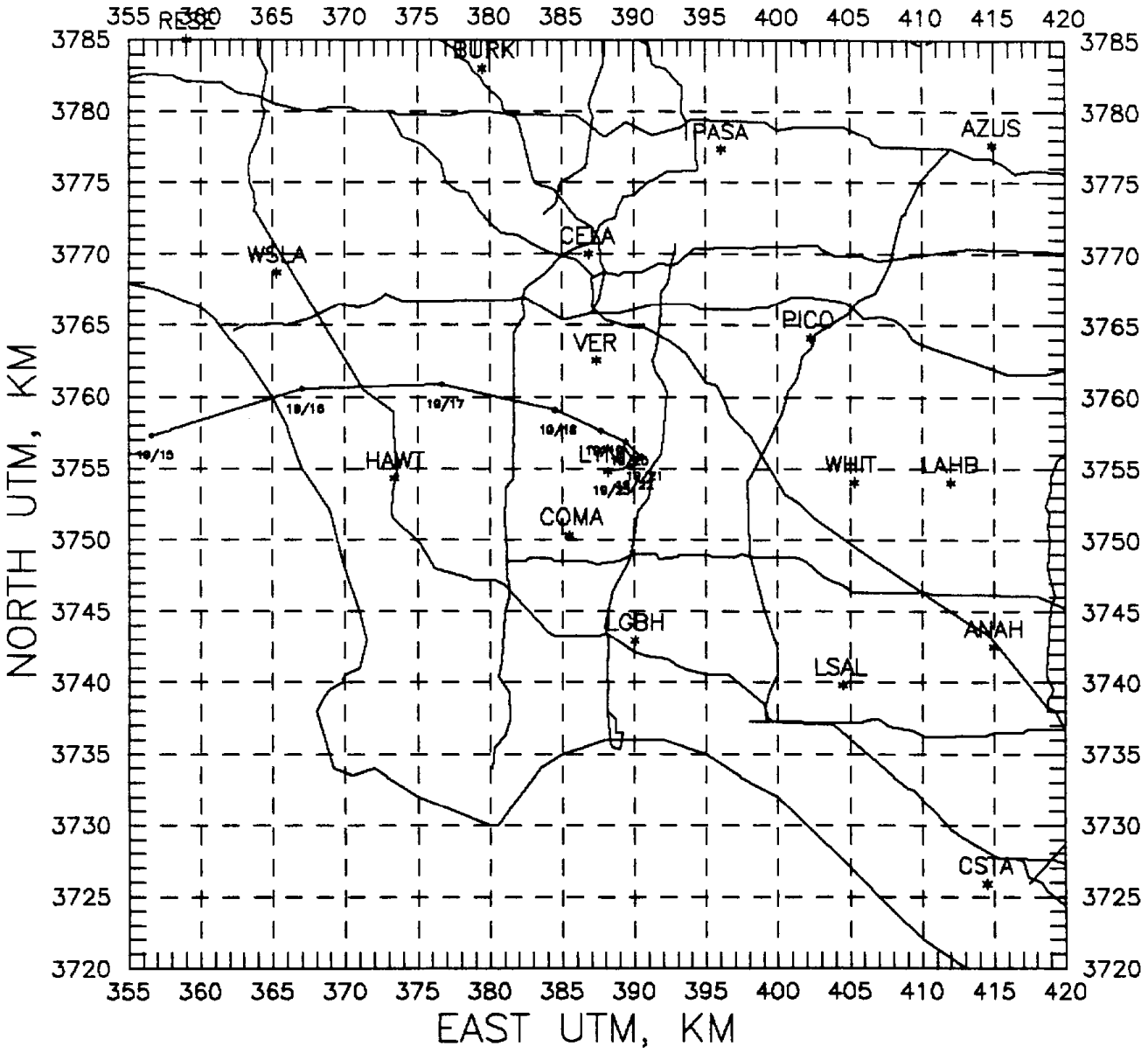
TRAJECTORY – ARRIVE LYNN – 1219/21



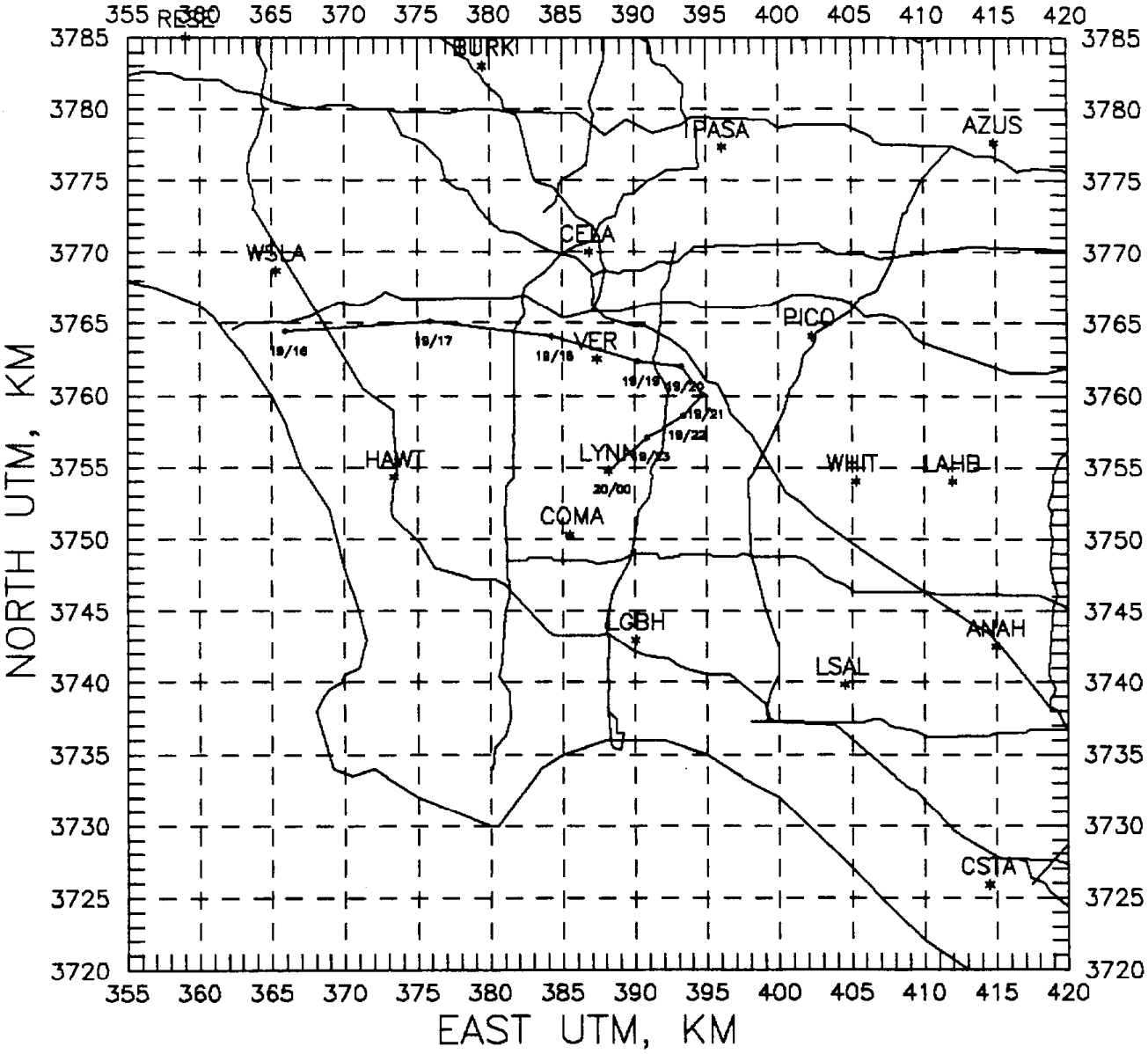
TRAJECTORY – ARRIVE LYNN – 1219/22

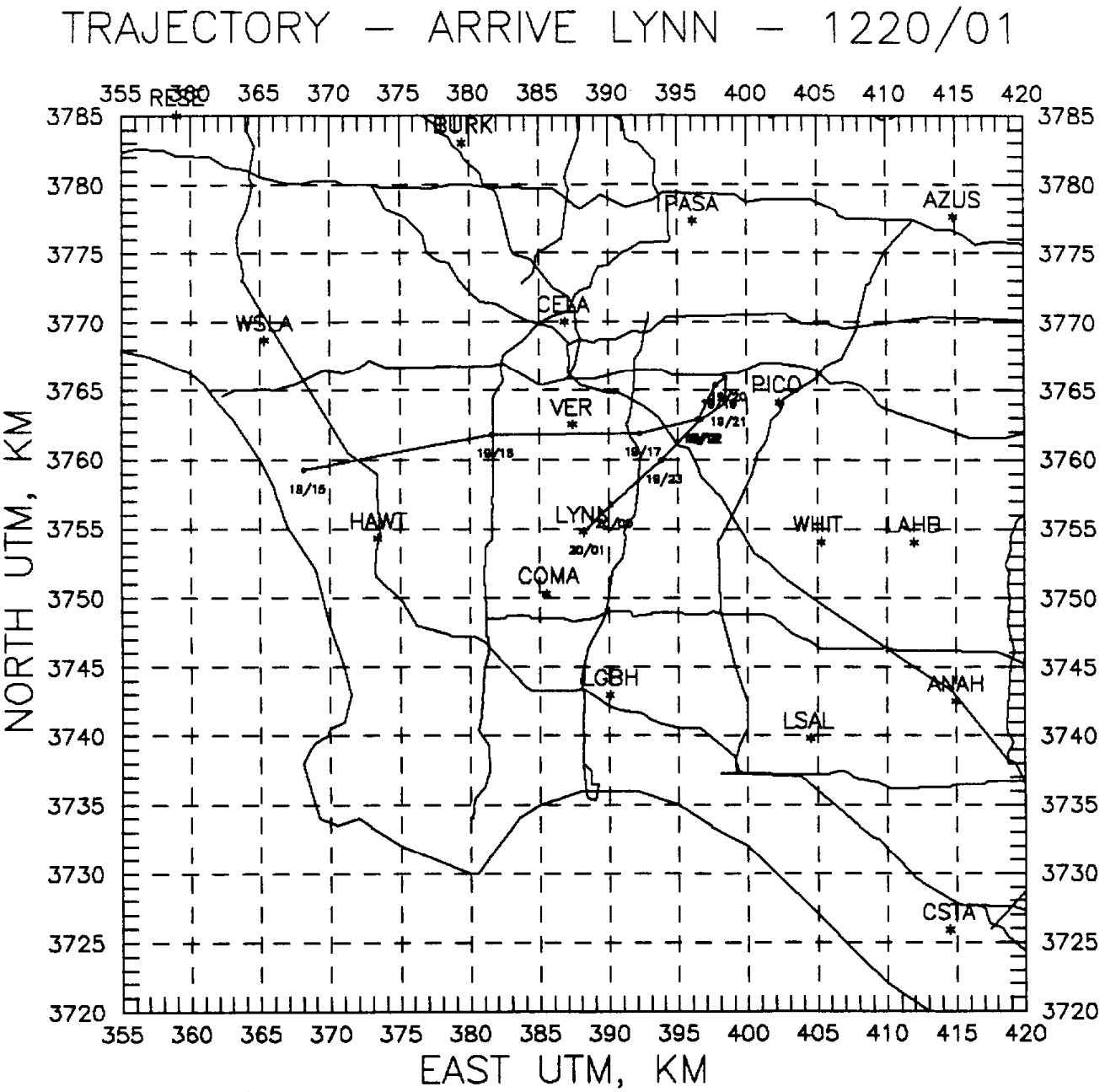


TRAJECTORY – ARRIVE LYNN – 1219/23



TRAJECTORY – ARRIVE LYNN – 1220/00




TRAJECTORY – ARRIVE LYNN – 1220/01
RESE
BURK
PASA
AZUS
CEBA
WSLA
PICO
VER
HAWT
LYNN
WHIT
LAHB
COMA
LGBH
ANAH
LSAL
CSTA
18/15
18/16
18/17
18/21
18/23
20/01
NORTH UTM, KM
EAST UTM, KM
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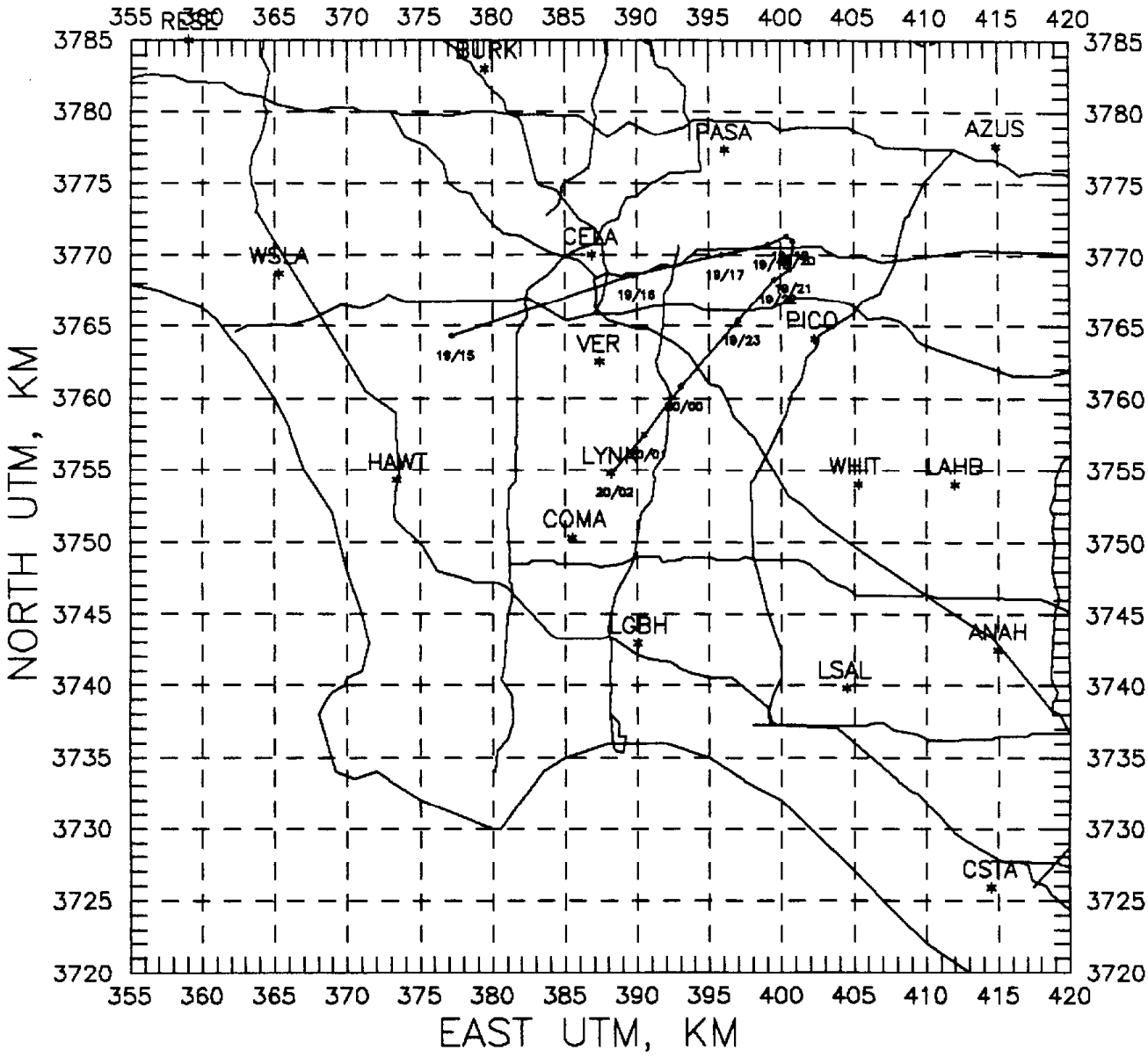
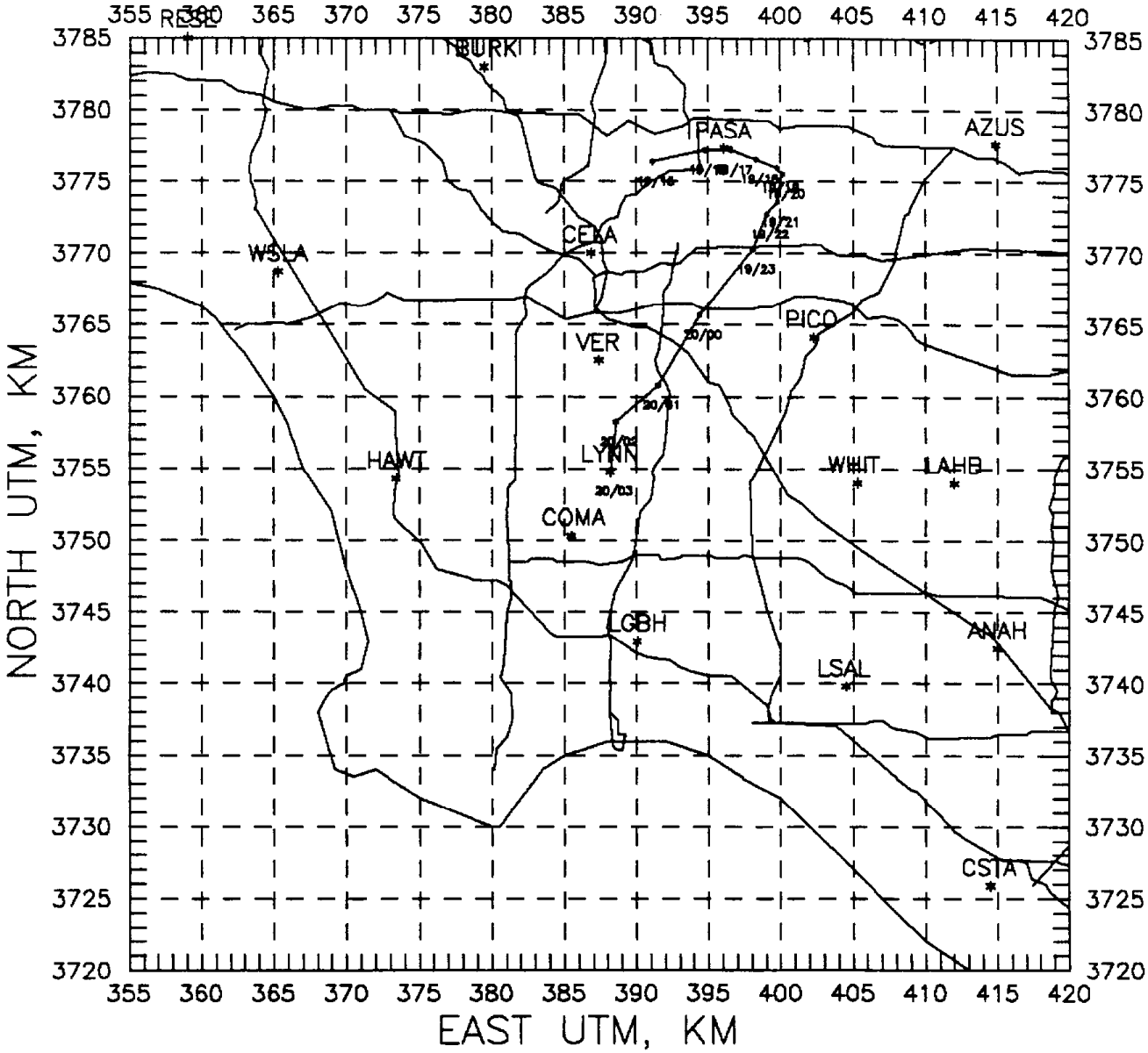
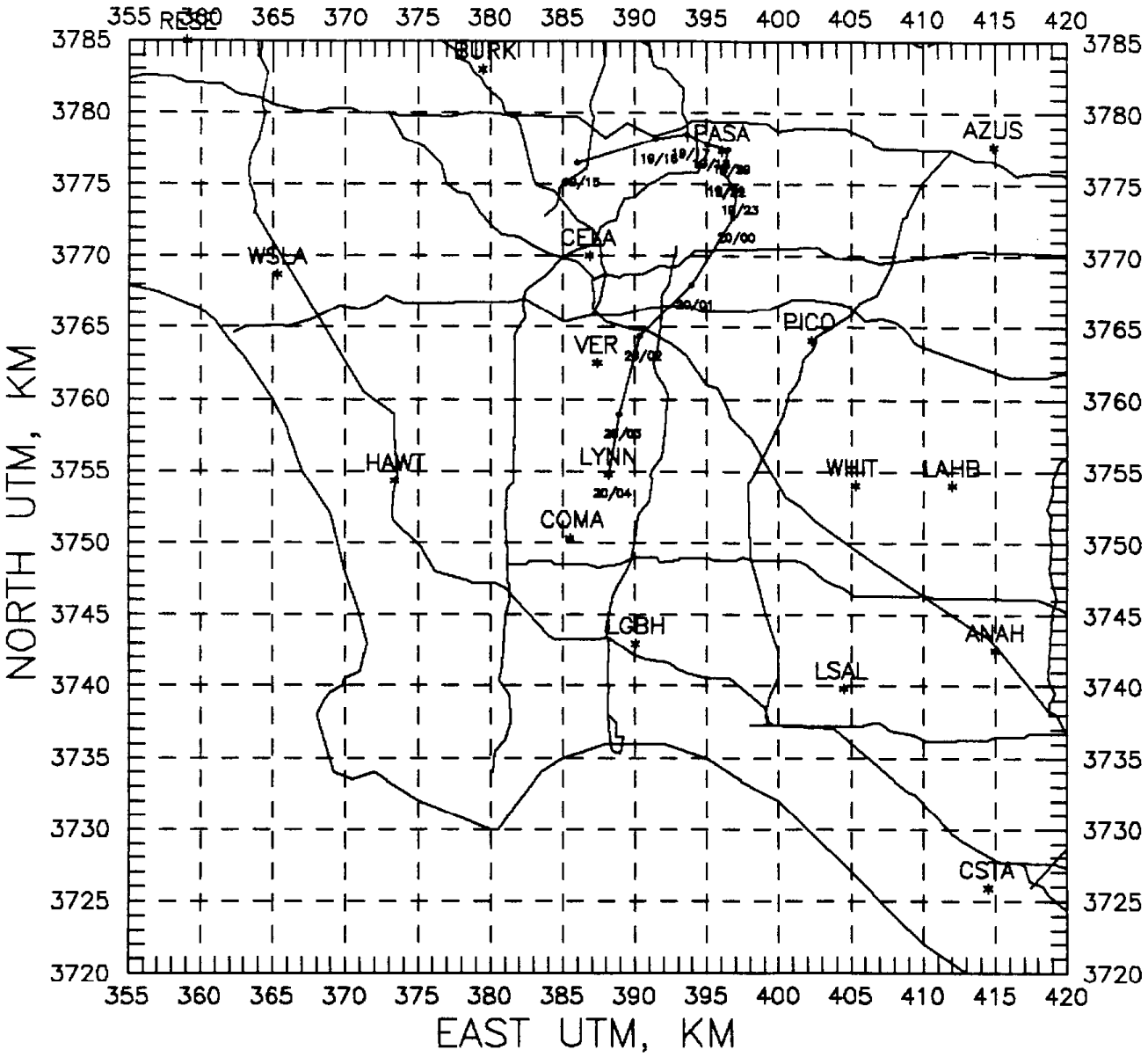
TRAJECTORY – ARRIVE LYNN – 1220/02



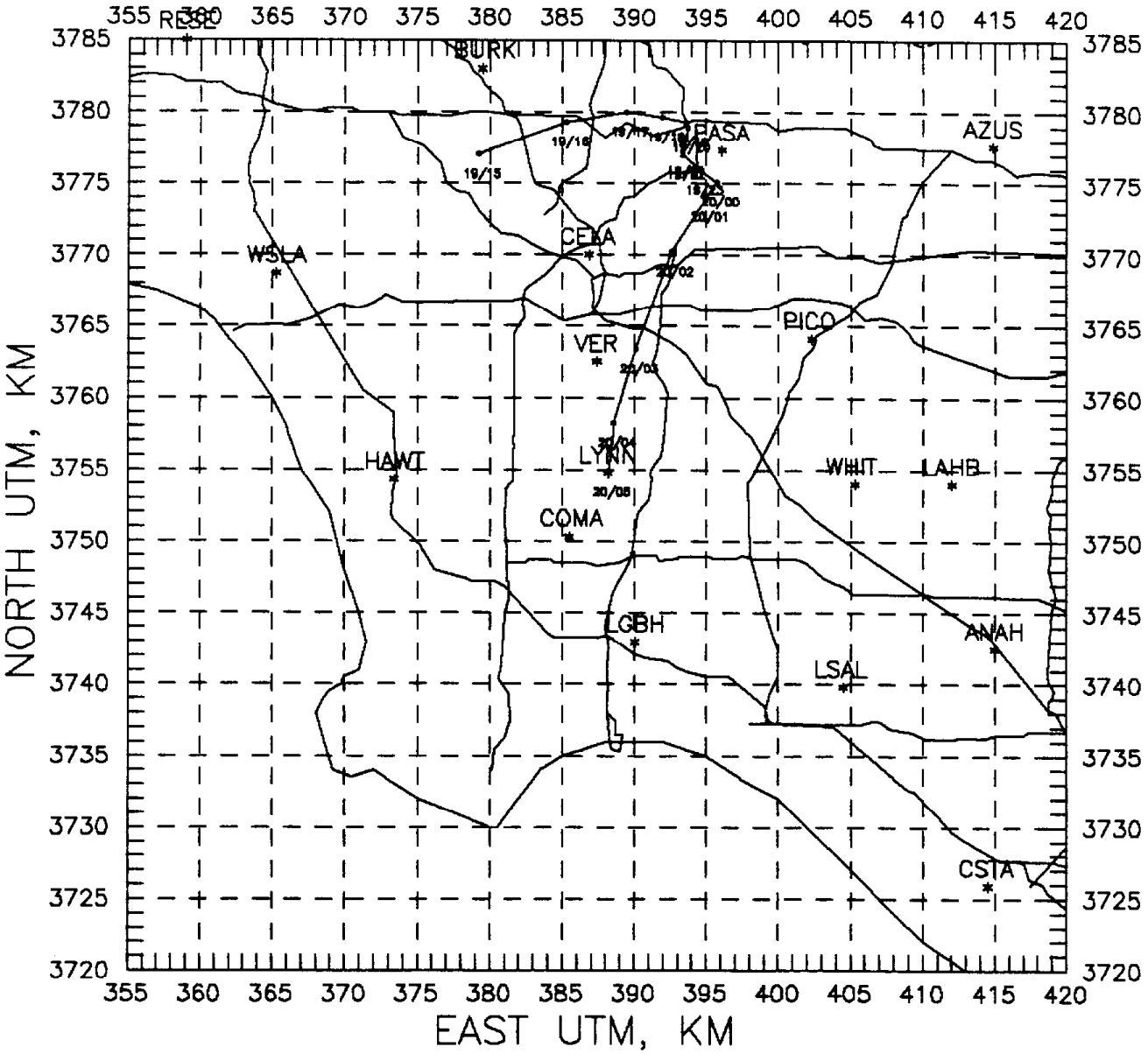
TRAJECTORY – ARRIVE LYNN – 1220/03



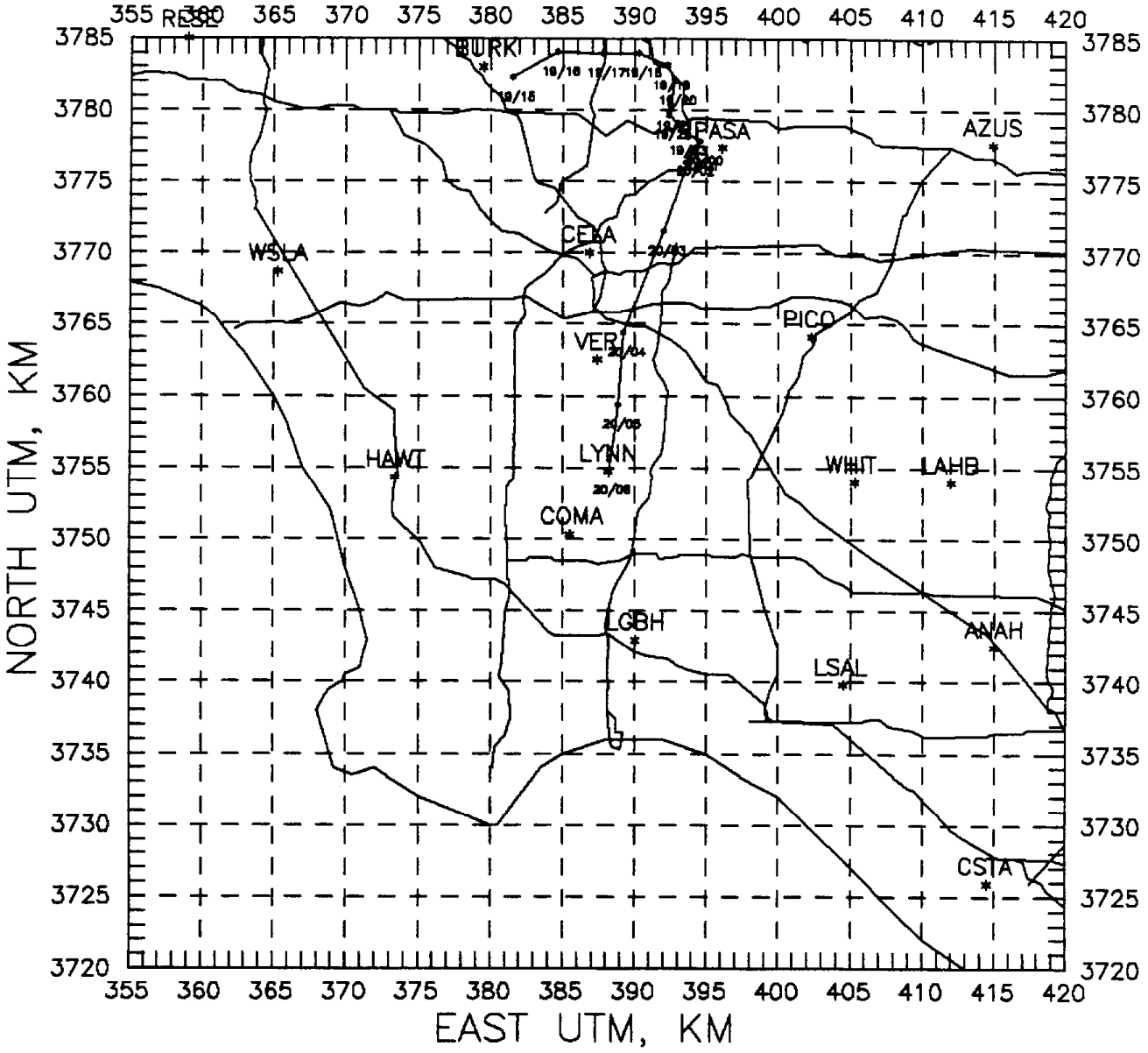
TRAJECTORY – ARRIVE LYNN – 1220/04



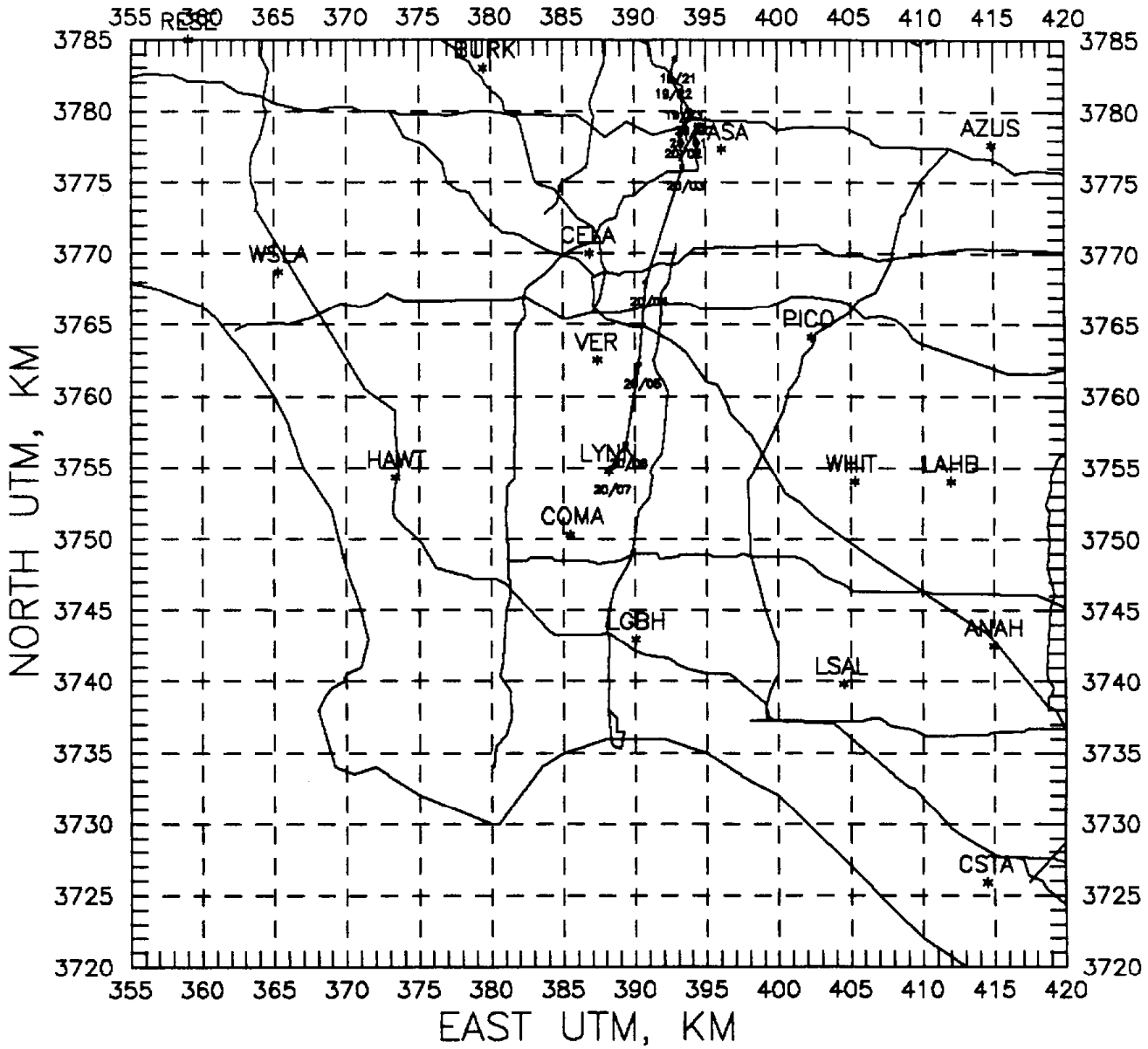
TRAJECTORY – ARRIVE LYNN – 1220/05



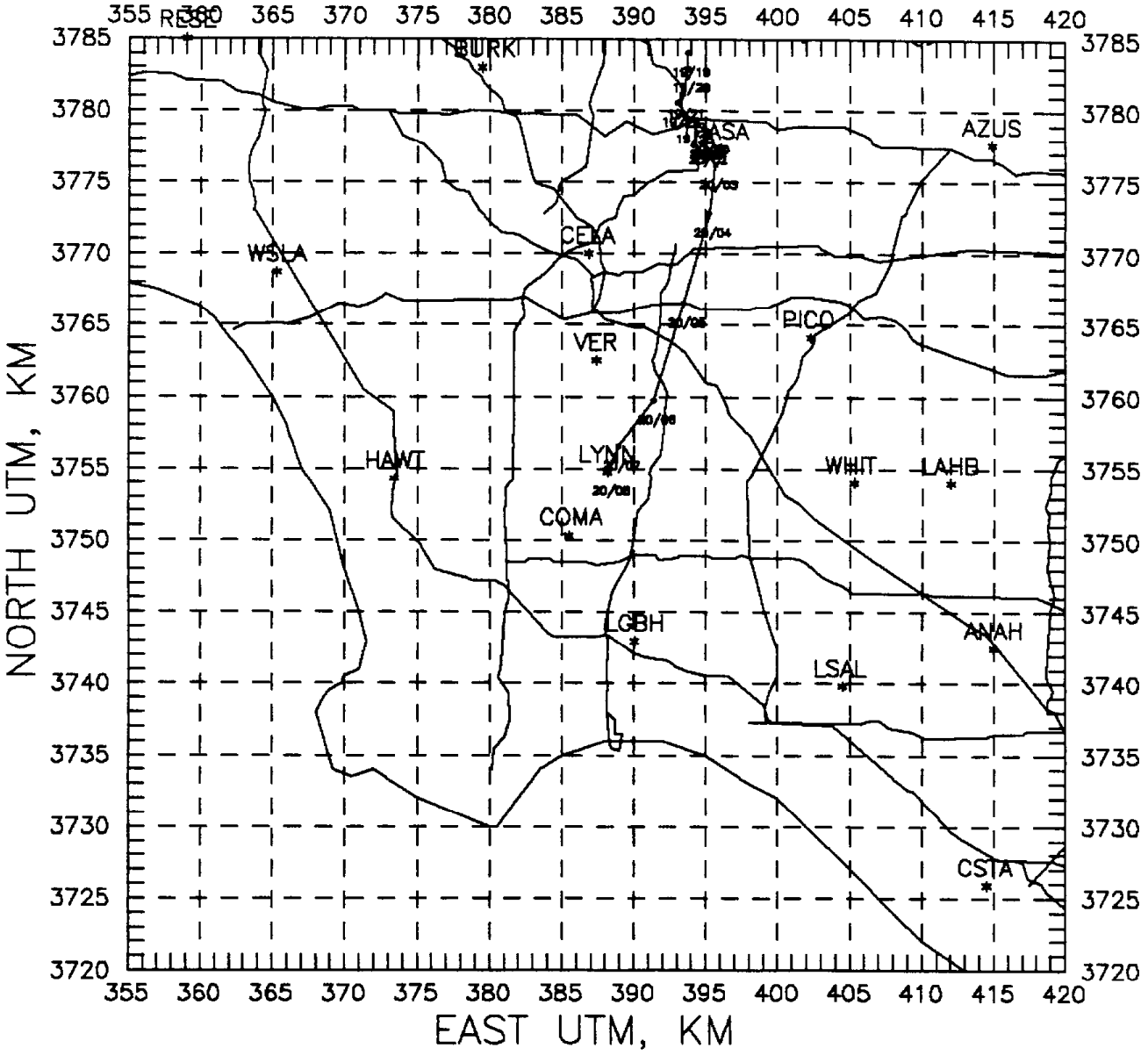
TRAJECTORY – ARRIVE LYNN – 1220/06



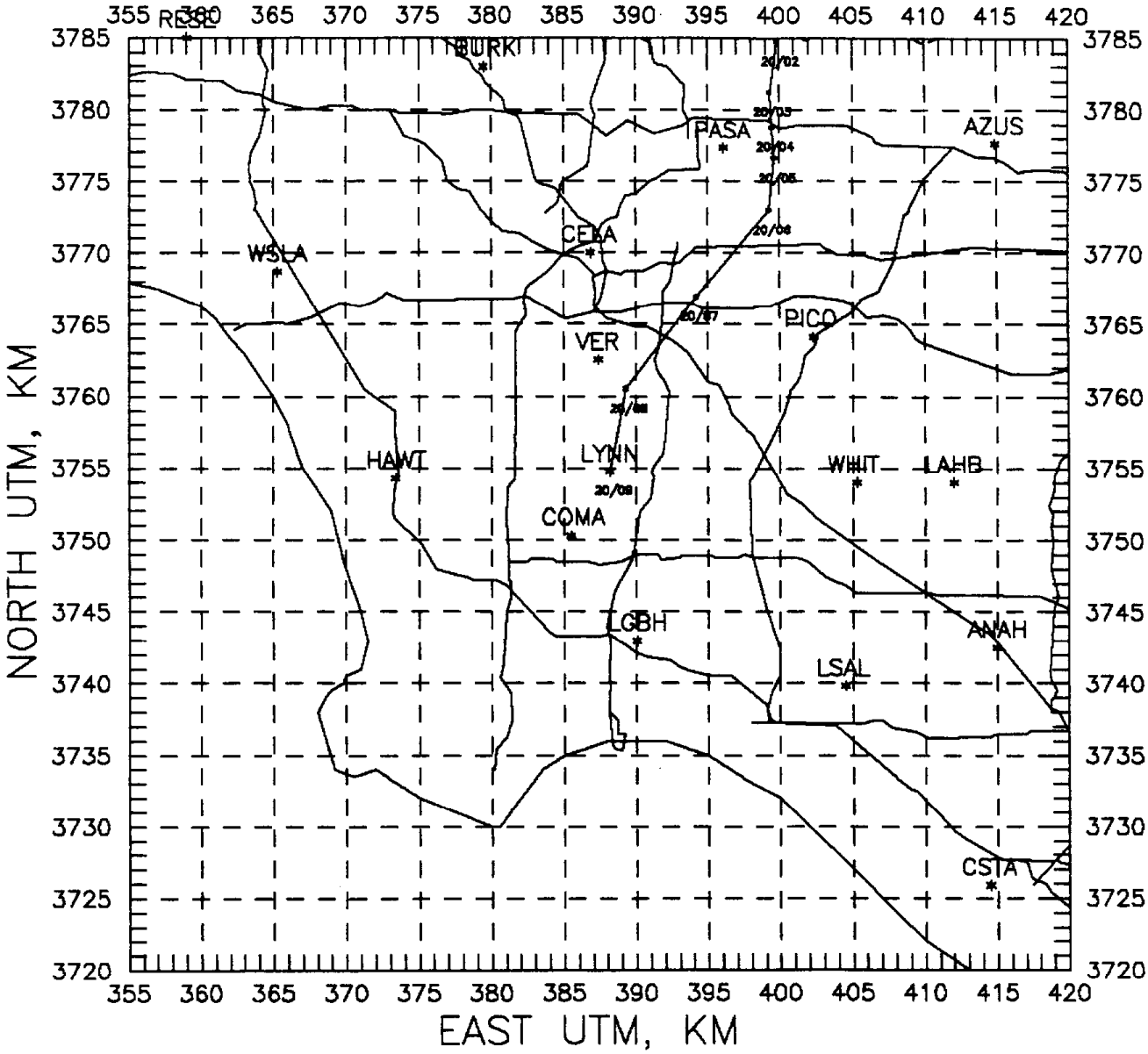
TRAJECTORY – ARRIVE LYNN – 1220/07



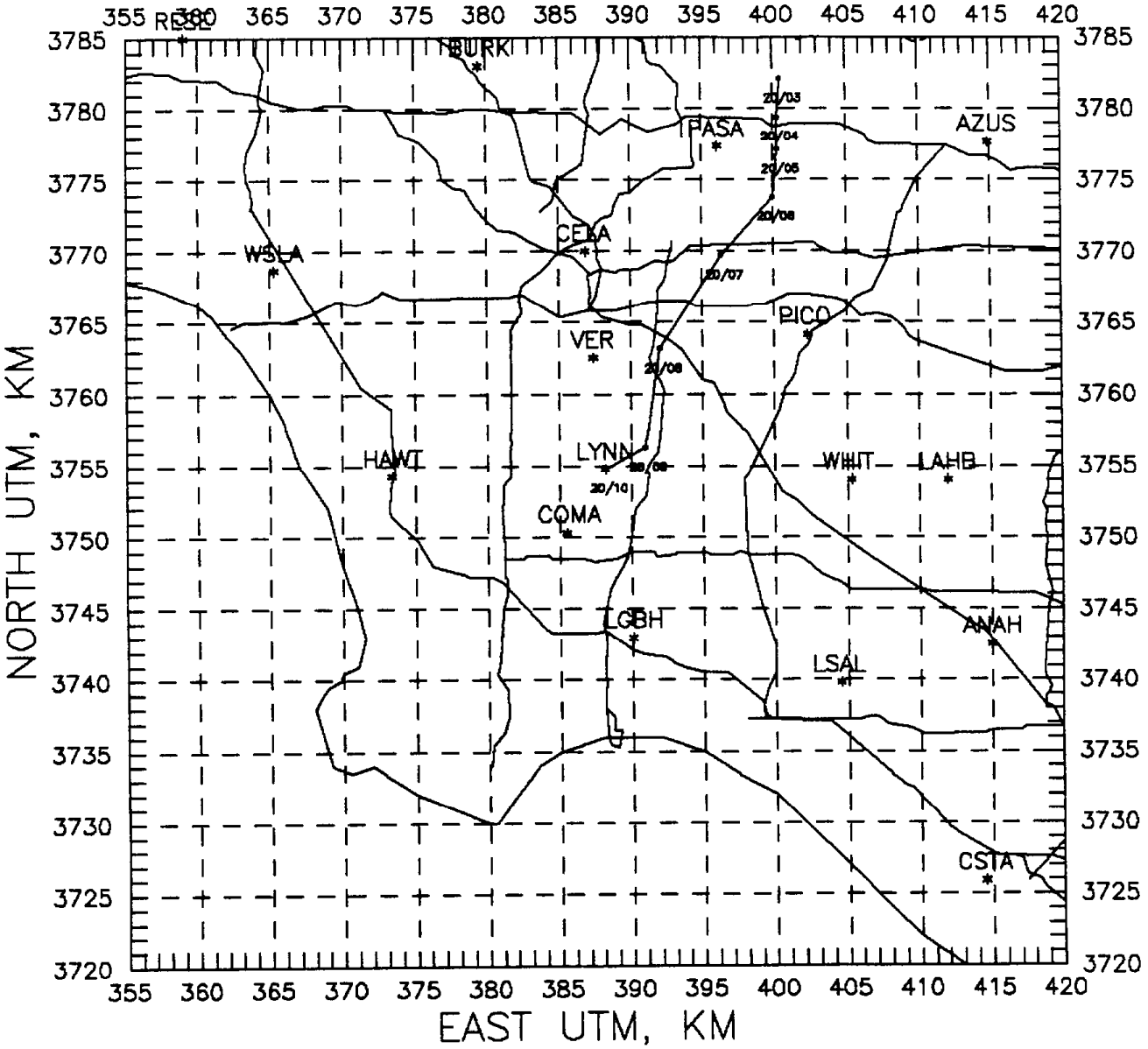
TRAJECTORY – ARRIVE LYNN – 1220/08



TRAJECTORY – ARRIVE LYNN – 1220/09

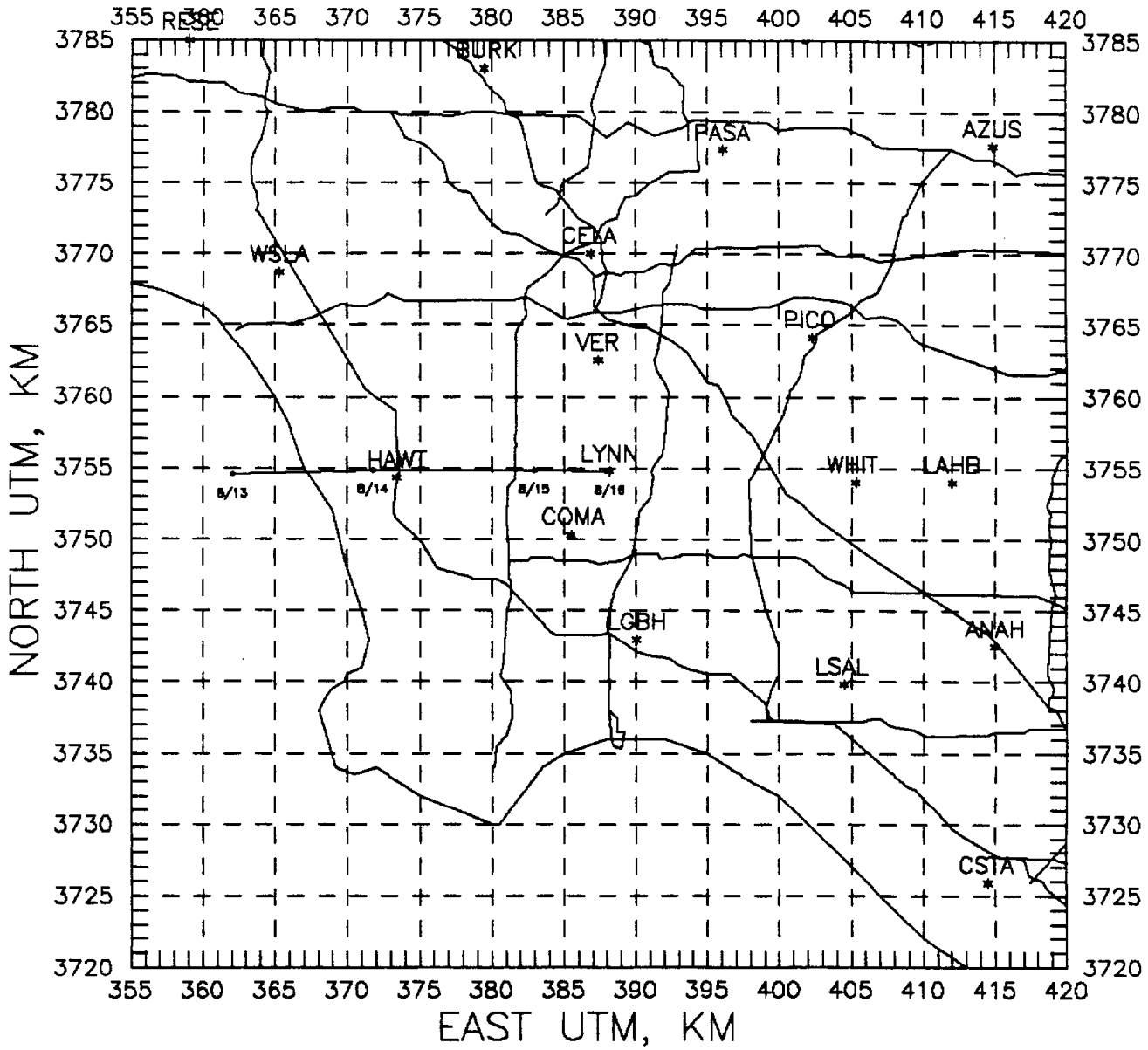


TRAJECTORY – ARRIVE LYNN – 1220/10

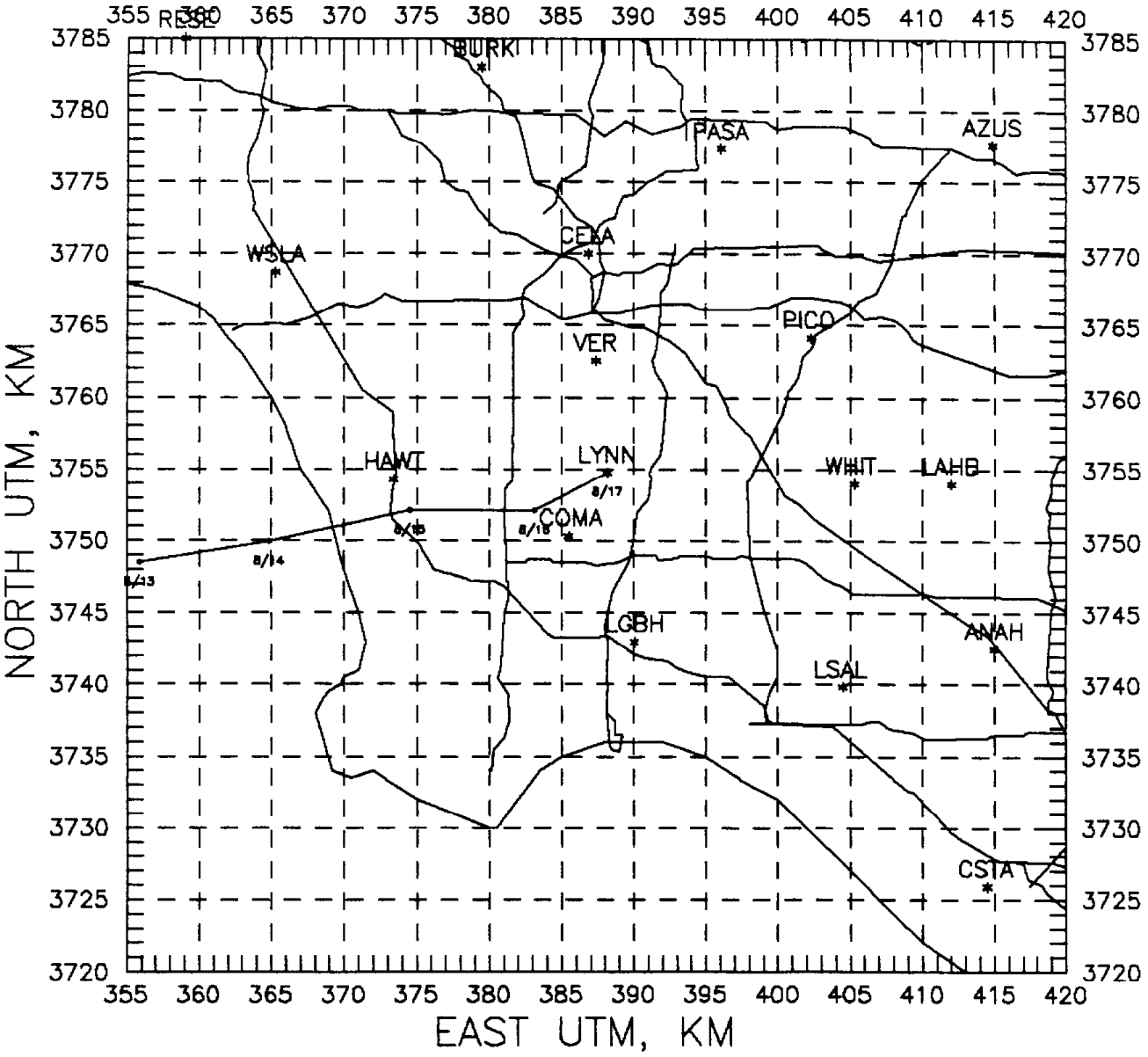


Trajectories of Air Arriving at LYNN
for January, 1990

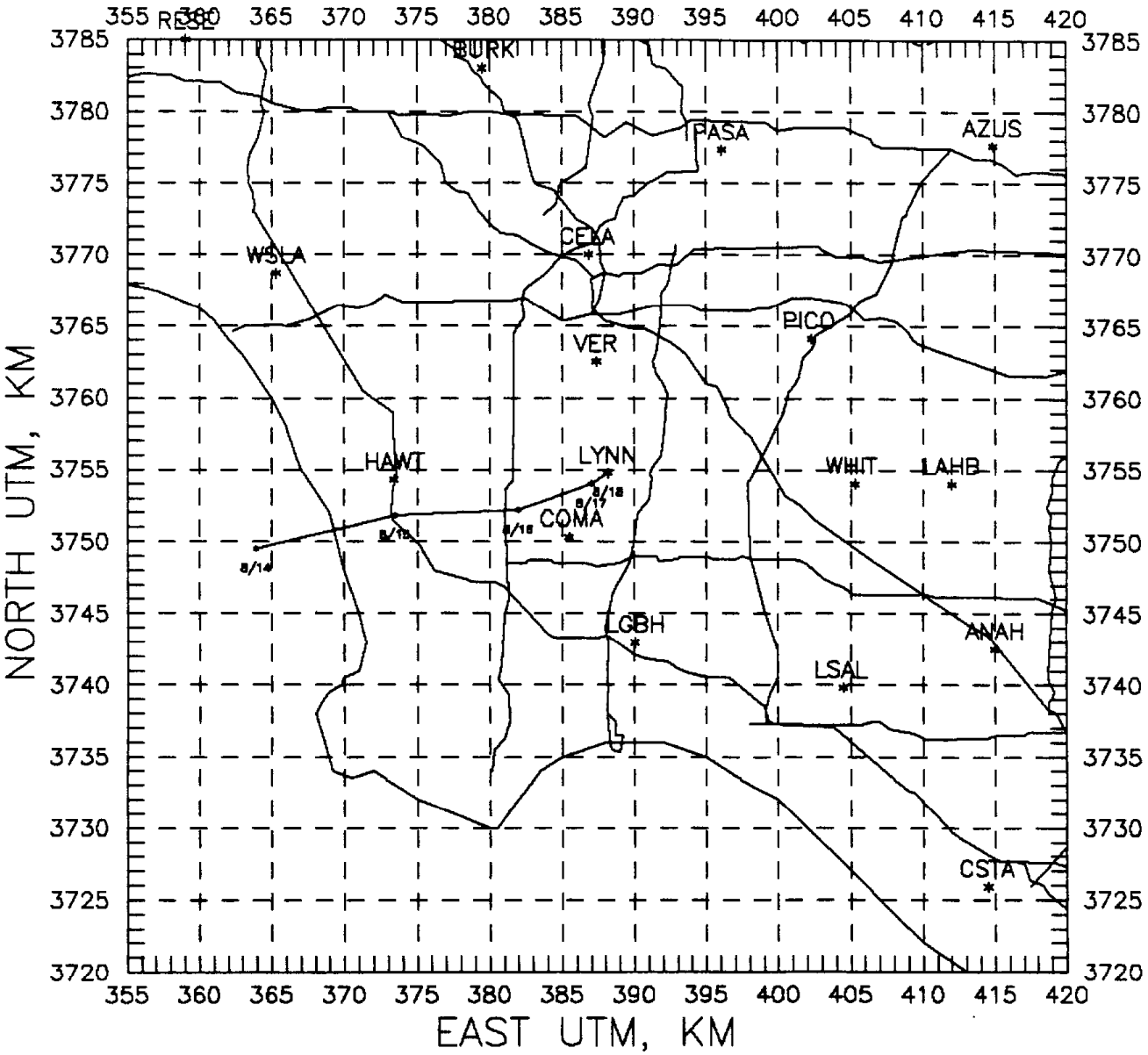
TRAJECTORY – ARRIVE LYNN – 0108/16



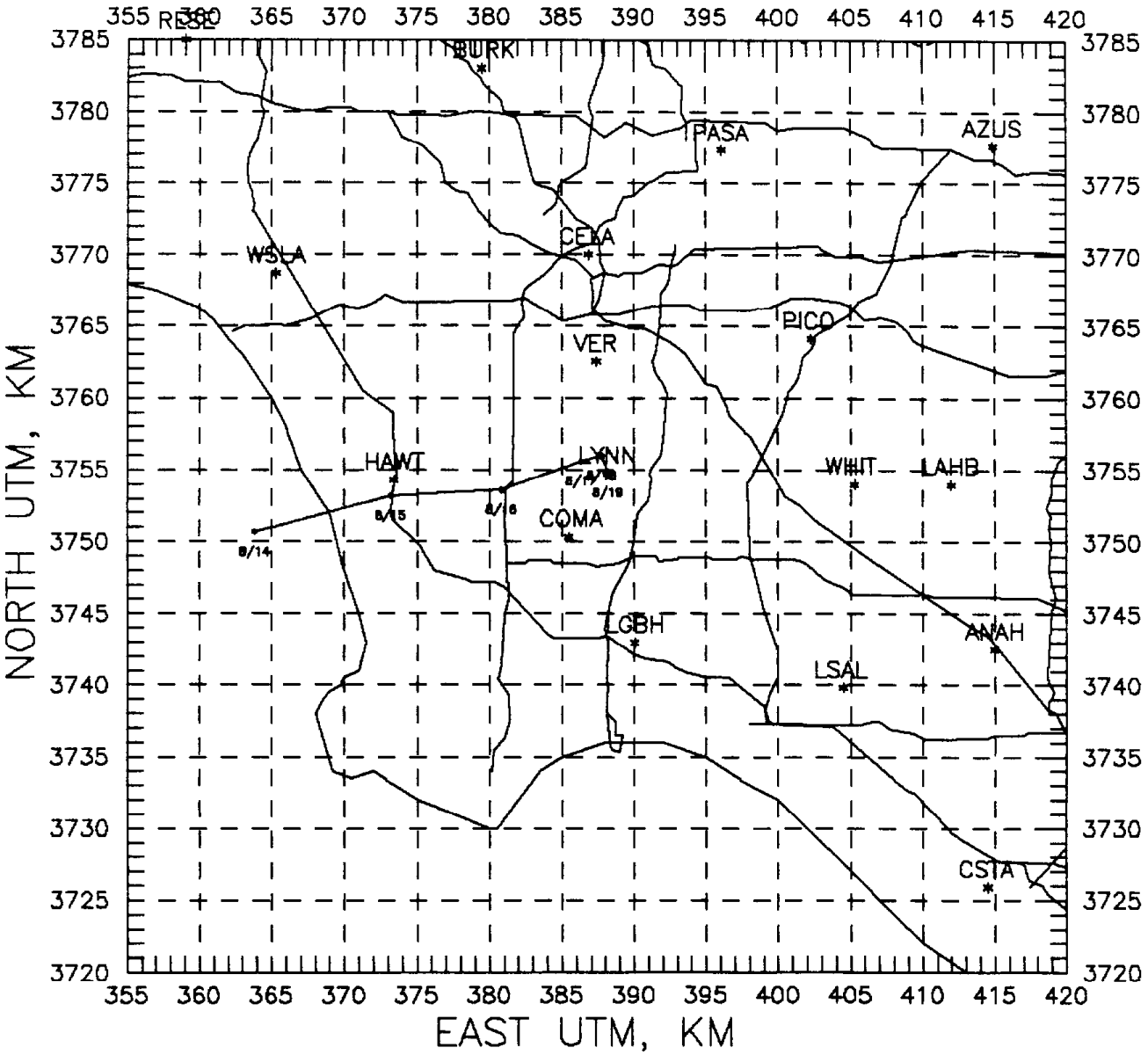
TRAJECTORY – ARRIVE LYNN – 0108/17



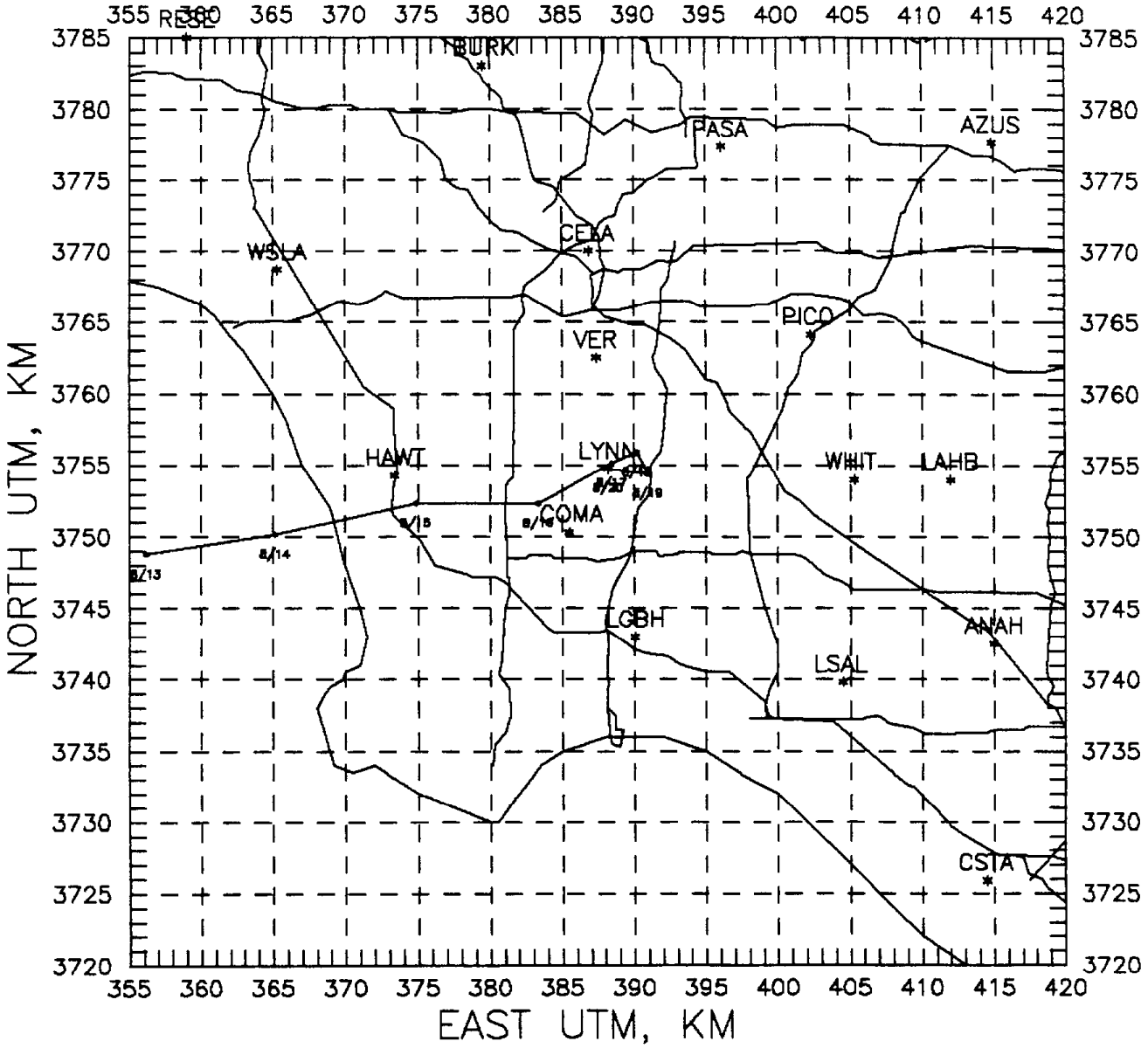
TRAJECTORY — ARRIVE LYNN — 0108/18



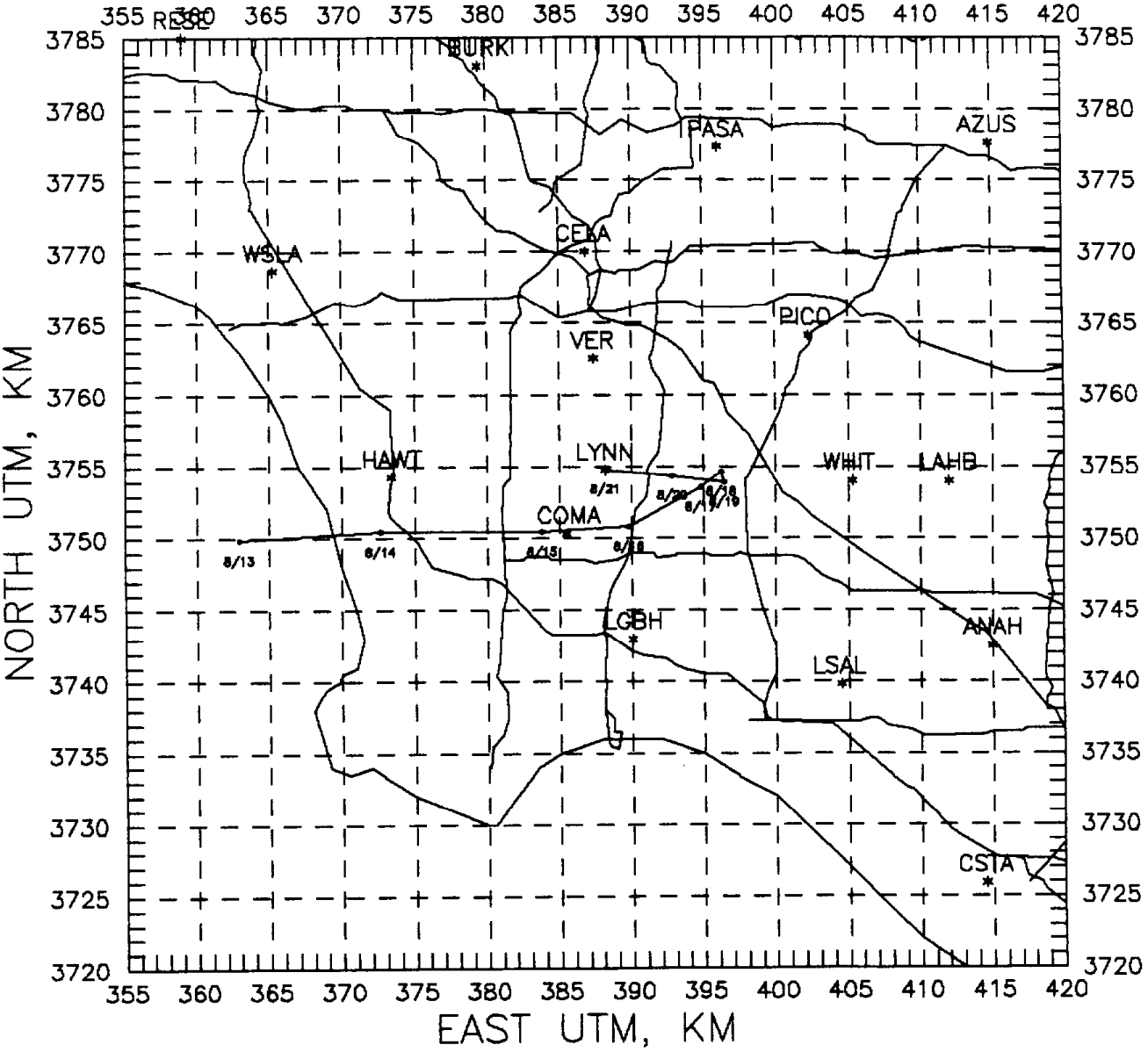
TRAJECTORY — ARRIVE LYNN — 0108/19



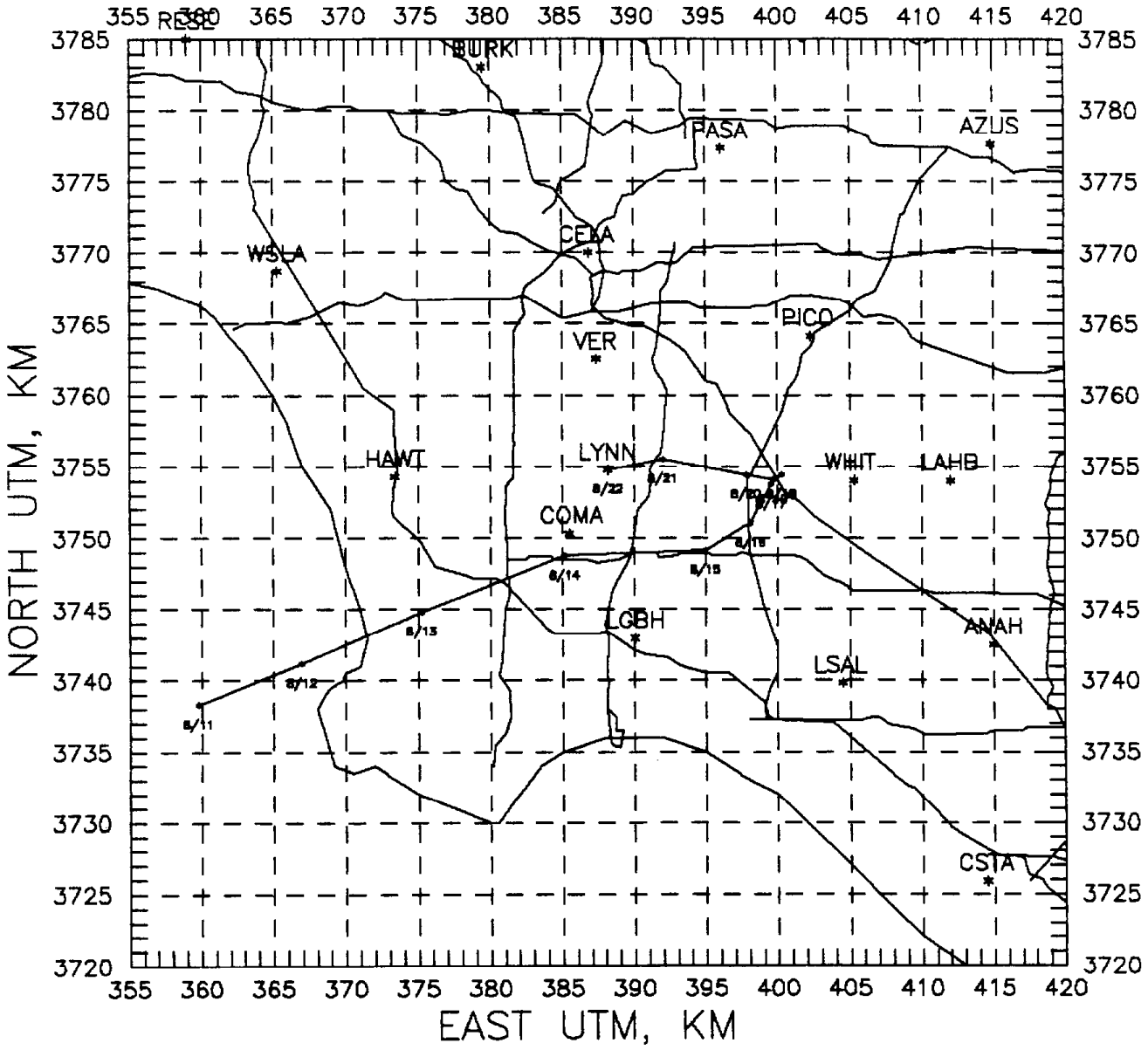
TRAJECTORY – ARRIVE LYNN – 0108/20



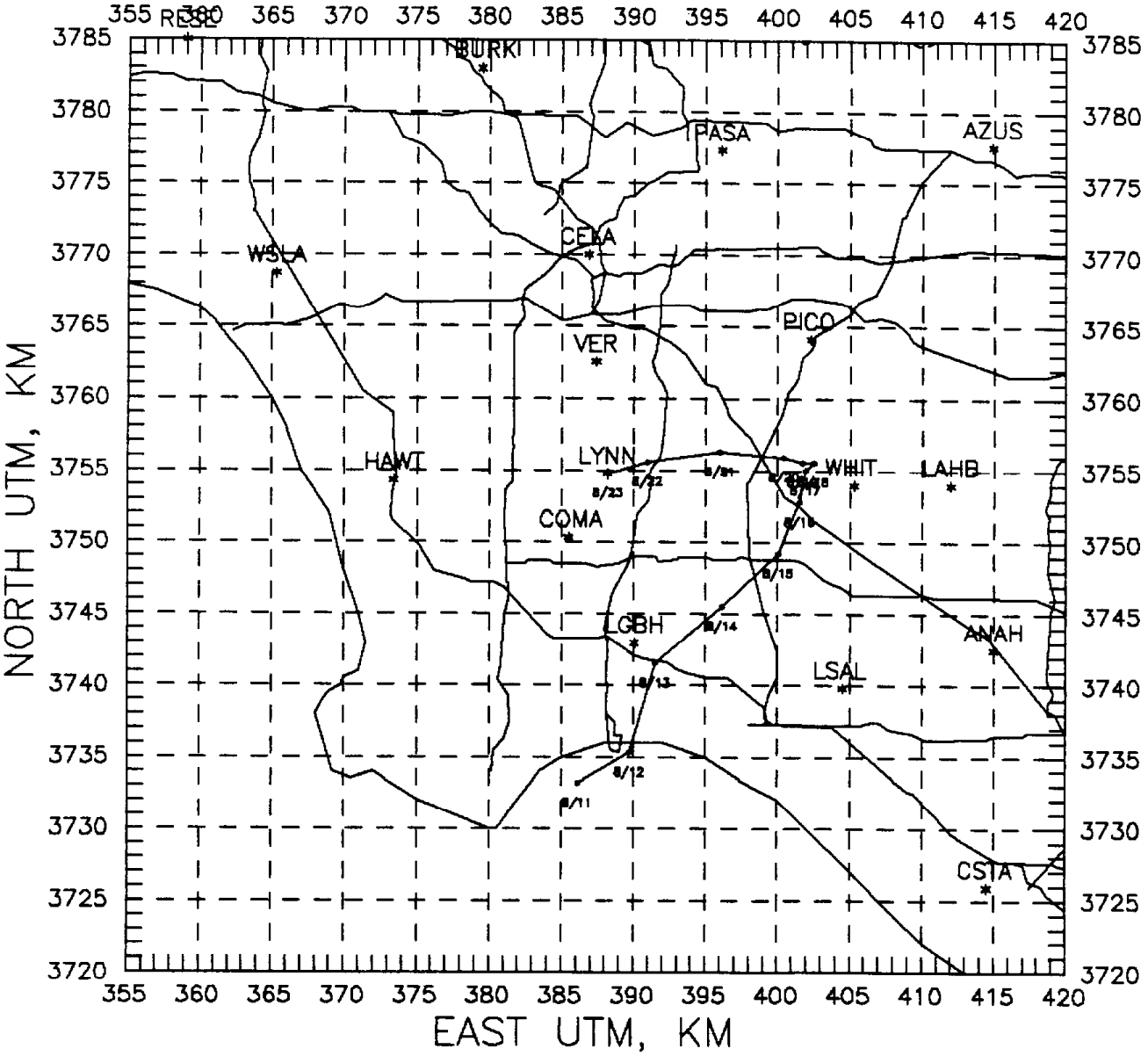
TRAJECTORY – ARRIVE LYNN – 0108/21



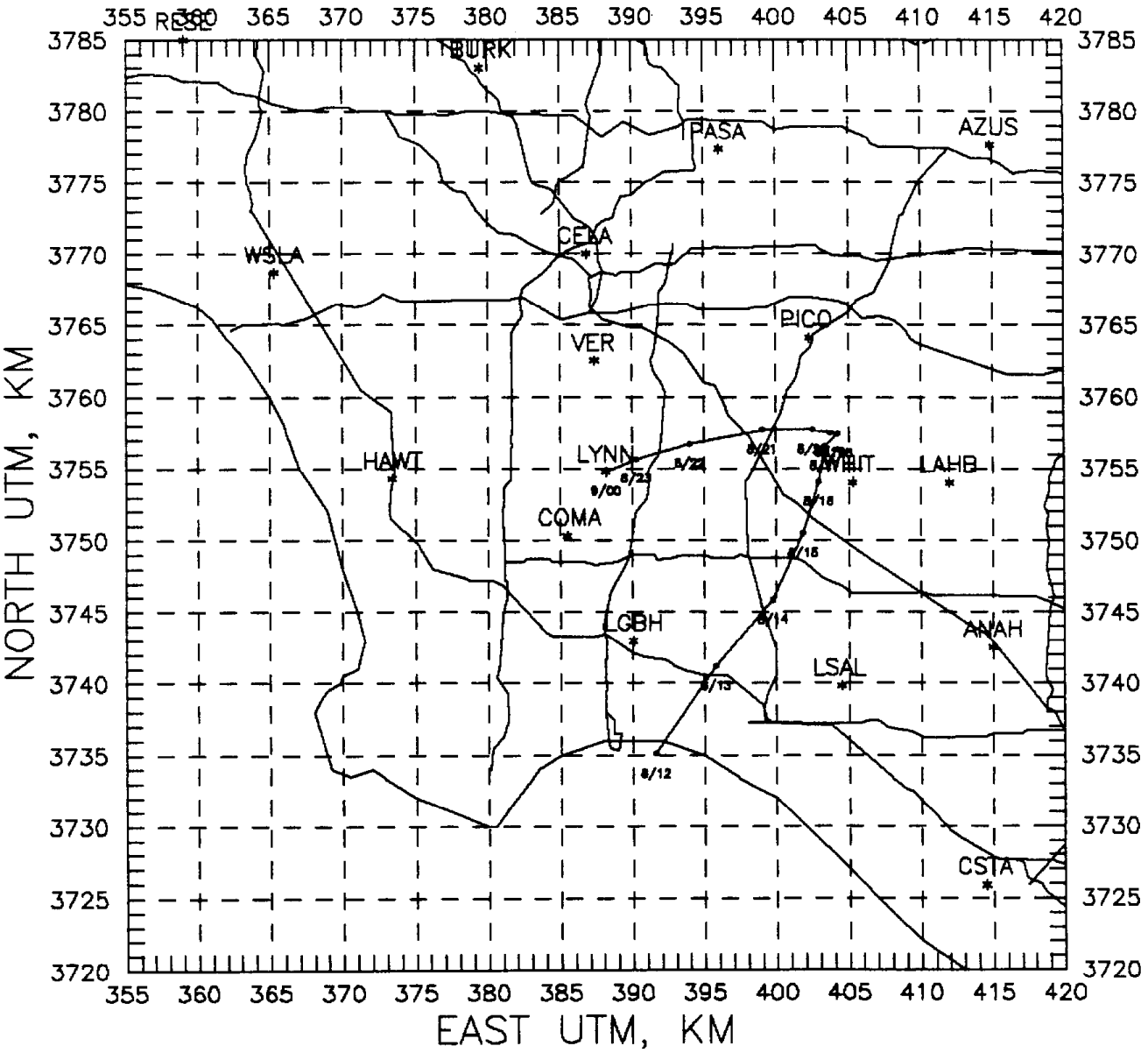
TRAJECTORY – ARRIVE LYNN – 0108/22



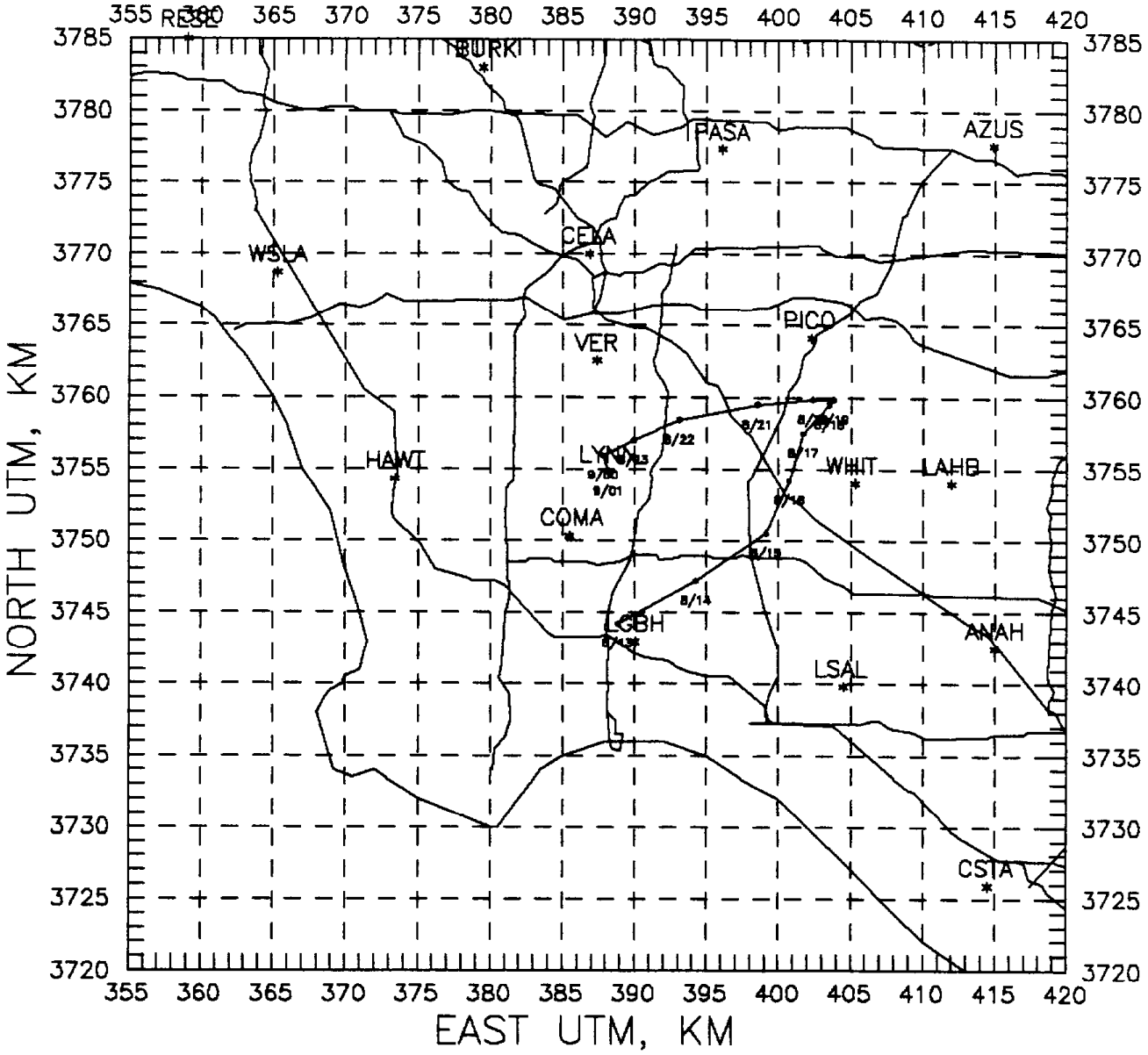
TRAJECTORY – ARRIVE LYNN – 0108/23



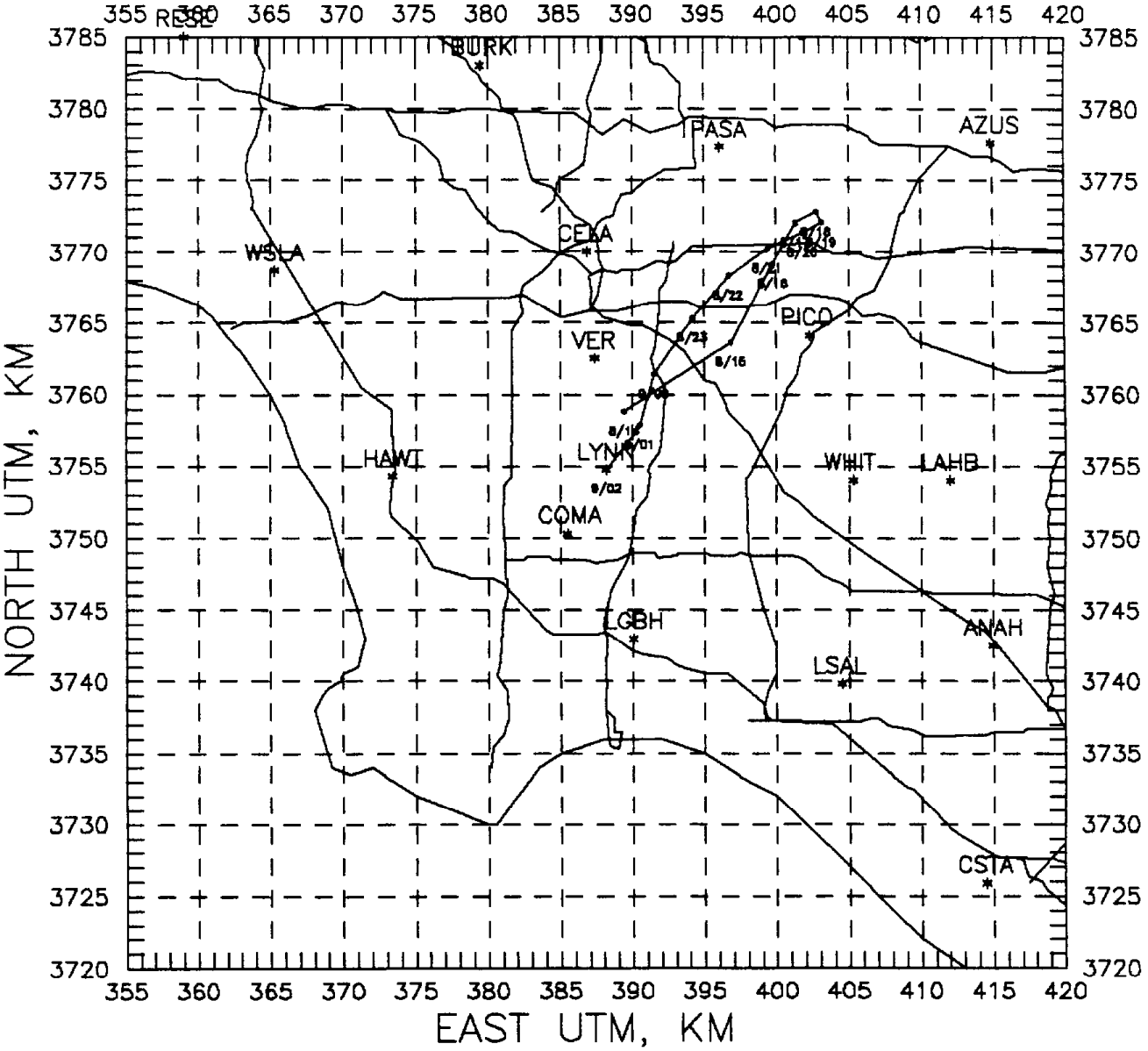
TRAJECTORY – ARRIVE LYNN – 0109/00



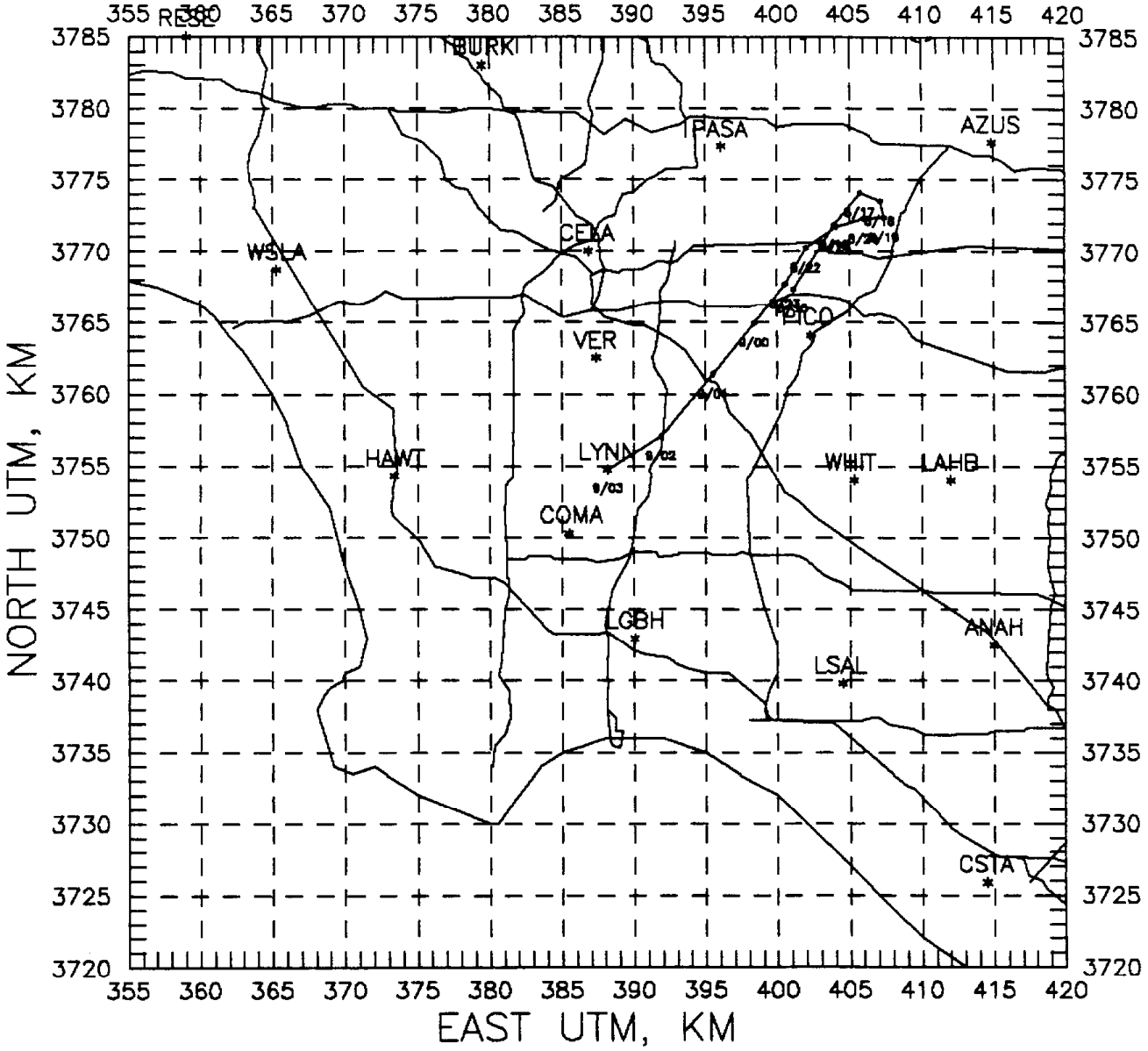
TRAJECTORY – ARRIVE LYNN – 0109/01



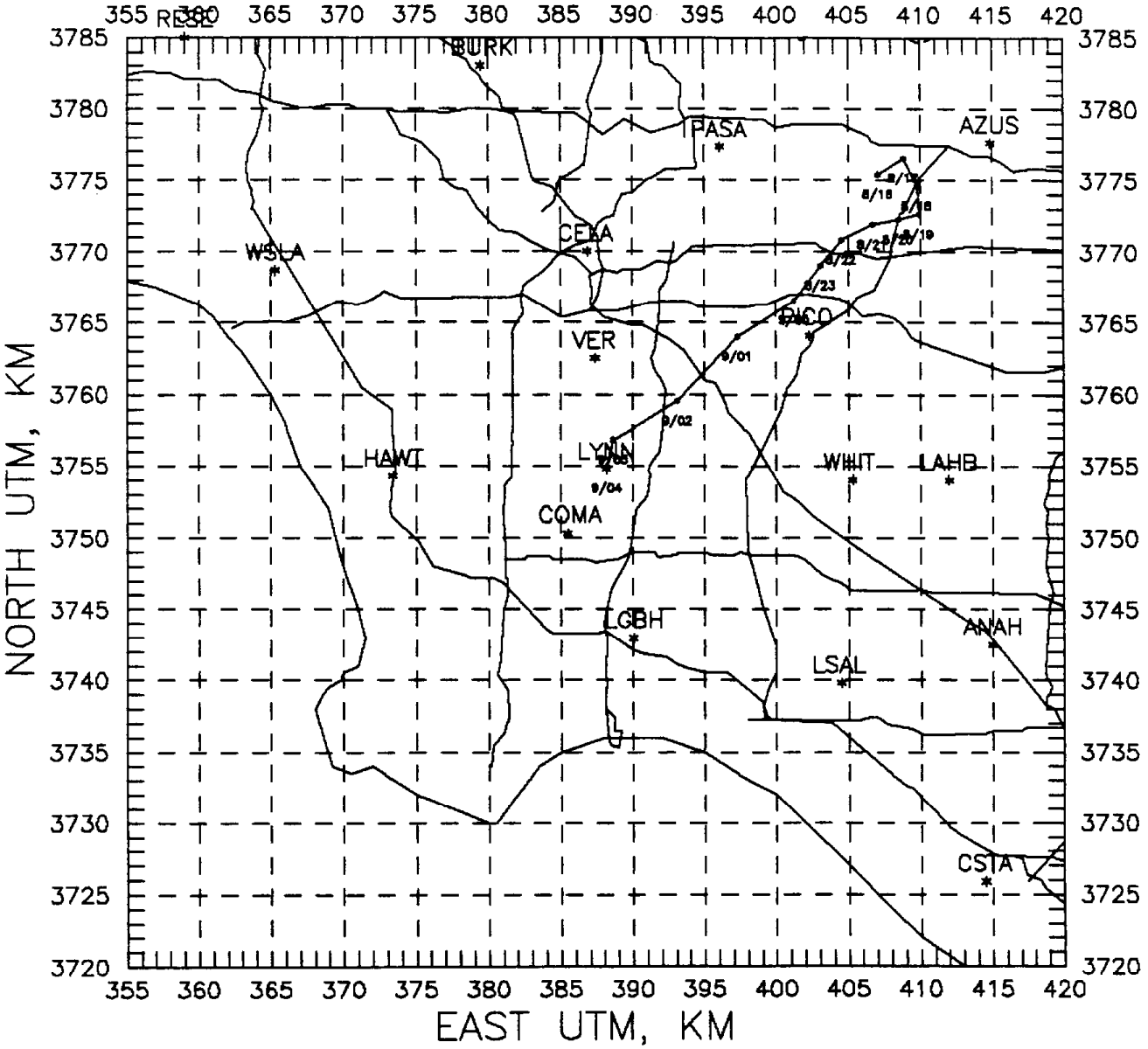
TRAJECTORY – ARRIVE LYNN – 0109/02



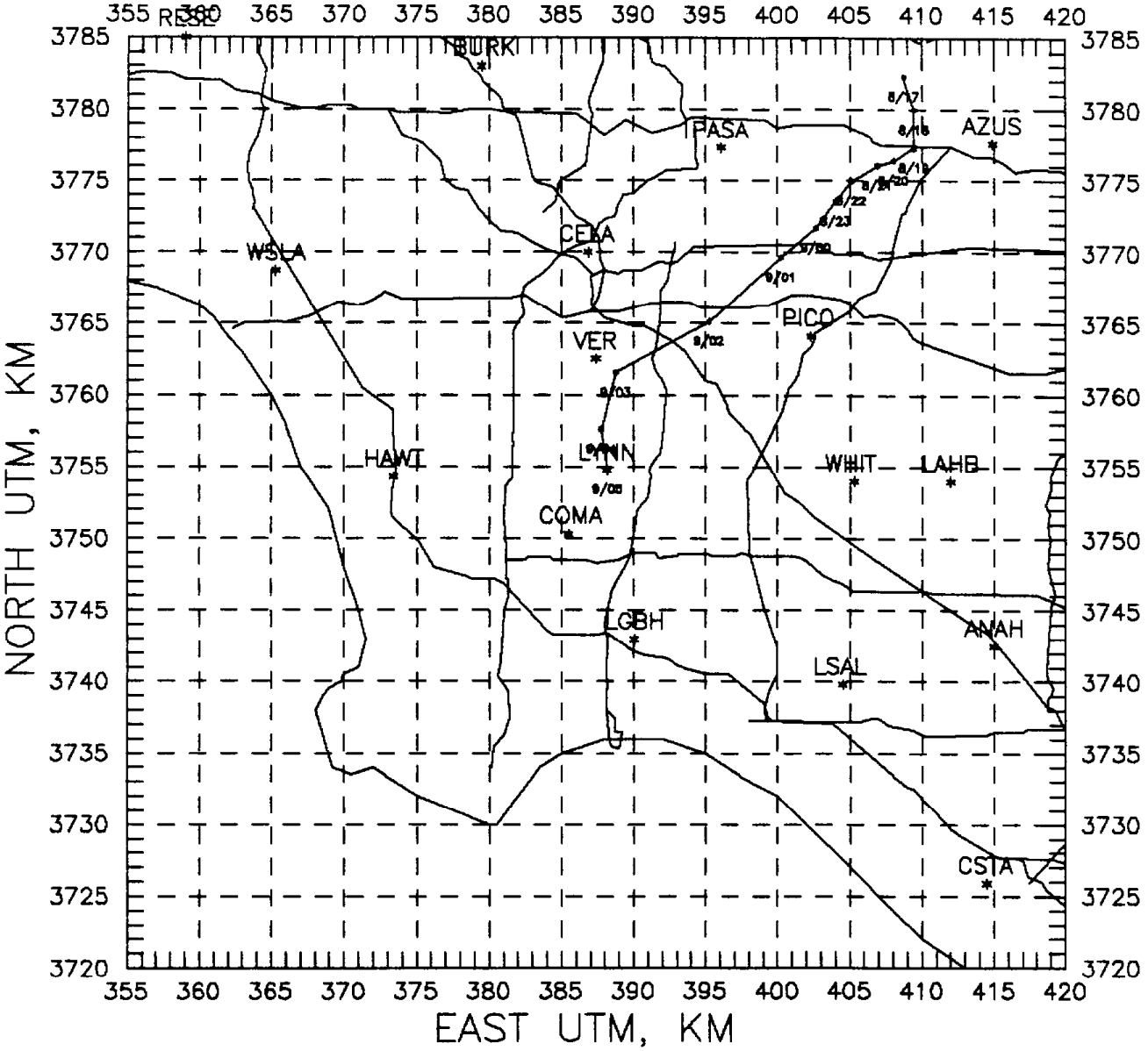
TRAJECTORY – ARRIVE LYNN – 0109/03



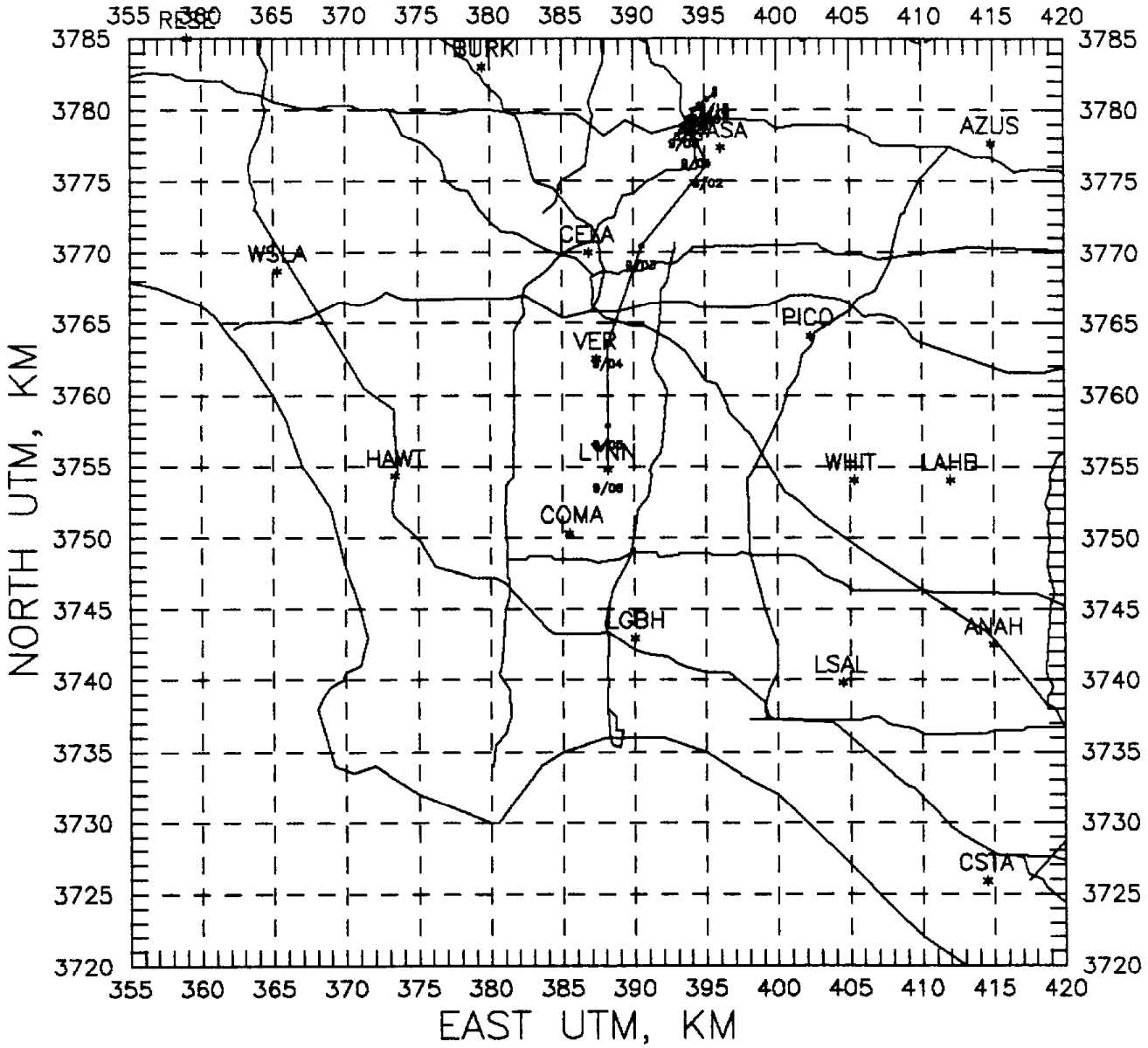
TRAJECTORY – ARRIVE LYNN – 0109/04



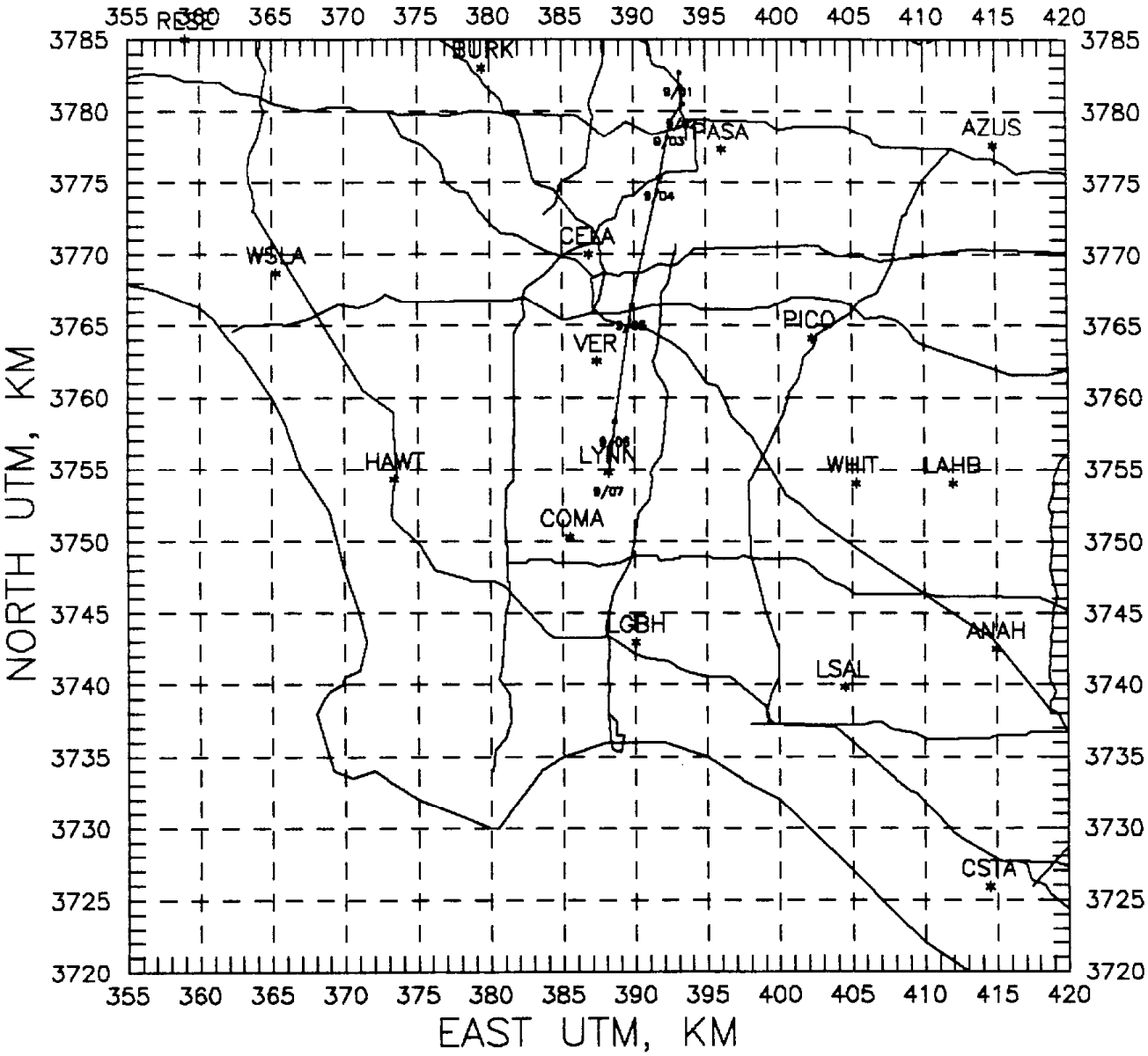
TRAJECTORY – ARRIVE LYNN – 0109/05



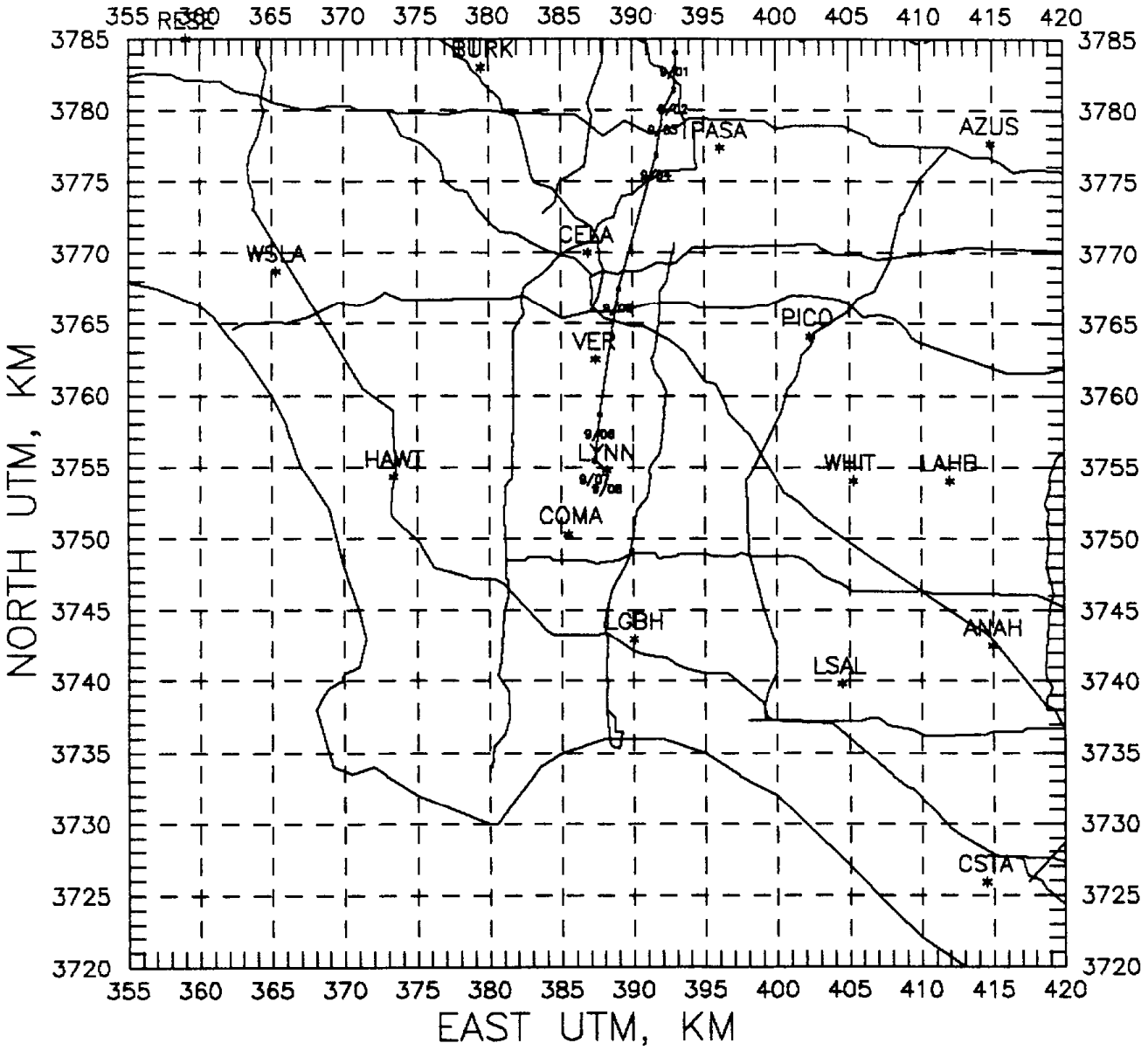
TRAJECTORY – ARRIVE LYNN – 0109/06



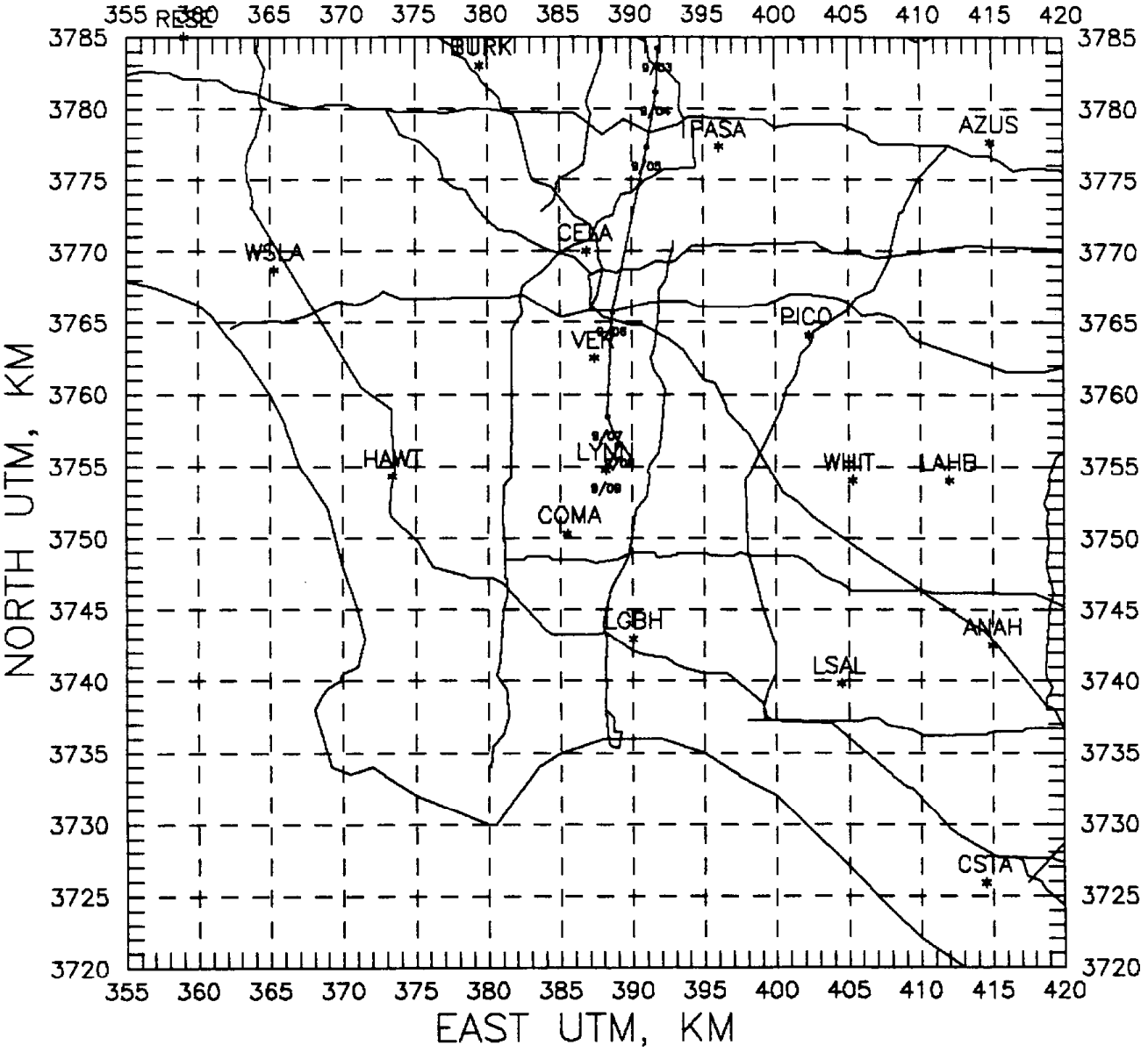
TRAJECTORY – ARRIVE LYNN – 0109/07



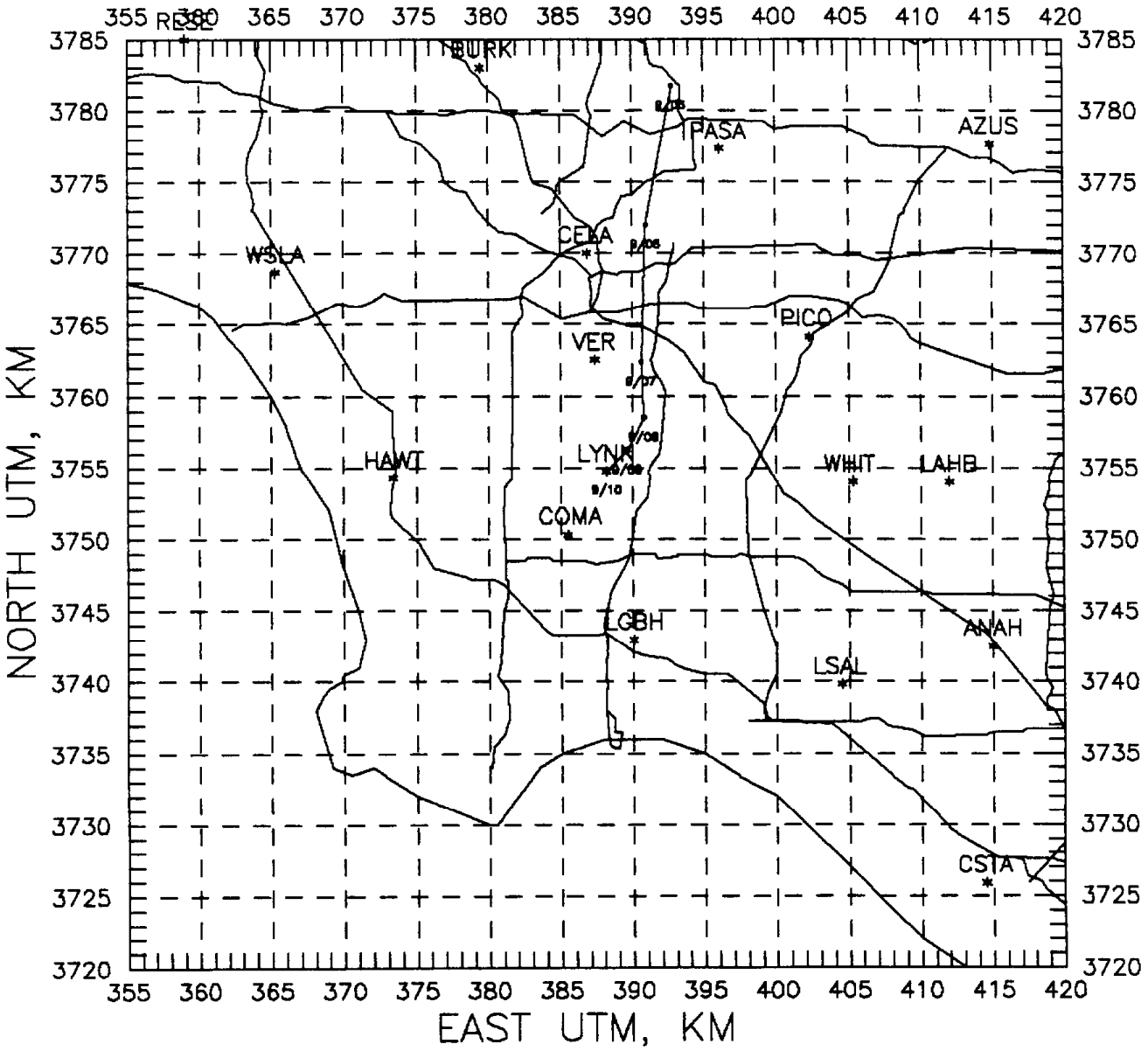
TRAJECTORY – ARRIVE LYNN – 0109/08



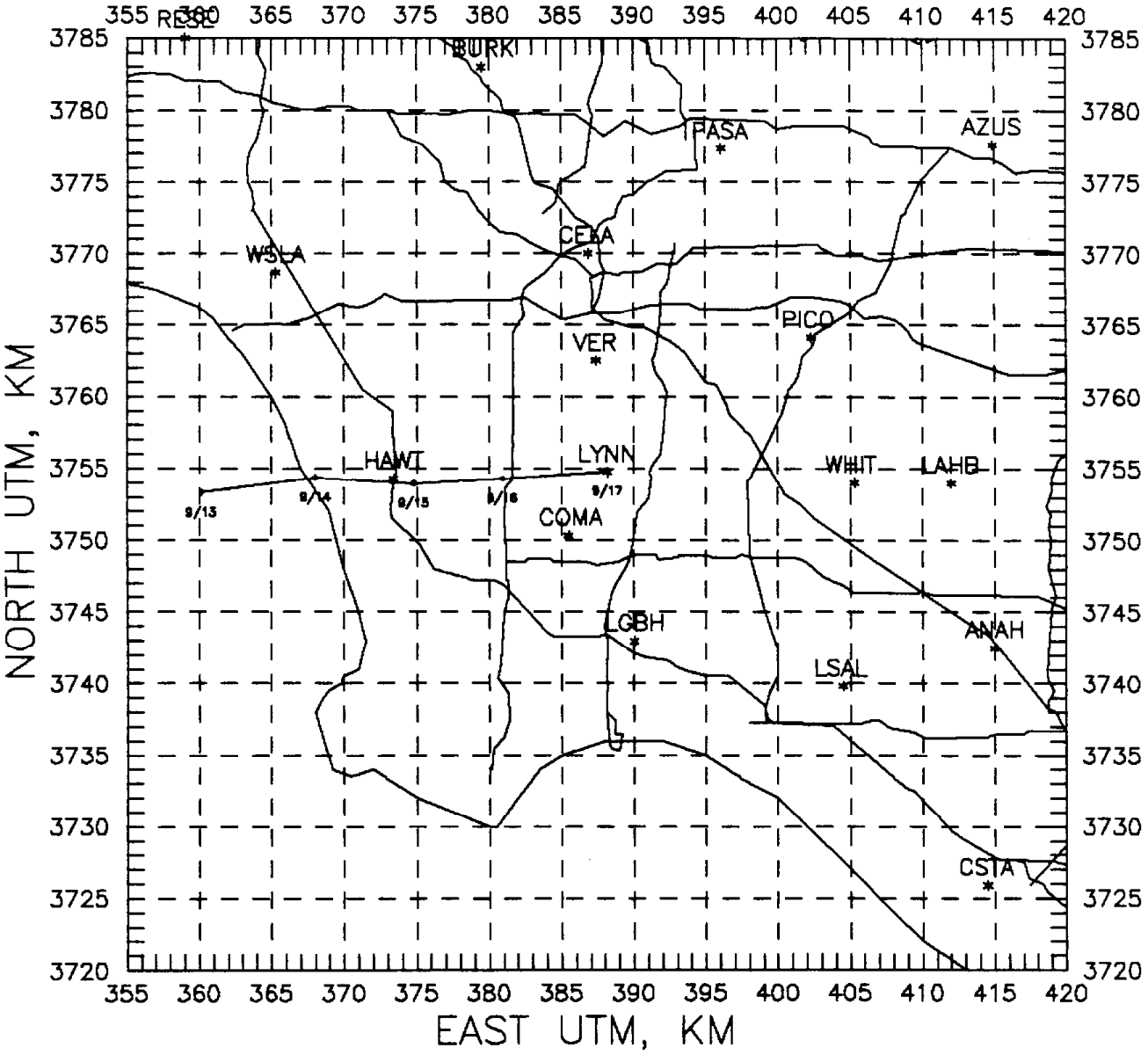
TRAJECTORY – ARRIVE LYNN – 0109/09



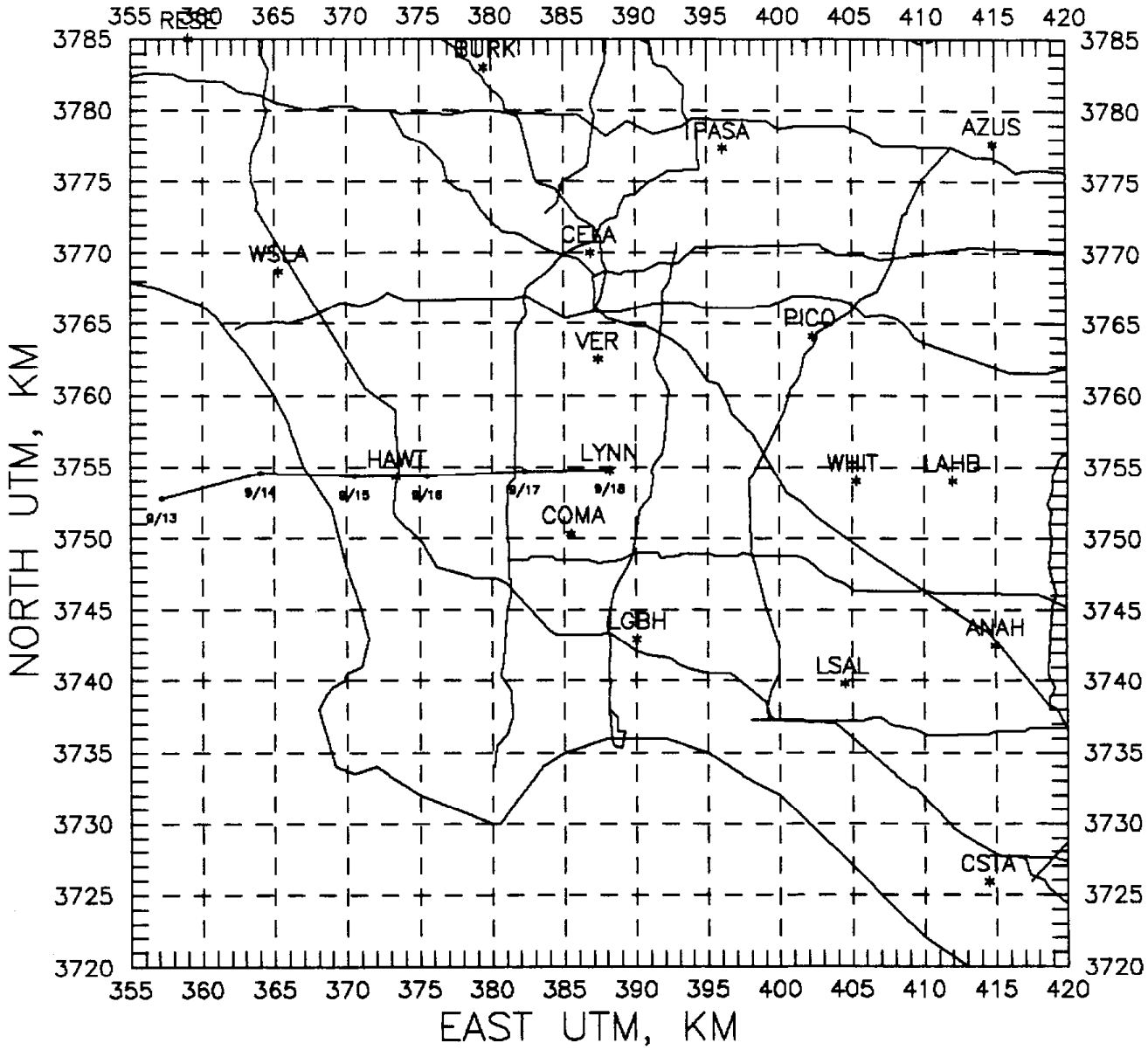
TRAJECTORY – ARRIVE LYNN – 0109/10



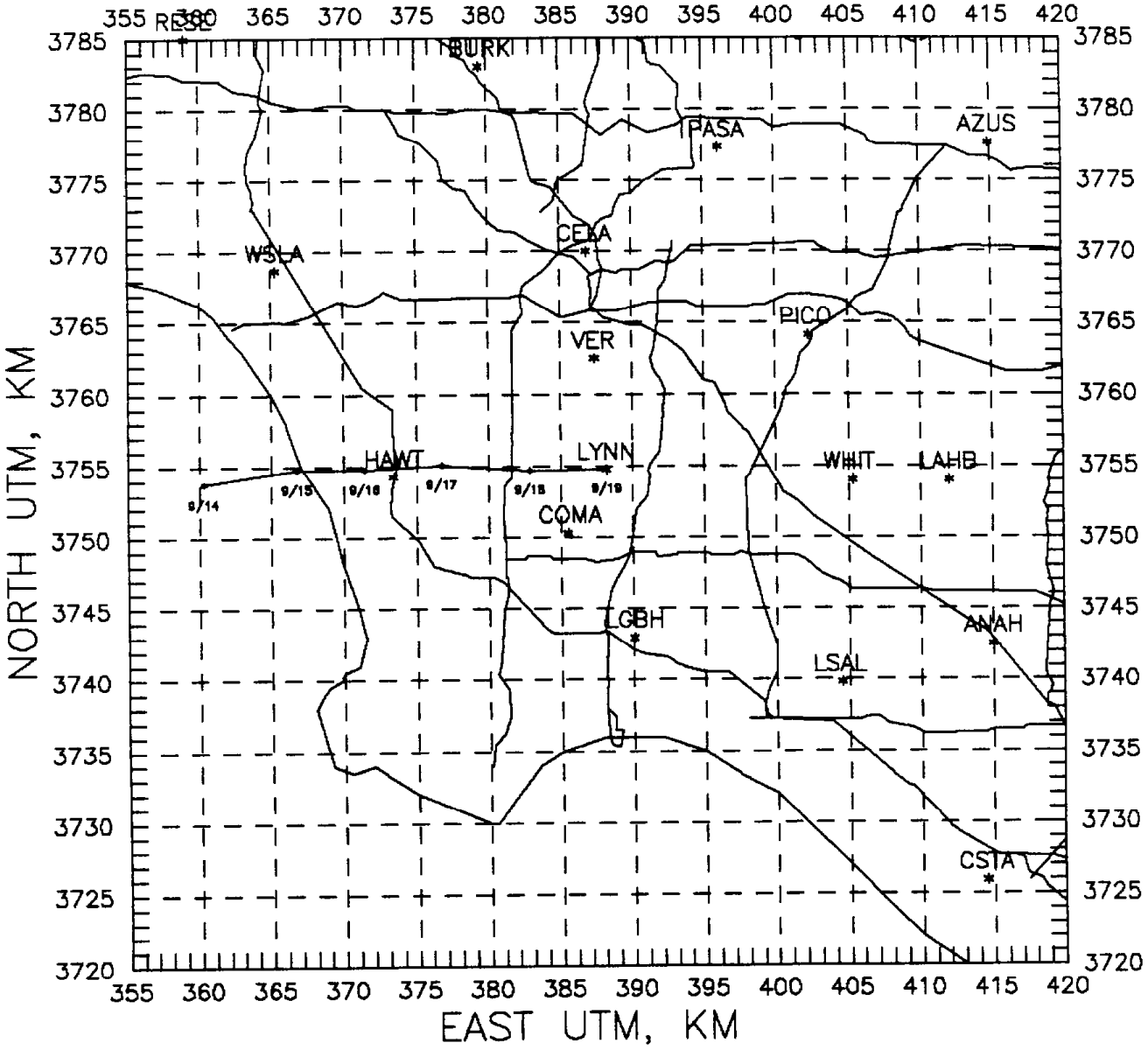
TRAJECTORY – ARRIVE LYNN – 0109/17



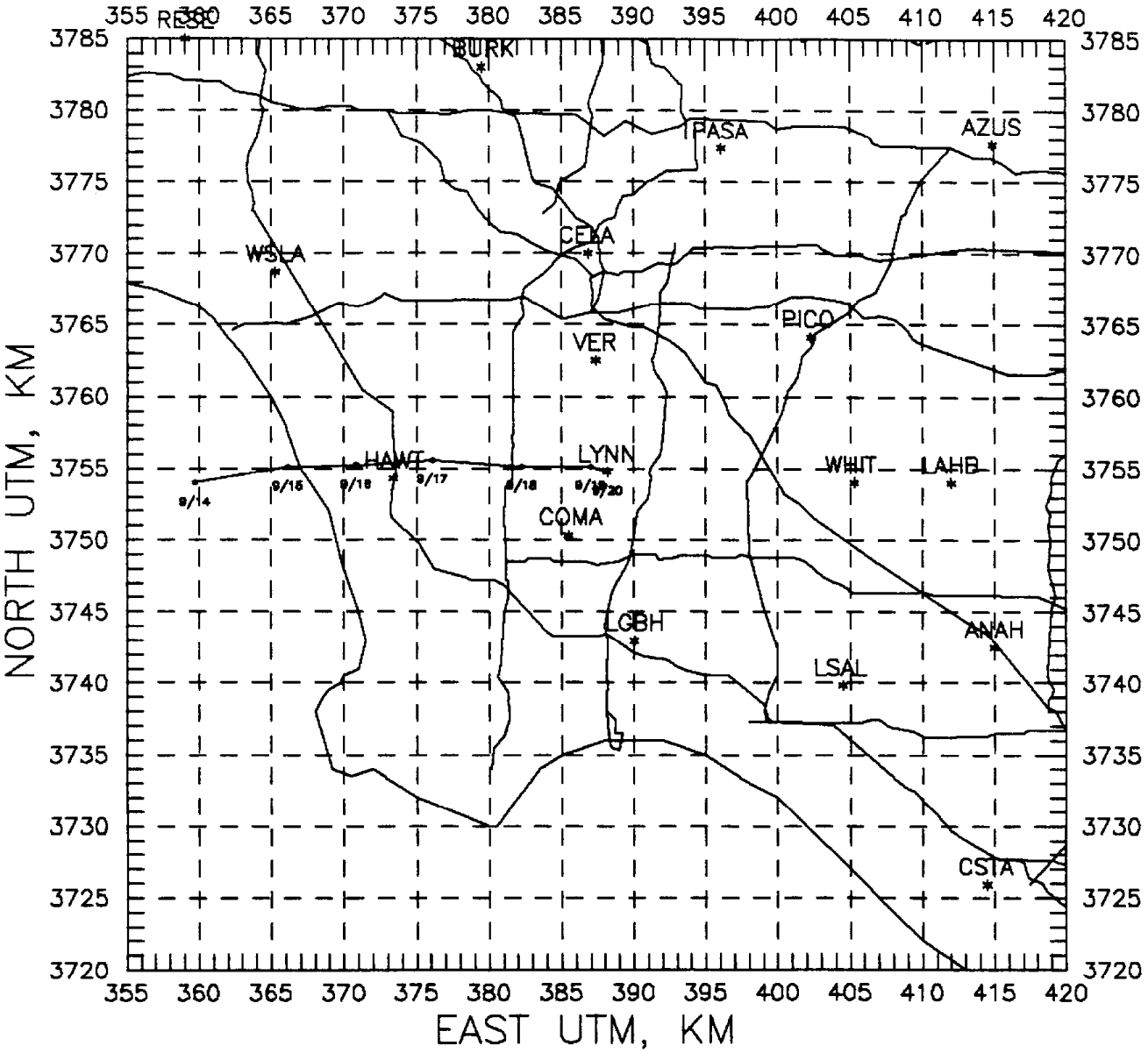
TRAJECTORY – ARRIVE LYNN – 0109/18



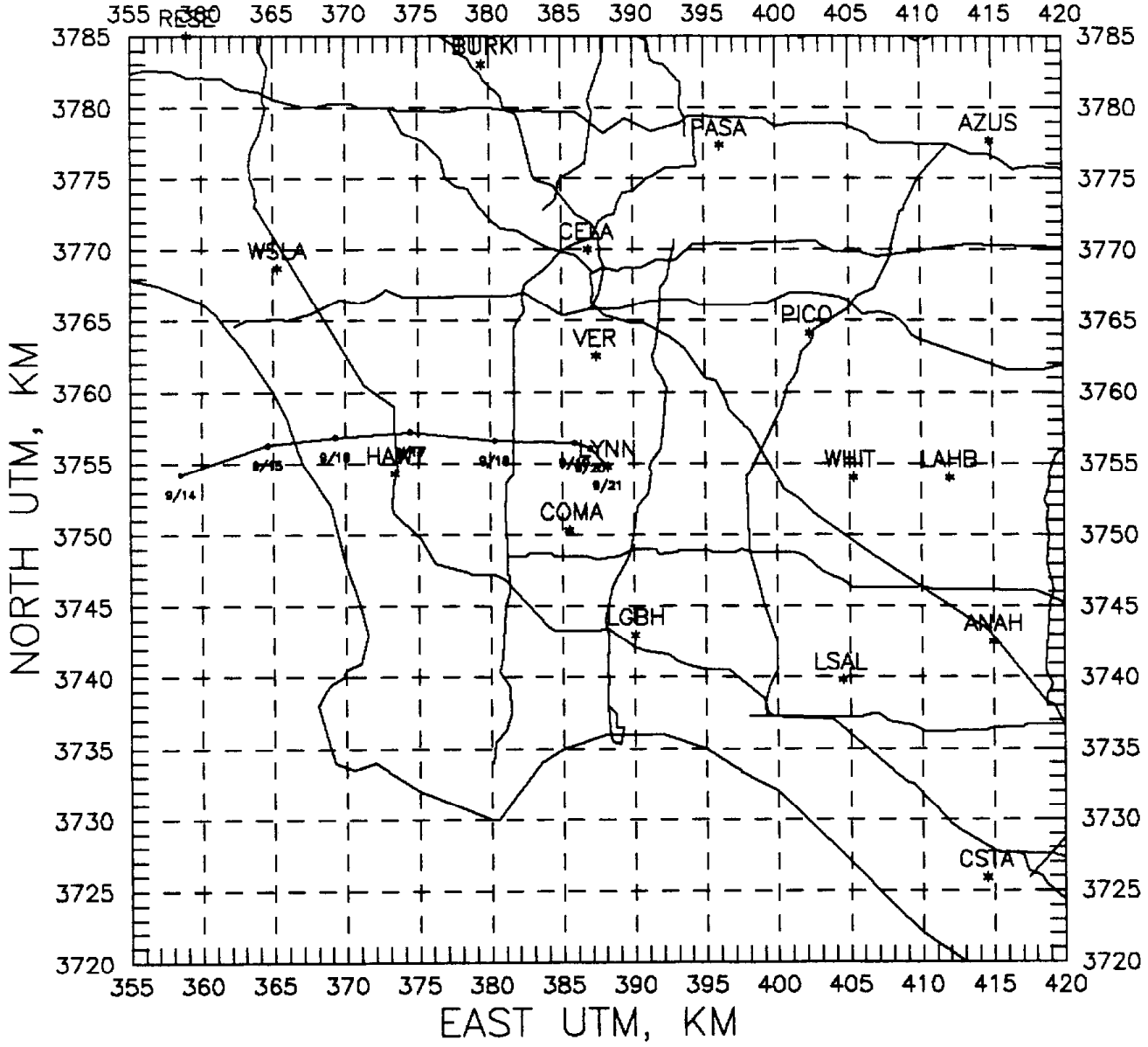
TRAJECTORY – ARRIVE LYNN – 0109/19



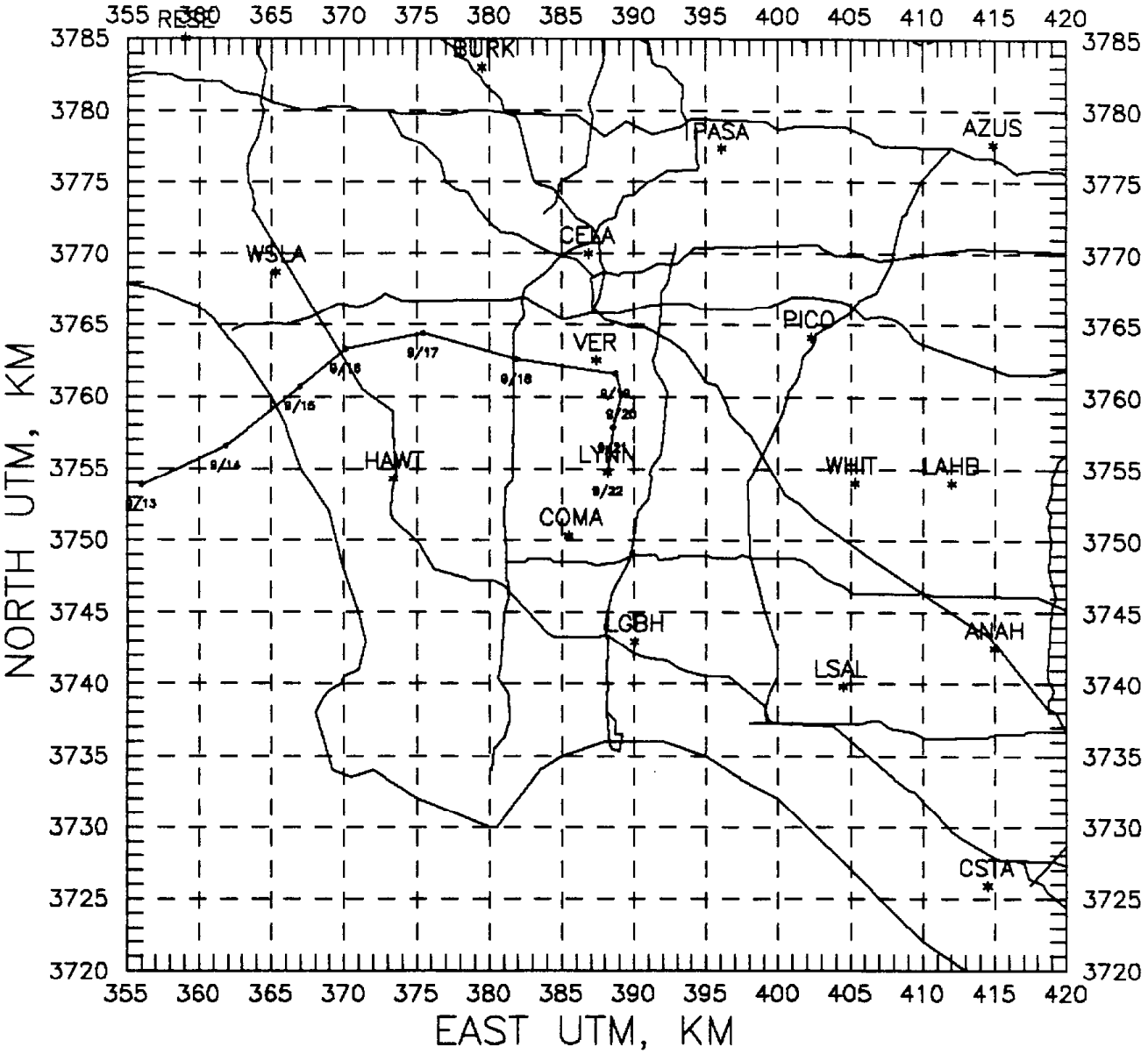
TRAJECTORY – ARRIVE LYNN – 0109/20



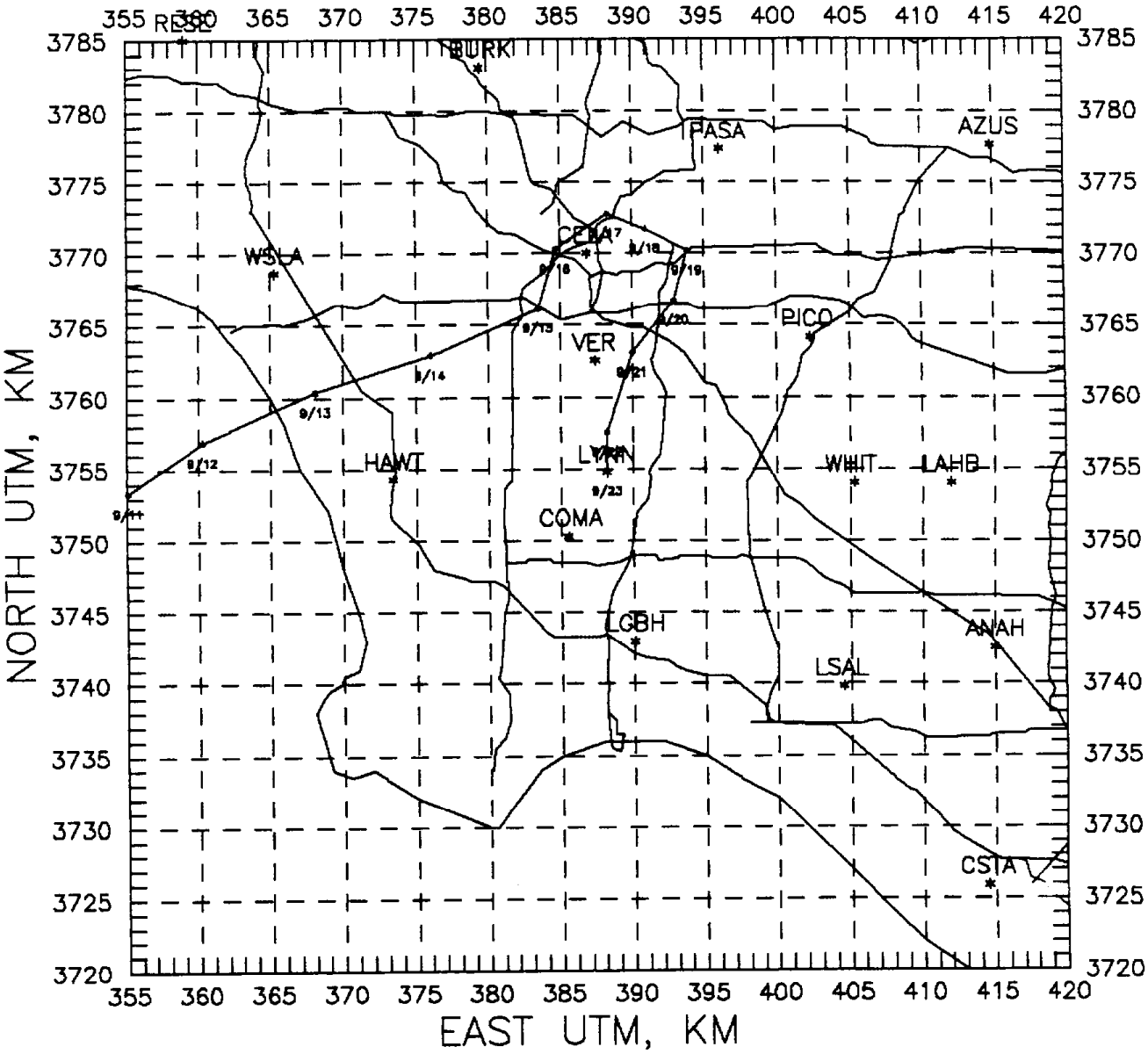
TRAJECTORY – ARRIVE LYNN – 0109/21



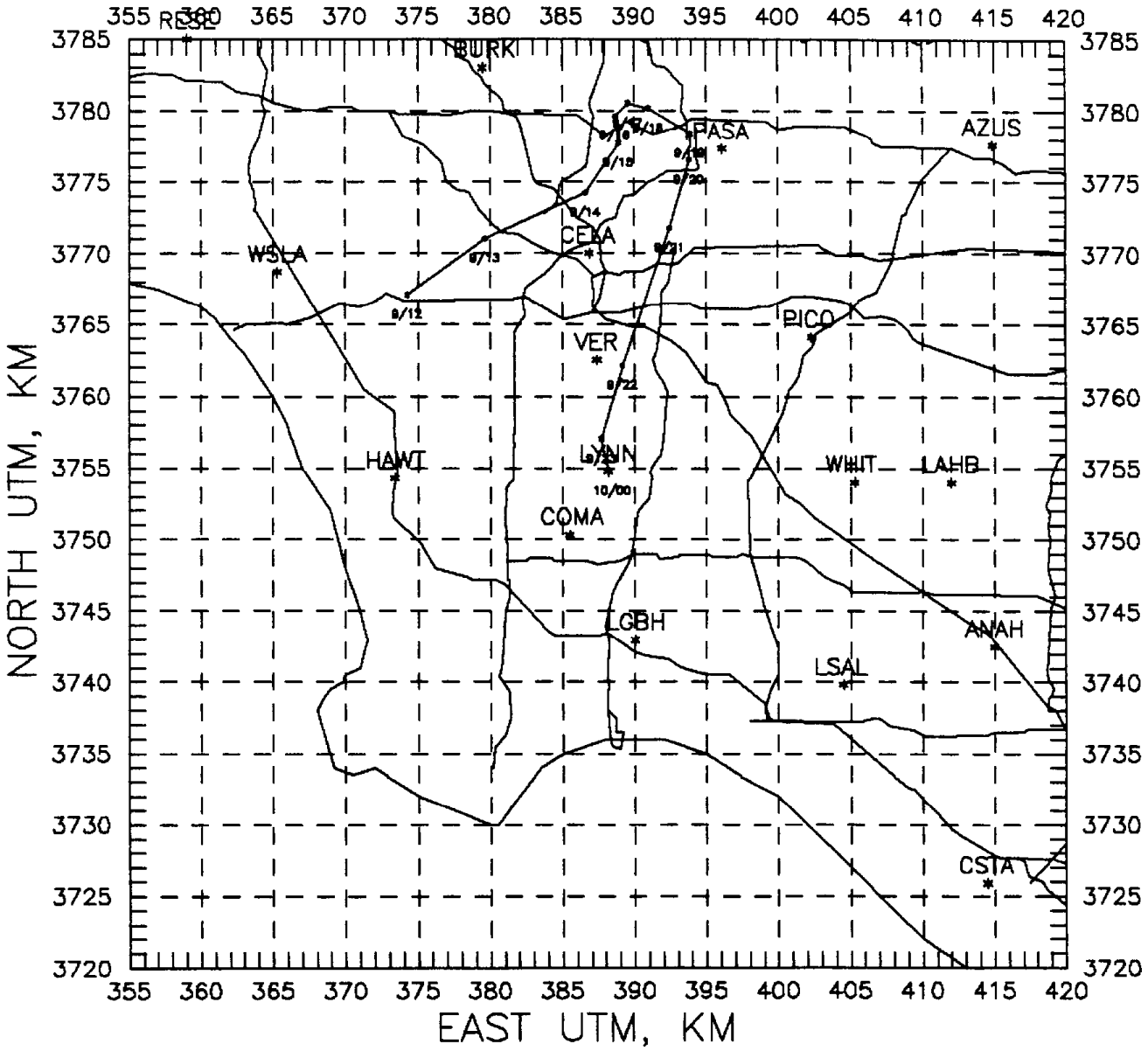
TRAJECTORY – ARRIVE LYNN – 0109/22



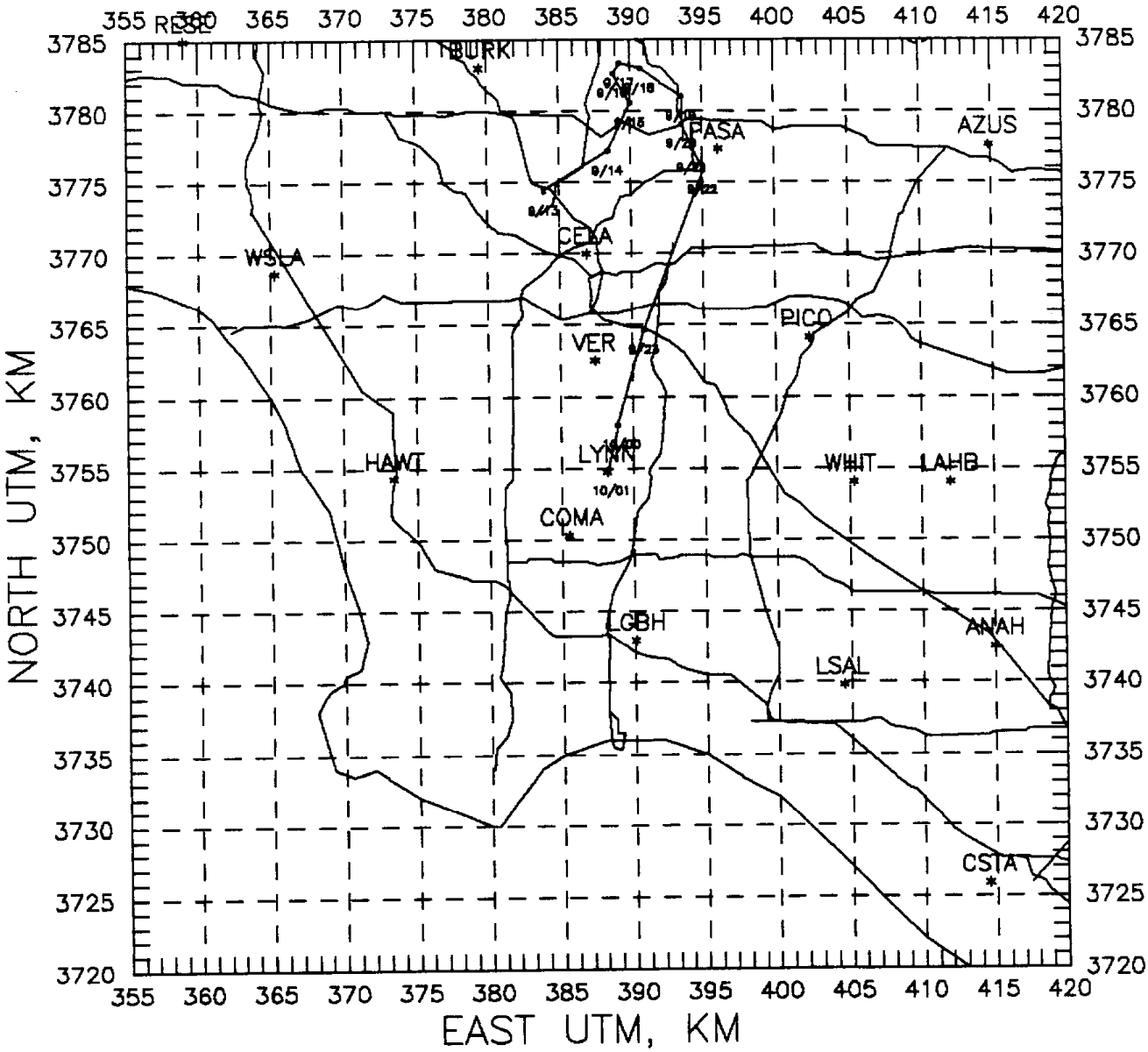
TRAJECTORY – ARRIVE LYNN – 0109/23



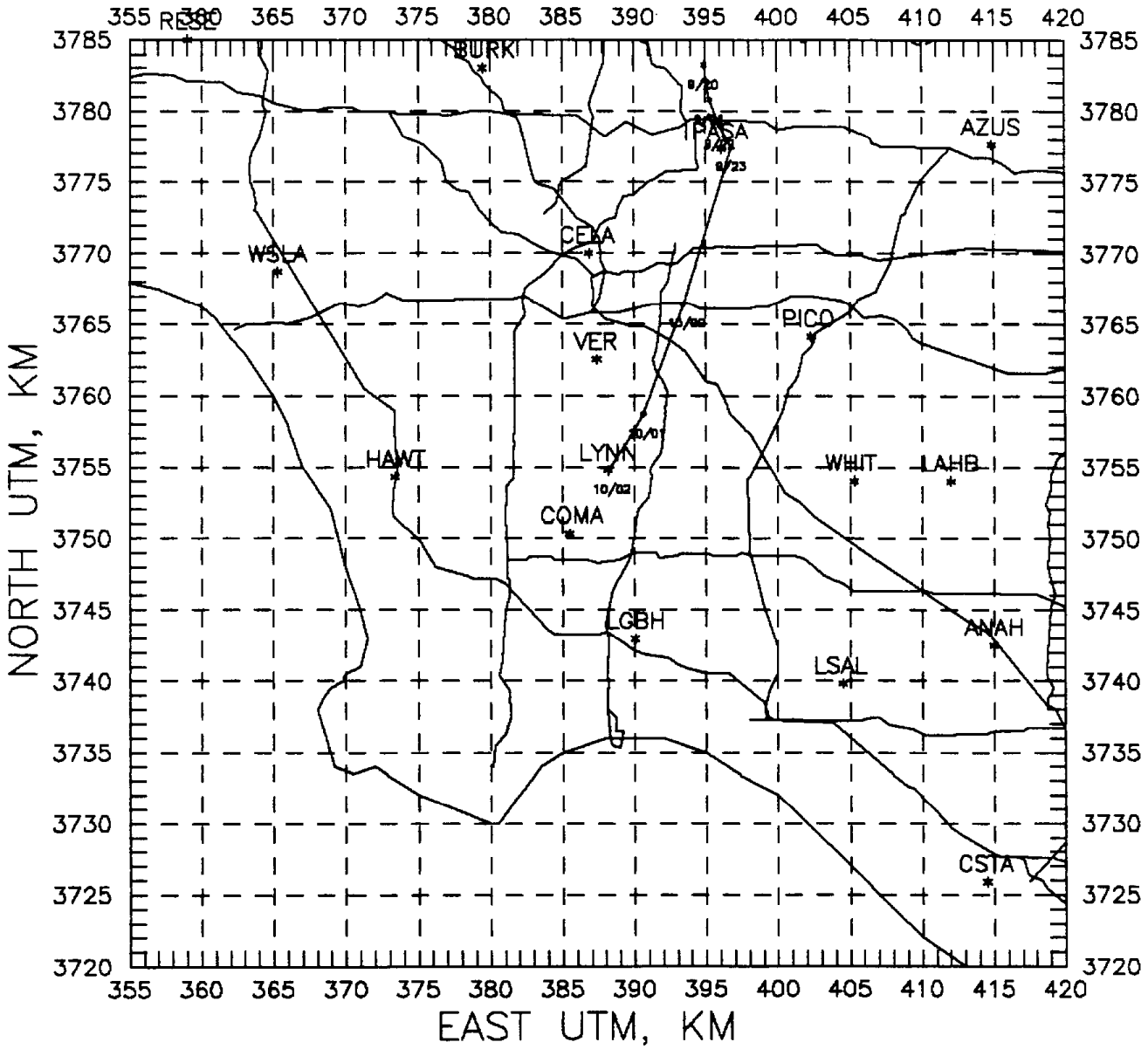
TRAJECTORY – ARRIVE LYNN – 0110/00



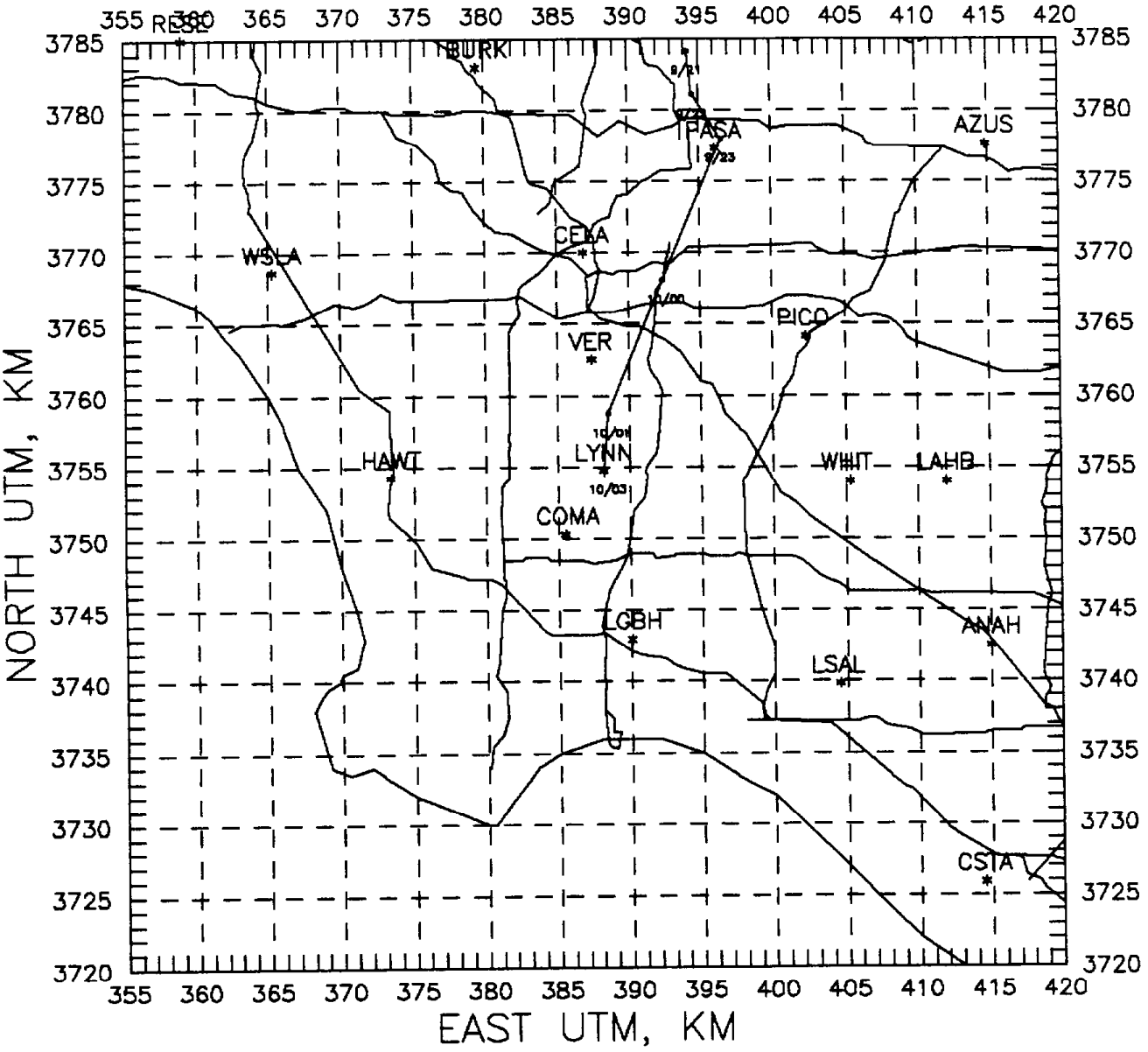
TRAJECTORY – ARRIVE LYNN – 0110/01



TRAJECTORY – ARRIVE LYNN – 0110/02

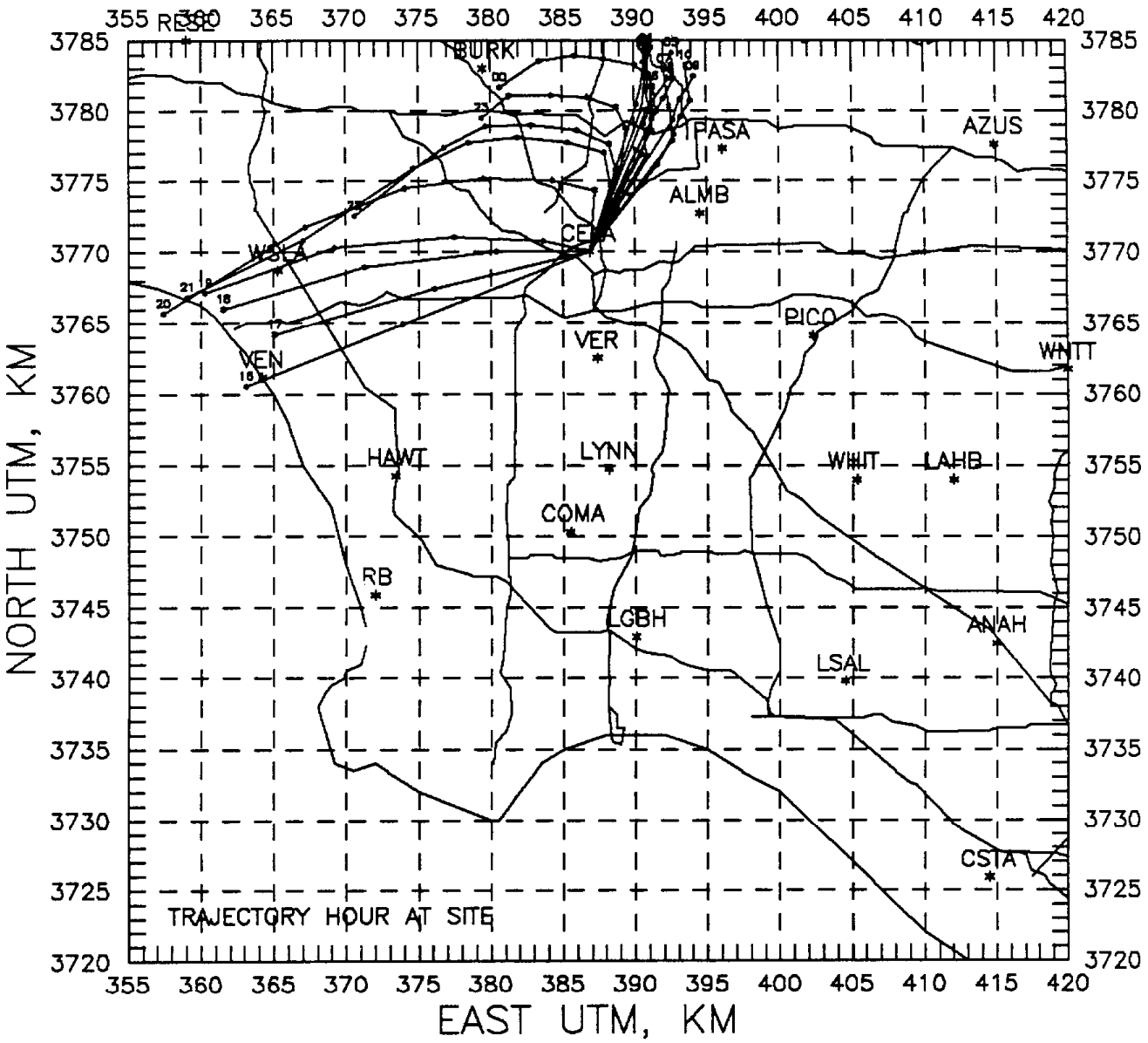


TRAJECTORY – ARRIVE LYNN – 0110/03

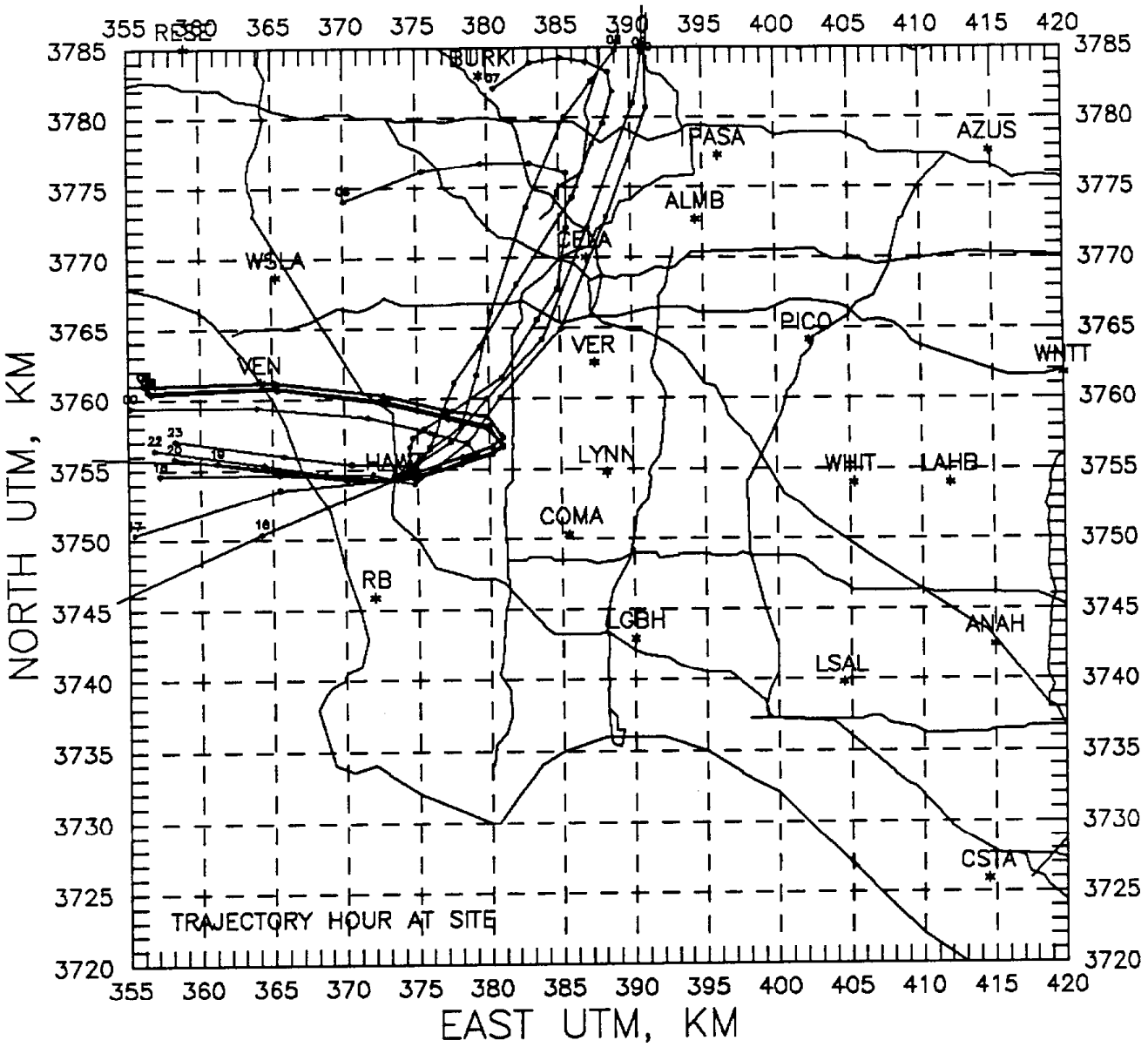


Trajectories of Air Arriving at CELA, HAWT, LGBH for December, 1989

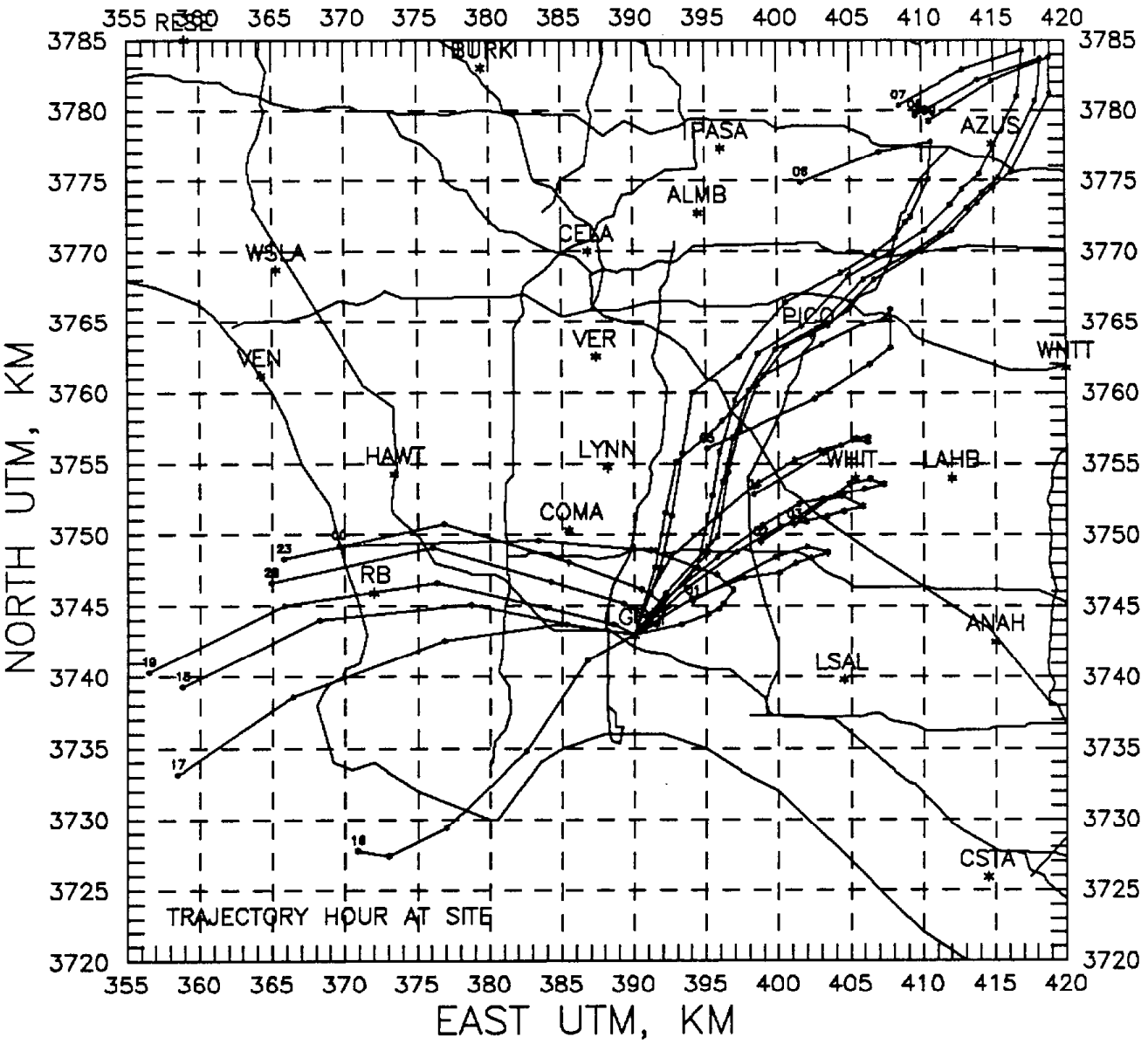
BACKWARD TRAJECTORY TO CENTRAL LA — DEC



BACKWARD TRAJECTORY TO HAWTHORNE – DEC

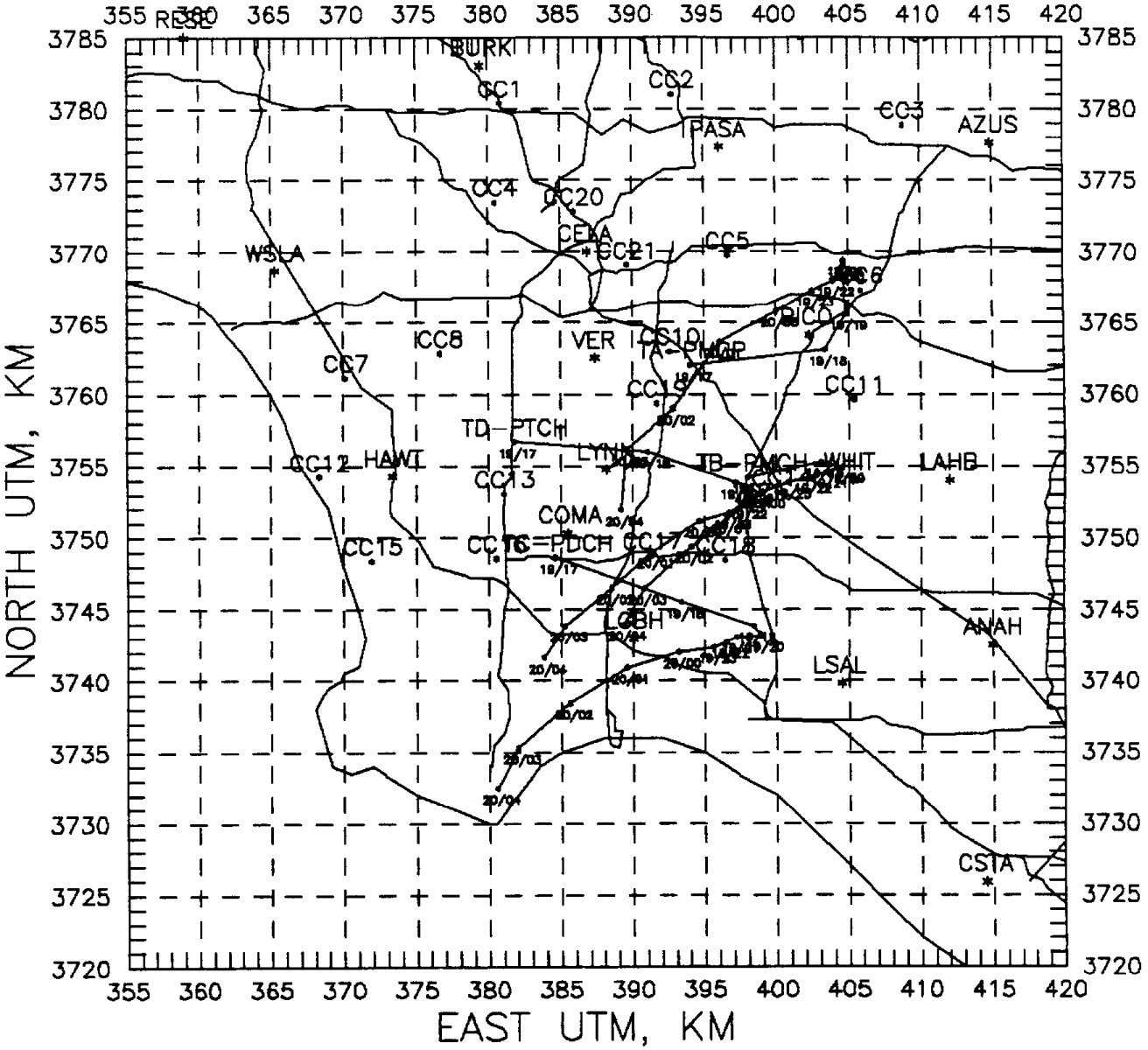


BACKWARD TRAJECTORY TO LONG BEACH — DEC

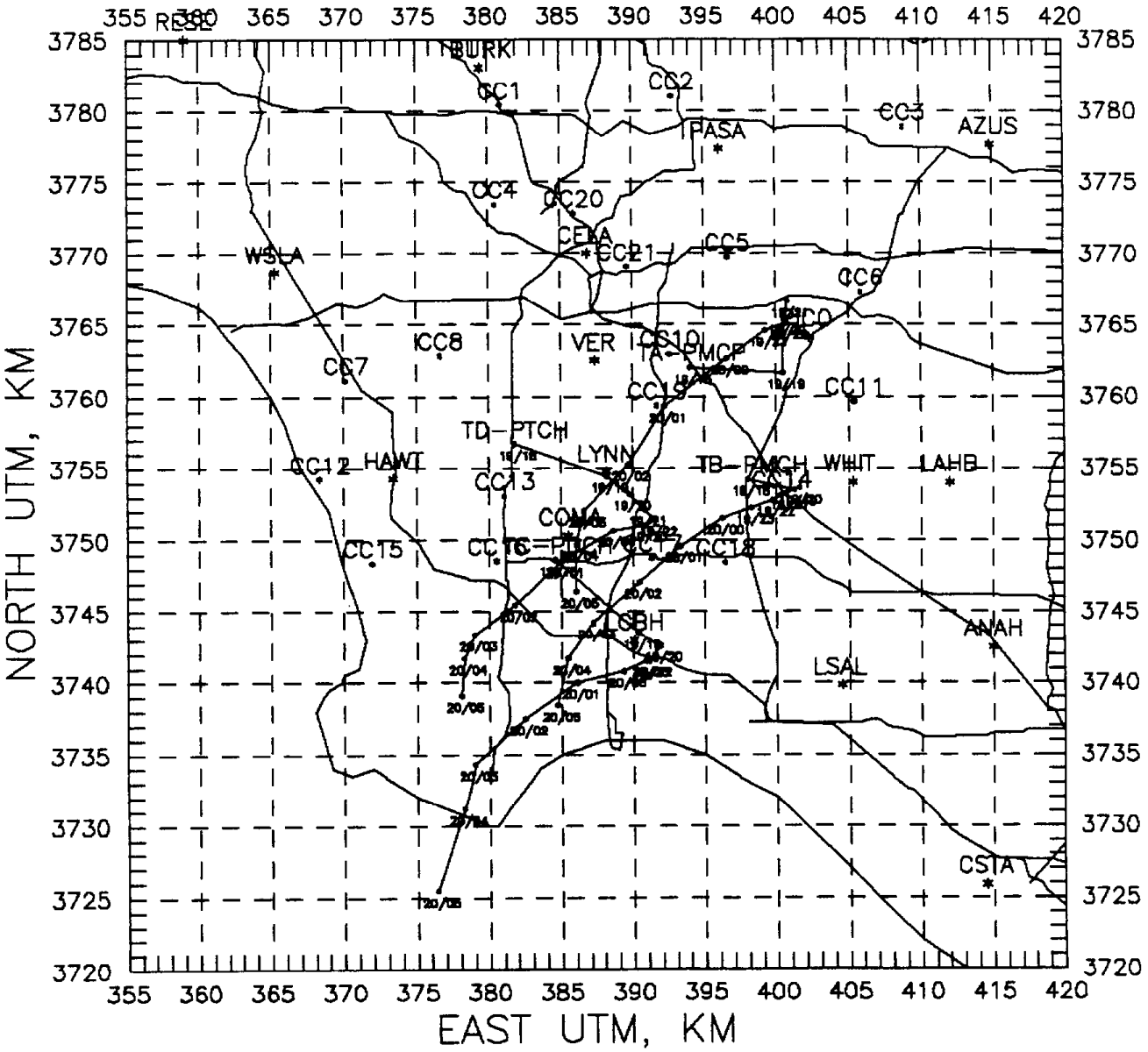


Trajectories of Tracer Releases for December 1989

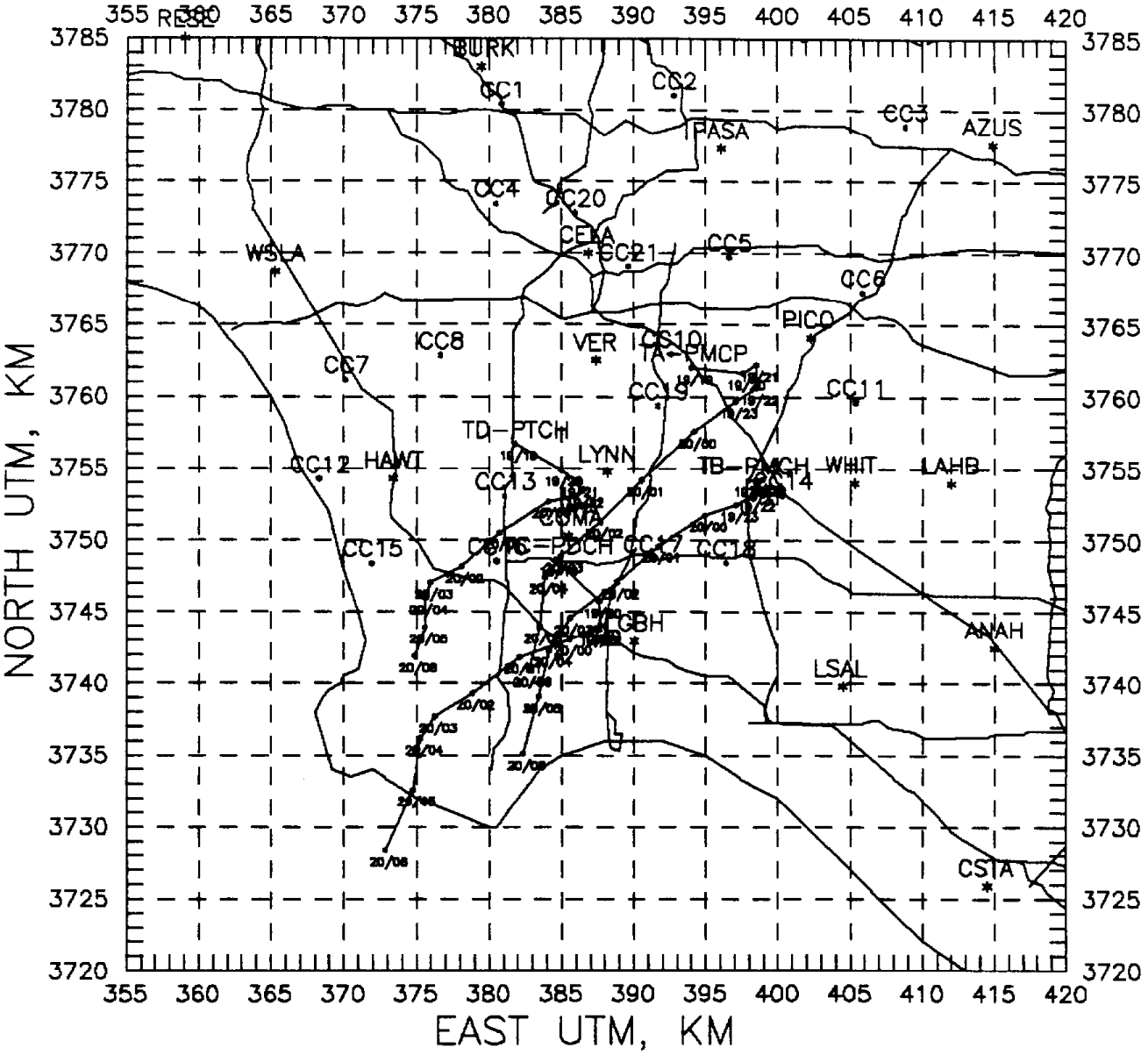
TRACER RELEASE 1219/1700



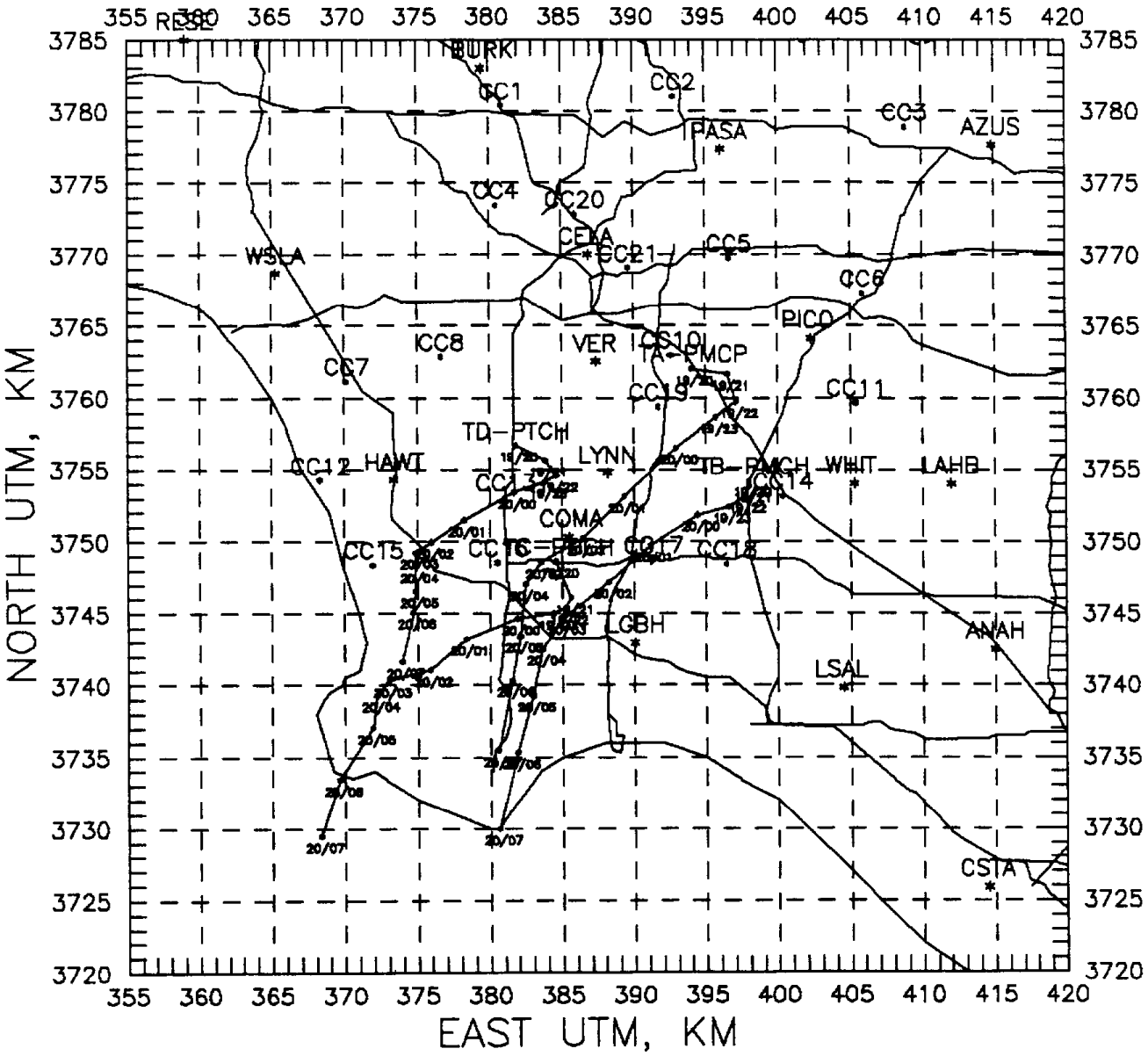
TRACER RELEASE 1219/1800



TRACER RELEASE 1219/1900



TRACER RELEASE 1219/2000



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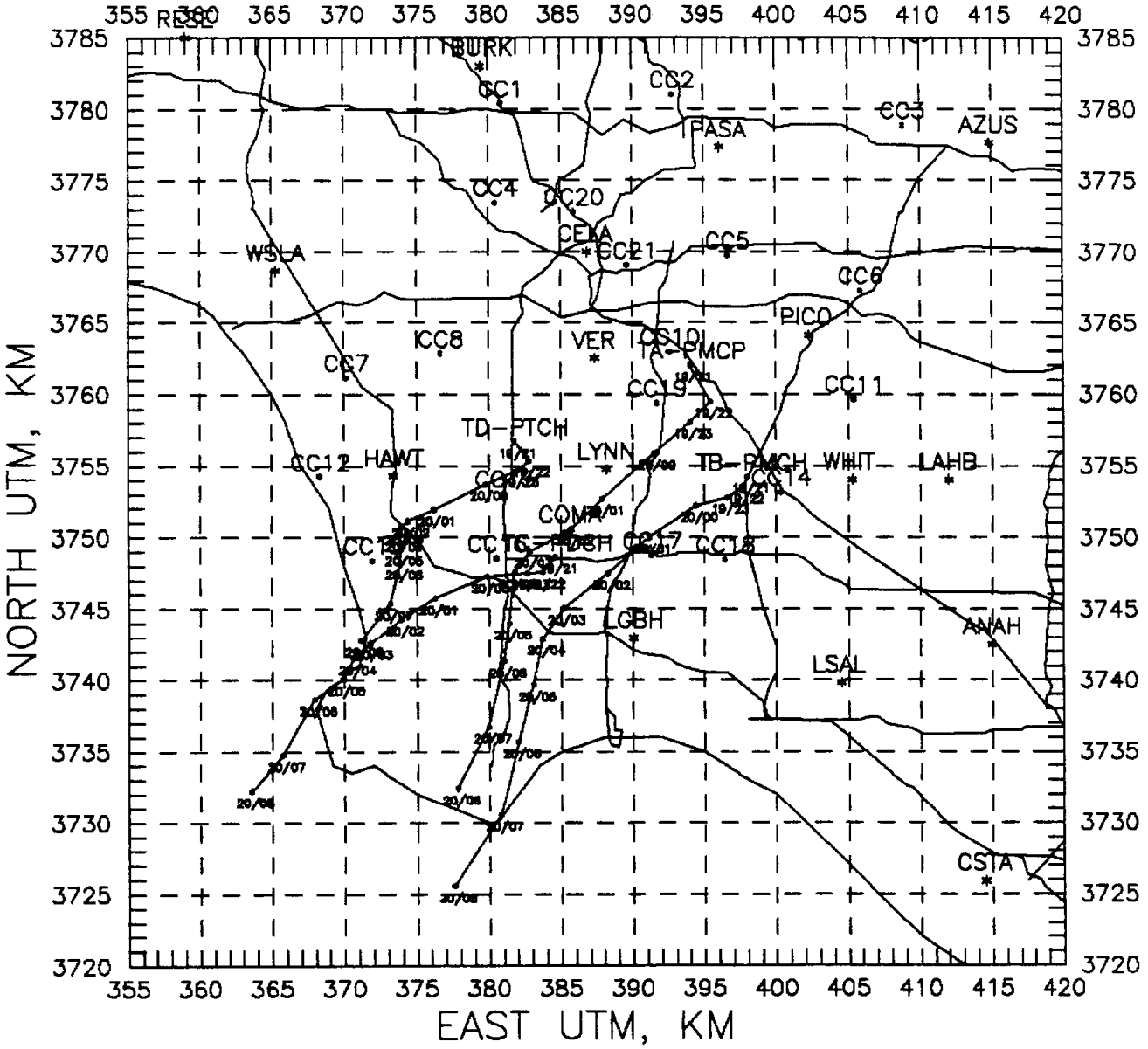

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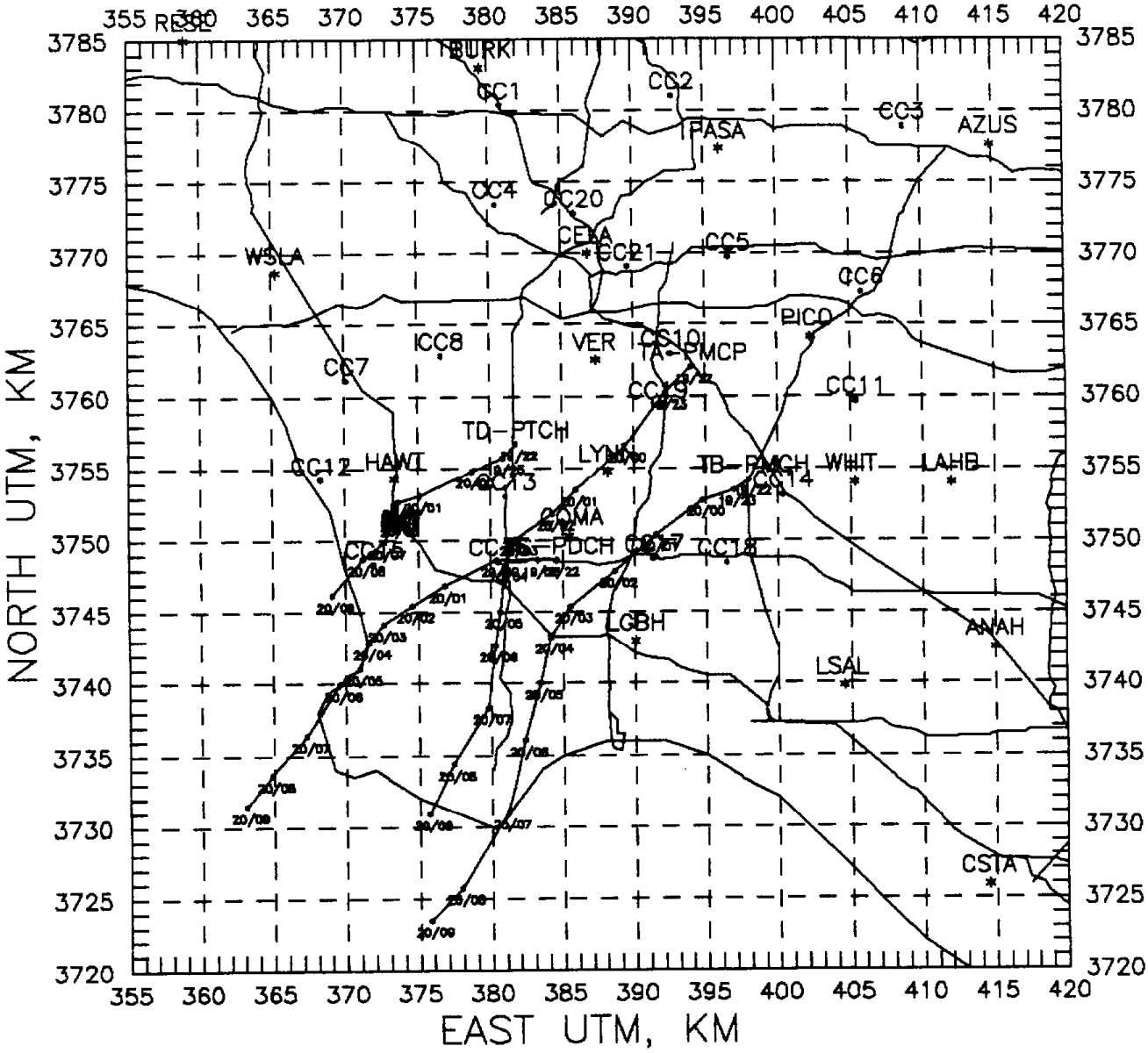

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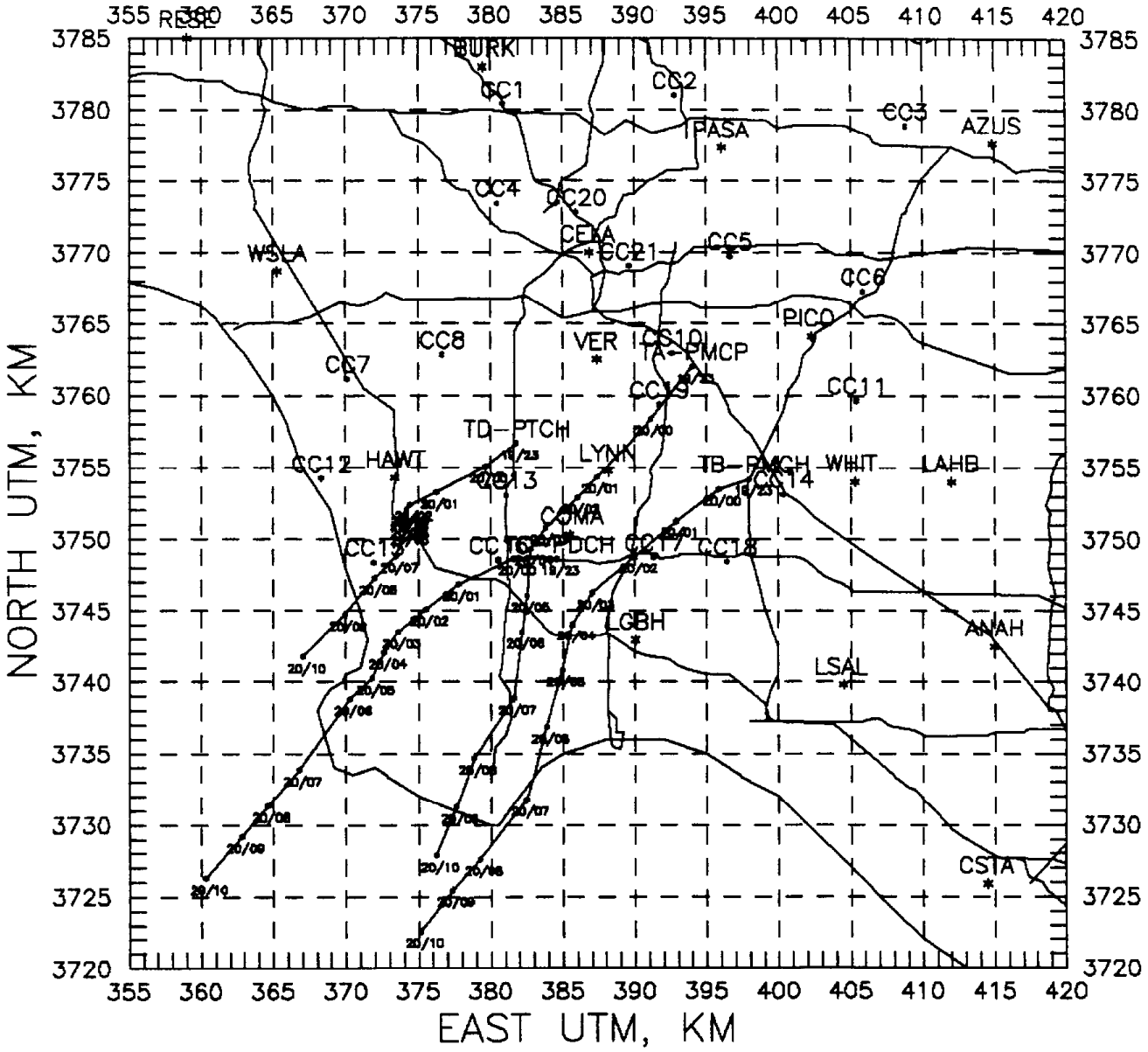

Trajectories of Tracer Releases for January 1990

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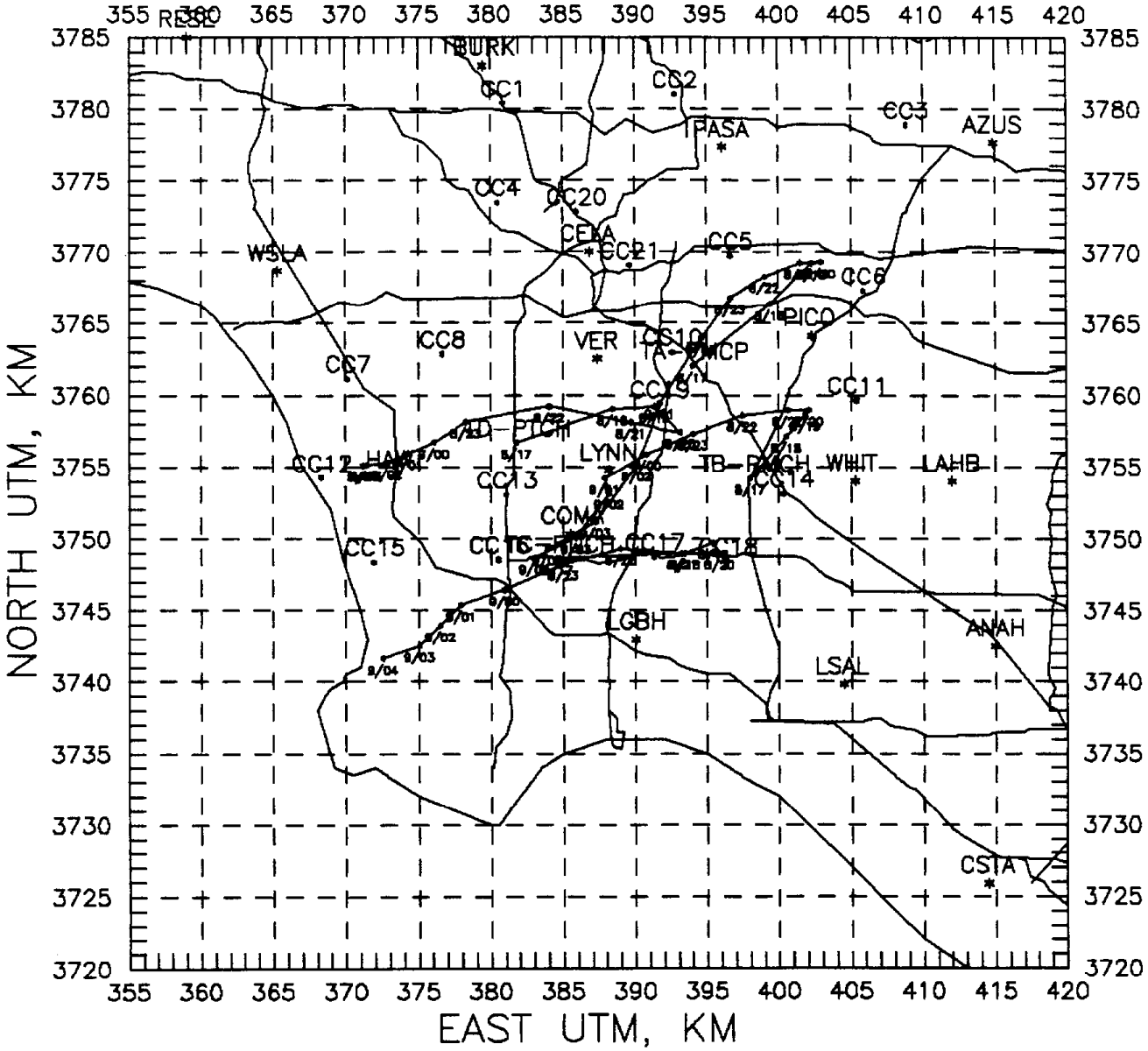

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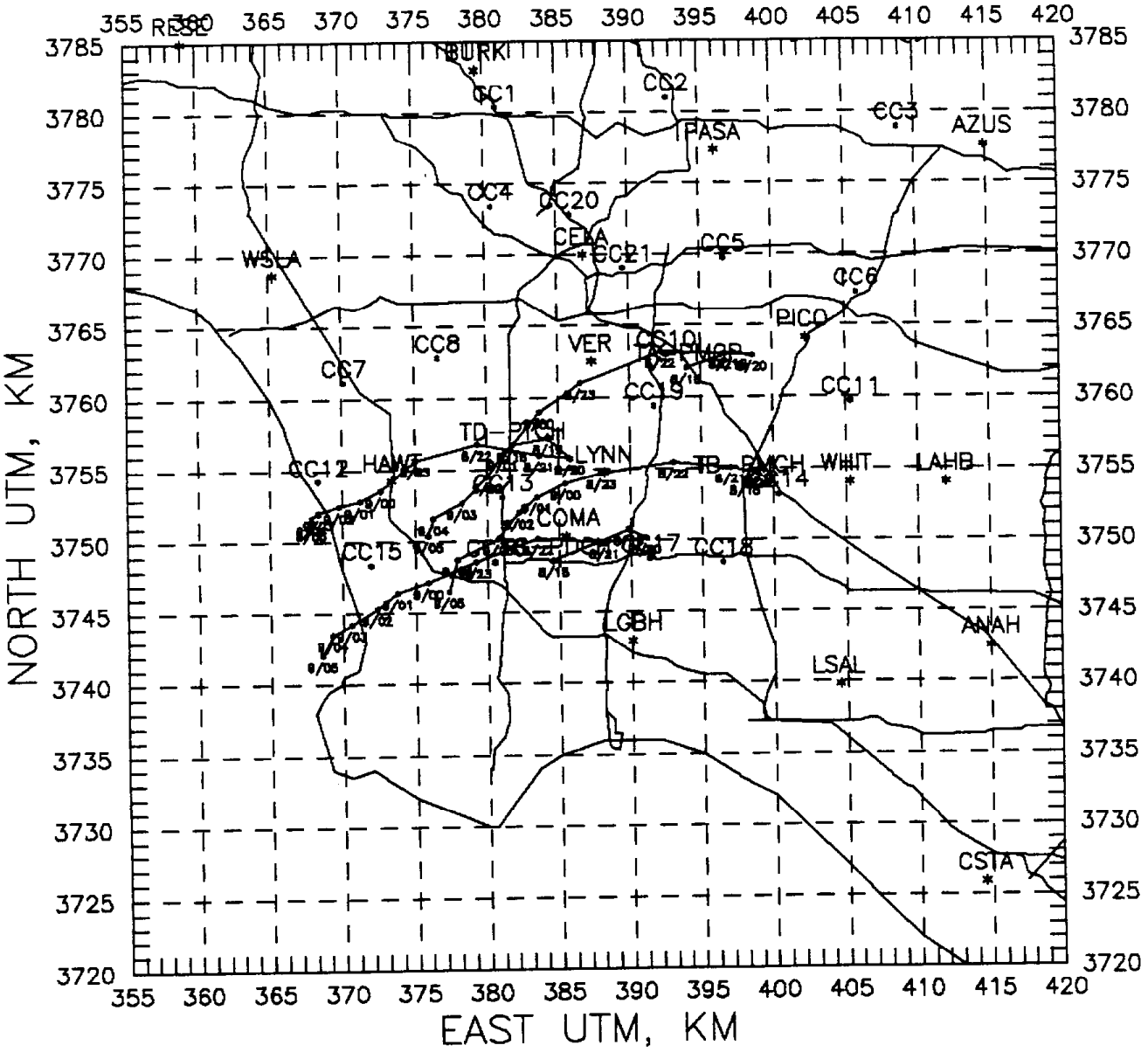

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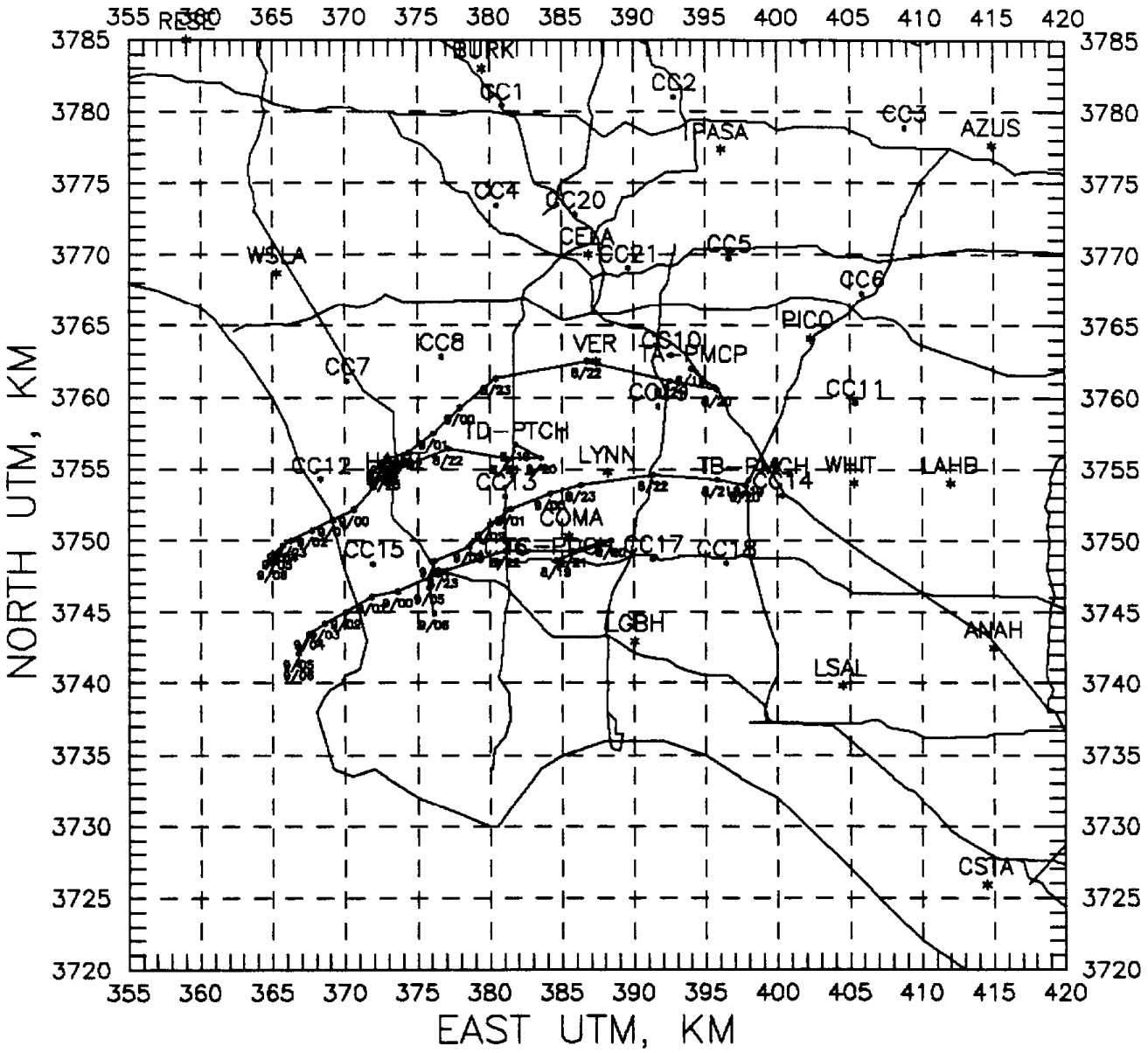

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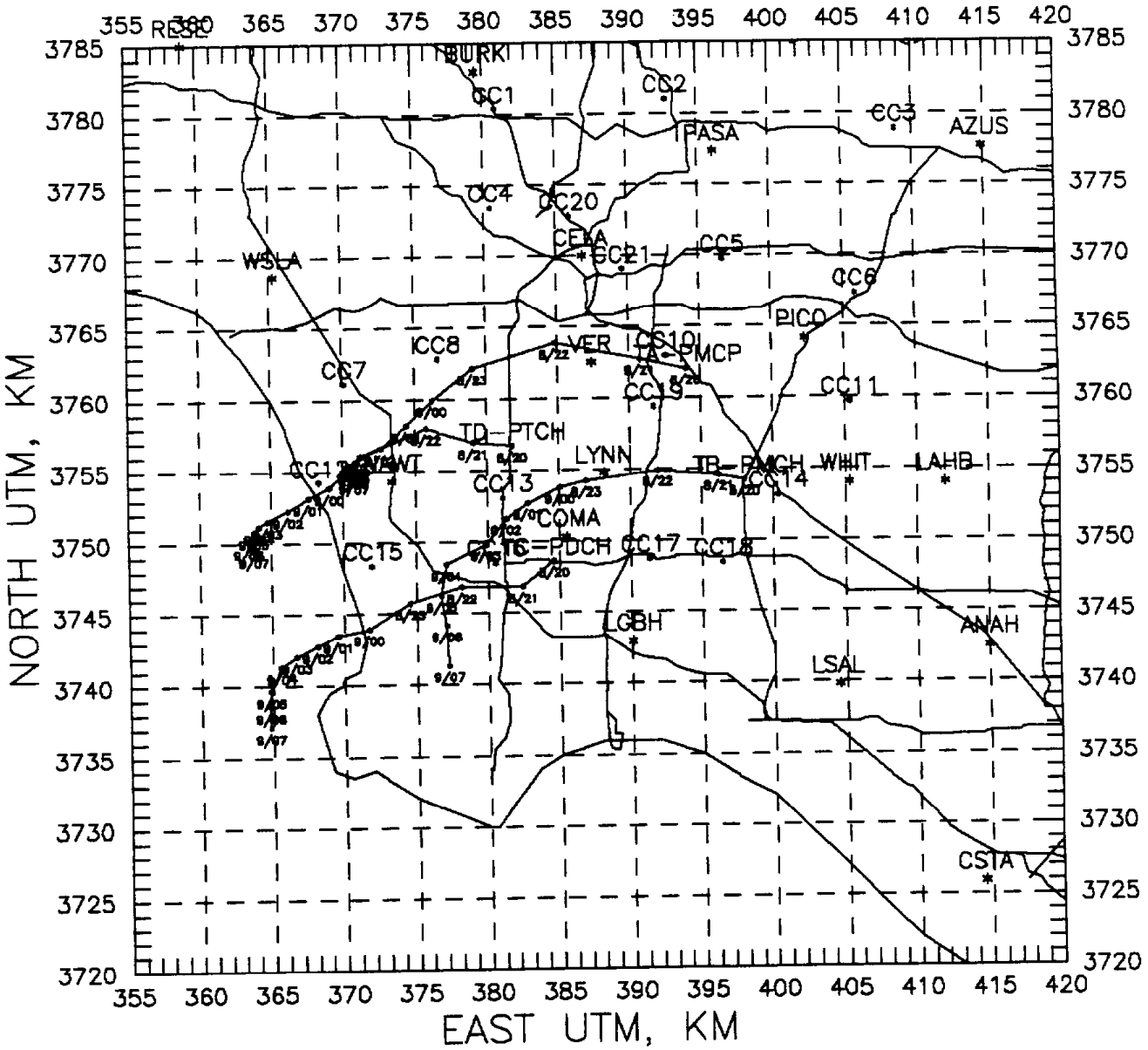

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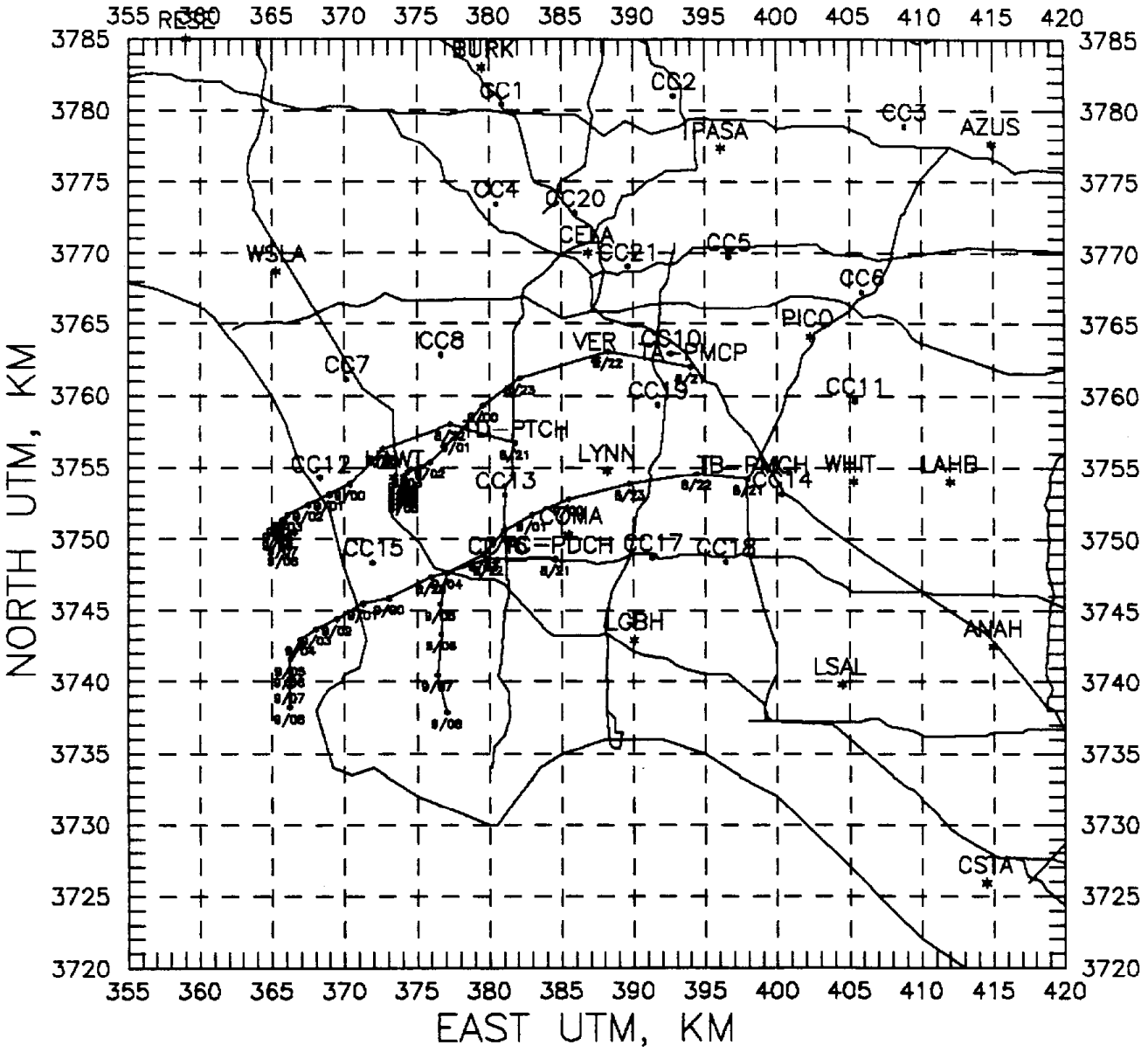

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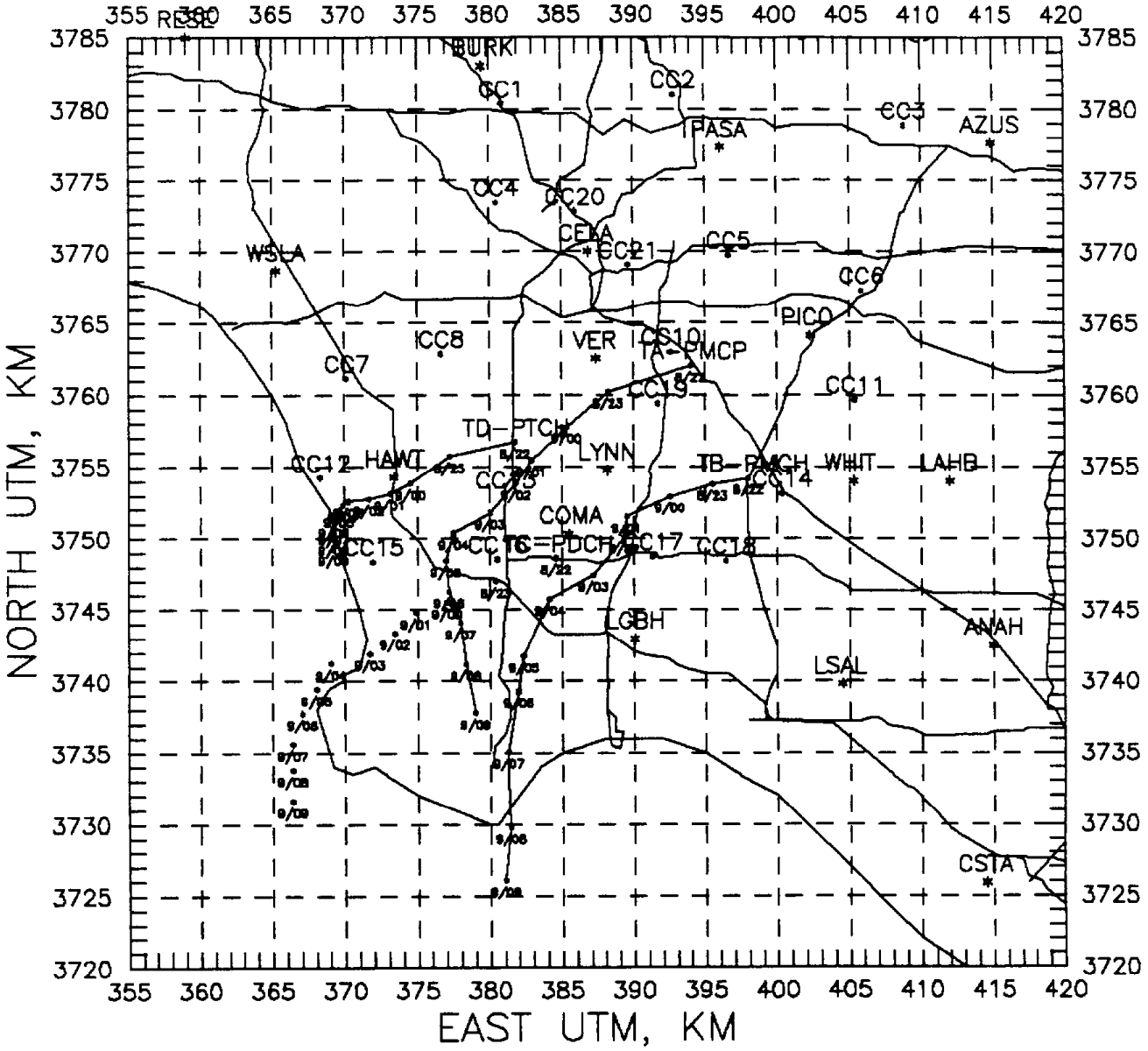

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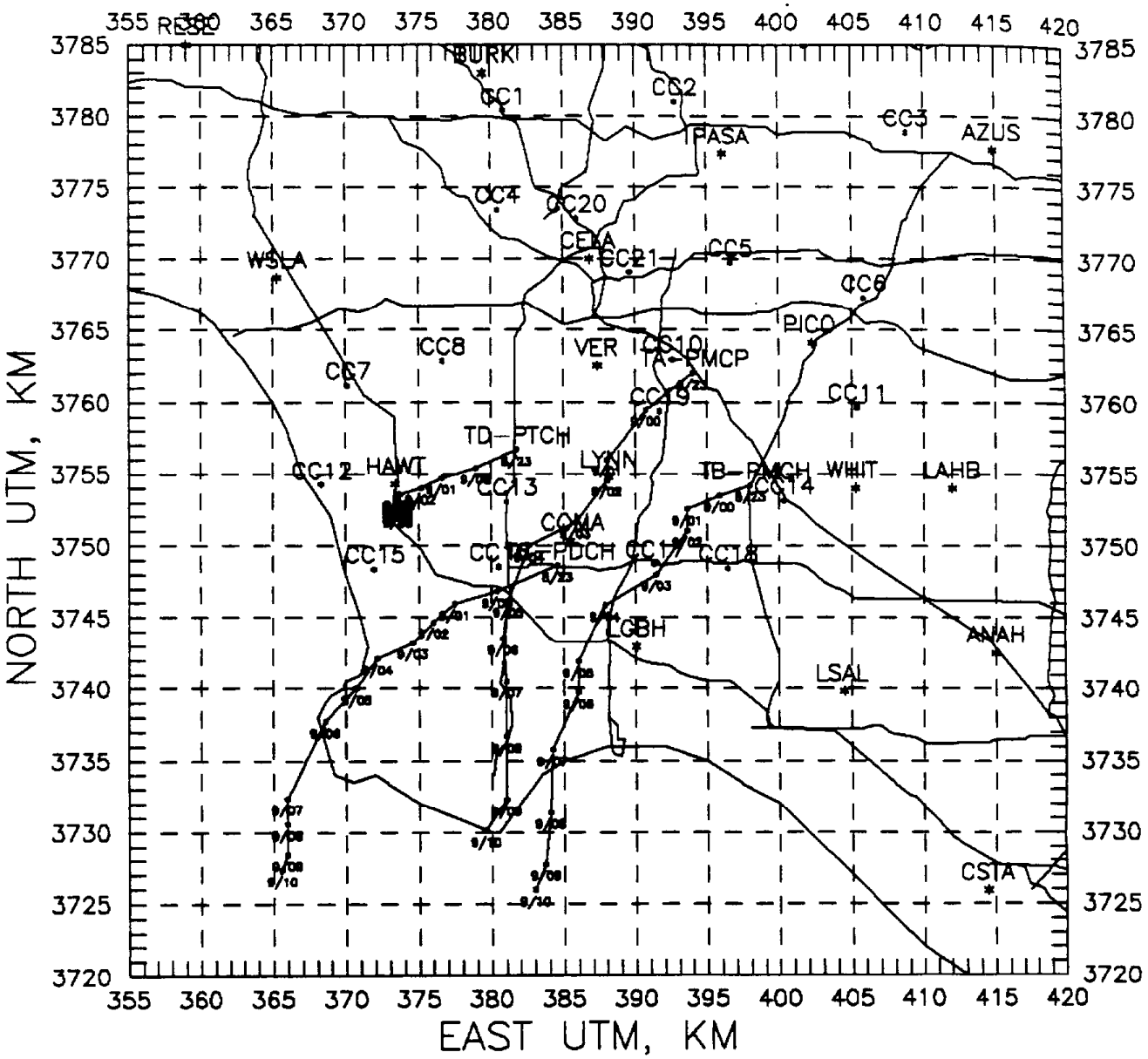

APPENDIX D

One- and Two-Hour Average Data Sets for Empirical Orthogonal Function Analysis

One-Hour Average Data Set

One Hour Data Set

YR	MON	DAY	HR	LYNN	LGBH	CELA	HAWT	WHIT	PICO	HS02	HS03	HS05	HS06	HS08	HS09	HS10	HS12
89	12	19	12	2	2	1	1	1	1	2.88		3			12.63	8	7.38
89	12	19	13	2	2		1	1	1	2.5		2.63			8	6.88	10
89	12	19	14	2	2	0	1	1	1	2.88		2.88			6.38	6.25	
89	12	19	15		3	1	0	2	1	3.38		3.38			5.63	7	8.25
89	12	19	16		4	1	1	3	2	3.5		3.38			5.25	8.88	
89	12	19	17	3	4	1	1	3	2	4		3.63			6.63	13.5	12.5
89	12	19	18	4	3	1	1	3	3	7					14.5	14.25	16.75
89	12	19	19	6	2	2	1	5	4	8		8.5			15.25	7	20.63
89	12	19	20	9	3	3	1	6	3	9.88		10.13			7.63	4.75	9.25
89	12	19	21	13	4	5	1	5	3	11.88		12.75			7.13	3.63	5.5
89	12	19	22	14	5	3	3	4	4	14.75		14.13			4	2.5	4.38
89	12	19	23	16	6	4	7	3	6	14.13		14			3.25	2.13	3.63
89	12	20	0	12	7	3	7	3	6			10.63			7.63	2.25	7.25
89	12	20	1	8	7	4	7	3	7	7.13		8.13			4.13	2.13	2
89	12	20	2	7	6	3	7	2	6	6.38		7			2	2.38	2
89	12	20	3	5	7	2	6	2	5	5.38		6.25			2.88	2.75	2.13
89	12	20	4							6.25		6.25			3.75	3.88	2.25
89	12	20	5	7	6	3	6	4	5	8		8.75				5.75	2.75
89	12	20	6	10	7	5	8	6	6	11.13		13			4.25	8.13	3.63
89	12	20	7	13	9	6	10	7	8	11.63		12.25				10.13	6.5
89	12	20	8	7	9	5	8	6	7	6.63		7			8.75	11.5	8.63
89	12	20	9	5	8	4	6	6	4	4.75		5.25				10.25	10
89	12	20	10	3	6	3	5	6	2	3.75		4.75				10.25	11.88
89	12	20	11	3	5	2	3	5	2	3.5		4			16.38	9.13	12.25
90	1	8	12	5	5	3	1	2	3								
90	1	8	13	3	4	3	1	3	3								
90	1	8	14	3	3	2	0	3	3	3.5	4	3	3	4.25		16	8.25
90	1	8	15	3	2	2	0	2	2	3.75	3.25	2.63	2.5	4		22.25	13
90	1	8	16	3	2	1	0	3	3	5	3.63	4.18	2.75	5.5		18.75	
90	1	8	17	4	4	1	1	3	4	4	5.38	3.38	3.5	4.38		9.13	16.88
90	1	8	18	4	3	2	3	5	4	4.1	4.63	2.8	4.13	4.38		5	17.13
90	1	8	19	7	4	3	3	5	5	6.75	7.38	7.5	7.25	9		4.13	
90	1	8	20	10	5	6	6	6	4	9.5	10	9.63	8.93	11.63		4.63	
90	1	8	21	7	6	6	7	6	5	7	6.88		7.3	8.75		4.5	
90	1	8	22	6	5	6	7	6	6		6.38	6.88	6.63	8.75		5.25	
90	1	8	23	7	5	7	7	6	8	7.5	7.13	7.5	7.38	8.25		5.25	
90	1	9	0	7	6	7	7	5	8	5.63	7.25	7.45	7.38	8			2.25
90	1	9	1	8	6	5	7	4	6			10.75	8.13	8.75		7.13	1.63
90	1	9	2	8	6	5	7	3	6	7.9	7.63	7.38	7.5	8.13		5.88	2.75
90	1	9	3	7	6	4	7	3	7	7.5	7.5	7.13	7.5			5.88	
90	1	9	4							8.38		7.38	7.8	7.38		5.88	4.38

One Hour Data Set

90	1	9	5	11	6	4	8	6	5	12.13	11.13	10.25		11.25	6.75	6.88
90	1	9	6	18	8	6	13	8	6	14.18	15.75	15	15.45	19.38	6.88	8.5
90	1	9	7	21	8	6	14	11	9	20.43	16.63		20.7	25		8.13
90	1	9	8	23	10	5	19	10	9	11.88	20.13	16.68	21.5	21.88	6.88	6.5
90	1	9	9	16	10	6	11	5	7	5.5	14.38	14.38	15	17.88		6.63
90	1	9	10	11	8	3	7	4	3	6.13	6	5.63	5.55	7.88	7.38	7.25
90	1	9	11	4	7	3	6	4	3	4	4.75	3.75	4.75	4.75		7.38
90	1	9	12	4	9	2	3	3	3	4.75	5.5	4.38	5.38	5.38		
90	1	9	13	5	8	2	2	3	4		6	4.88	3	5.63	10	7.5
90	1	9	14	5	6	4	2	2	3							
90	1	9	15	5	6	5	2	4	4							
90	1	9	16	6	6	5	2	5	5	7.5	8.38	7.33		8.5	6.5	7.5
90	1	9	17	7	7	8	2	7	7	7.25	9.25	7.5	8	7.75	12.05	6.05
90	1	9	18	7	5	9	1	11	9	10.75	13	10.25	9.95	10.25	9.25	4.5
90	1	9	19	8	4	12	1	12	8	12.25	13.75	12.75	13.5	13.13	7.88	3.63
90	1	9	20	10	3	13	2	10	8	13.63	15.63	15.63	14.5	16	4.13	3.25
90	1	9	21	14	5	13	4	9	11	16.25	15	15.13	14.75	16.18	3.88	3.38
90	1	9	22	15	5	11	6	8	13	14.3	15.38	14	14.13	16.13	3.25	3.63
90	1	9	23	17	8	8	7	8	12	16.25	11	14.88	15	15.63	3.75	3.5
90	1	10	0	16	9	5	9	7	7	13.75	12.25	12.75	13.5	13.5	3.5	4.38
90	1	10	1	16	10	5	11	7	5	12.38	7.18	11.88	12	11.88	3.88	5.13
90	1	10	2	14	9	3	11	5	4	9.13	6.88	7.88	7.75	8.13		6
90	1	10	3	12	7	2	10	3	3			9.9	10.9	10		5.1

Two-Hour Average Data Set

Two Hour Data Set

YEAR	MON	DAY	HR	CC05	CC06	CC08	CC10	CC12	CC13	CC14	CC16	CC17	CC18	CC19	CC20	CC21	HS01	HS02	HS03	HS05	HS06
89	12	19	12	-99	-99	1.63	1.88	1.88	1.63	2.75	1.88	11.13	1.5	1.63	2.5	-99	3.25	2.69	-99	2.815	-99
89	12	19	14	-99	-99	1.56	2	1.25	1.68	4.63	1.75	9.88	1.75	2	-99	-99	2.63	3.13	-99	3.13	-99
89	12	19	16	-99	-99	1.63	2.5	1.31	1.88	8.63	1.8	10	3	3.13	2.75	-99	2.75	3.75	-99	3.505	-99
89	12	19	18	-99	-99	2.13	3	1.38	2	7.13	3.2	12.75	3.63	4.63	3.88	-99	-99	7.5	-99	-99	-99
89	12	19	20	-99	-99	2.06	4.75	1.63	1.88	9.13	4.63	10.38	6	7.38	6.13	-99	-99	10.88	-99	11.44	-99
89	12	19	22	-99	-99	3.75	7.5	1.58	1.83	7.25	6.75	4.33	7.88	10	5	-99	-99	14.44	-99	14.065	-99
89	12	20	0	-99	-99	5.13	5	4	1.75	-99	8.68	2.88	7.38	-99	5	-99	-99	-99	-99	9.38	-99
89	12	20	2	-99	-99	4.13	3.63	7.13	2.5	-99	8.55	-99	7.38	-99	4.25	-99	-99	5.88	-99	6.625	-99
89	12	20	4	-99	-99	3.5	3.63	5.75	1.75	-99	9.63	-99	6.75	-99	4.63	-99	-99	7.125	-99	7.5	-99
89	12	20	6	-99	-99	4.75	4.75	7.88	1.83	-99	10.25	-99	9.25	6.38	7.63	-99	-99	11.38	-99	12.625	-99
89	12	20	8	-99	-99	7.56	4	8.38	1.83	-99	6.8	-99	9.38	4.5	6	-99	-99	5.69	-99	6.125	-99
89	12	20	10	-99	-99	4.31	2.38	4.45	1.88	-99	4.13	-99	4.88	3	3.5	-99	-99	3.625	-99	4.375	-99
90	1	8	12	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
90	1	8	14	-99	3.5	1.4	2.5	-99	2.75	3.38	2.3	2.08	2.75	2.75	-99	4.13	2.63	3.625	3.625	2.815	2.75
90	1	8	16	3.58	3.18	2.13	2.88	-99	2.88	3.88	1.75	1.58	2.38	2.5	-99	3.93	3.25	4.5	4.505	3.78	3.125
90	1	8	18	5.25	4.68	2.05	3.25	-99	4.33	4.55	3.58	2.5	3.63	5.15	-99	5.38	5.63	5.425	6.005	5.15	5.69
90	1	8	20	8.75	6.3	2.83	5.5	-99	7.25	4.75	5.7	3.43	5	6.88	-99	5.88	8.75	8.25	8.44	-99	8.115
90	1	8	22	7.7	7.2	6.33	6.63	-99	7.75	6.13	7.38	6.25	5.88	7	-99	7.25	7.38	-99	6.755	7.19	7.005
90	1	9	0	6.75	7.38	5.75	6.13	-99	7.5	7	6.63	6.95	6.75	8.25	-99	5.45	7.63	-99	-99	9.1	7.755
90	1	9	2	7	-99	6.75	5.38	-99	7.5	7.3	6.63	6.5	7.5	7.38	-99	5	7.75	7.7	7.565	7.255	7.5
90	1	9	4	4.38	4.93	6.25	4.5	-99	7.75	7.68	7.75	7.38	7.63	6.88	-99	4.3	8.75	10.255	-99	8.815	-99
90	1	9	6	-99	5.65	5.58	9.38	-99	10.88	10.38	12.05	7.1	9.38	12.75	-99	9.08	18.55	17.305	16.19	-99	18.075
90	1	9	8	-99	7.13	7.75	8.13	-99	11.25	5.7	12.88	7.43	10.13	9.5	-99	8.5	15.63	8.69	17.255	15.53	18.25
90	1	9	10	4.7	-99	7.13	3.13	-99	7.13	4.25	7.75	7.75	6.88	3.75	-99	3.55	5	5.065	5.375	4.69	5.15
90	1	9	12	2.75	3.38	3.8	3.13	-99	4.75	6.3	-99	8.5	4.25	3.63	-99	3.55	5	-99	5.75	4.63	4.19
90	1	9	14	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
90	1	9	16	-99	-99	3	6.25	-99	4.7	-99	3.5	-99	-99	6.5	-99	-99	6.88	7.375	8.815	7.415	-99
90	1	9	18	-99	-99	5.33	7.5	-99	5.38	-99	3.38	-99	-99	7.38	-99	-99	7.25	11.5	13.375	11.5	11.725
90	1	9	20	-99	-99	7.13	11.63	-99	5.8	-99	4.3	-99	-99	12.5	-99	-99	-99	14.94	15.315	15.38	14.625
90	1	9	22	-99	-99	9.9	9.38	-99	12.25	-99	6.4	-99	-99	12.75	-99	-99	14.38	15.275	13.19	14.44	14.565
90	1	10	0	-99	-99	7.5	4.38	-99	11.13	-99	7.5	-99	-99	7.5	-99	-99	14.38	13.065	9.715	12.315	12.75
90	1	10	2	-99	-99	5.5	2.75	-99	7	-99	8	-99	-99	3.75	-99	-99	13.25	-99	-99	8.89	9.325

Two Hour Data Set

HS7A	HS7B	HS7C	HS08	HS09	HS10	HS12	HS13	HS14	HS15	HS16	LYNN	LGBH	CELA	HAWT	WHIT	PICO
9.13	1.6	1.8	-99	10.315	7.44	8.69	7.5	7.25	6.13	-99	2	2	-99	1	1	1
8.25	1.9	2.3	-99	6.005	6.625	-99	16.25	6.88	7.75	-99	-99	2.5	0.5	0.5	1.5	1
7	3.5	2.6	-99	5.94	11.19	-99	14.5	6.38	8.63	-99	-99	4	1	1	3	2
5.63	4.1	3.6	-99	14.875	10.625	18.69	5.25	3.75	11.88	-99	5	2.5	1.5	1	4	3.5
9	4.88	2.88	-99	7.38	4.19	7.375	-99	3.75	15.5	-99	11	3.5	4	1	5.5	3
6.75	-99	5.63	-99	3.625	2.315	4.005	3.25	-99	11	-99	15	5.5	3.5	5	3.5	5
4.25	4.88	5.5	-99	5.88	2.19	4.625	2.63	-99	6.25	-99	10	7	3.5	7	3	6.5
-99	6	4	-99	2.44	2.565	2.065	2.5	-99	3.88	-99	6	6.5	2.5	6.5	2	5.5
-99	7.25	4.63	-99	-99	4.815	2.5	2	4.38	3.38	-99	-99	-99	-99	-99	-99	-99
-99	5.63	6.13	-99	-99	9.13	5.065	1.75	3.25	1.75	-99	11.5	8	5.5	9	6.5	7
-99	4.25	4.13	-99	-99	10.875	9.315	2.13	3	1.63	-99	6	8.5	4.5	7	6	5.5
-99	6.25	3.63	-99	-99	9.69	12.065	2.13	2.5	1.88	-99	3	5.5	2.5	4	5.5	2
-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	4	4.5	3	1	2.5	3
7.13	4.63	5.2	4.125	-99	19.125	10.625	15	8.63	8.13	7.75	3	2.5	2	0	2.5	2.5
4.15	-99	3.5	4.94	-99	13.94	-99	9.5	5.5	11.13	12.5	3.5	3	1	0.5	3	3.5
4.88	-99	3.25	6.69	-99	4.565	-99	-99	3.88	15.95	16.88	5.5	3.5	2.5	3	5	4.5
6.13	5.25	4.38	10.19	-99	4.565	-99	-99	-99	14.63	19	8.5	5.5	6	6.5	6	4.5
6.8	4.13	4	8.5	-99	5.25	-99	4.38	3.75	13.13	15	6.5	5	6.5	7	6	7
7.38	4.38	6.25	8.375	-99	-99	1.94	1.88	4.63	-99	12.88	7.5	6	6	7	4.5	7
7.38	5.63	6	-99	-99	5.88	-99	3.13	4.45	11.58	6.13	7.5	6	4.5	7	3	6.5
7.38	6.13	5.38	9.315	-99	6.315	5.63	-99	4.38	10.63	5	-99	-99	-99	-99	-99	-99
14.18	6.75	6.65	22.19	-99	-99	8.315	3.75	5.55	-99	5	19.5	8	6	13.5	9.5	7.5
17.5	6.63	10.75	19.88	-99	-99	6.565	-99	6.25	3	-99	19.5	10	5.5	15	7.5	8
4.88	6	4.63	6.315	-99	-99	7.315	-99	5.88	4.08	3.5	7.5	7.5	3	6.5	4	3
4.25	9.13	4.83	5.505	-99	-99	-99	2.63	7.5	3.13	4.13	4.5	8.5	2	2.5	3	3.5
-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	5	6	4.5	2	3	3.5
6.63	7.13	5.63	8.125	-99	9.275	6.775	6.63	5.38	6.88	5.63	6.5	6.5	6.5	2	6	6
7.65	7.5	5.75	11.69	-99	8.565	4.065	5.88	6.13	7.5	5.75	7.5	4.5	10.5	1	11.5	8.5
10.13	8	5.5	16.09	-99	4.005	3.315	6.25	7.38	7.88	5.75	12	4	13	3	9.5	9.5
15.75	8.38	10.25	15.88	-99	3.5	3.565	-99	-99	8.13	5.75	16	6.5	9.5	6.5	8	12.5
13.5	8	6.88	12.69	-99	3.69	4.755	7.13	4.13	8.63	6.88	16	9.5	5	10	7	6
8.5	4.38	5.63	9.065	-99	-99	5.55	7.13	-99	8.88	-99	13	8	2.5	10.5	4	3.5