

GEOLOGICAL SURVEY OF CANADA

COMMISSION GÉOLOGIQUE DU CANADA



DEPARTMENT OF ENERGY, MINES AND RESOURCES
MINISTÈRE DE L'ÉNERGIE DES MINES ET DES RESSOURCES

Airborne Geophysical Survey
of the
**Ruttan Area &
Ruttan Detail Area**
Manitoba
1990

NTS 64B/12 and parts of 64B/5,6,11,13,14 64C/8,9,16

Contents include geology, gamma ray spectrometric,
VLF, and magnetic colour maps and accompanying stacked profiles

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2301

GEOLOGICAL SURVEY OF CANADA
COMMISSION GÉOLOGIQUE DU CANADA
OTTAWA

AIRBORNE GEOPHYSICAL SURVEY

In 1990 a multi-parameter geophysical survey was flown by the Geological Survey of Canada in the Ruttan area of Manitoba. The survey was flown in two parts, the light stippled area shown on the index map outlines a regional 1000 meter line spaced survey. The darker area outlines a detailed 500 meter line spaced survey in the vicinity of the Ruttan mine. Gamma ray spectrometric, VLF electromagnetic and total field magnetic data were recorded.

All data were sampled at one second intervals. The airborne radiometric measurements were made using a 256 channel spectrometer, with twelve 102x102x406 mm NaI(Tl) detectors. A Geometrics proton precession airborne magnetometer model G-803 and a Hertz Totem 1A VLF unit were installed as ancillary equipment. The GSC Skyvan was flown at a mean terrain clearance of 125 m with average ground speed of 190 km/h. The flight line direction was north-south.

Data are presented as a set of colour maps at 1 : 250 000 scale and as stacked profiles at 1 : 150 000 scale. Profile data include the seven radiometric parameters, radar terrain clearance, magnetic total field and VLF total field and quadrature components for each flight line. The colour maps include : eight gamma ray spectrometric maps (exposure rate, potassium, equivalent uranium and equivalent thorium concentrations, the eU/eTh, eU/K, eTh/K ratios and a Ternary Radioelement map); two magnetic total field colour maps (the standard 39 colours and an experimental format); one calculated vertical magnetic gradient colour map; two GRIDDED VLF total field colour maps (one superimposed with VLF total field PROFILE data the other with quadrature PROFILE data). A flight path map and a portion of the geological map published by the Manitoba Mineral Resources Division, 1980, Mineral Map of Manitoba, scale 1 : 1 000 000, Map 80-1.

Gamma Ray Spectrometric Data

Potassium is measured directly from the 1.46 MeV gamma ray photons emitted by ^{40}K , whereas uranium and thorium are measured indirectly from gamma ray photons emitted by daughter products in their decay chains. Uranium is monitored by means of gamma ray photons at approximately 1.76 MeV from ^{214}Bi , and thorium, from 2.62 MeV photons emitted by ^{208}Tl . The energy windows used are as follows:

Potassium	^{40}K	1.36– 1.56 MeV
Uranium	^{214}Bi	1.66– 1.86 MeV
Thorium	^{208}Tl	2.41–2.81 MeV

Uranium, thorium and potassium counts have been corrected for dead time, ambient temperature changes, background radiation, spectral scattering and deviations of terrain clearance from the planned survey altitude. The data as presented represent an average surface concentration which is influenced by varying amounts of outcrop, overburden, vegetation, soil moisture and surface waters. As a result, the concentrations as shown are usually lower than the actual concentrations in the bedrock.

Factors for converting the airborne measurements to concentrations were determined by relating the airborne count rates to the known ground concentrations of a test strip in the Ottawa area. The factors used to convert the airborne measurements to ground concentrations are:

1 % K	91.0 cps
1 ppm eU	9.1 cps
1 ppm eTh	7.0 cps

The exposure rate, in micro Roentgens per hour ($\mu\text{R}/\text{h}$) has been computed from the measured concentrations of potassium, uranium and thorium (Grasty, R.L., Carson, J.M., Charbonneau, B.W., and Holman, P.B., 1984, Natural Background Radiation in Canada, Geol. Sur. Can., Bull. 360). To compare these data with earlier total count maps expressed in Units of Radioelement concentrations (Ur), the conversion factor is $1 \mu\text{R}/\text{h} = 1.67 \text{ Ur}$.

VLF Data

The primary electromagnetic field is generated by VLF communication stations. For this survey, the receiving coils were tuned to station NLK at Seattle, Washington, which transmits at a frequency of 24.8 kHz.

Anomalies reflect distortions in the primary field caused by a secondary electromagnetic field generated by eddy currents flowing in geological and man-made conductors. Anomalies produce positive peaks on the total field trace and are of the cross-over type (negative to positive) on the quadrature trace. Both parameters are plotted with positive deflections toward west. The profiles presented are the total field value (vector sum of the horizontal and vertical components) and the quadrature value (out-of-phase component). The mean value or line average of the total field and quadrature component were removed along each flight line. The resultant values are plotted with a two second lag. The quadrature, which depends on the flight line direction, was inverted for lines flown from south to north. A five point weighted average filter was applied to both total field and quadrature PROFILE data for final presentation. A twenty one point triangular filter was applied to the line data and the resultant was then subtracted before the data was gridded. This effectively removed the long wave length response created by changing field strength, instrument drift, altitude effects, etc.

Magnetic Data

The low resolution aeromagnetic data were acquired using an instrument with one (1) nT sensitivity. Digital processing of the magnetic data supplemented with manual editing was used to remove obvious errors caused by spikes, heading effects or diurnal variations.

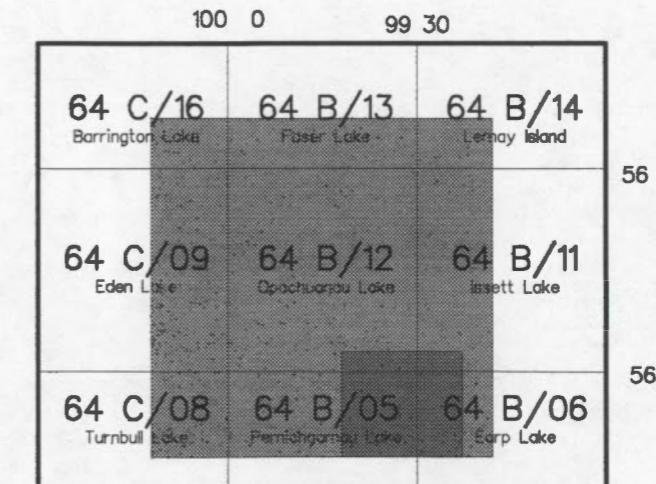
Three colour contour maps are presented. The first uses the traditional 39 colours to represent the Total field magnetic data. The second is an experimental colour selection which permits the use of a smaller contour interval allowing more information for both the extreme magnetic ranges and small magnetic anomalies. The third is a calculated vertical magnetic gradient map.

Information regarding Open File 2301 may be obtained from: Geological Survey of Canada, 601 Booth St., Ottawa, Ontario, K1A 0E8. Tel.: (613)995-4342. Copies of this Open File release may be purchased directly through: Ashley Reproduction Inc., 386 Bank Street, Ottawa, Ontario K2P 1Y4. Tel.: (613)235-2115

Base map material supplied by Surveys and Mapping Branch

Cartography by Geological Survey of Canada

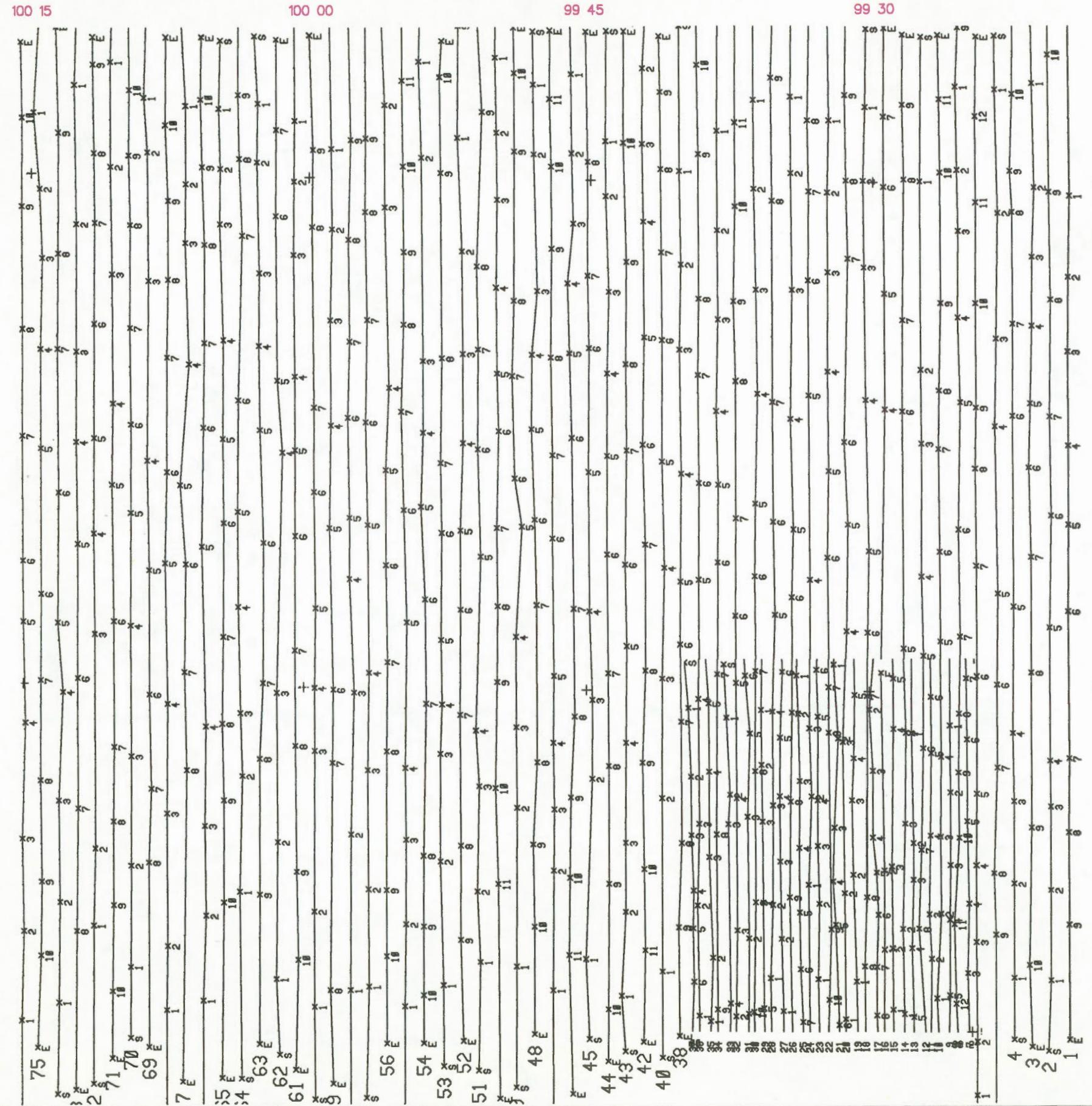
Airborne gamma ray spectrometer, VLF and magnetic survey
flown, compiled and funded by Geological Survey of Canada



INDEX MAP

OPEN FILE 2301

FLIGHT PATH MAP



GEOLOGICAL SURVEY OF CANADA



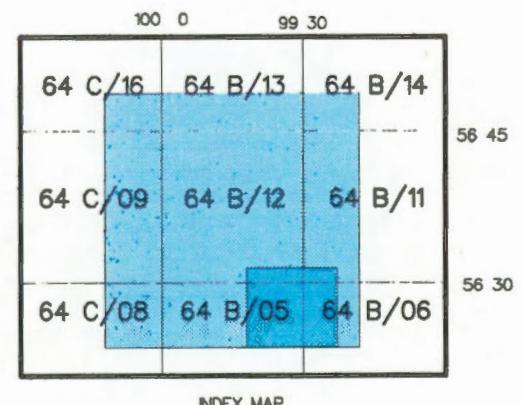
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DEPARTMENT OF ENERGY, MINES AND RESOURCES
MINISTÈRE DE L'ÉNERGIE DES MINES ET DES RESSOURCES

Airborne Geophysical Survey
of the
Ruttan Area
Manitoba.

0 25 5 7.5 10
KILOMETRES
Map scale = 1 : 250 000

Date flown = June, 1990
Compiled by = RJ Hetu



Survey flown, compiled and funded by
Airborne Geophysics Section
Mineral Resources Division
Geological Survey of Canada



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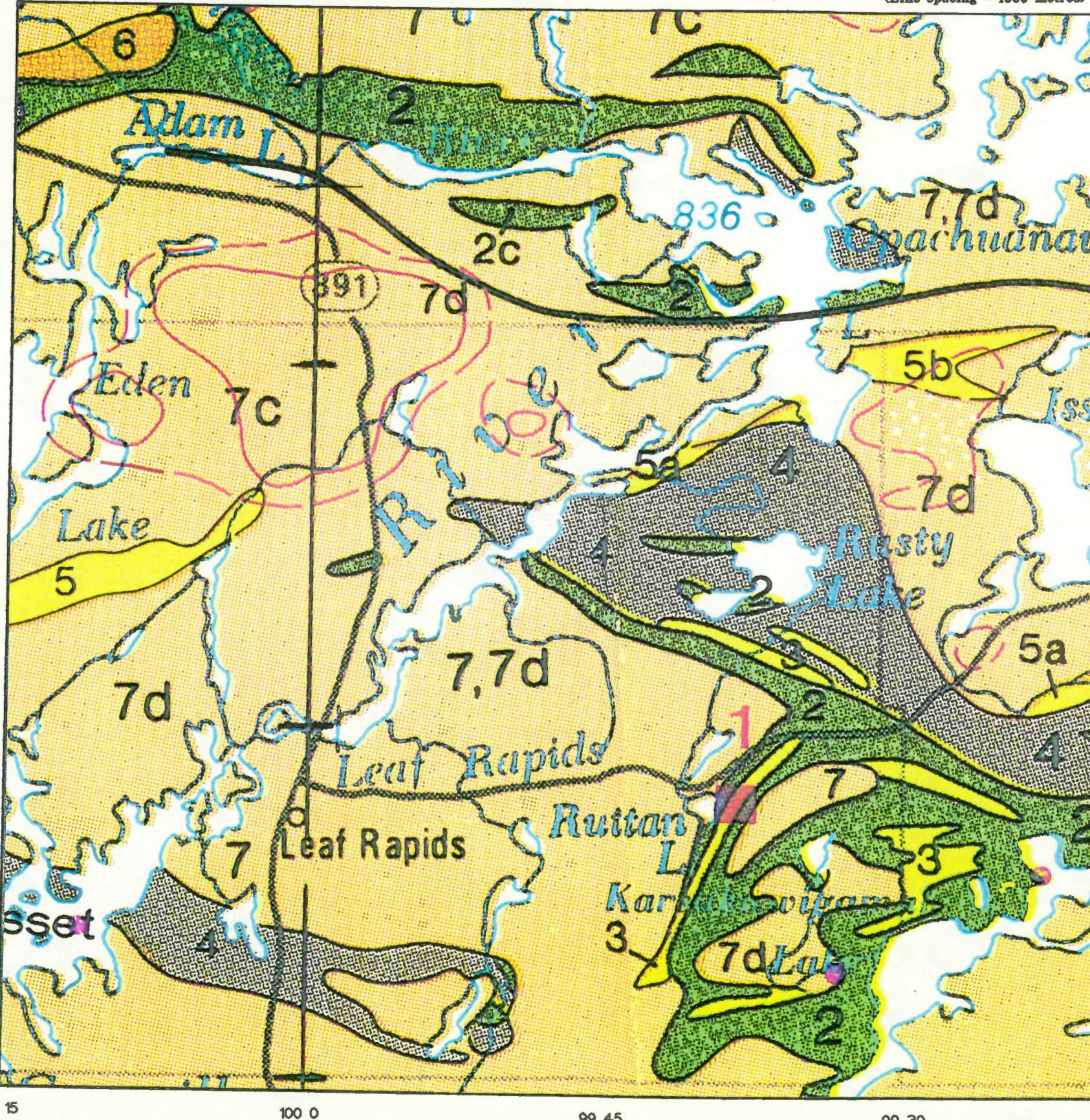
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Geology Map
Derived from Mineral Map of Manitoba
MAP 80-1

MAIN SURVEY AREA
(Line spacing = 1000 metres)



GEOLOGICAL SURVEY OF CANADA



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Airborne Geophysical Survey
of the
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0 2.5 5 7.5 10
KILOMETRES
Map scale = 1 : 250 000

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64 B

- 1 ■ RUTTAN
2 * MacBride Lake
3 ● Rat Lake

Cu, Zn, Ag, Au
Zn, Cu
cs/gr

64 C

- 1 ■ FOX
2 ● Lynn Lake "A" Plug
2 ● Lynn Lake "E" Mine
3 * Lasthope
4 * Z Deposit
5 * F.L. and D.H. Groups
6 * Agassiz
7 * Goodenough (Sherlynn)
8 * Barrington Lake
9 * Frances Lake
10 ● Fox Lake

Cu, Zn, Ag, Au
Ni, Cu, Co
Ni, Cu, Co
Au
Cu, Zn, Au
Zn, Cu
Au, Ag
Cu, Zn, Au
Cu, Zn
Zn, Cu, Ag, Au
cs/gr

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LEGEND

PHANEROZOIC

Cenozoic
Tertiary

T

Turtle Mountain Formation (TM), Paleocene: bentonitic carbonaceous sand, silt and clay; thin lignite beds, silty shale

Mesozoic

Cretaceous

K

Bossevain Formation (B): impure sandstone; shale, in part kaolinitic

Riding Mountain Formation (RM): soft greenish bentonitic shale (m: Millwood Member)*; hard siliceous shale (o: Odanah Member); soft bentonitic siltstone and shale (c: Coulter Member)

Vermilion River Formation (VR): carbonaceous shale (Morden Member); speckled carbonaceous and carbonaceous shale (Boyne Member); thin bentonite beds, carbonaceous shale, and bentonitic shale (Pembina Member)

Favel Formation (F): calcareous speckled shale; minor limestone, bentonite, and low-grade oil shale

Ashville Formation (A): carbonaceous shale; minor sand (including "Ashville sand"), silt, and bentonite

Swan River Formation (SR): quartzose sandstone, kaolinitic shale; minor lignite; glauconitic sandstone (includes channel and karst fill in Mesozoic and Paleozoic outcrop belts)

Jurassic

J

Melita Formation: sandstone, variegated and red shale; minor limestone
Reston Formation: limestone, dolomite, shale
Amaranth Formation: red argillaceous dolomitic siltstone and sandstone, gypsum and anhydrite

Paleozoic

Permian (?)

P

St. Martin Complex: trachyandesite and carbonate, granitic, and polymict breccias, in crypto-explosion (meteorite impact?) crater structure

Mississippian (subsurface only)**

M

Charles Formation: anhydrite, dolomitic anhydrite, dolomite
Mission Canyon Formation: limestone (petroleum-bearing), anhydrite
Lodgepole Formation: limestone (petroleum-bearing), argillaceous limestone, shale
Bakken Formation: black shale, pyritic siltstone, locally oil-stained

D

Souris River Formation (SR): basal red shale, argillaceous and high-calcium limestone, dolomite
Dawson Bay Formation (DB): basal red shale, bituminous dolomite, high-calcium micritic limestone, calcareous shale, coral-stromatoporoid high-calcium limestone, dolomite
Prairie Formation (subsurface only): salt, potash, anhydrite; minor dolomite
Winnipegosis Formation (W): lower member—dolomite, platform facies, grades laterally to Elm Point Formation (EP): high-calcium limestone; upper member—thin inter-reef dolomitic and calcareous bituminous laminates, or thick reefal dolomite (W/r)
Ashern Formation (A): dolomitic shale, argillaceous dolomite

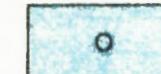
(HUDSON BAY BASIN AREA)
Upper Member of Kenogami River (KRu), Stooping River (STR), Kwataboahegan (K) and Moose River (MR) Formations: limestone, dolomitic limestone, argillaceous limestone and dolomite, bituminous limestone; minor chert and shale

Silurian

S

Interlake Group: Fisher Branch (FB), Inwood (I), Moose Lake (ML), Atikameg (A), East Arm (EA), and Cedar Lake (CL) Formations; micritic, fossiliferous, stromatolitic and biostromal dolomite; sandy/argillaceous marker beds
(HUDSON BAY BASIN AREA)
Severn River (SR), Ekwani River (ER), Attawapiskat (AT), and Lower and Middle Members of Kenogami River (KR I, m) Formations: limestone, dolomite, dolomitic limestone, siltstone, shale; some gypsum, minor anhydrite

Ordovician

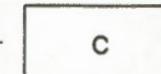


Stonewall Formation (S): dolomite, medial sandy argillaceous marker may define Ordovician-Silurian boundary
Stony Mountain Formation (SM): calcareous shale, thin limestone beds, argillaceous dolomite (gp: Gunn and Penitentiary Members); nodular dolomite and sandy argillaceous dolomite (gw: Gunton and Williams Members)

Red River Formation (RR): mottled dolomitic limestone, grades northward to dolomite (dh: Dog Head Member); dolomite, in part cherty and calcareous (ch: Cat Head Member); mottled dolomitic limestone (Tyndall stone), cherty high-calcium limestone, grades northward to dolomite (s: Selkirk Member); aphantic and cherty dolomite, shaly marker bed, high-calcium limestone beds (fg: Fort Garry Member)

Winnipeg Formation (W): quartzose sandstone; shale, in part kaolinitic, silty, and sandy (HUDSON BAY BASIN AREA)
Bad Cache Rapids Group (BCR), Churchill River Group (CR), and Red Head Rapids Formation (RHR): basal sandstone and shale; limestone, dolomitic limestone, dolomite; minor shale, chert, and anhydrite

Cambrian (subsurface only)**



Deadwood Formation: glauconitic and quartzose siltstone and sandstone, shale

* Subdivisions within a grouping are described in ascending sequence
**Only subsurface units that have known or suspected economic potential are listed. Other subsurface units are present, e.g. Jurassic Waskada Formation, and Devonian Duperow, Nisku (Birdbear) and Lyleton Formations

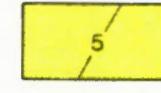
PRECAMBRIAN



Churchill Province Granite and granitoid gneiss: (7a) fluorite granite; (7b) hypersthene-bearing granite; (7c) porphyritic granite; (7d) tonalite-granodiorite; (7e) tonalitic gneiss and minor amphibolite; (7f) layered migmatitic gneiss



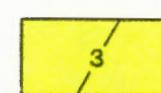
Gabbro: (6a) anorthositic gabbro; (6b) diorite; (6c) enderbitite



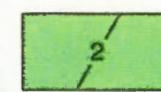
Metasediment, gneiss and migmatite derived from arkose, arenite, quartzite and minor greywacke and conglomerate: (5a) metaconglomerate with minor arkosic gneiss; (5b) migmatite dominant; (5c) felsic gneiss and migmatite of uncertain origin



Metasediment, gneiss and schist derived from greywacke, mudstone and siltstone with local minor grit and conglomerate: (4a) highly metamorphosed and partly migmatitic derivative



Felsic metavolcanic rocks, rhyolite and dacite



Mafic and intermediate metavolcanic rocks and amphibolite: (2a) basalt; (2b) andesite; (2c) amphibolite and other mafic rocks of uncertain origin; (2d) calc-silicate gneiss, amphibolite, marble and minor quartzite and iron formation



Felsic granulites and associated granitoid complexes with minor gabbro and anorthosite



Ultramafic rocks:
Serpentinized peridotite, serpentinite, pyroxenite; beneath Phanerozoic cover—known from diamond drill hole intersection and interpreted from magnetic anomalies



Differentiated ultramafic/mafic intrusions (large and small); beneath Phanerozoic cover—known from diamond drill hole intersection and interpreted from magnetic anomalies

SYMBOLS

Geological boundary (defined or approximate)



Geological boundary, Precambrian (gradational; inferred from aeromagnetic signature and trend)



Geological boundary, Phanerozoic (estimated)



Geological boundary, Phanerozoic (sub-surface—projected to bedrock interface where thickness of overburden exceeds 15 metres)



Margin of Churchill-Superior boundary zone under Phanerozoic cover extrapolated from aeromagnetic trends, etc.



Estimated limit of structural disturbance—Phanerozoic—Lake St. Martin, Denbeigh (Denby), and Highrock Lake structures



Location of diamond drill hole used in construction of cross-section B-B': Hudson Bay Lowlands



Fault



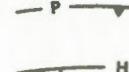
Line of cross-section



Extensive drift-covered areas of the Precambrian Shield with no bedrock exposure; geology inferred almost entirely from aeromagnetic signature



Area of exploration drilling for potash



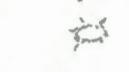
Eastern limit of potash in Devonian Prairie Formation



Eastern limit of halite in Devonian Prairie Formation



Eastern limit of Mississippian strata in the subsurface



Eastern limit of Cambrian strata in the subsurface



Structural contour on Precambrian basement beneath Phanerozoic cover. Contour Interval 152.4 m; local basement structural or paleotopographic high. The contour pattern shows primarily the effect of post-Precambrian tectonic (basin) subsidence. Paleotopographic features on the eroded Precambrian surface should show as irregularities in the contour pattern, but available data, at least for southwestern Manitoba, indicate an almost flat peneplain surface. Several minor structural flexures are evident, notably the northeast-trending synclinal flexure in the Moose Lake area, coincident with the extension of the Churchill-Superior boundary zone. The several sharply defined local structural highs reflect local structural (meteorite impact?) deformation. In the Hudson Bay area, data are sparse and the contours are approximate. Paleotopographic and/or structural relief on this surface cannot be estimated at present. However, a prominent paleotopographic high up to several hundred metres in relief has produced the Precambrian window in the Churchill area.

REGIONAL URANIUM RECONNAISSANCE PROGRAM ANOMALIES

AIRBORNE GAMMA-RAY SPECTROMETER

Equivalent Uranium



4-8 ppm. equivalent uranium



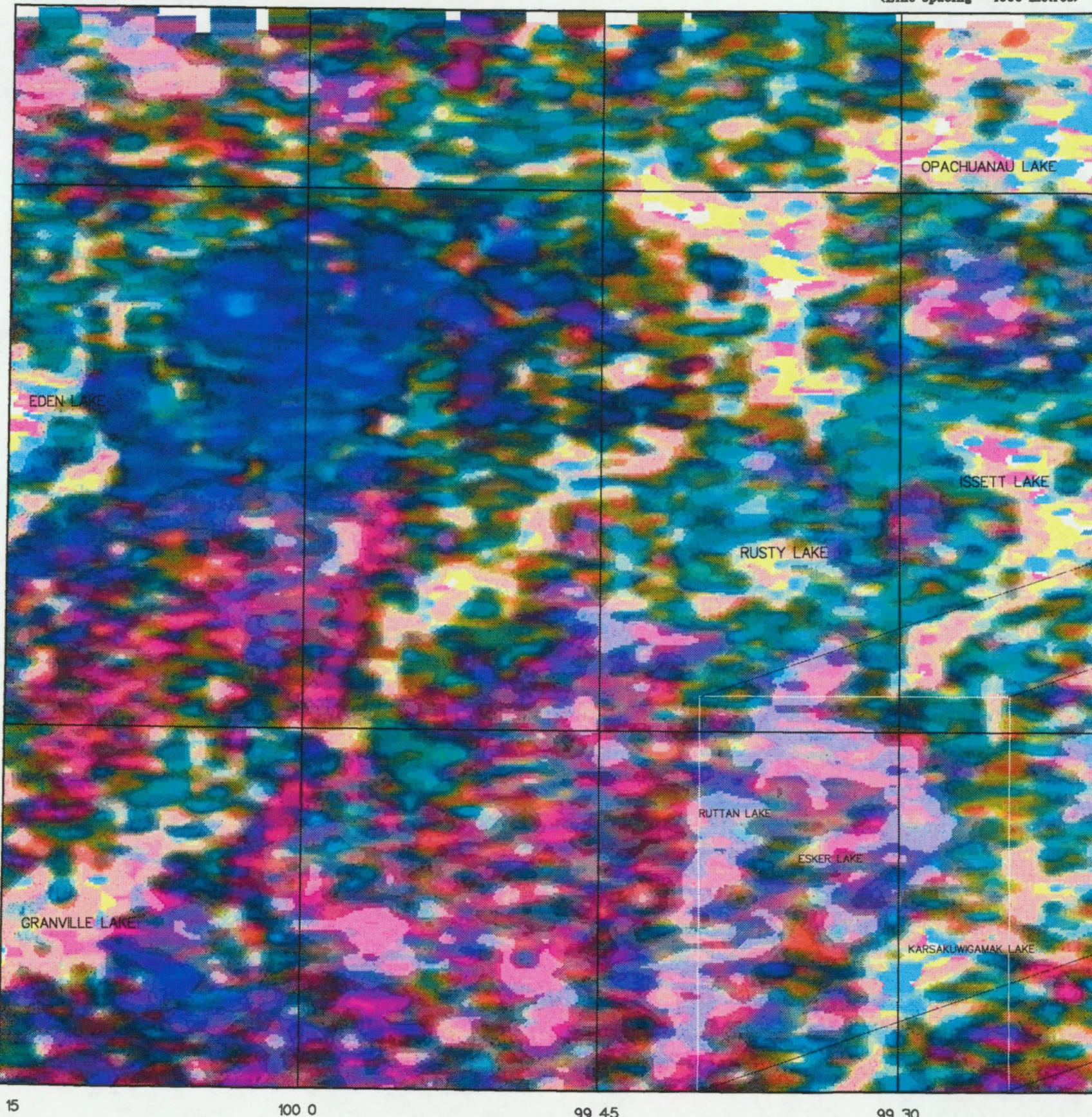
2-4 ppm. equivalent uranium



1.6-2 ppm. equivalent uranium

Data has been compiled and generalized by N. Soonawala from photographic reductions of 1:250 000 sheets. Surveys were implemented from 1975 to 1979 under Federal/Provincial Uranium Reconnaissance Program which covered the entire Precambrian Shield in Manitoba with exception of NTS areas 64H, 54E/W½, 54D and southwest corner of 54C.

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Airborne Geophysical Survey

of the

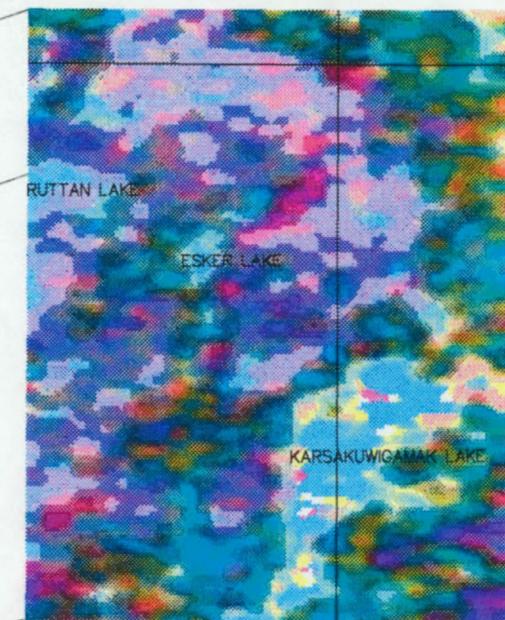
Ruttan Area Manitoba.

0 2.5 5 7.5 10
KILOMETRES
Map scale = 1:250 000

Date flown = June, 1990
Compiled by = RJ Hetu

DETAIL SURVEY AREA
(Line spacing = 500 metres)

99 30

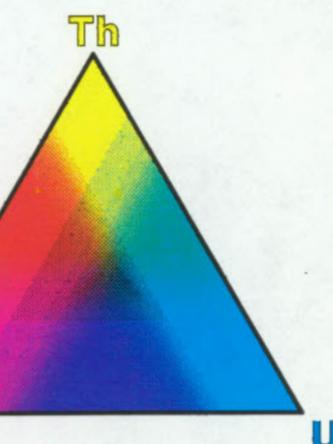


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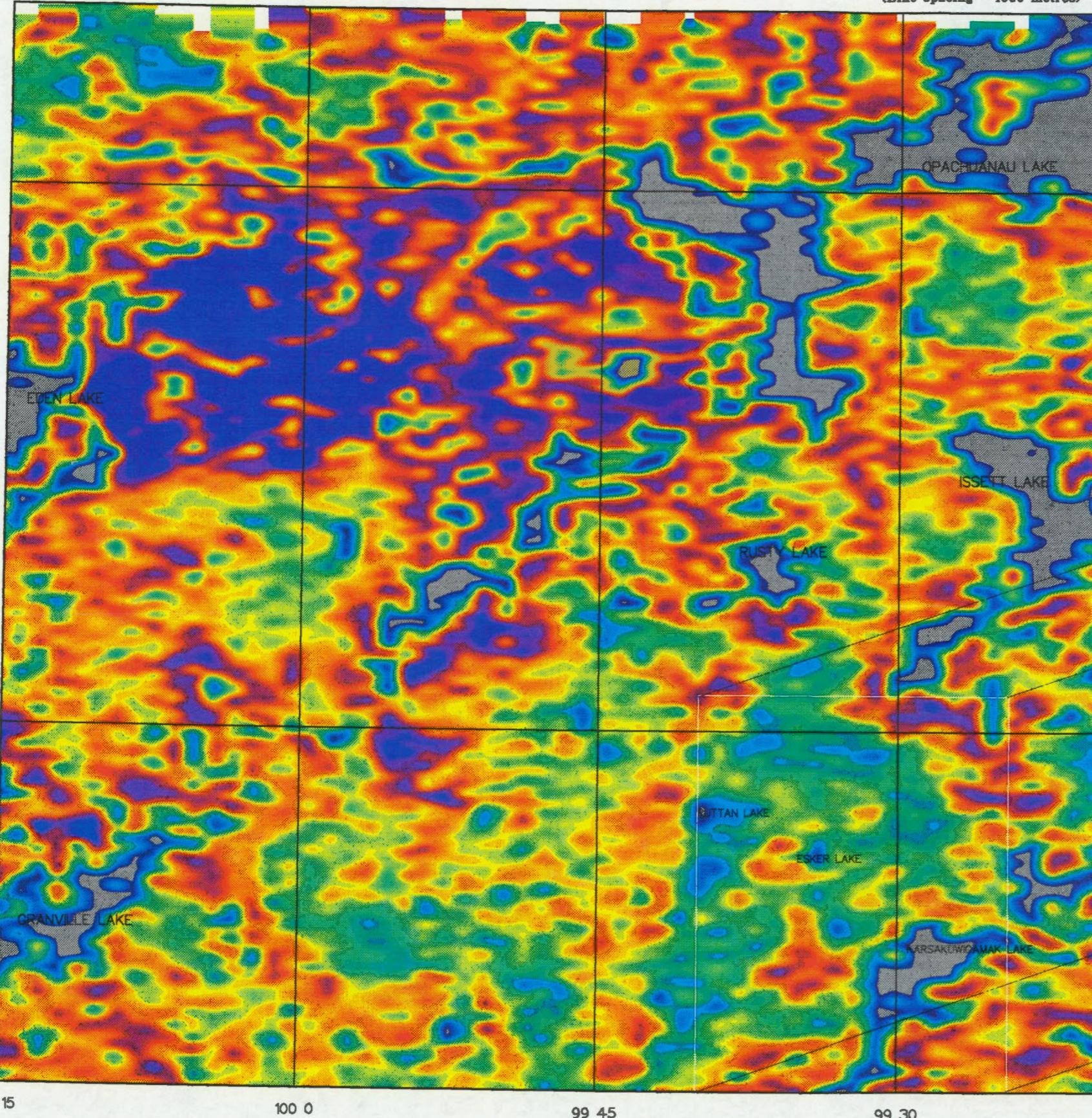


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EXPOSURE RATE ($\mu\text{R}/\text{h}$)

MAIN SURVEY AREA
(Line spacing = 1000 metres)



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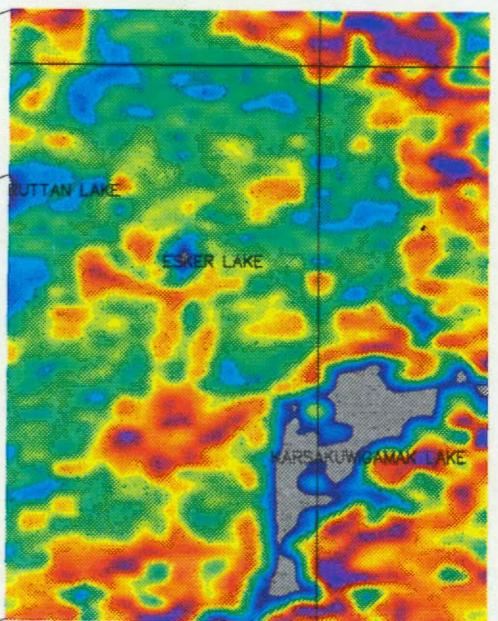
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Airborne Geophysical Survey of the Ruttan Area Manitoba.

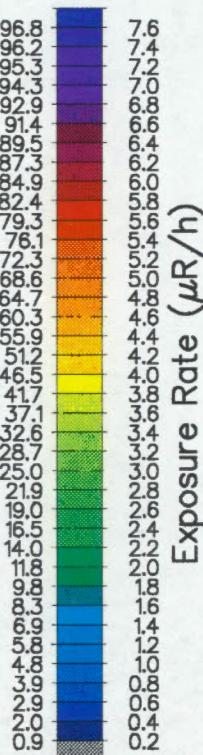
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KILOMETRES
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DETAIL SURVEY AREA
(Line spacing = 500 metres)
99 30



Cumulative Frequency



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POTASSIUM (%)

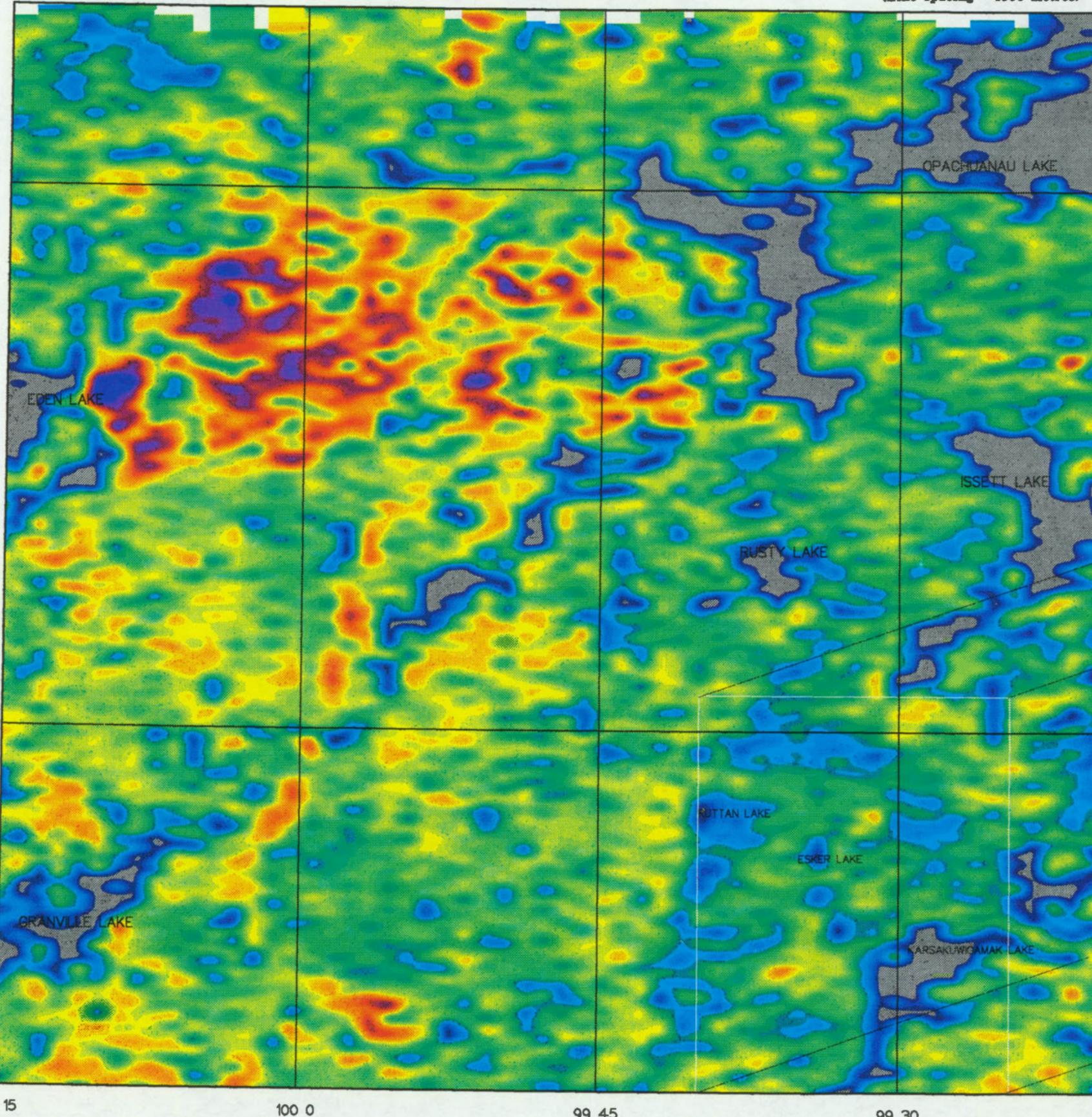
MAIN SURVEY AREA
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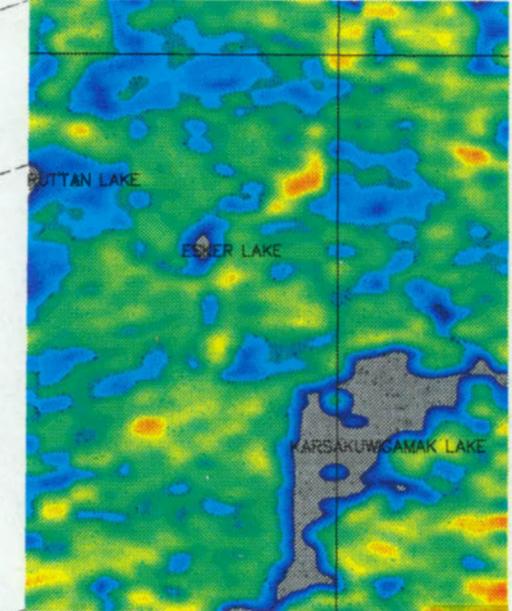
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56 45

56 30

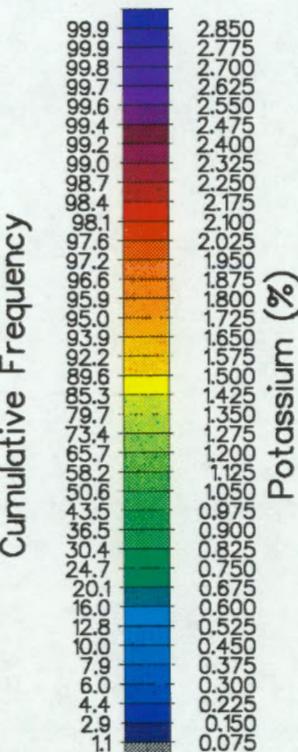


0 2.5 5 7.5 10
KILOMETRES
Map scale = 1:250 000

Date flown = June, 1990
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DETAIL SURVEY AREA
(Line spacing = 500 metres)

99 30



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EQUIVALENT URANIUM (PPM)

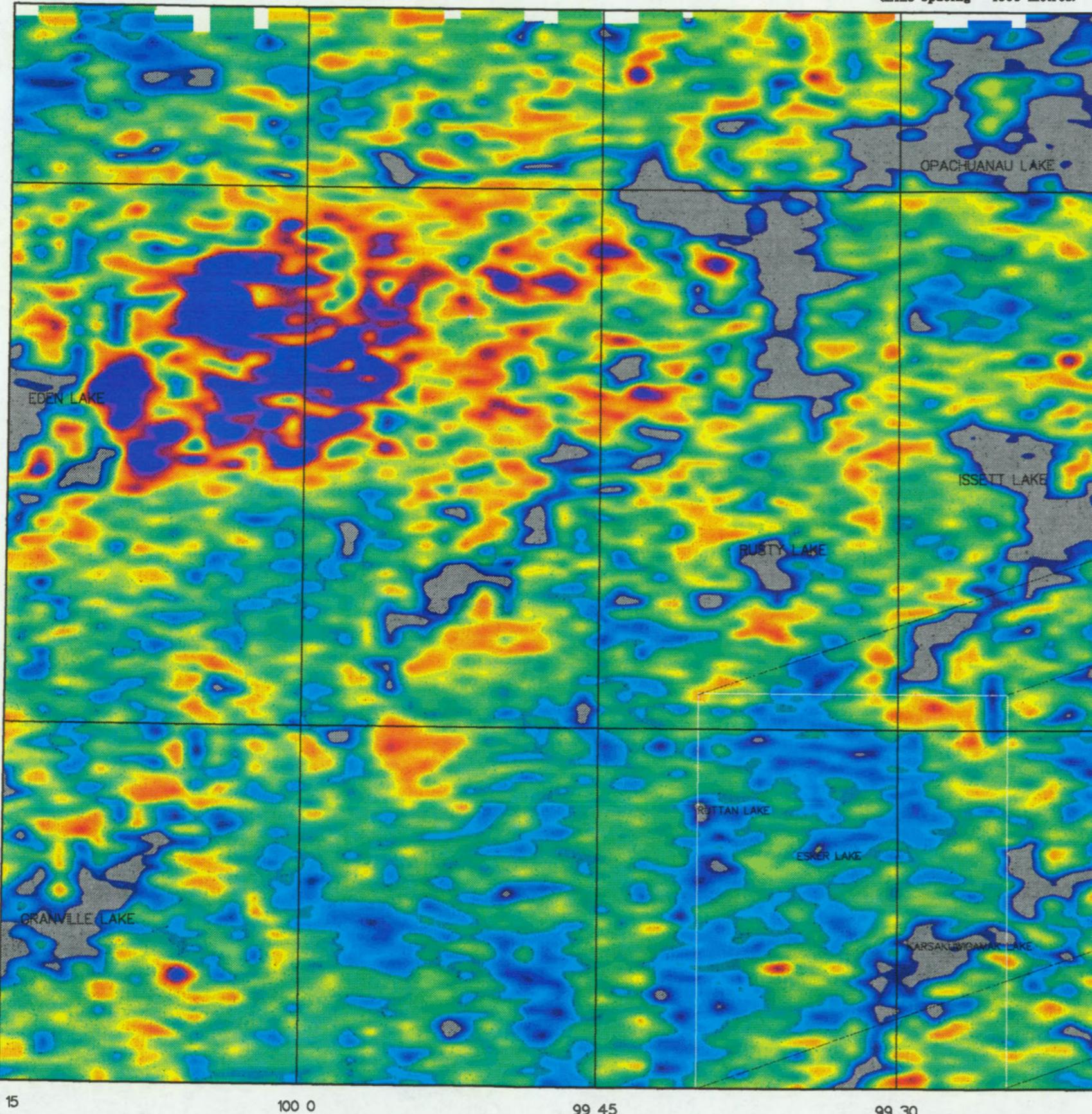
MAIN SURVEY AREA
(Line spacing = 1000 metres)

GEOLOGICAL SURVEY OF CANADA



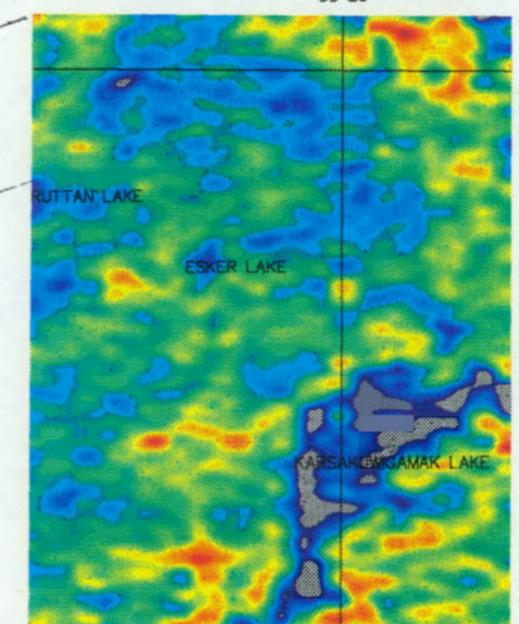
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56 45

56 30

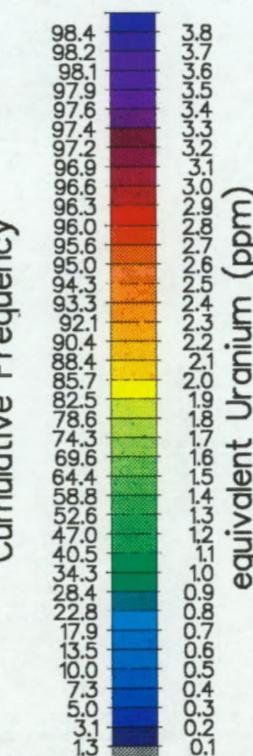


DETAIL SURVEY AREA
(Line spacing = 500 metres)

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Geological Survey of Canada

0 2.5 5 7.5 10
KILOMETRES
Map scale = 1:250 000

Date flown = June, 1990
Compiled by = RJ Hetu



Cumulative Frequency

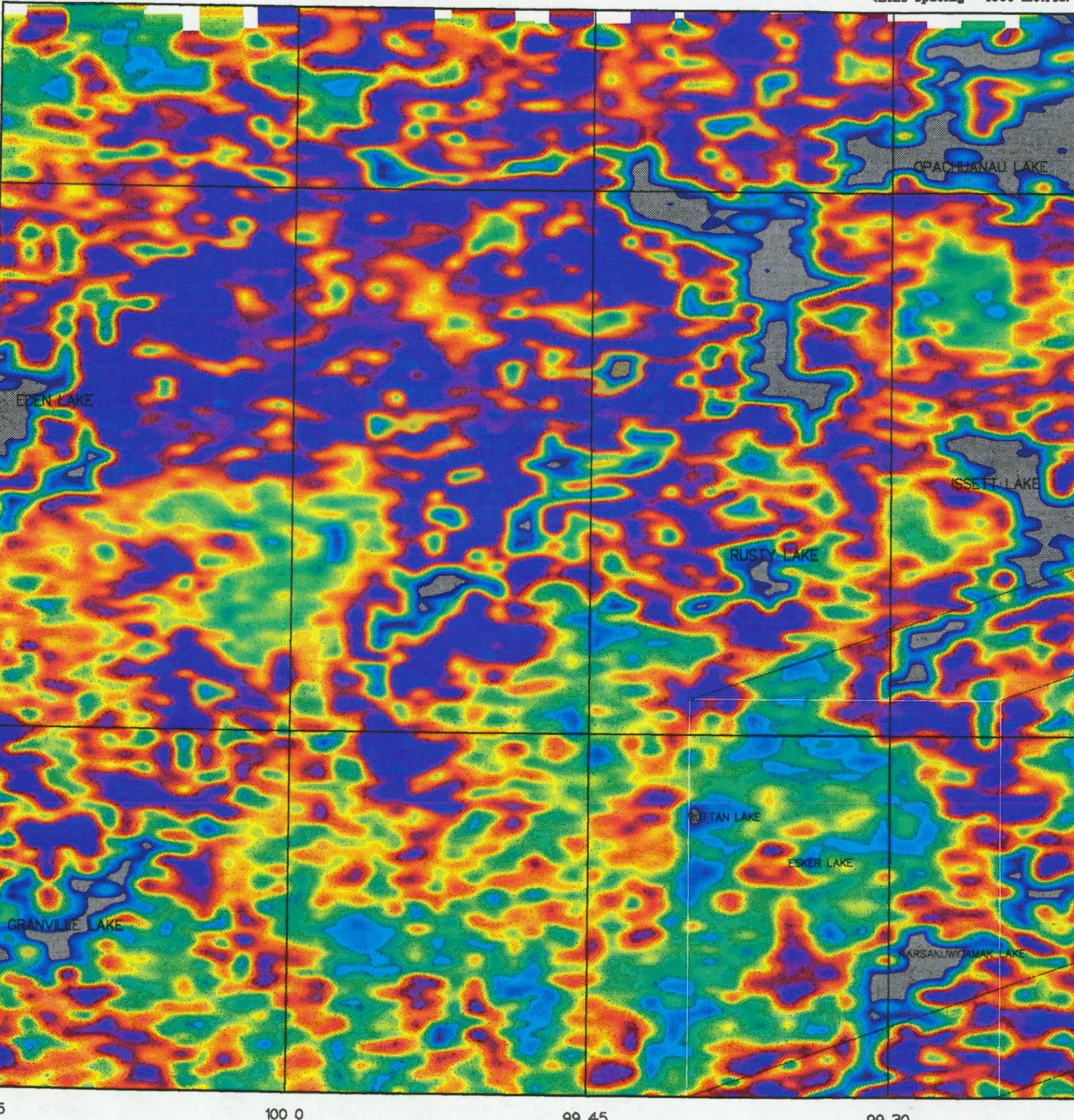
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EQUIVALENT THORIUM (PPM)

MAIN SURVEY AREA
(Line spacing = 1000 metres)



GEOLOGICAL SURVEY OF CANADA



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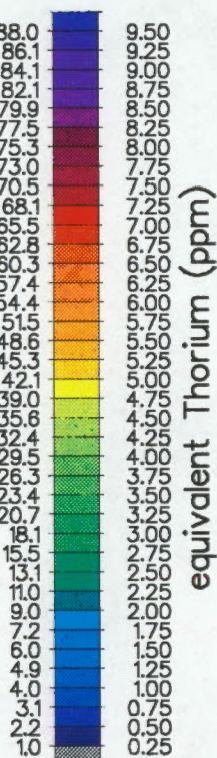
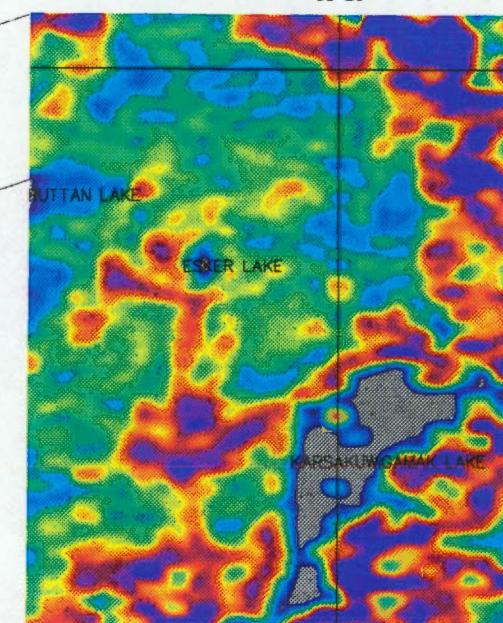
DEPARTMENT OF ENERGY, MINES AND RESOURCES
MINISTÈRE DE L'ÉNERGIE DES MINES ET DES RESSOURCES

Airborne Geophysical Survey of the Ruttan Area Manitoba.

0 2.5 5 7.5 10
KILOMETRES
Map scale = 1:250 000

Date flown = June, 1990
Compiled by = RJ Hetu

DETAIL SURVEY AREA
(Line spacing = 500 metres)



Survey flown, compiled and funded by
Airborne Geophysics Section
Mineral Resources Division
Geological Survey of Canada



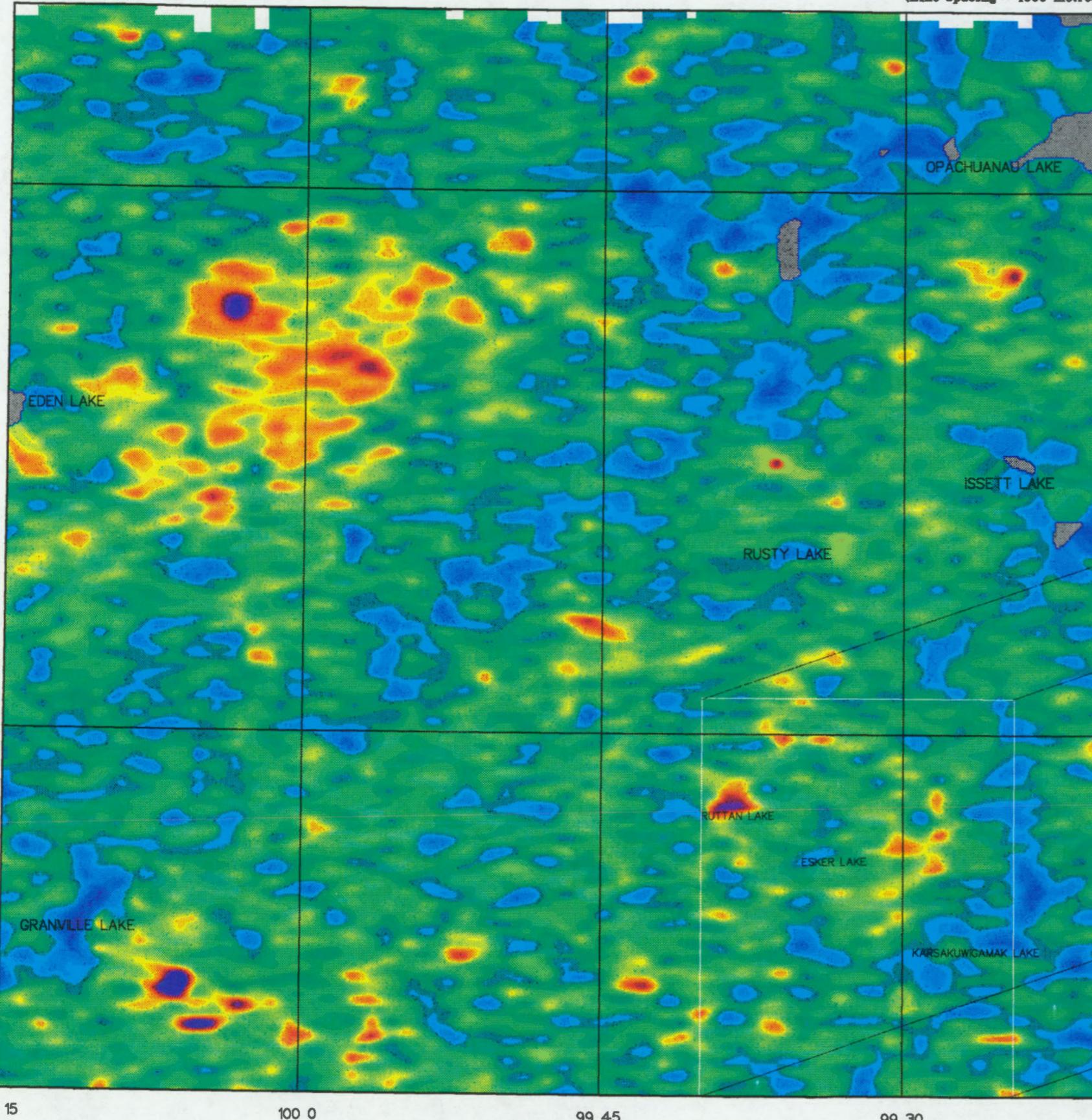
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EQUIVALENT URANIUM/EQUIVALENT THORIUM

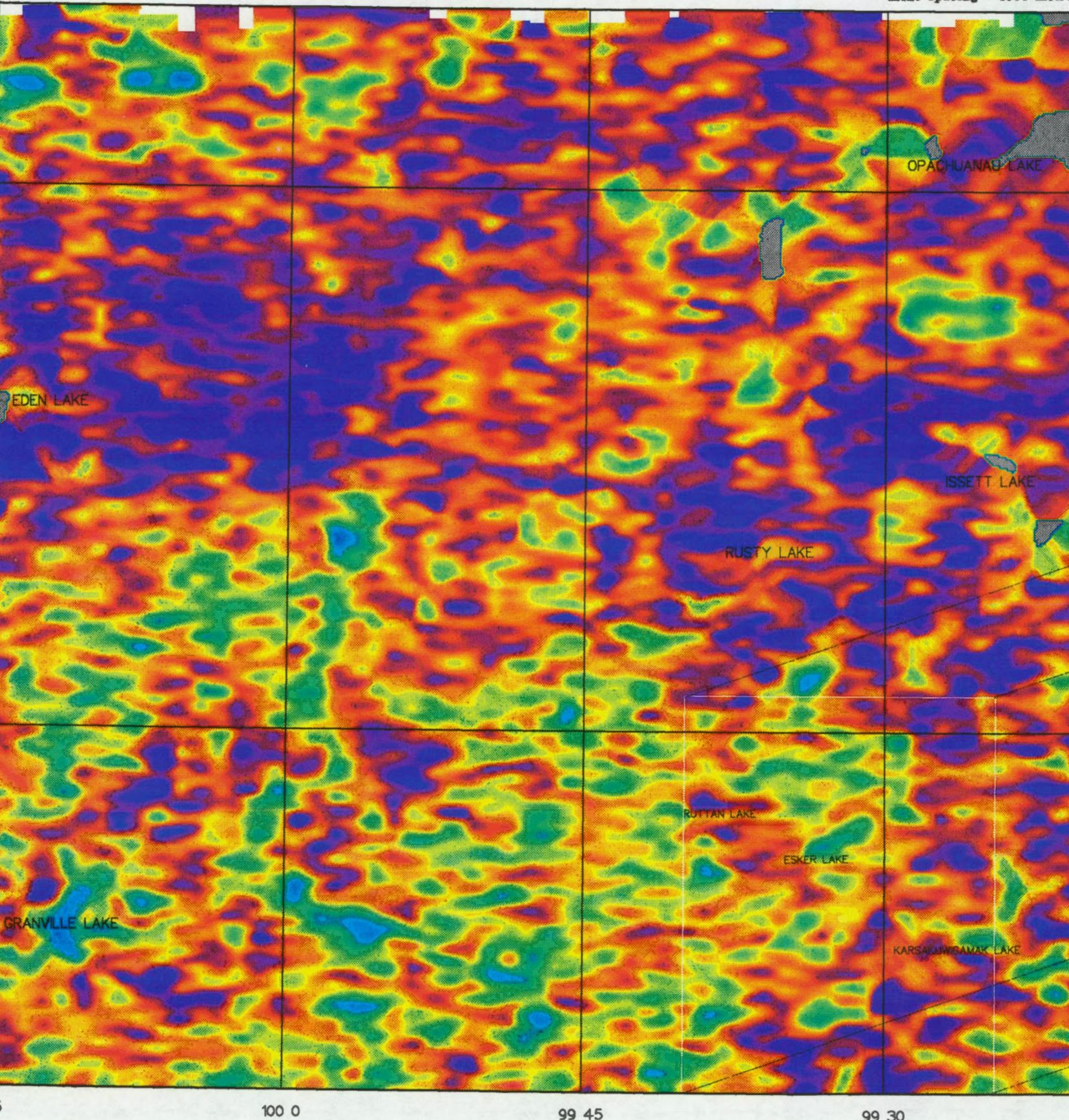
OPEN FILE 2301



OPEN FILE 2301

EQUIVALENT URANIUM/POTASSIUM

MAIN SURVEY AREA
(Line spacing = 1000 metres)



GEOLOGICAL SURVEY OF CANADA



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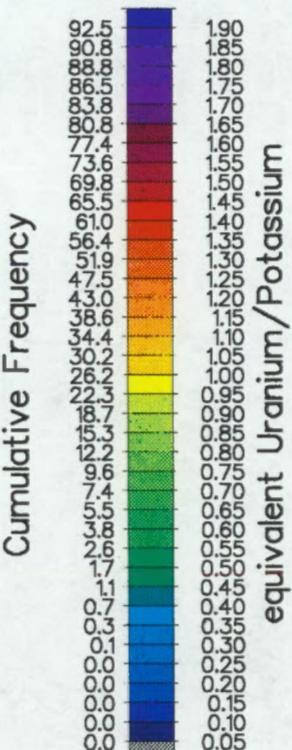
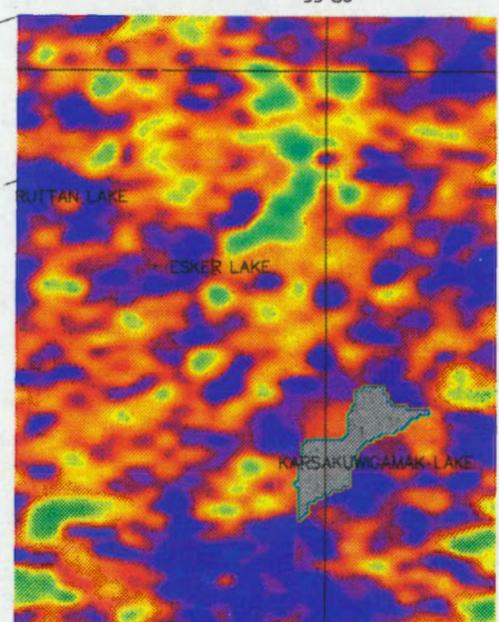
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DETAIL SURVEY AREA
(Line spacing = 500 metres)



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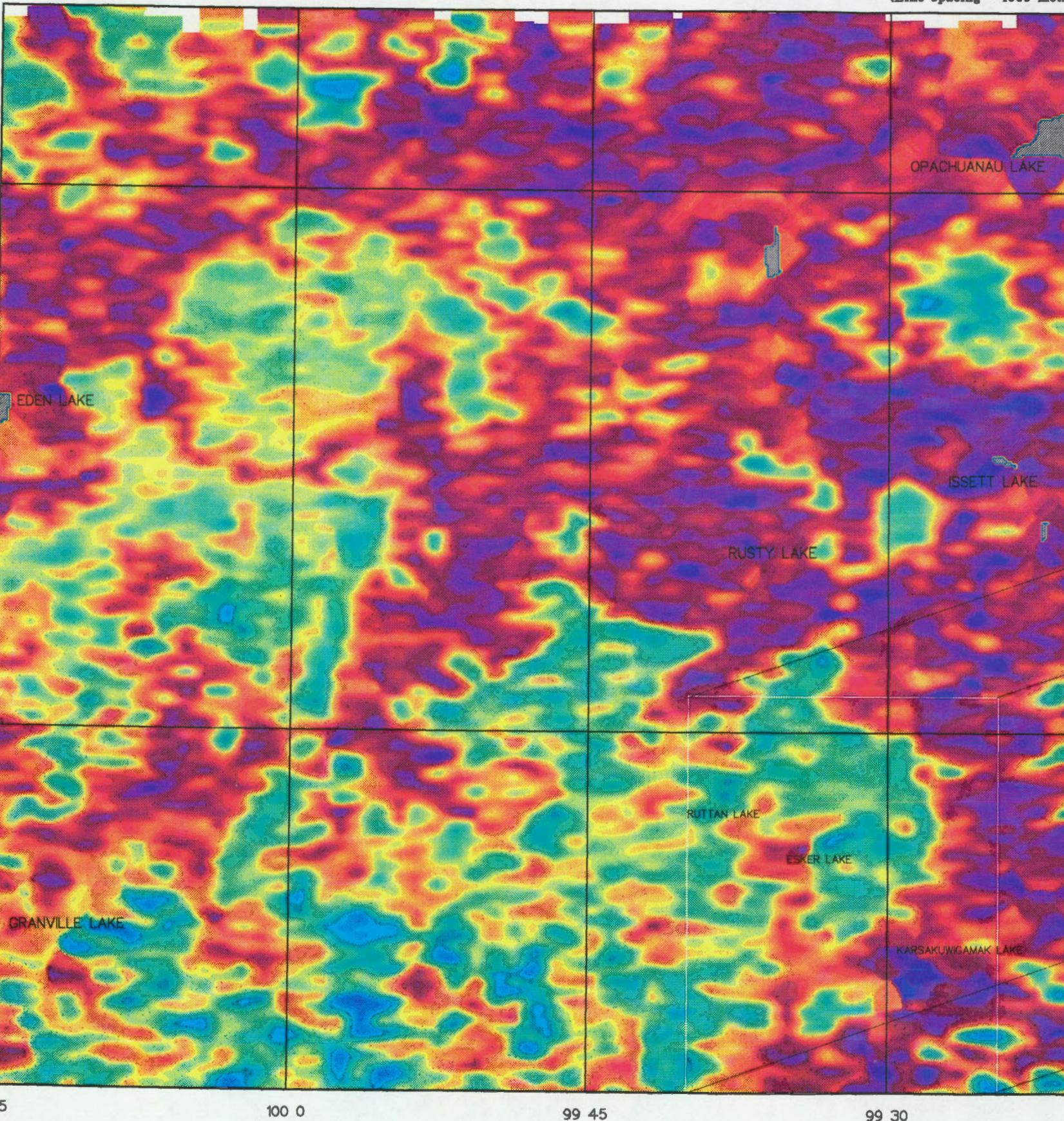
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EQUIVALENT THORIUM/POTASSIUM

MAIN SURVEY AREA
(Line spacing = 1000 metres)



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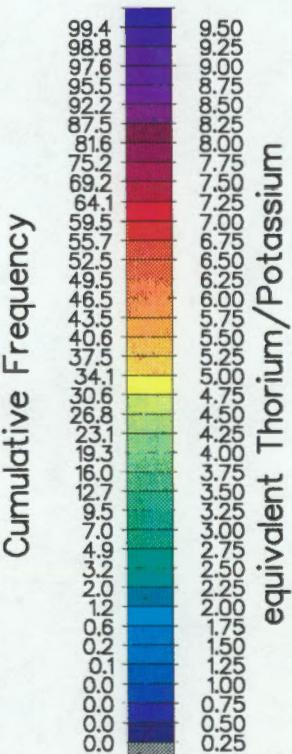
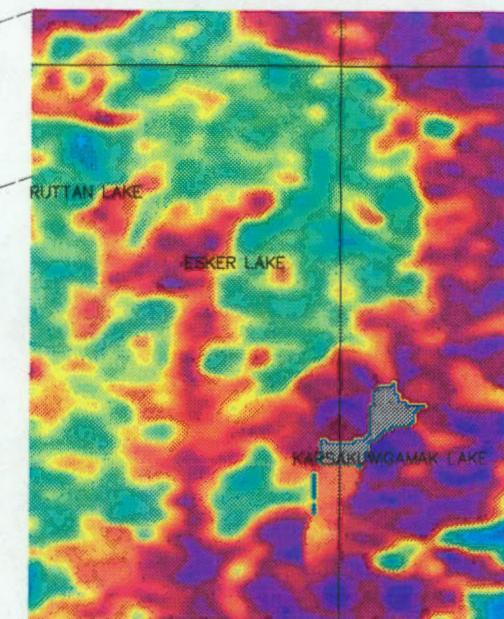
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DETAIL SURVEY AREA
(Line spacing = 500 metres)



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VLF Total Field (%)

OPEN FILE 2301

GRIDDED Data with VLF Total Field PROFILE Data

(Transmitting station - NLK at Seattle Washington - transmitting at 24.0 kHz)

MAIN SURVEY AREA

(Line spacing = 1000 metres)

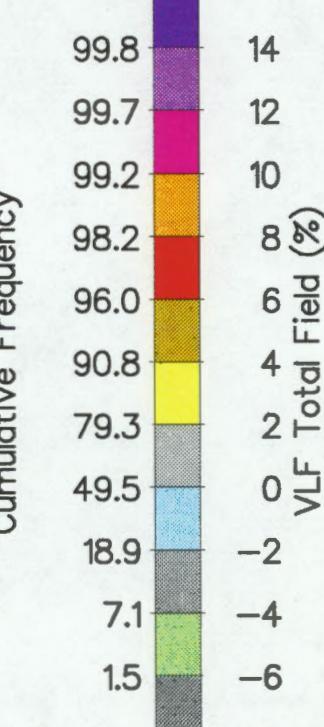
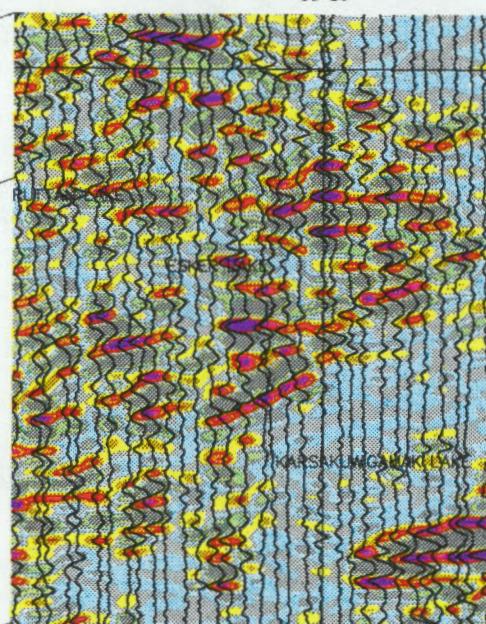
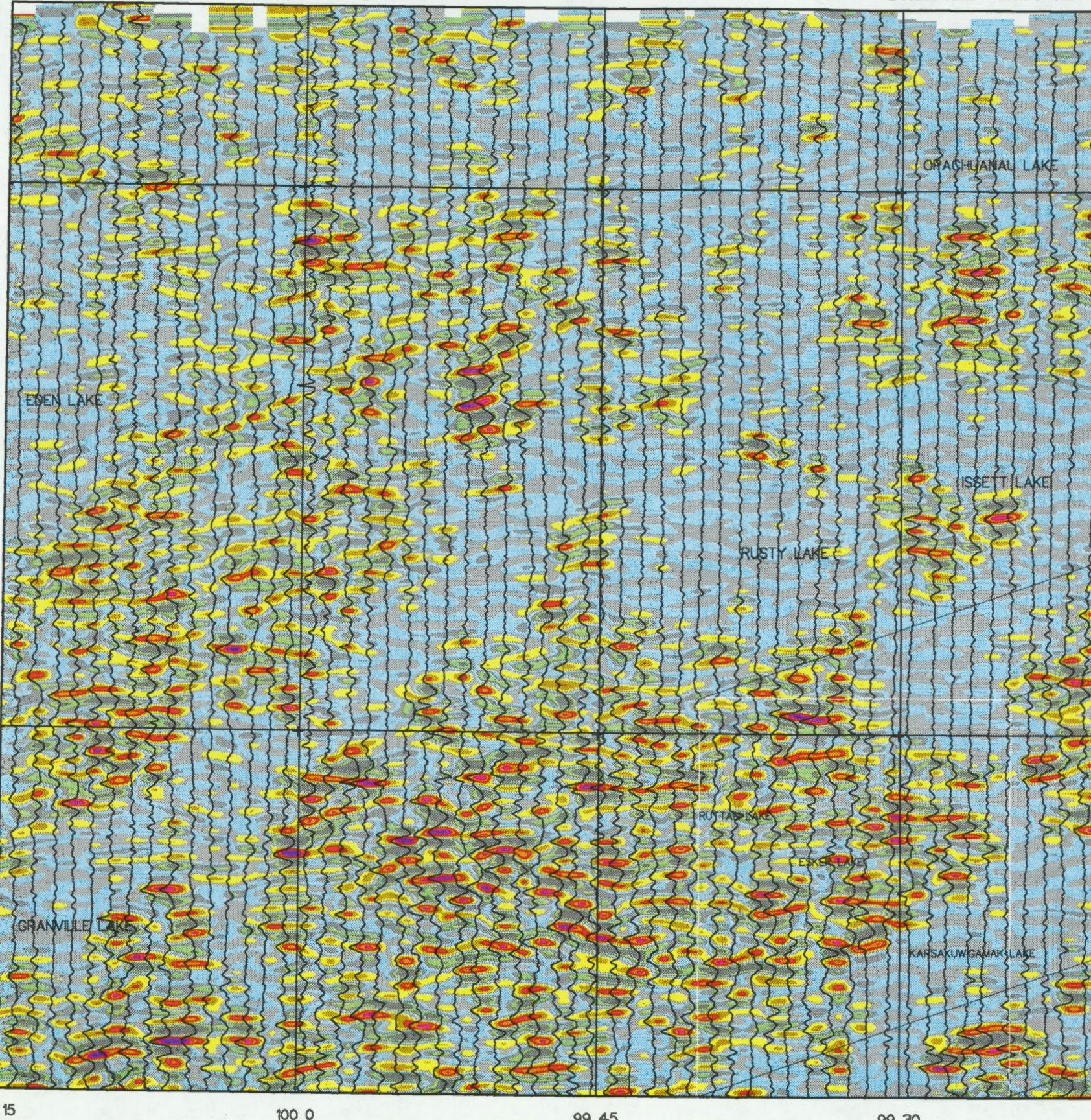
(Profile scale = 250% / cm)

GEOLOGICAL SURVEY OF CANADA



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Airborne Geophysical Survey of the Ruttan Area Manitoba.

0 2.5 5 7.5 10
KILOMETRES
Map scale = 1:250 000

Date flown = June, 1990
Compiled by = RJ Hetu

DETAIL SURVEY AREA
(Line spacing = 500 metres)
(Profile scale = 250% / cm)

99 30

56 30

VLF Total Field (%)

OPEN FILE 2301

GRIDDED Data with VLF Quadrature PROFILE Data

(Transmitting station - NLK at Seattle Washington - transmitting at 24.0 kHz)

MAIN SURVEY AREA

(Line spacing = 1000 metres)

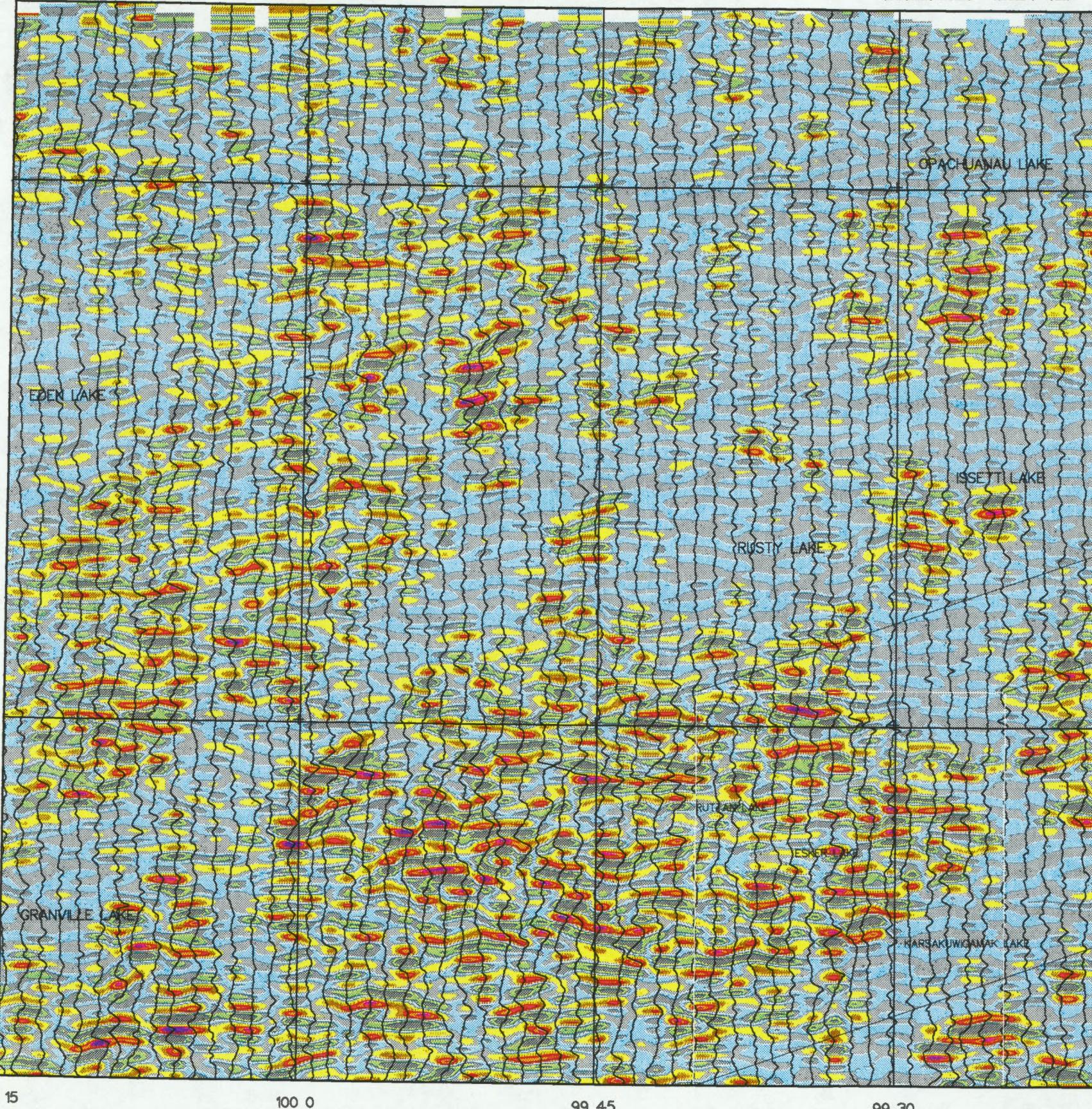
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GEOLOGICAL SURVEY OF CANADA

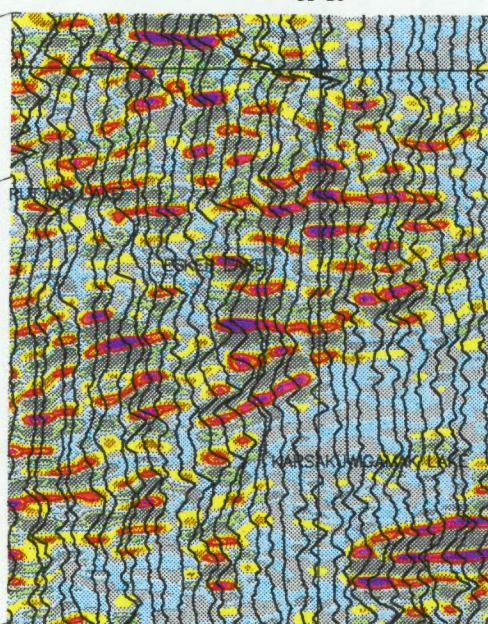


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MINISTÈRE DE L'ÉNERGIE DES MINES ET DES RESSOURCES



56 45



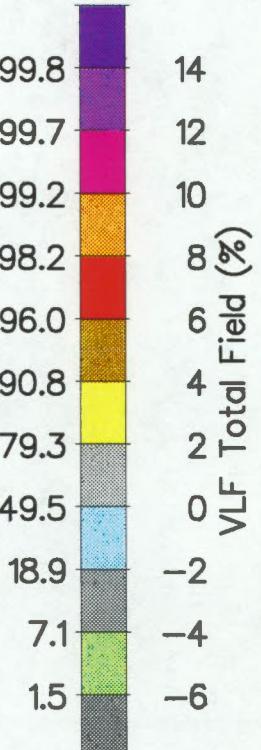
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0 2.5 5 7.5 10
KILOMETRES

Map scale = 1:250 000

Date flown = June, 1990
Compiled by = RJ Hetu

DETAIL SURVEY AREA
(Line spacing = 500 metres)
(Profile scale = 250% / cm)

99 30

Cumulative Frequency

Total Magnetic Field (nT)

OPEN FILE 2301

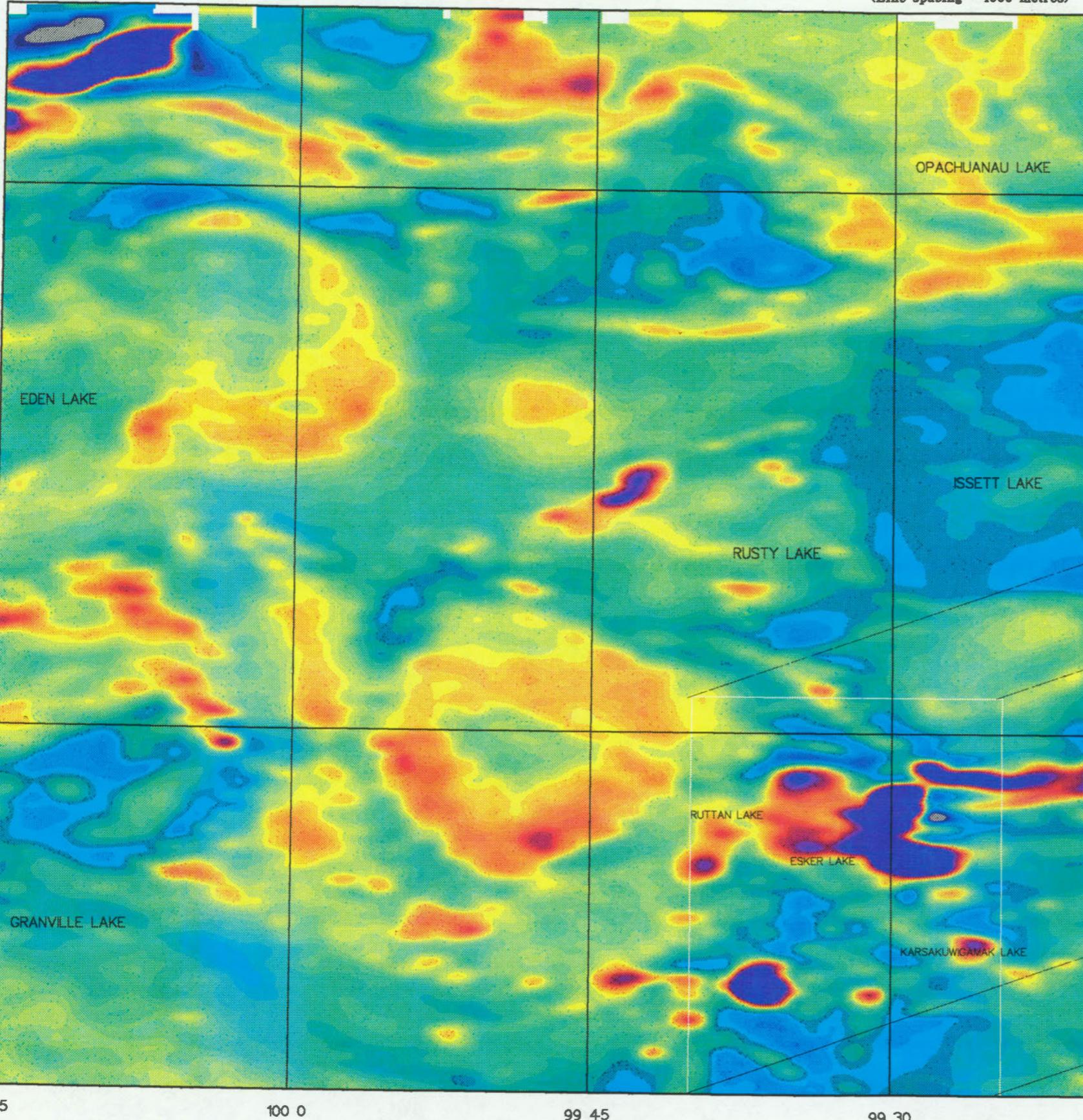
MAIN SURVEY AREA
(Line spacing = 1000 metres)

GEOLOGICAL SURVEY OF CANADA



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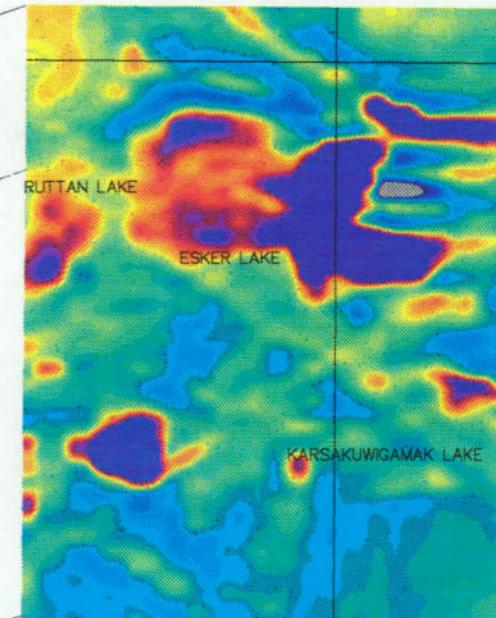
Airborne Geophysical Survey

of the
**Ruttan Area
Manitoba.**

0 2.5 5 7.5 10
KILOMETRES
Map scale = 1:250 000

Date flown = June, 1990
Compiled by = RJ Hetu

DETAIL SURVEY AREA
(Line spacing = 500 metres)
99 30



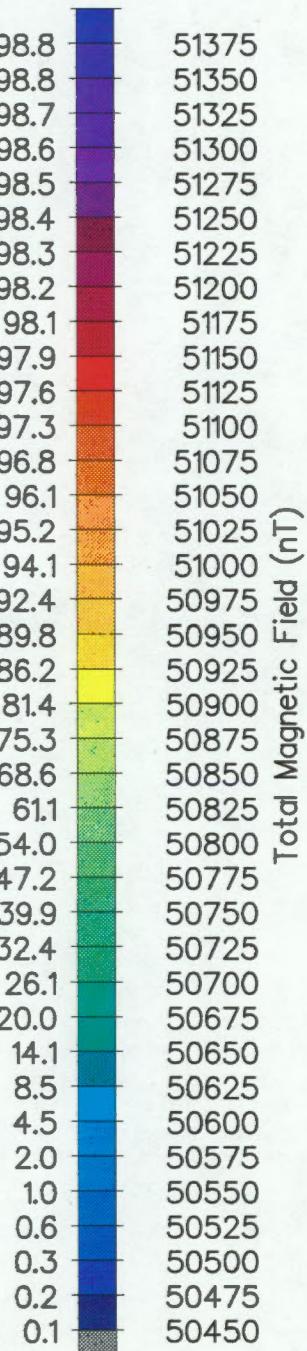
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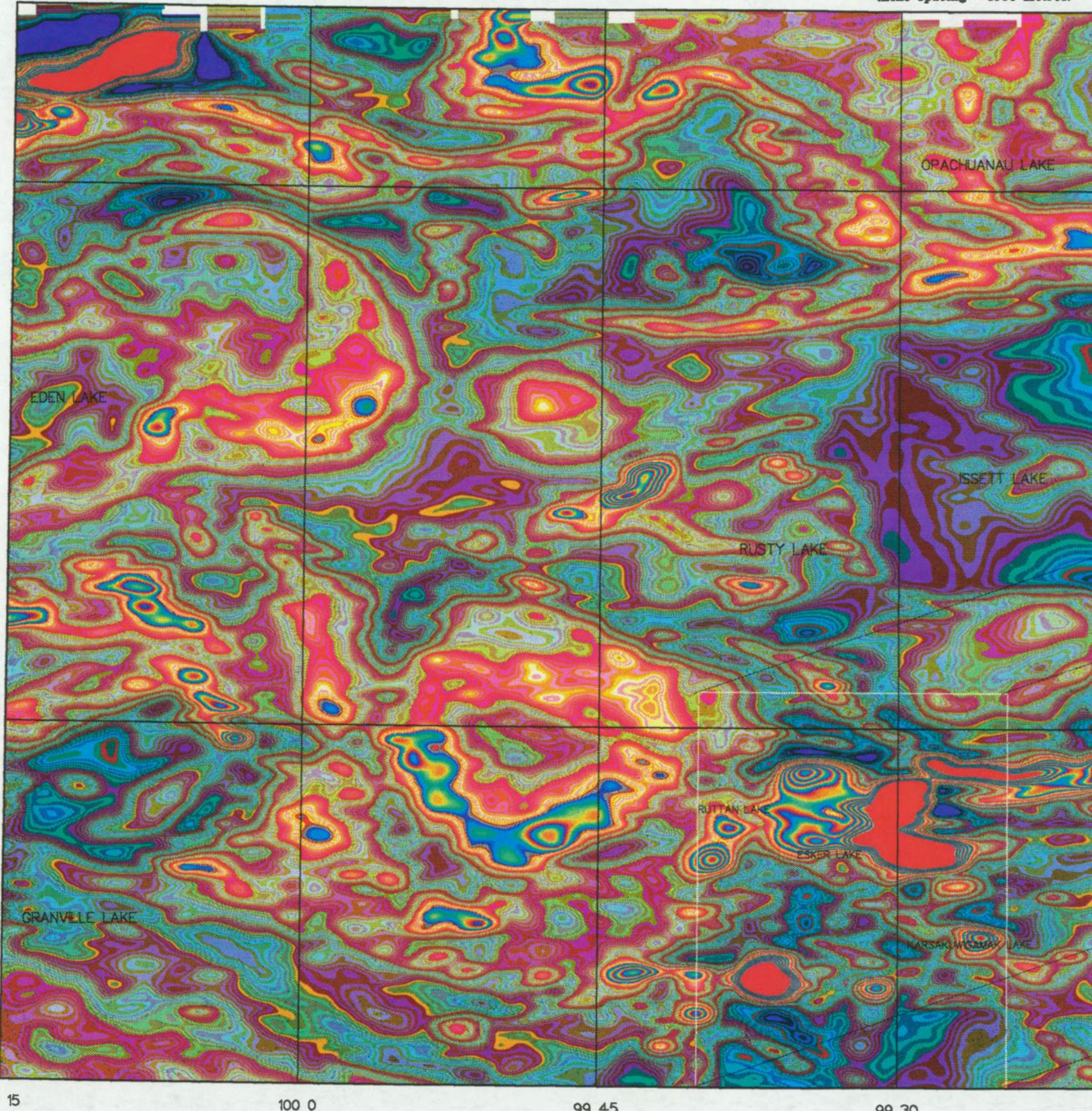
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Total Magnetic Field (nT)

Alternative Presentation

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Airborne Geophysical Survey

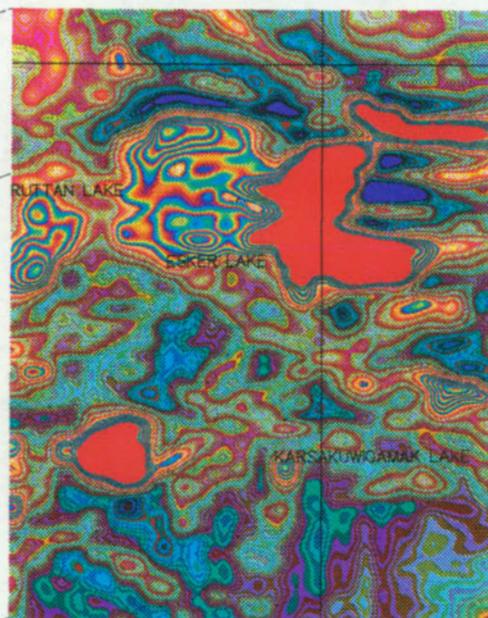
of the

Ruttan Area Manitoba.

0 2.5 5 7.5 10
KILOMETRES
Map scale = 1:250 000

Date flown = June, 1990
Compiled by = RJ Hetu

DETAIL SURVEY AREA
(Line spacing = 500 metres)



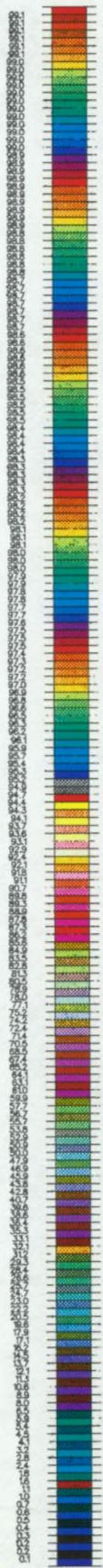
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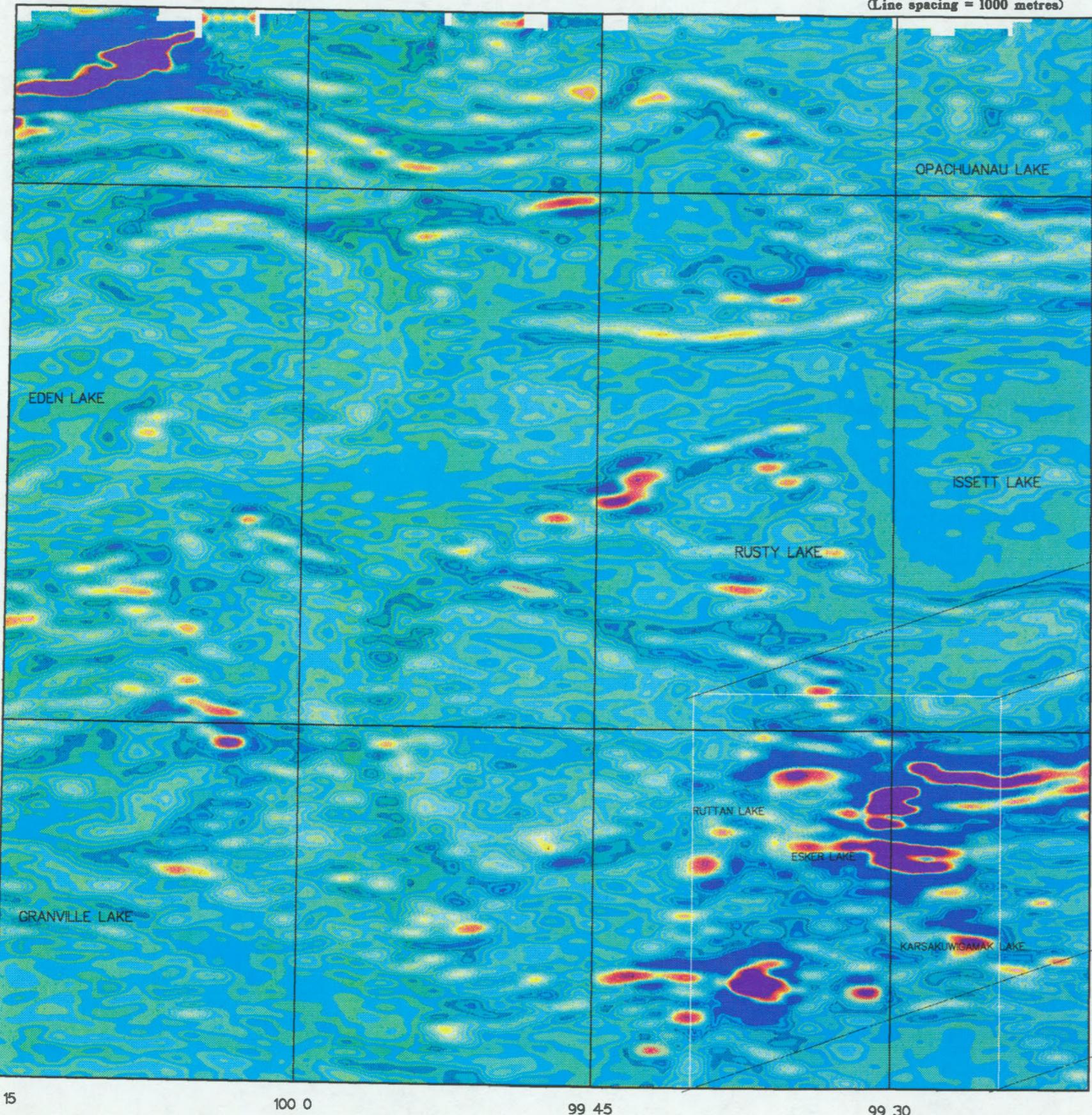
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Calculated Vertical Magnetic Gradient

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GEOLOGICAL SURVEY OF CANADA



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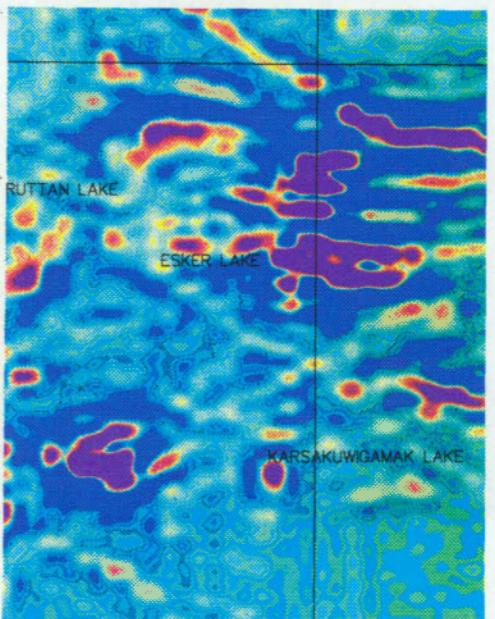
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Airborne Geophysical Survey of the Ruttan Area Manitoba.

0 2.5 5 7.5 10
KILOMETRES
Map scale = 1:250 000

Date flown = June, 1990
Compiled by = RJ Hetu

DETAIL SURVEY AREA
(Line spacing = 500 metres)
99 30



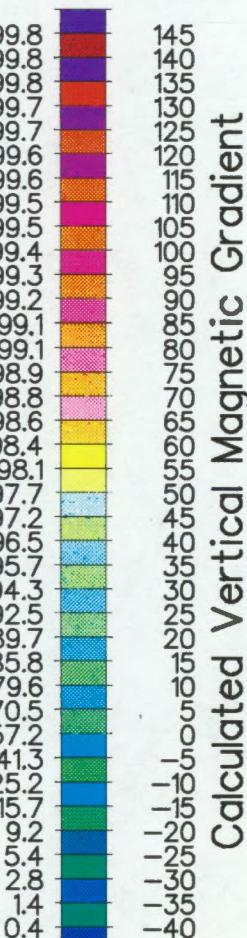
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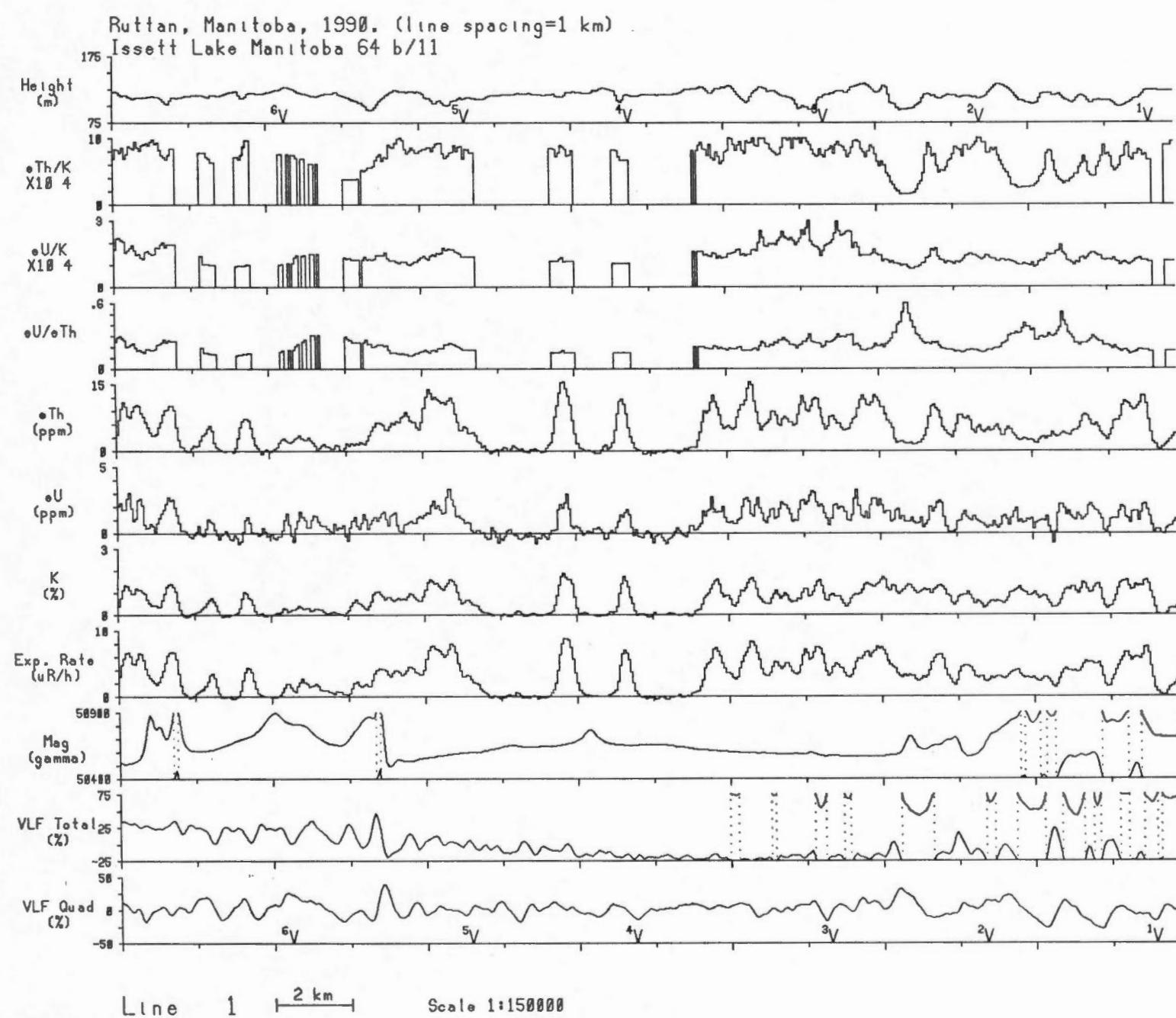
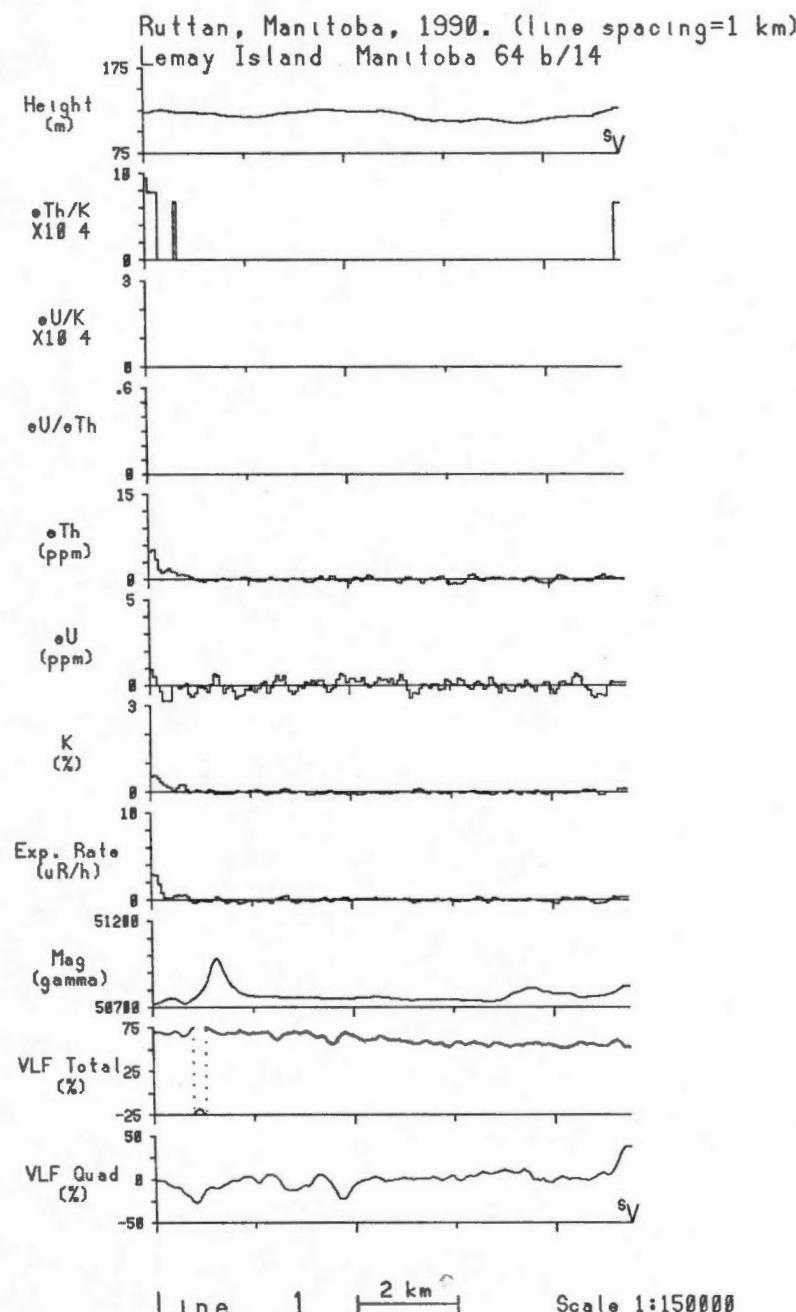
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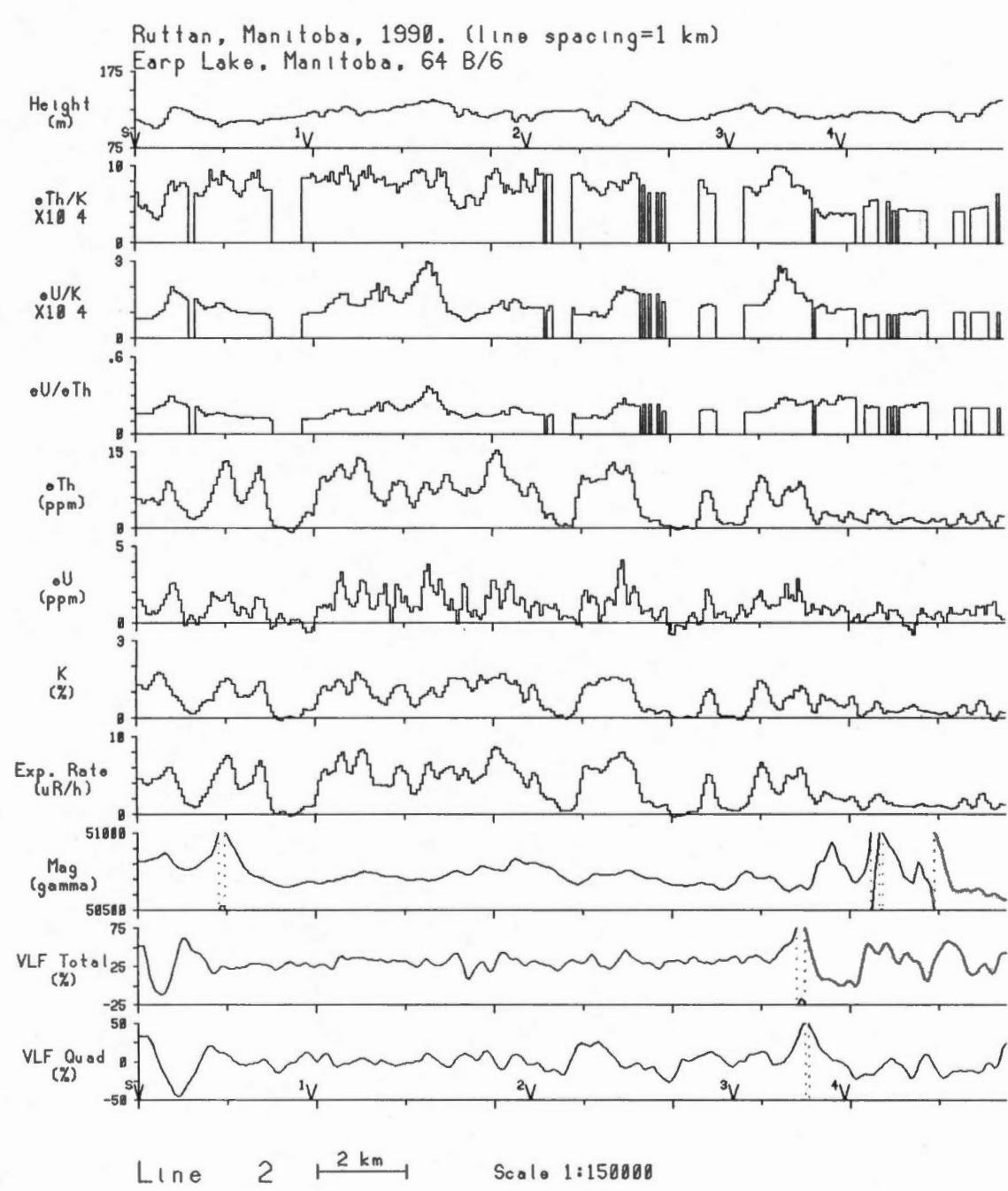
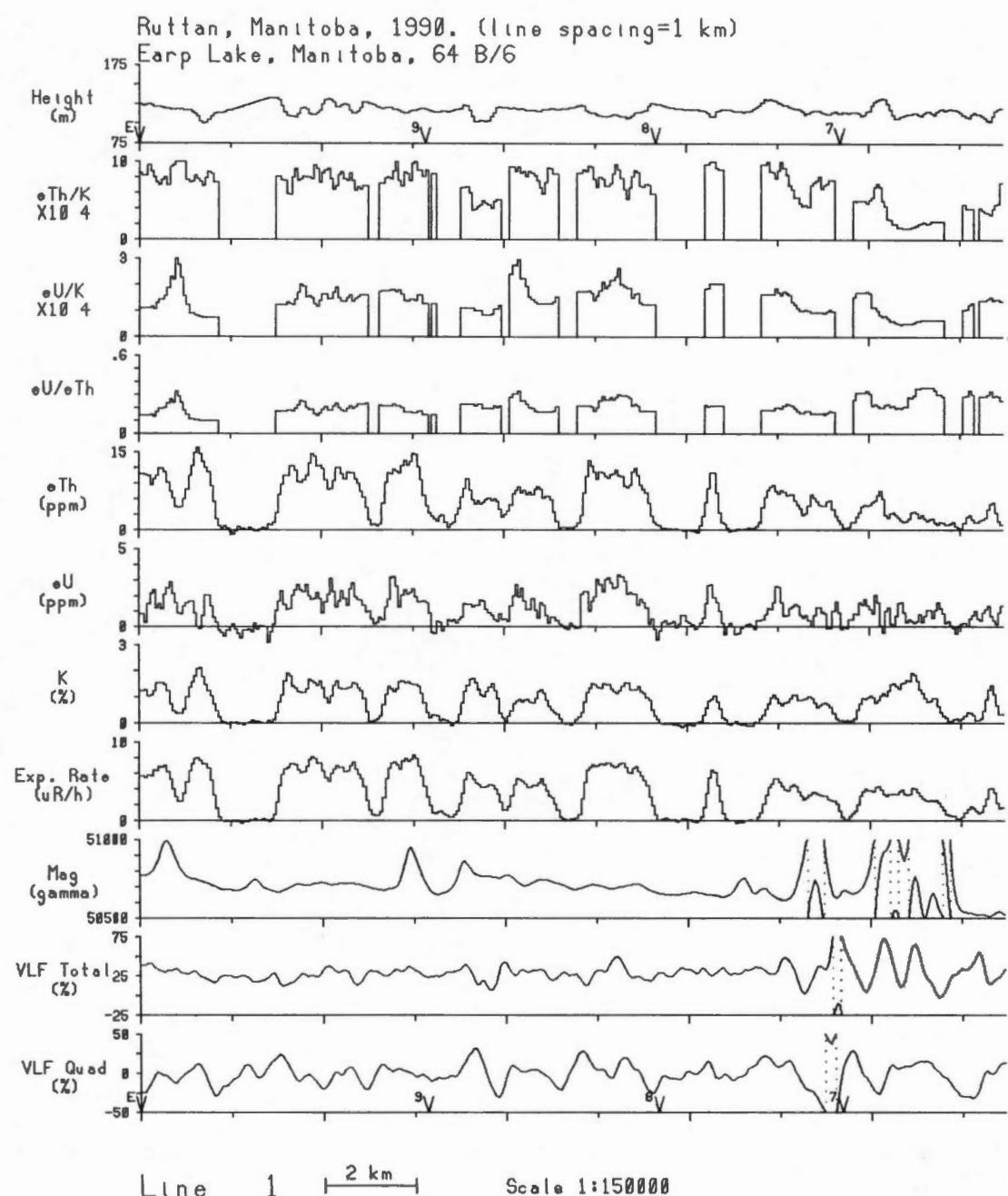
Canada

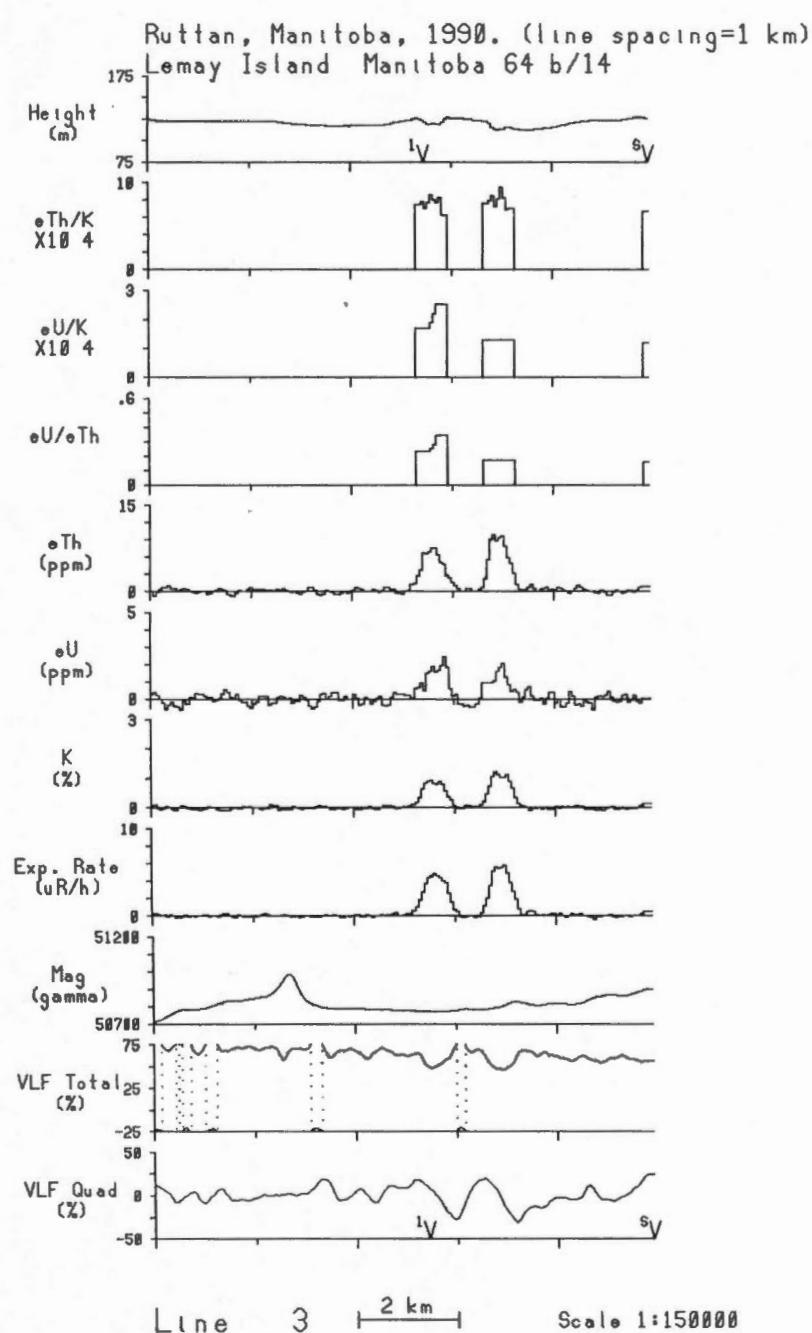
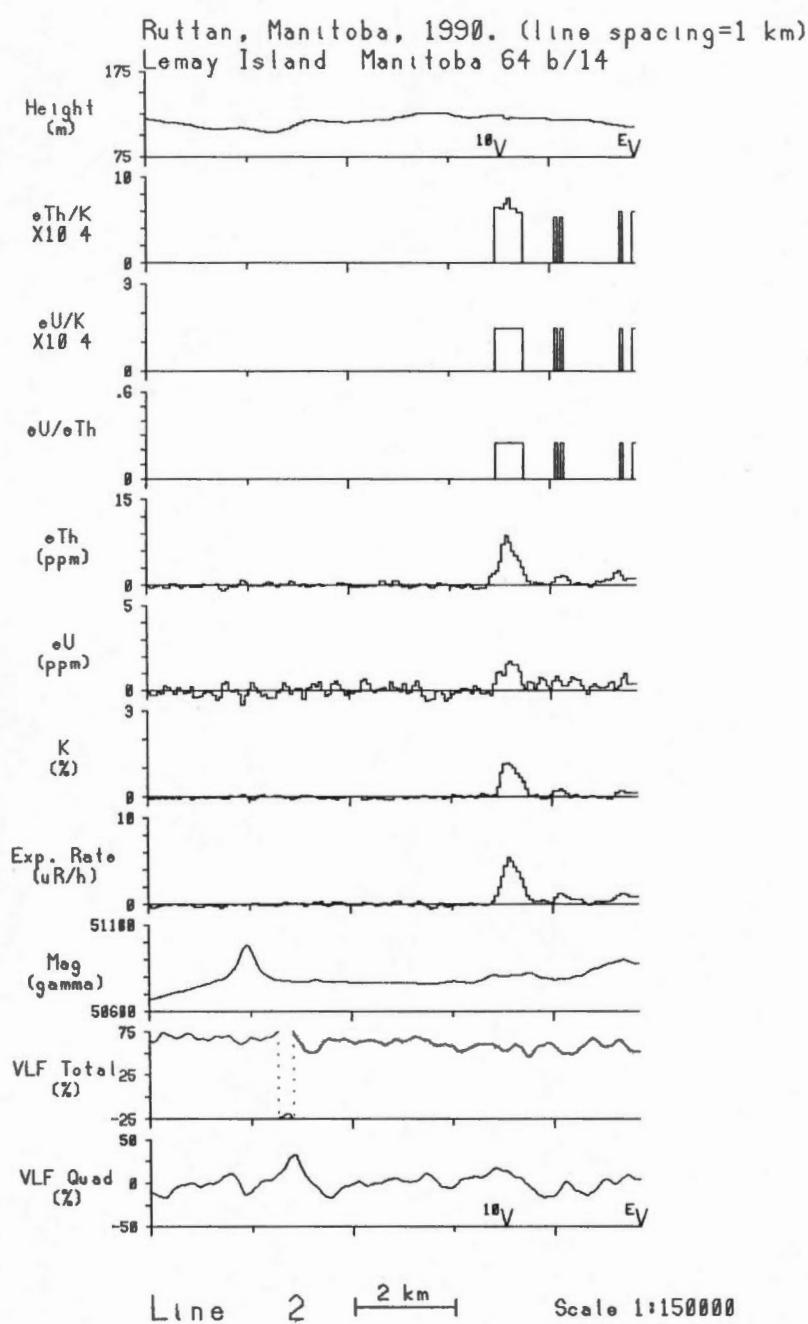
Cumulative Frequency

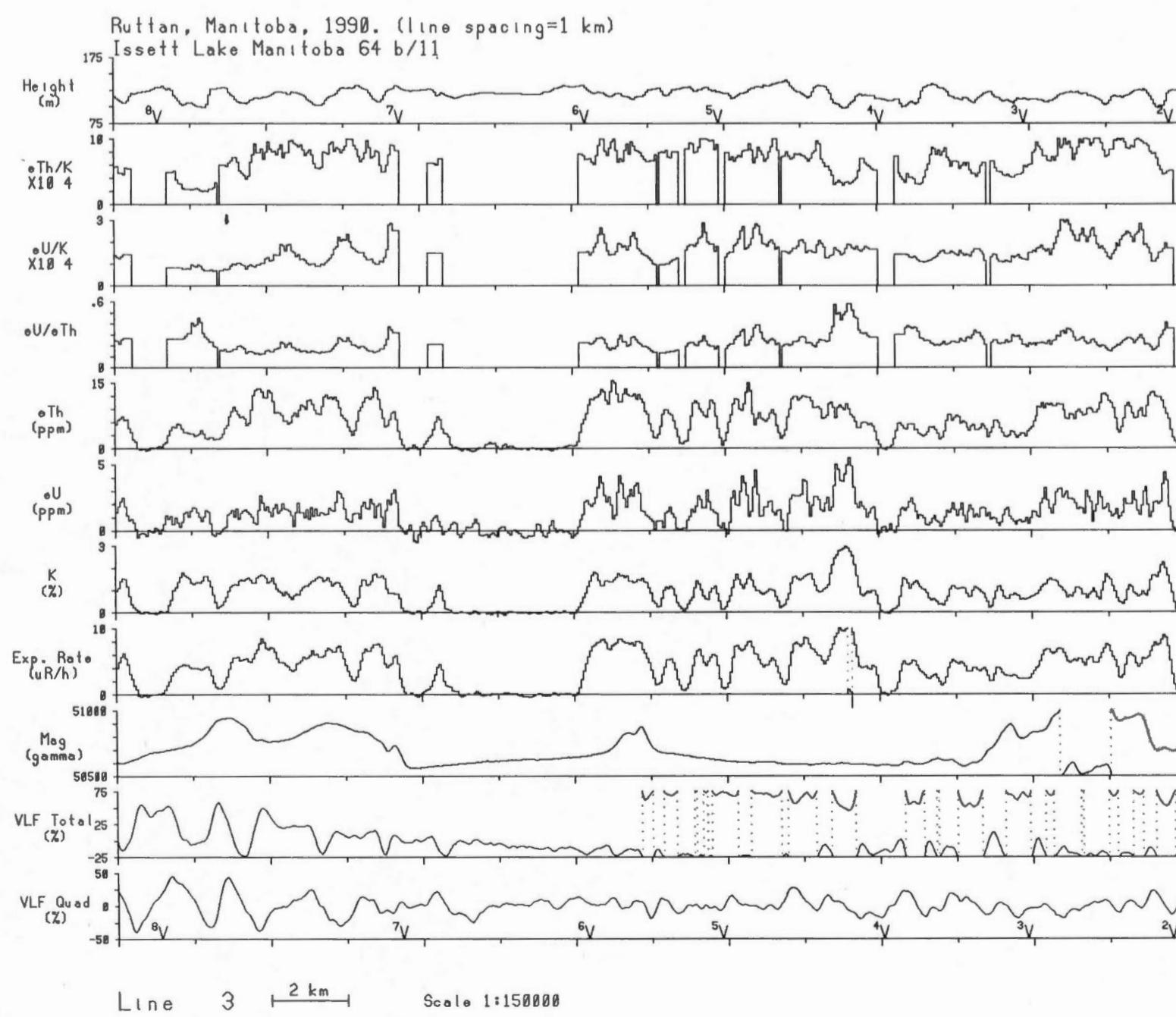
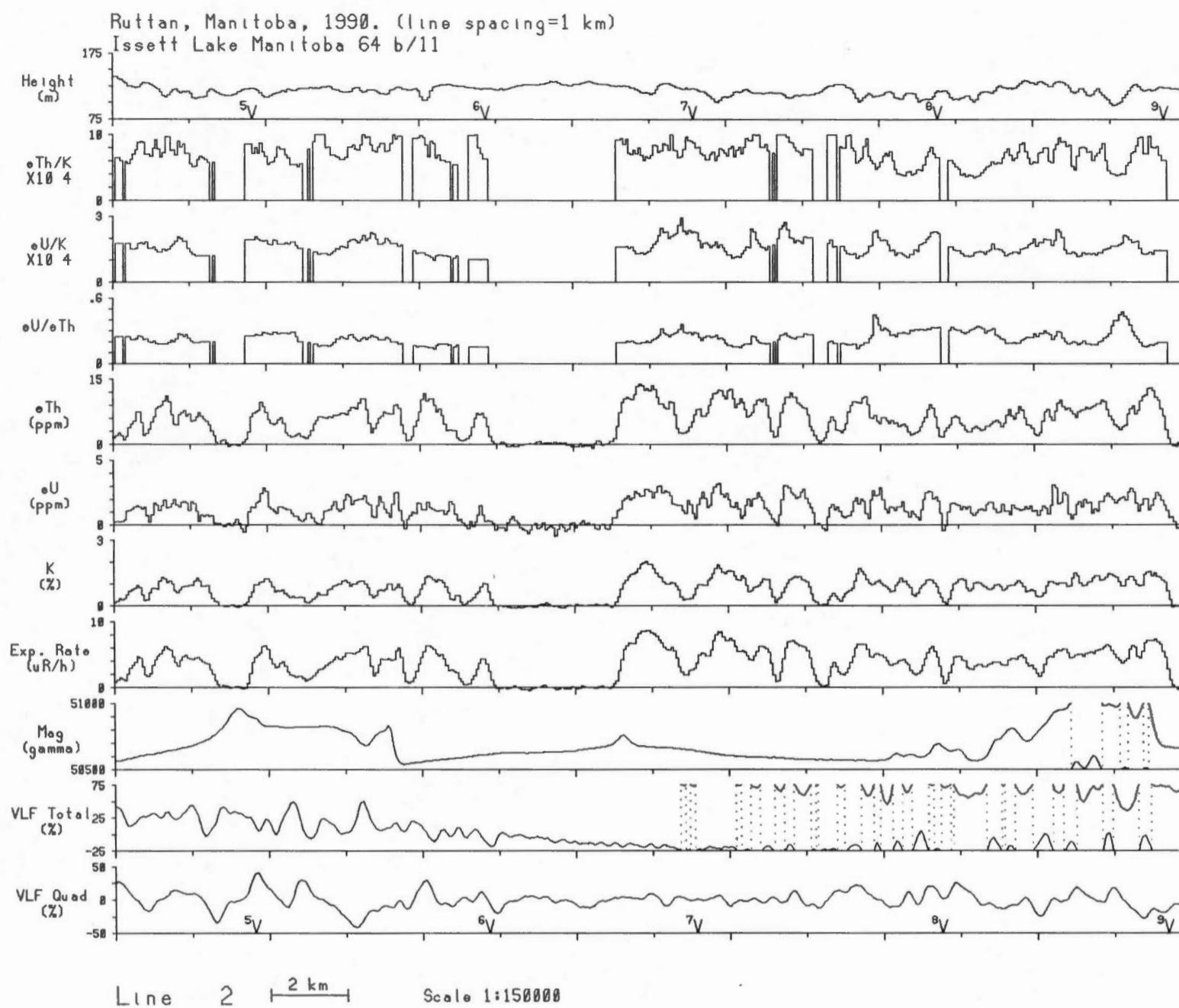


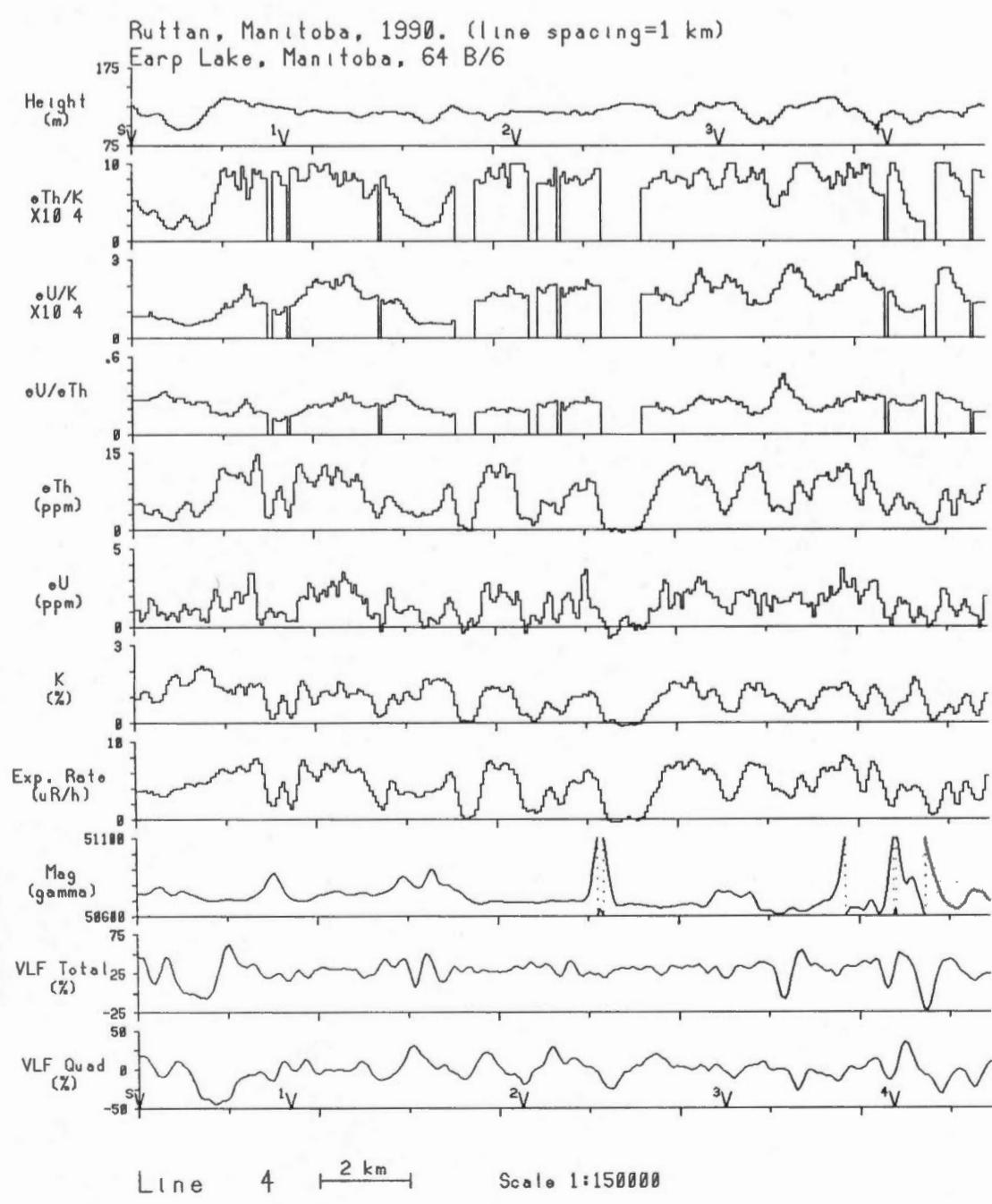
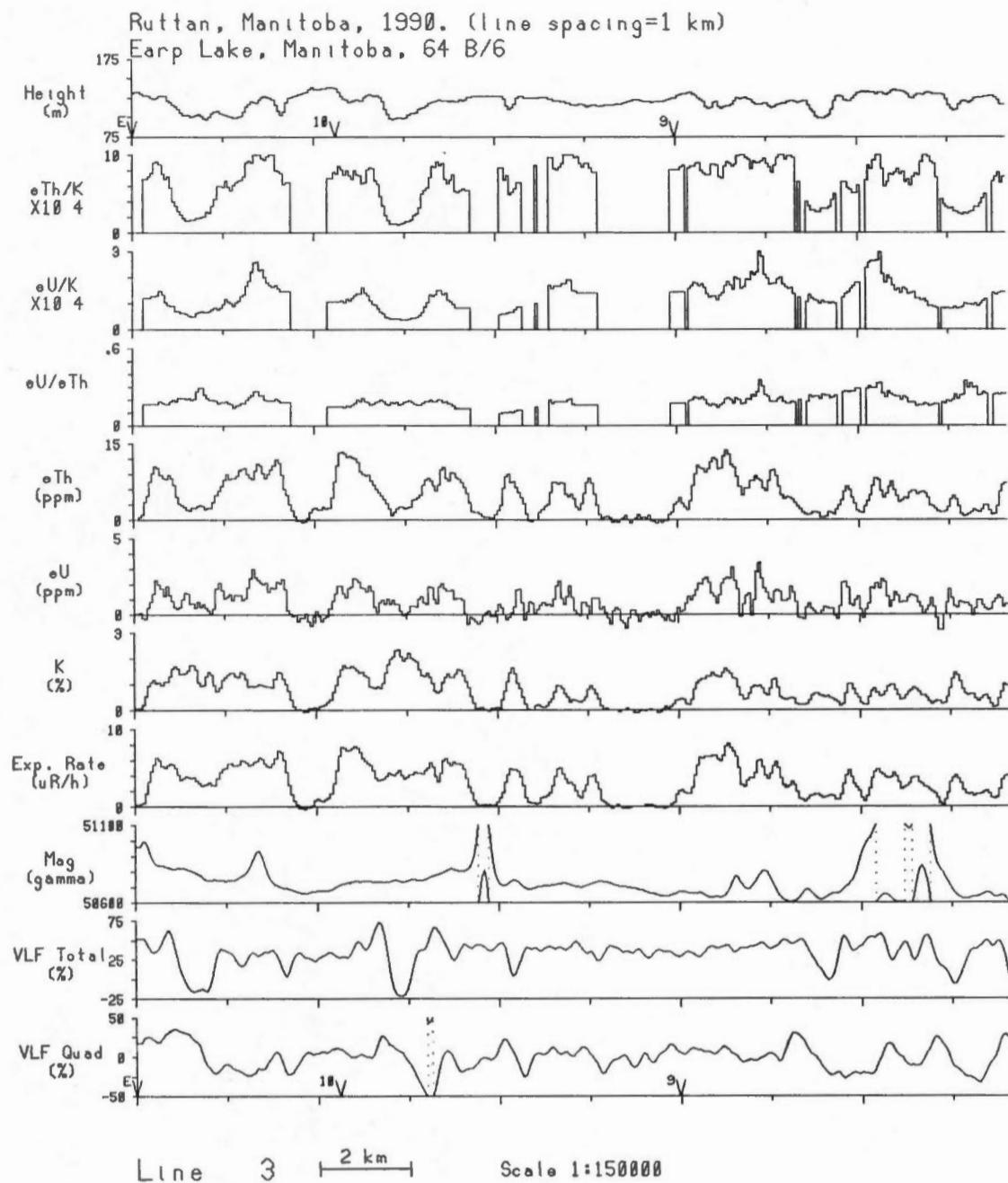
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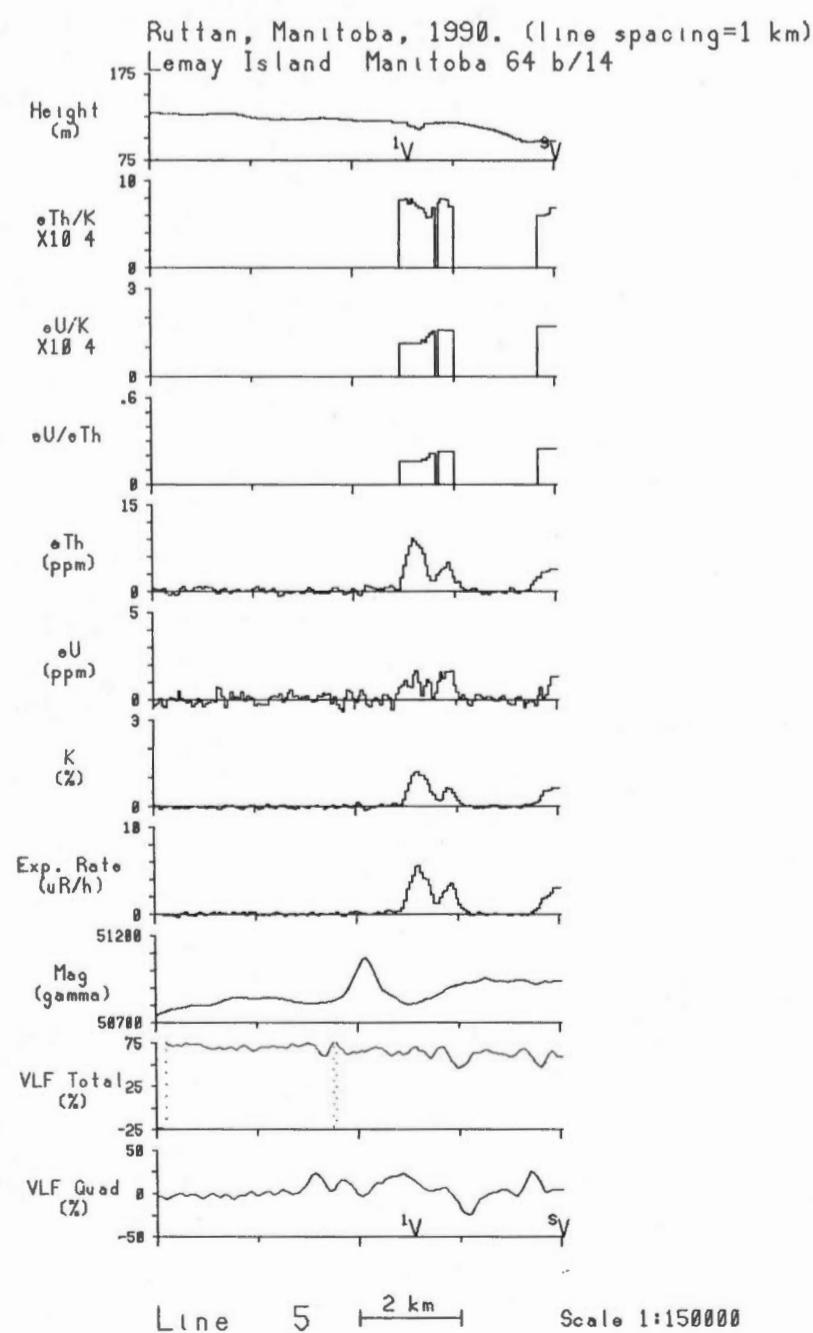
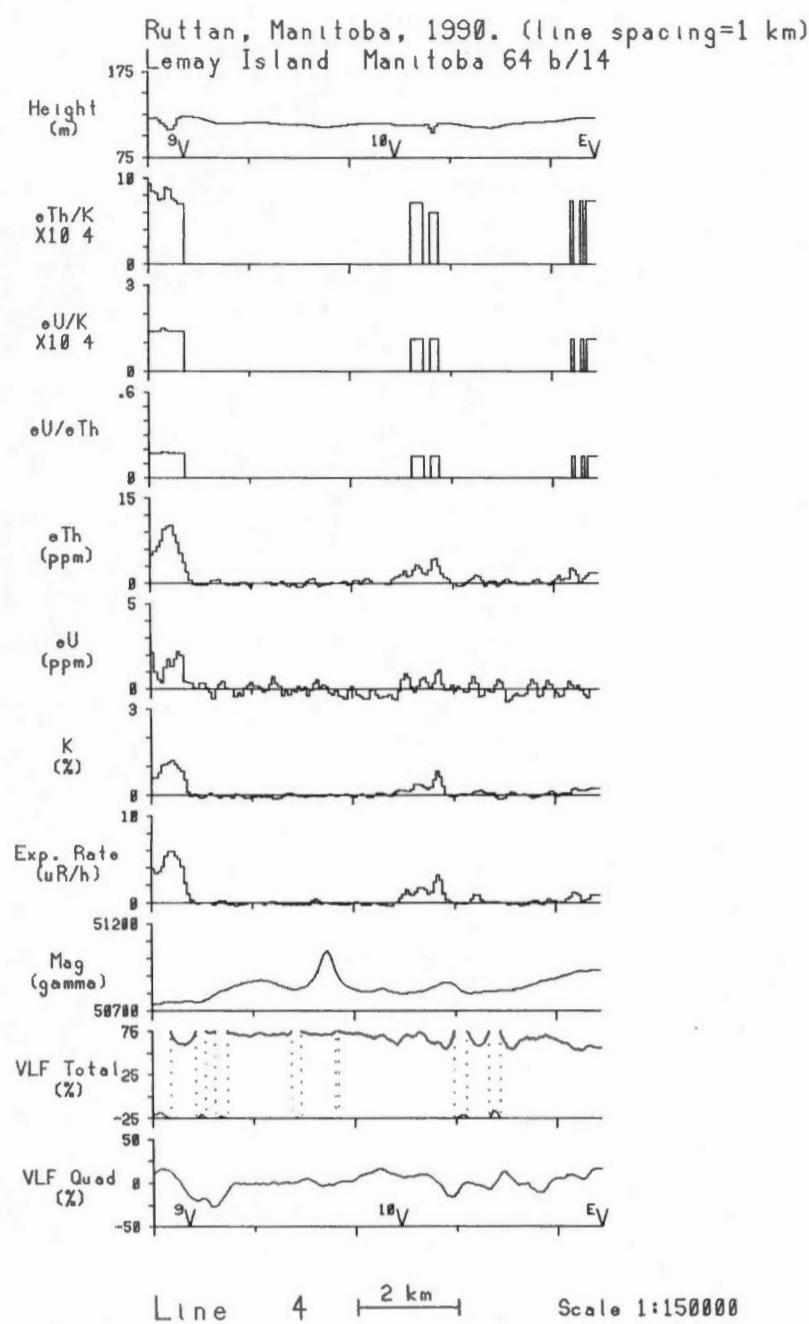


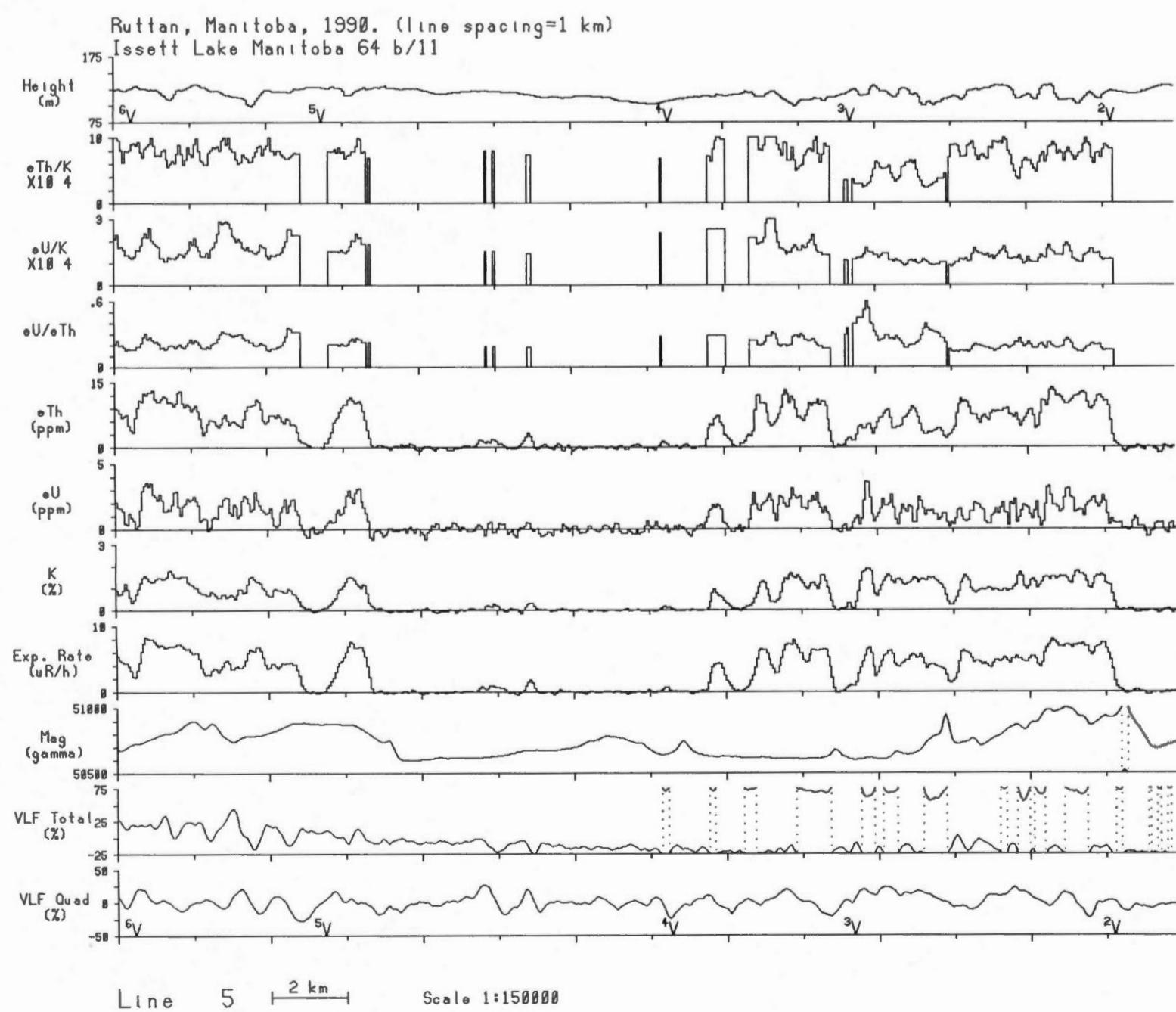
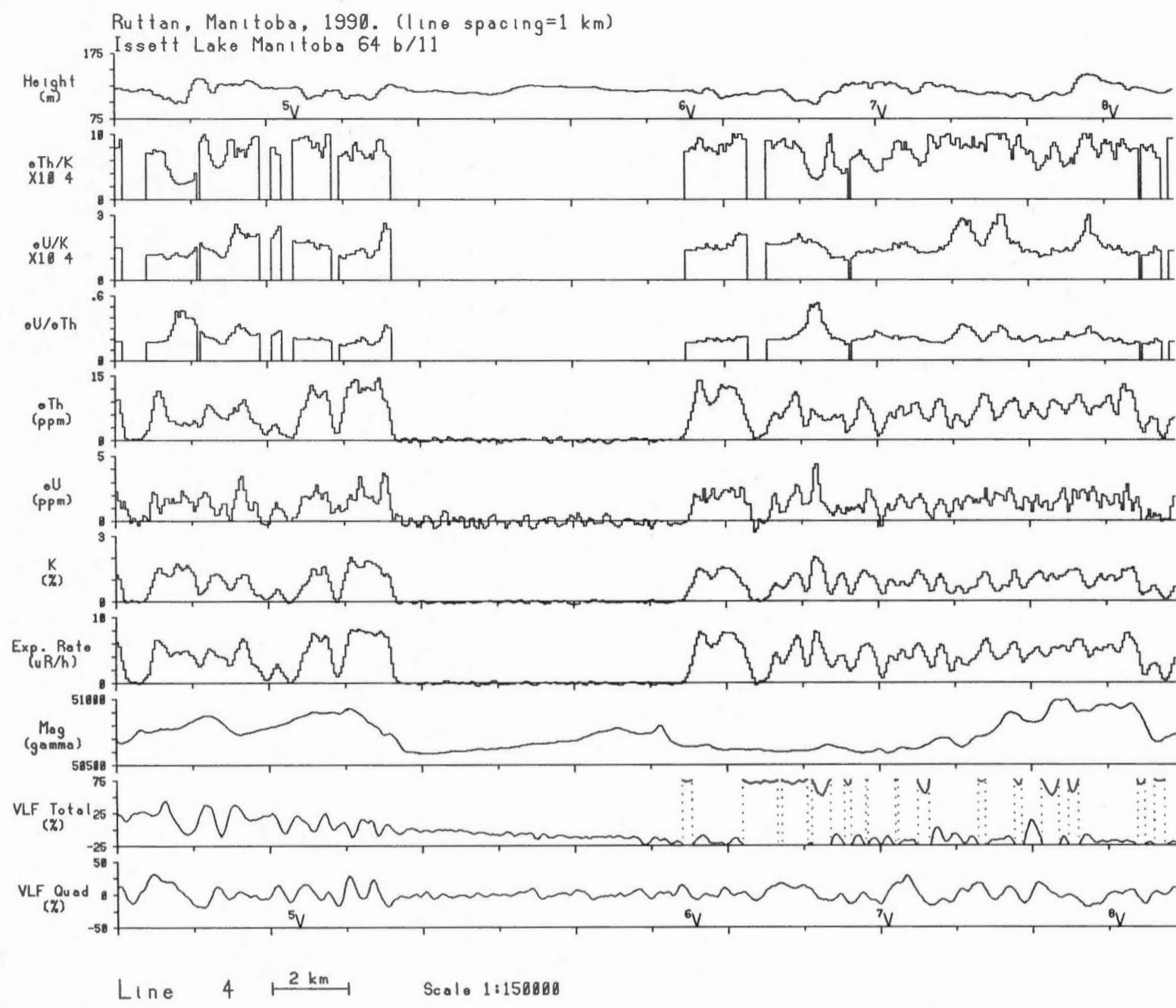


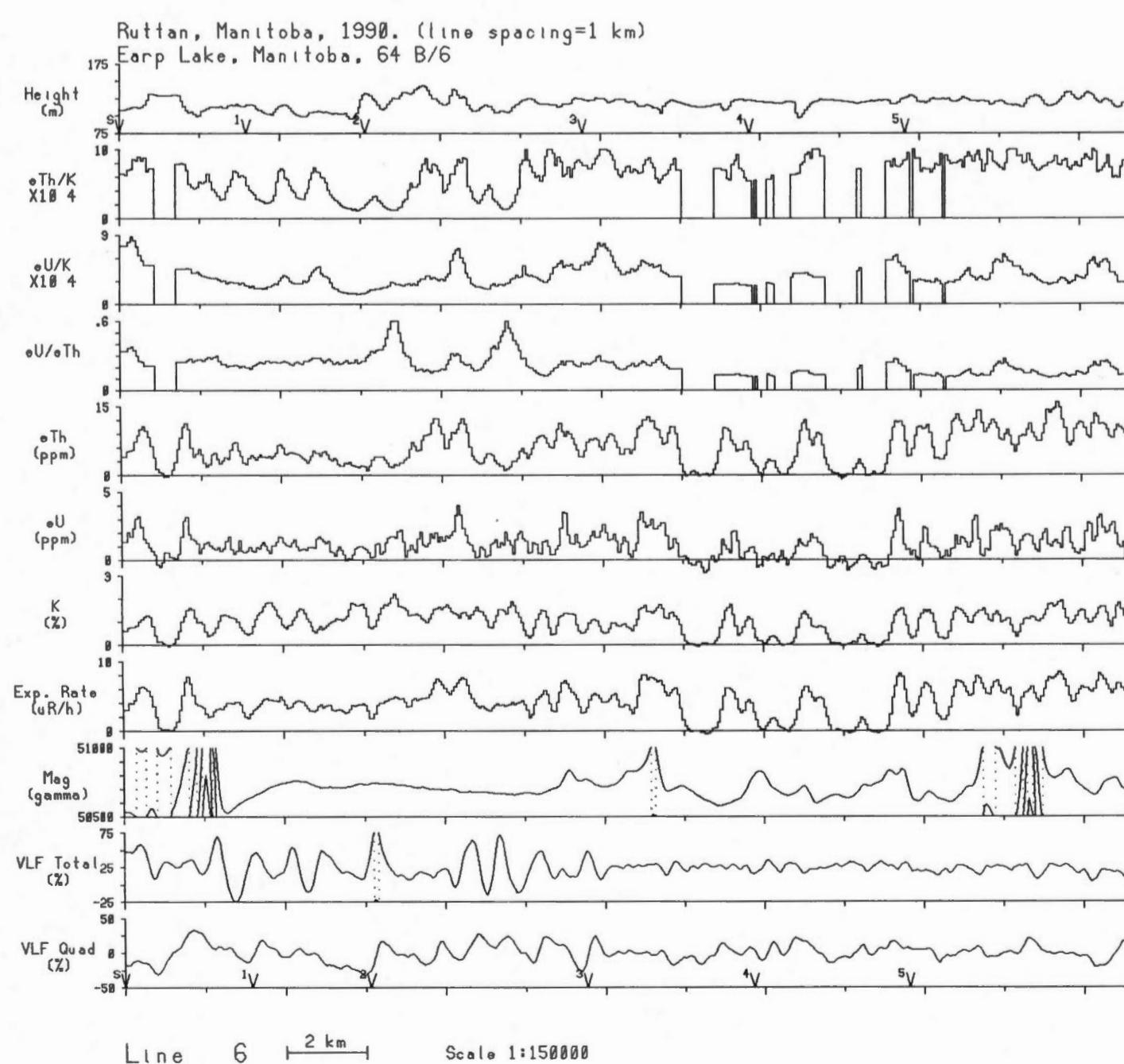
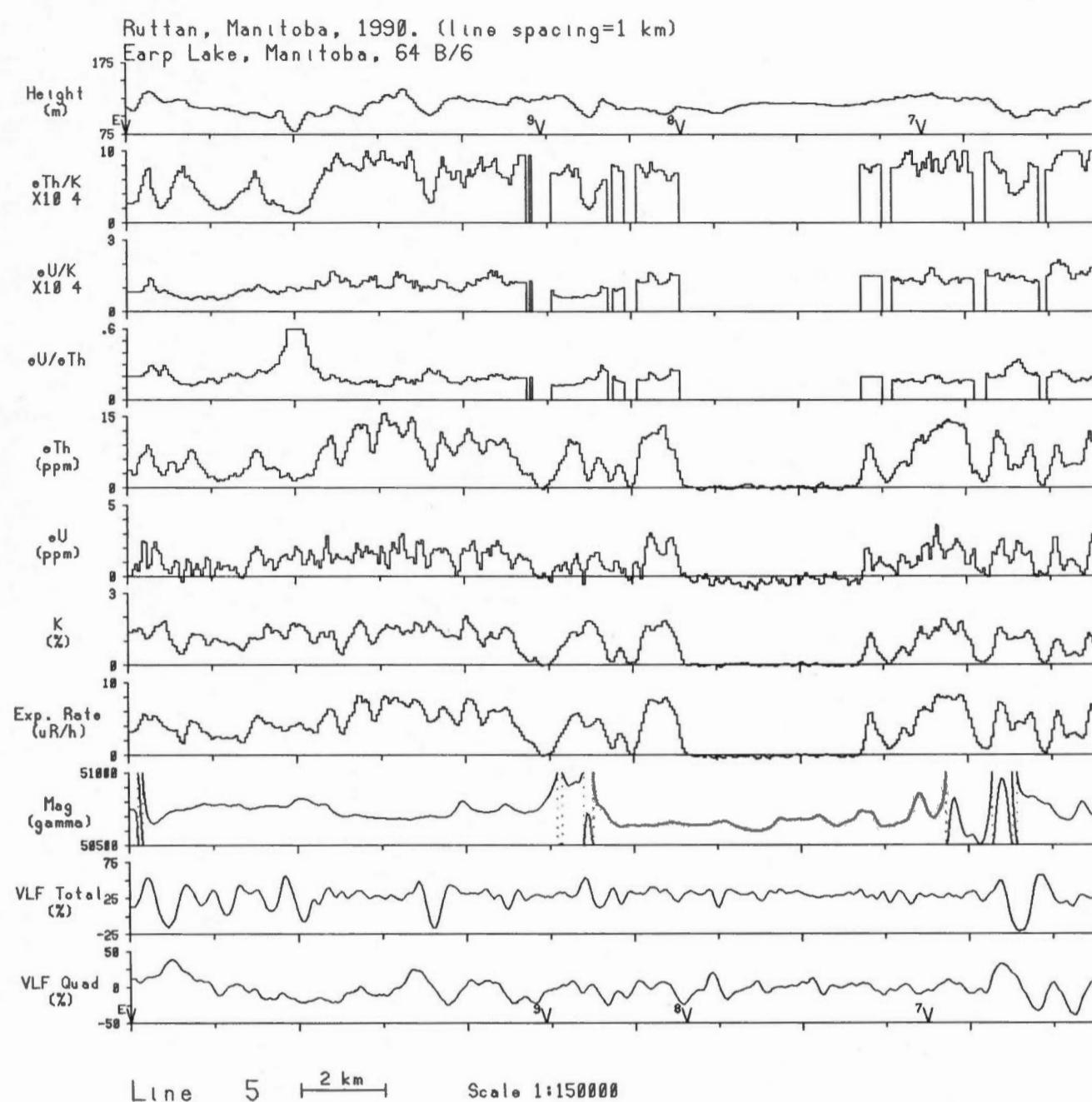


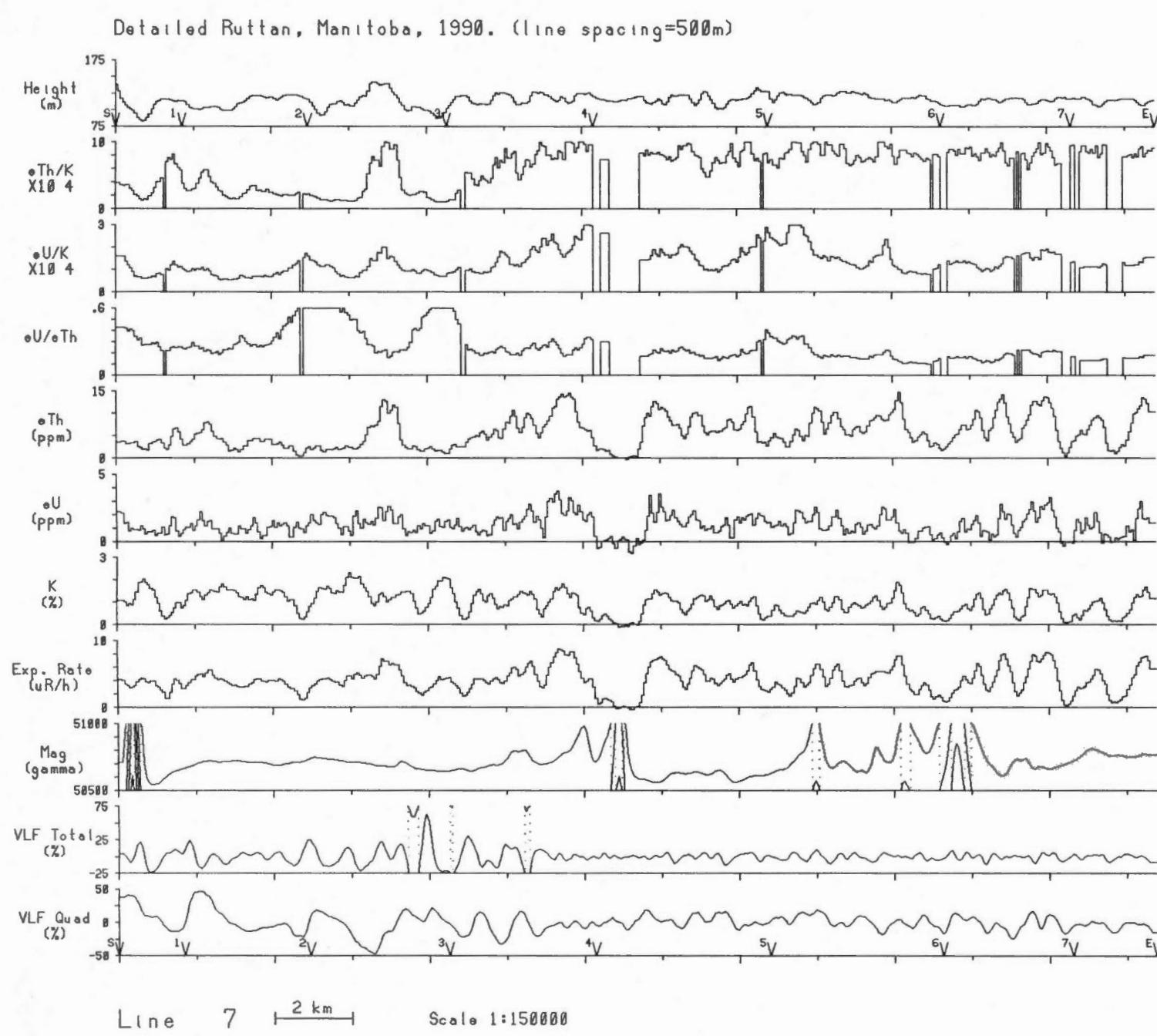
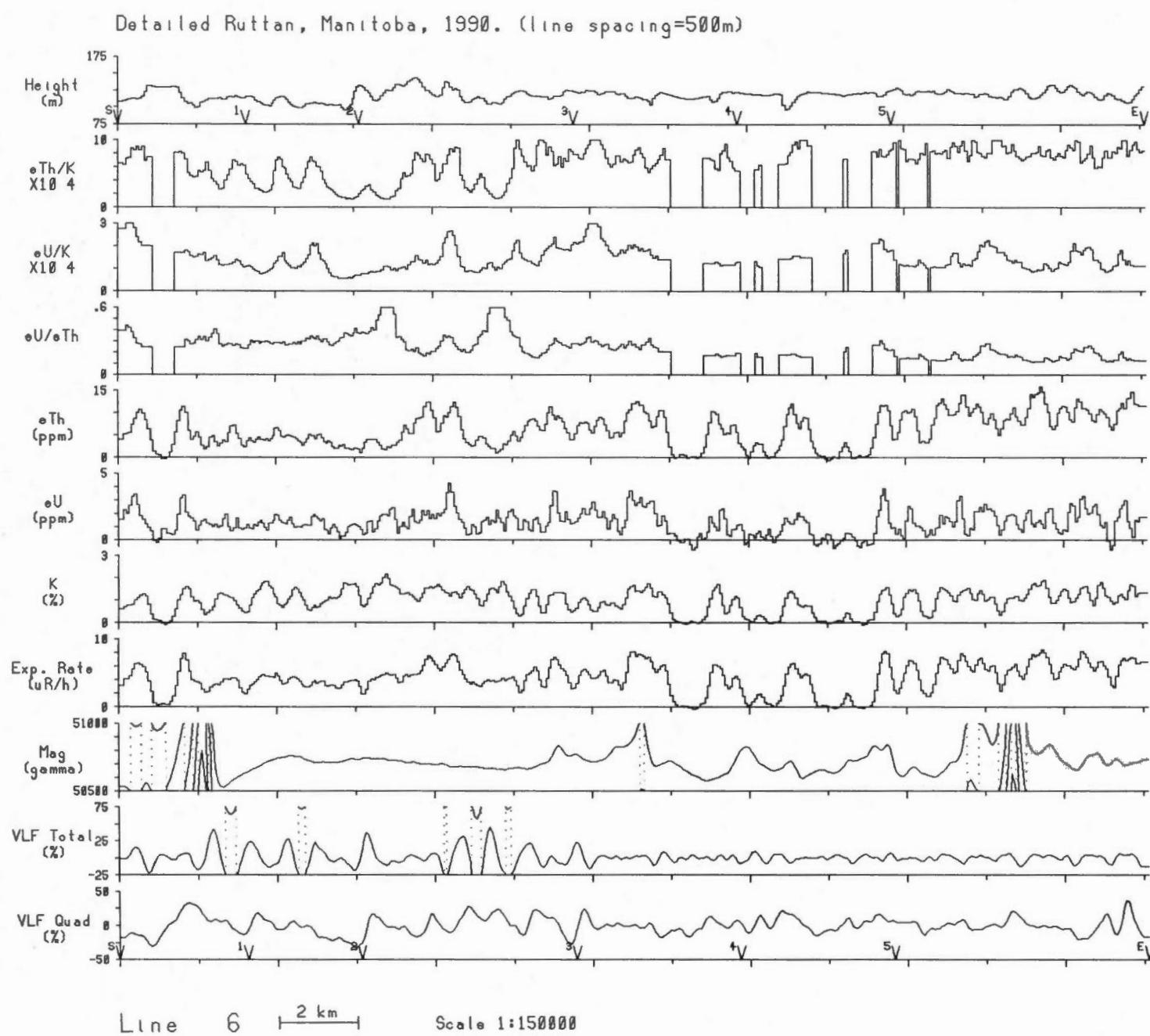


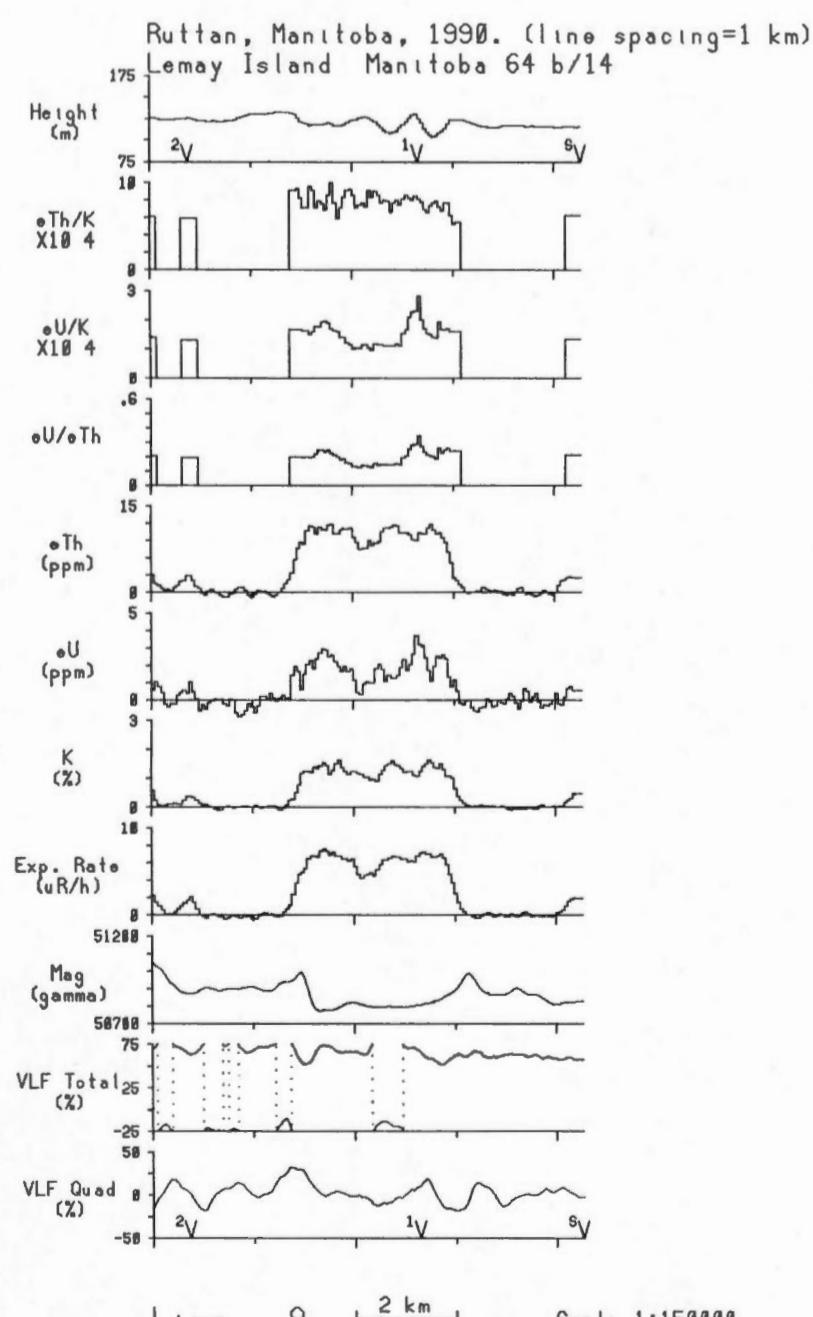
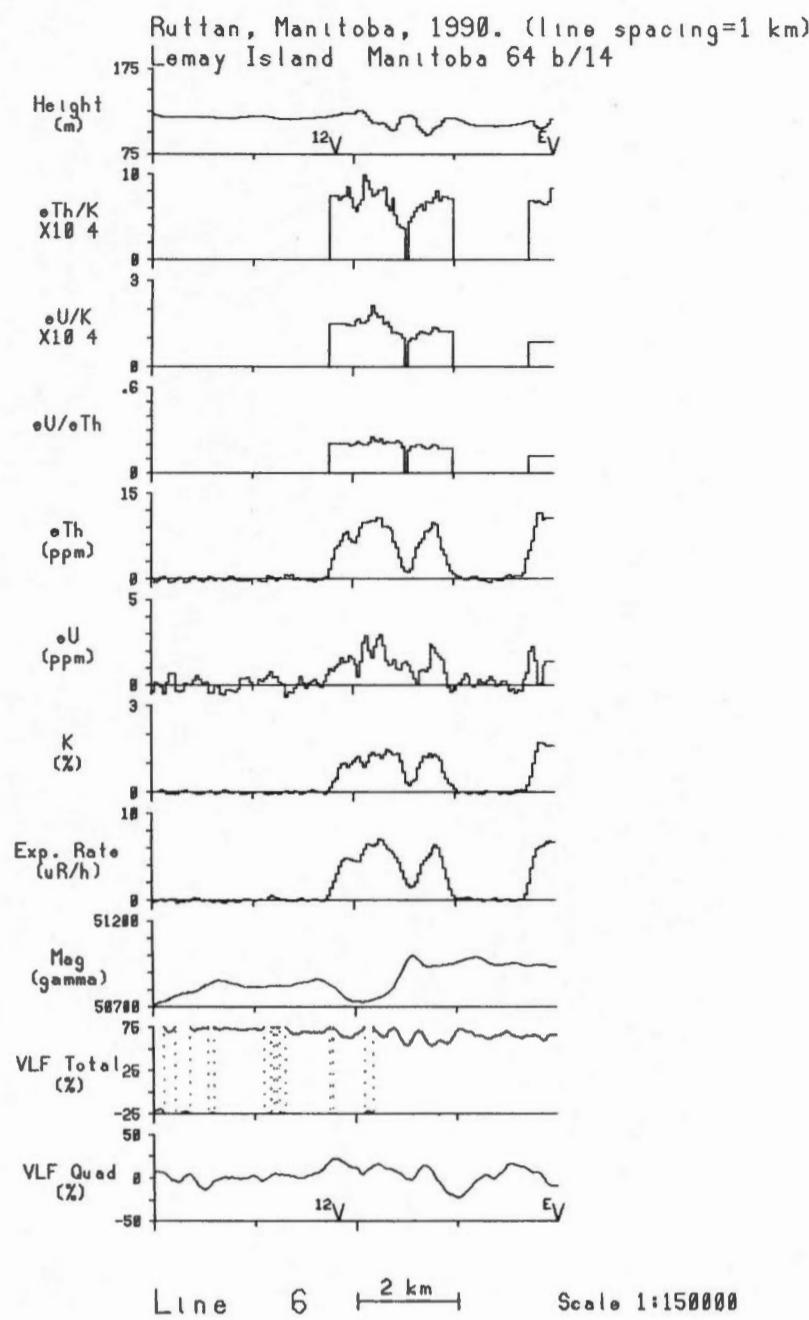


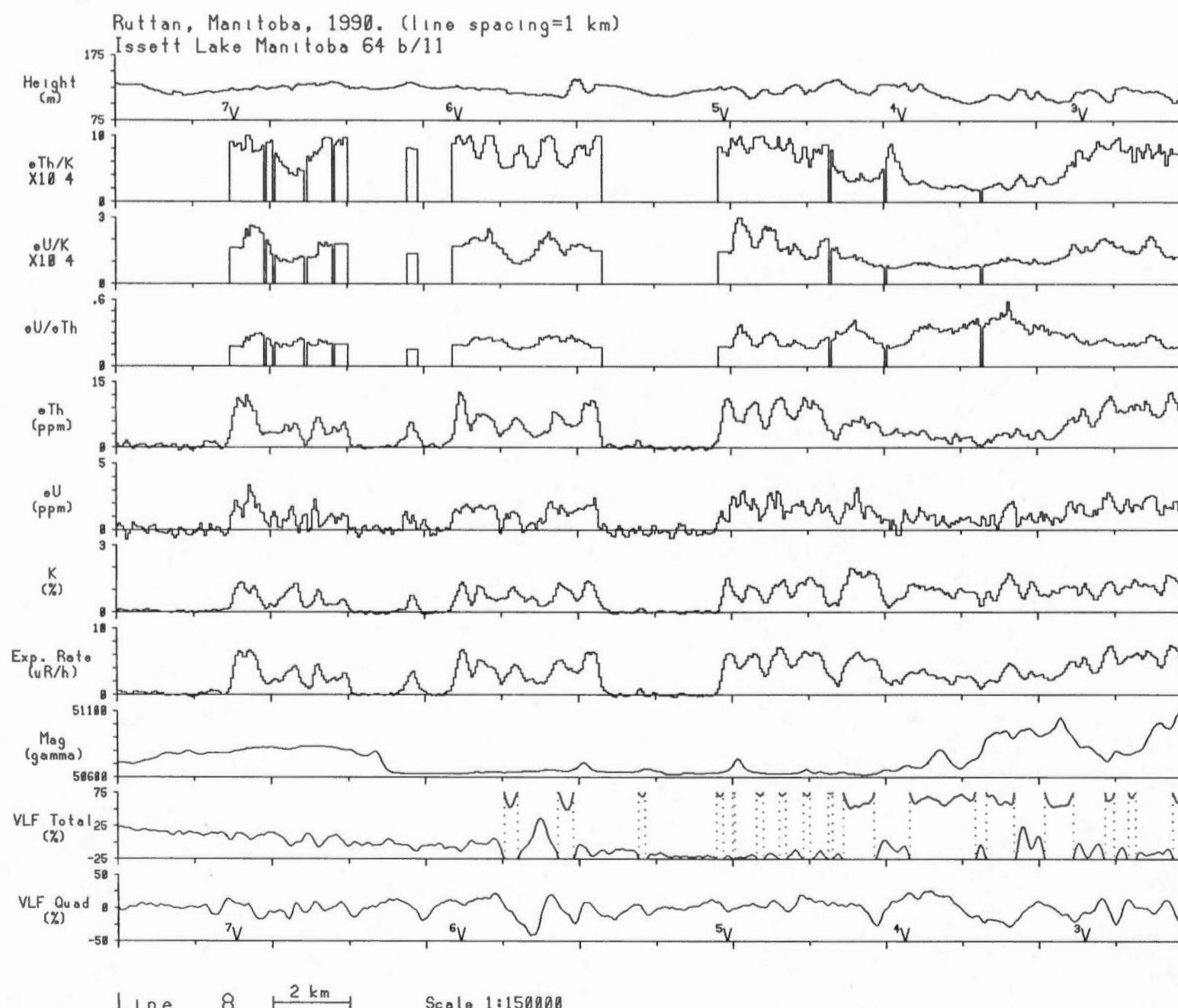
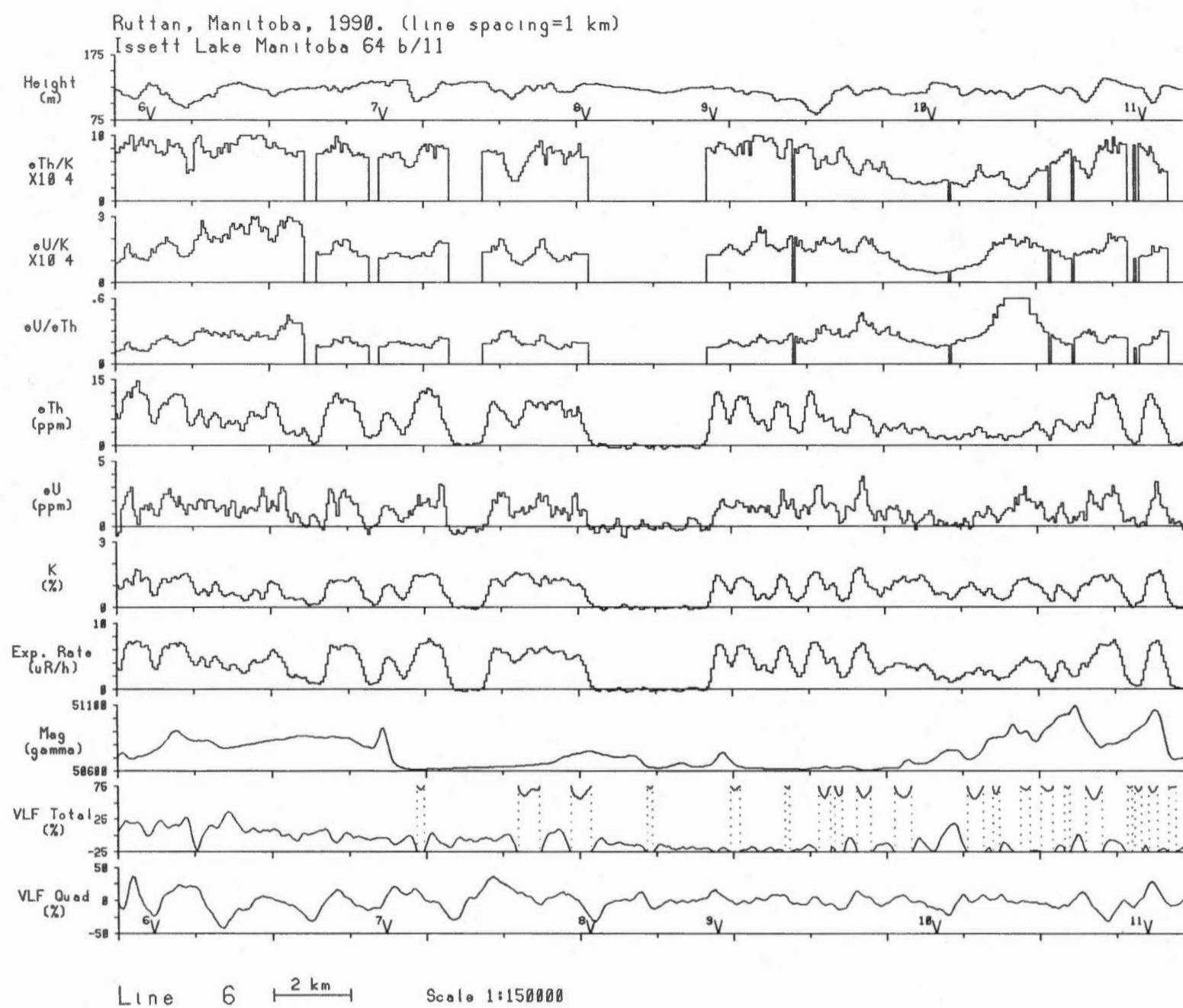


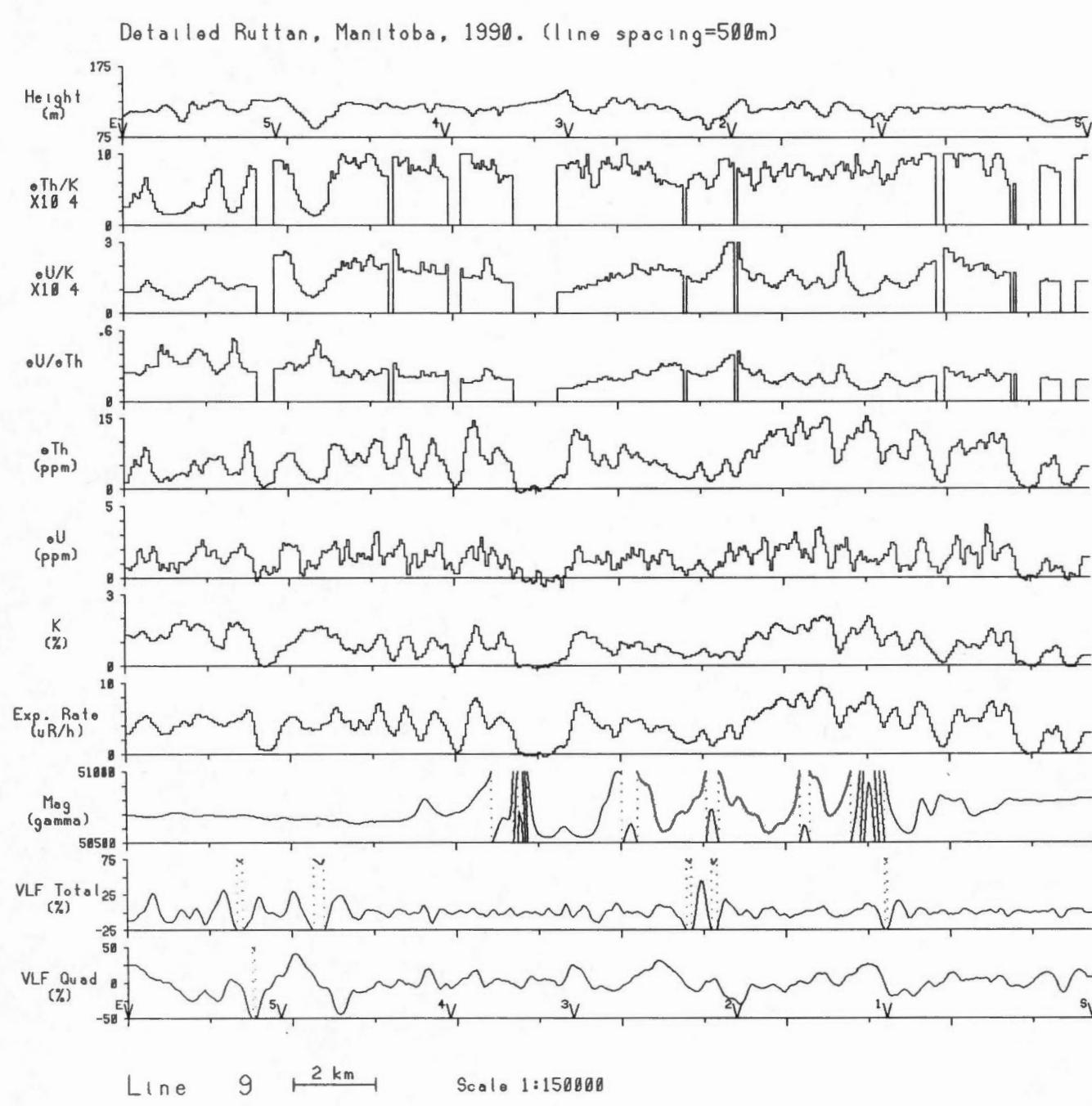
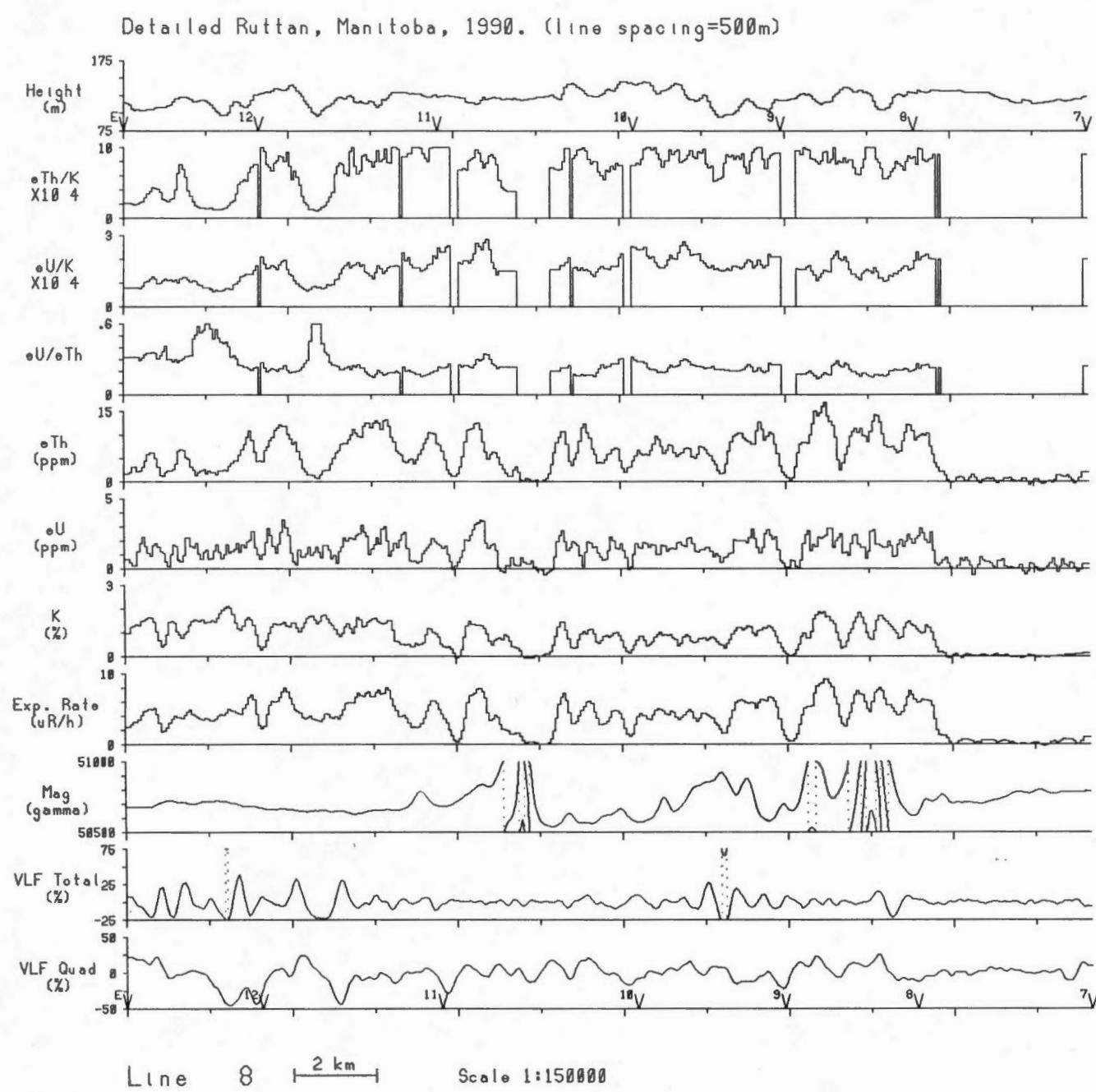


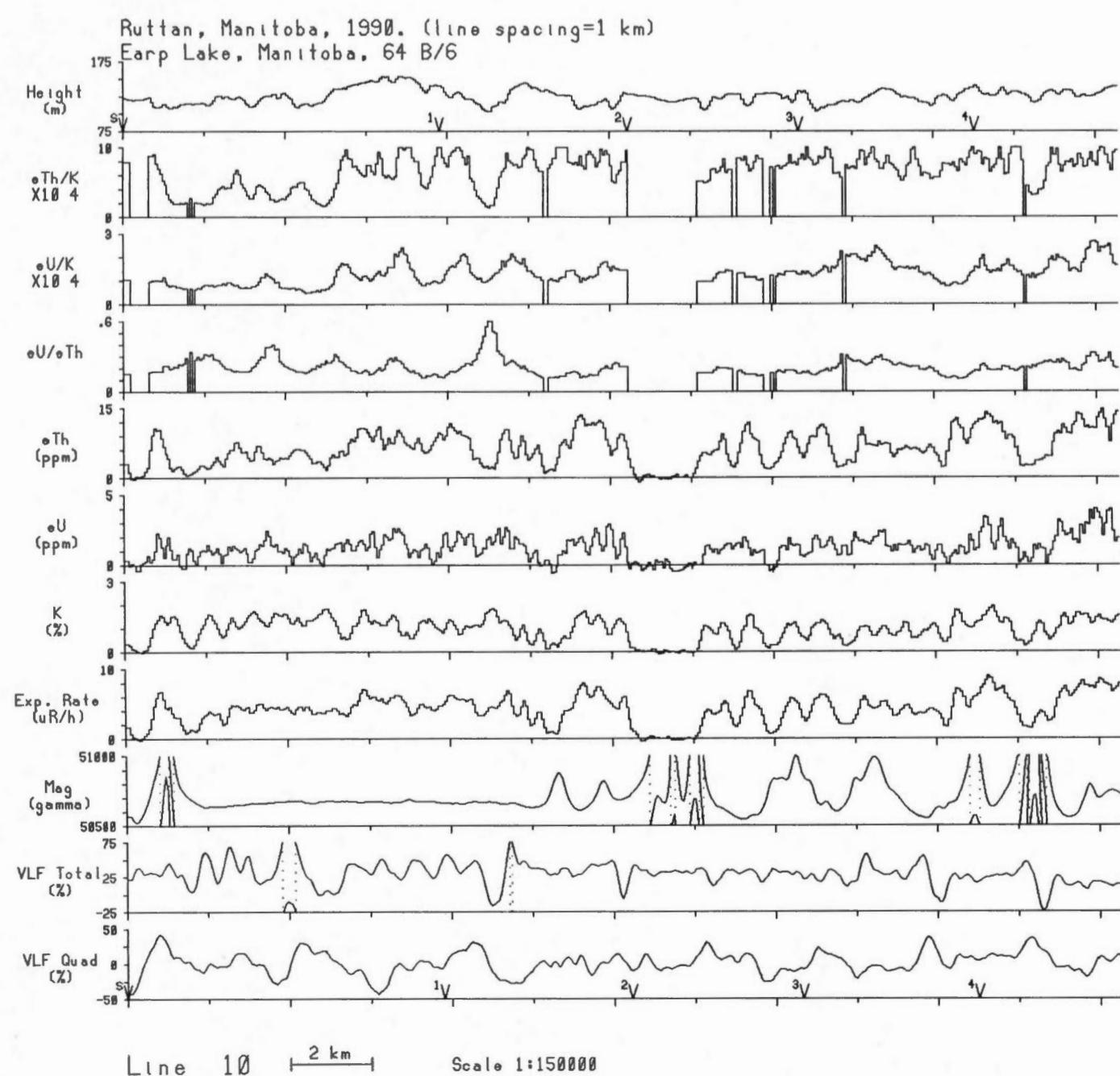
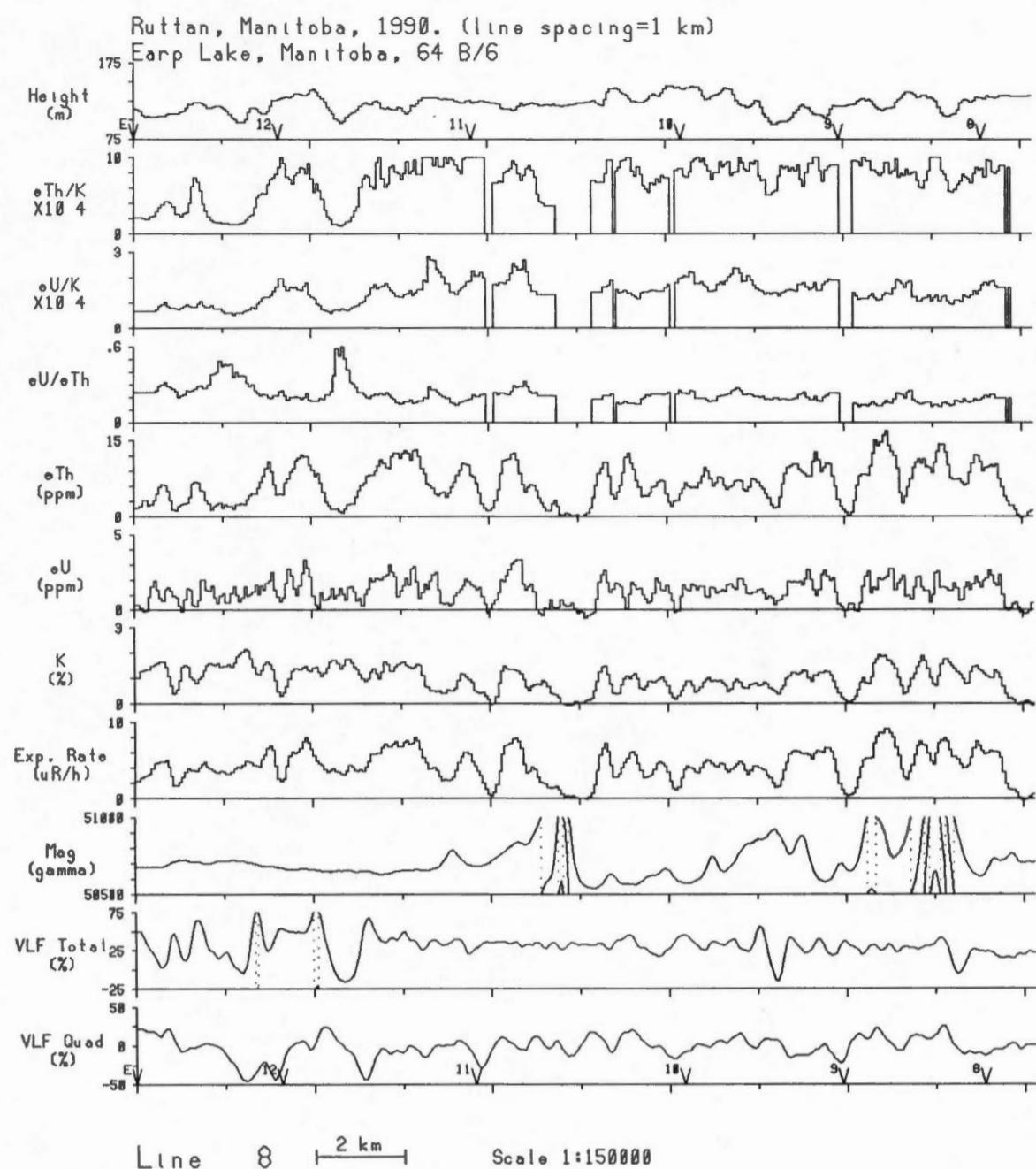


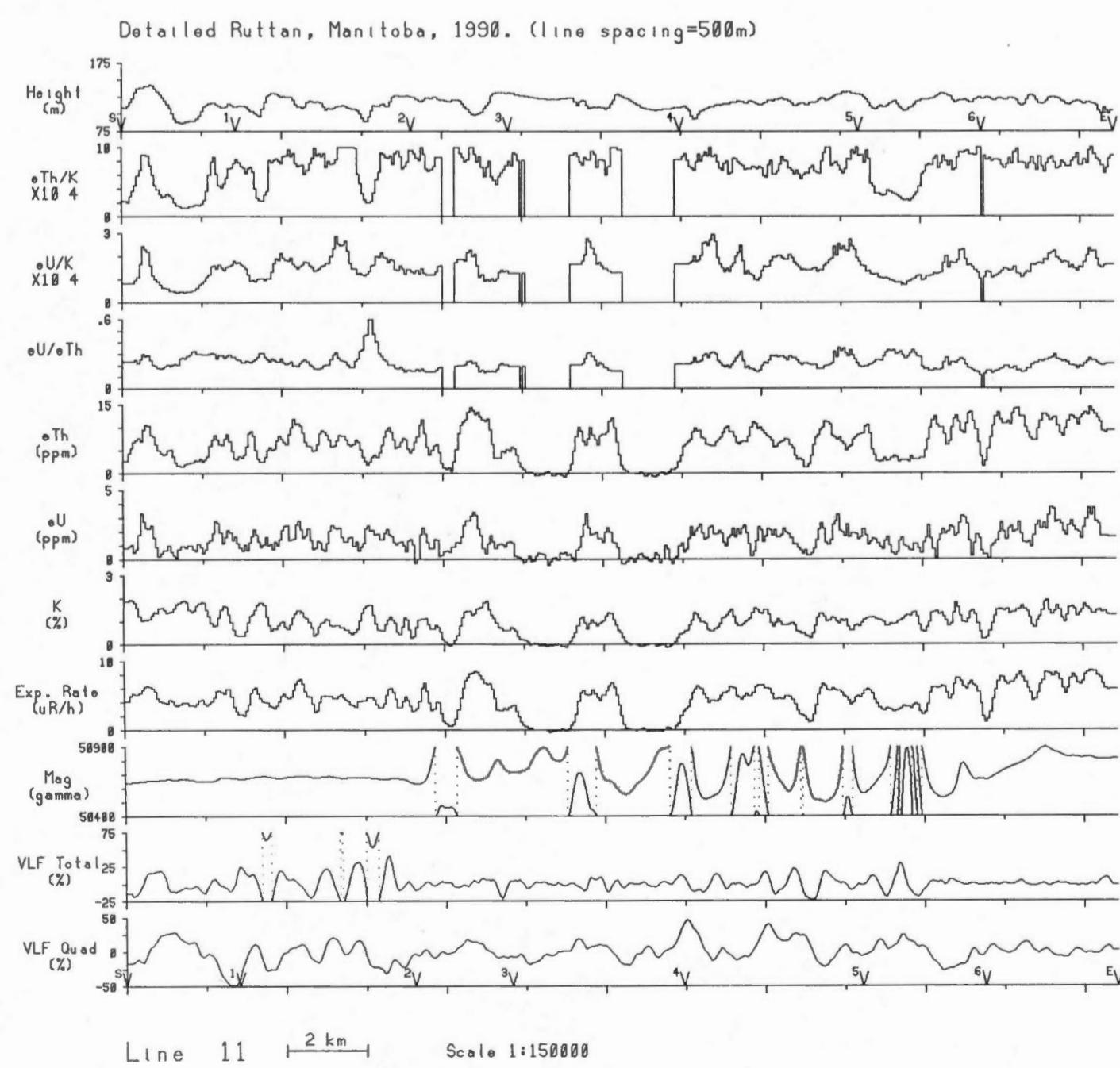
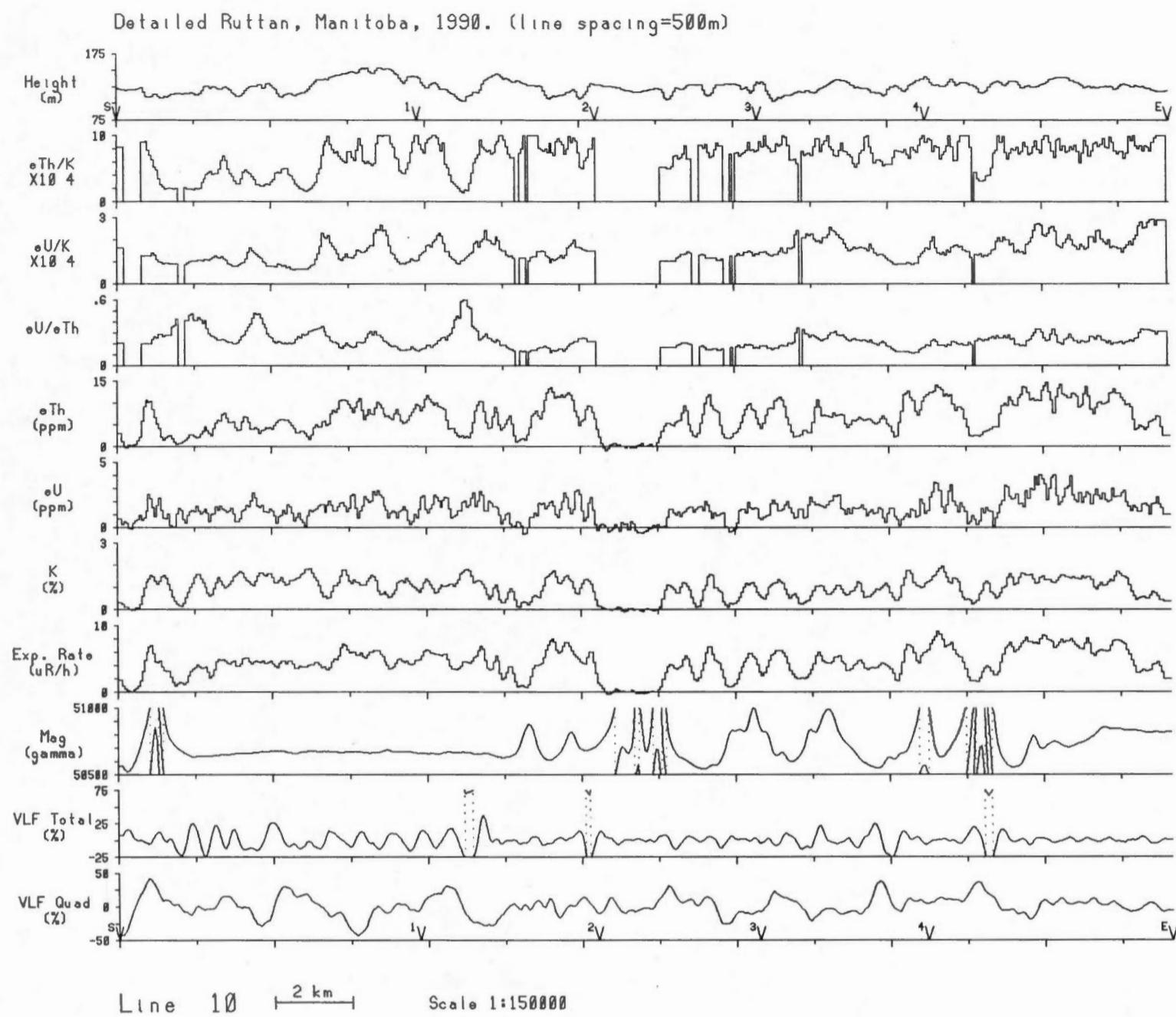


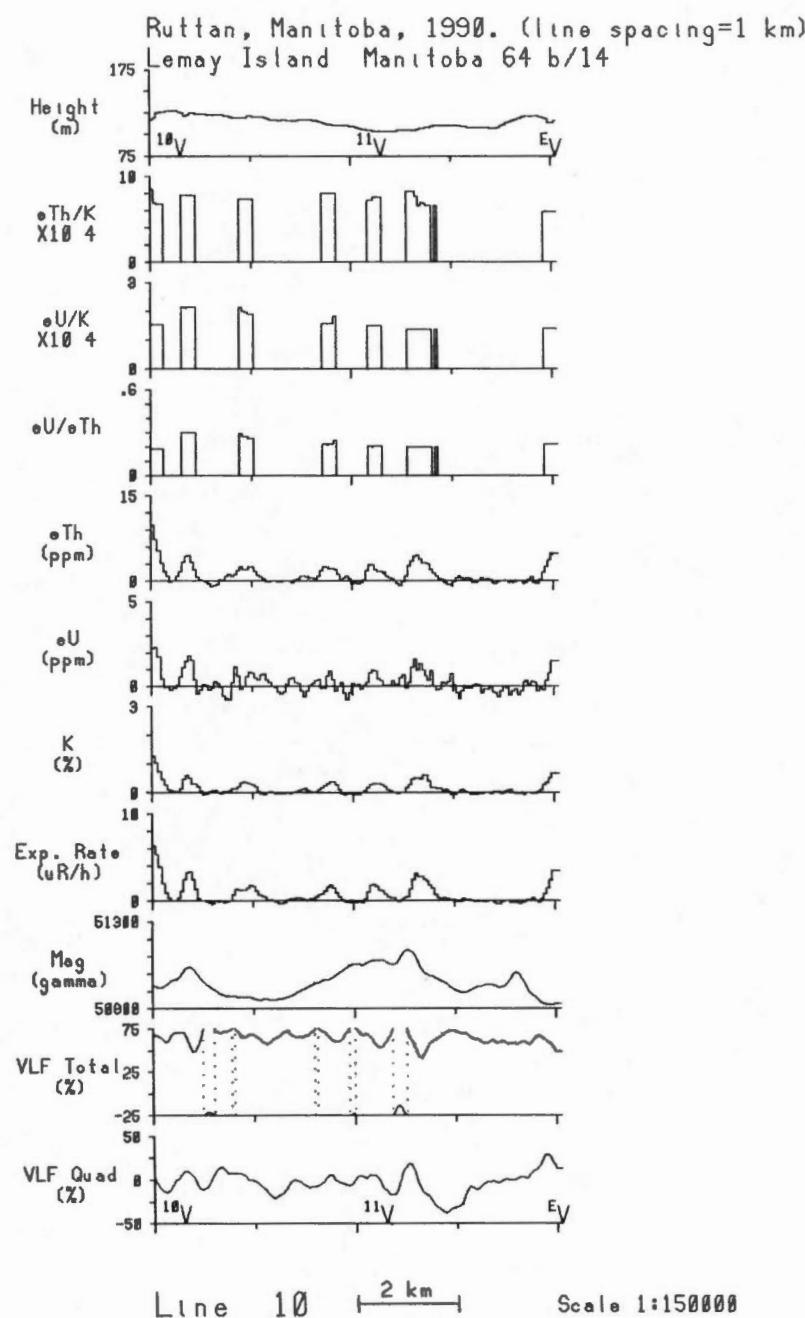




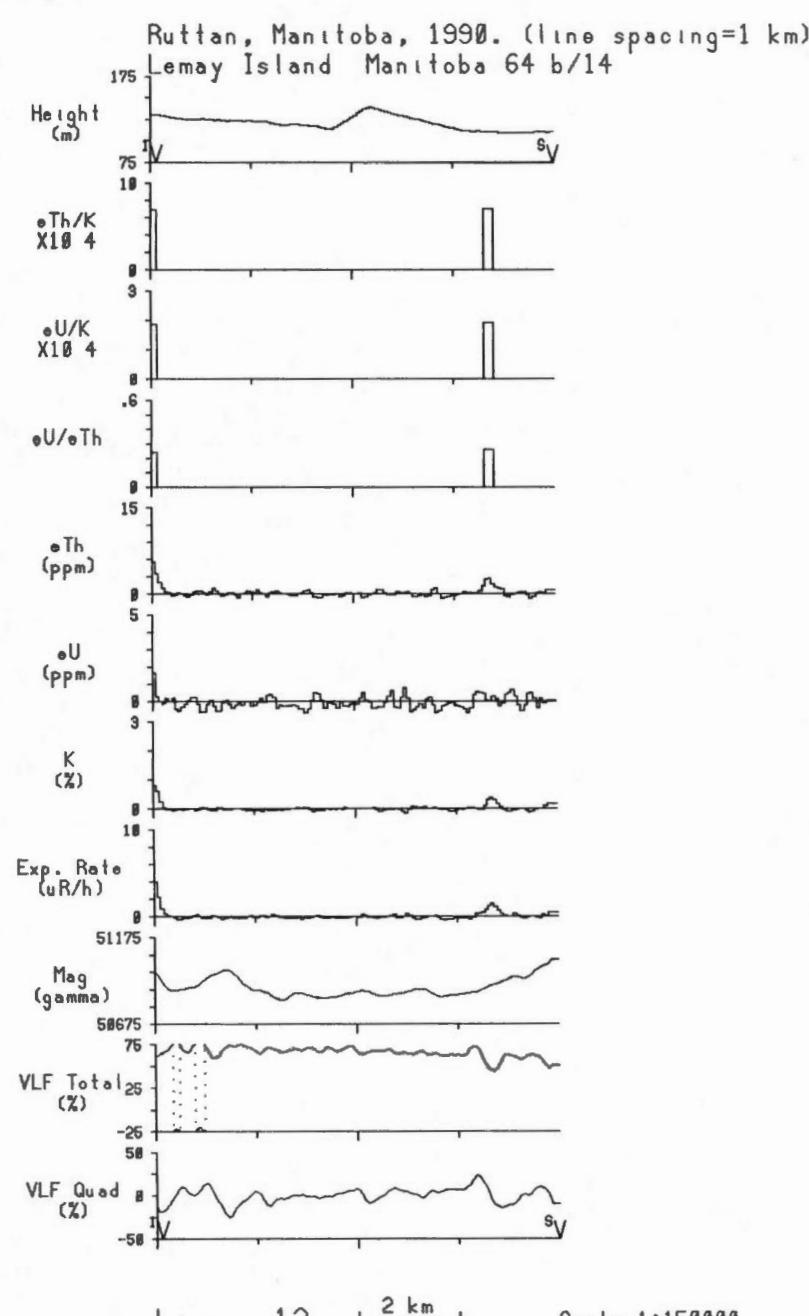




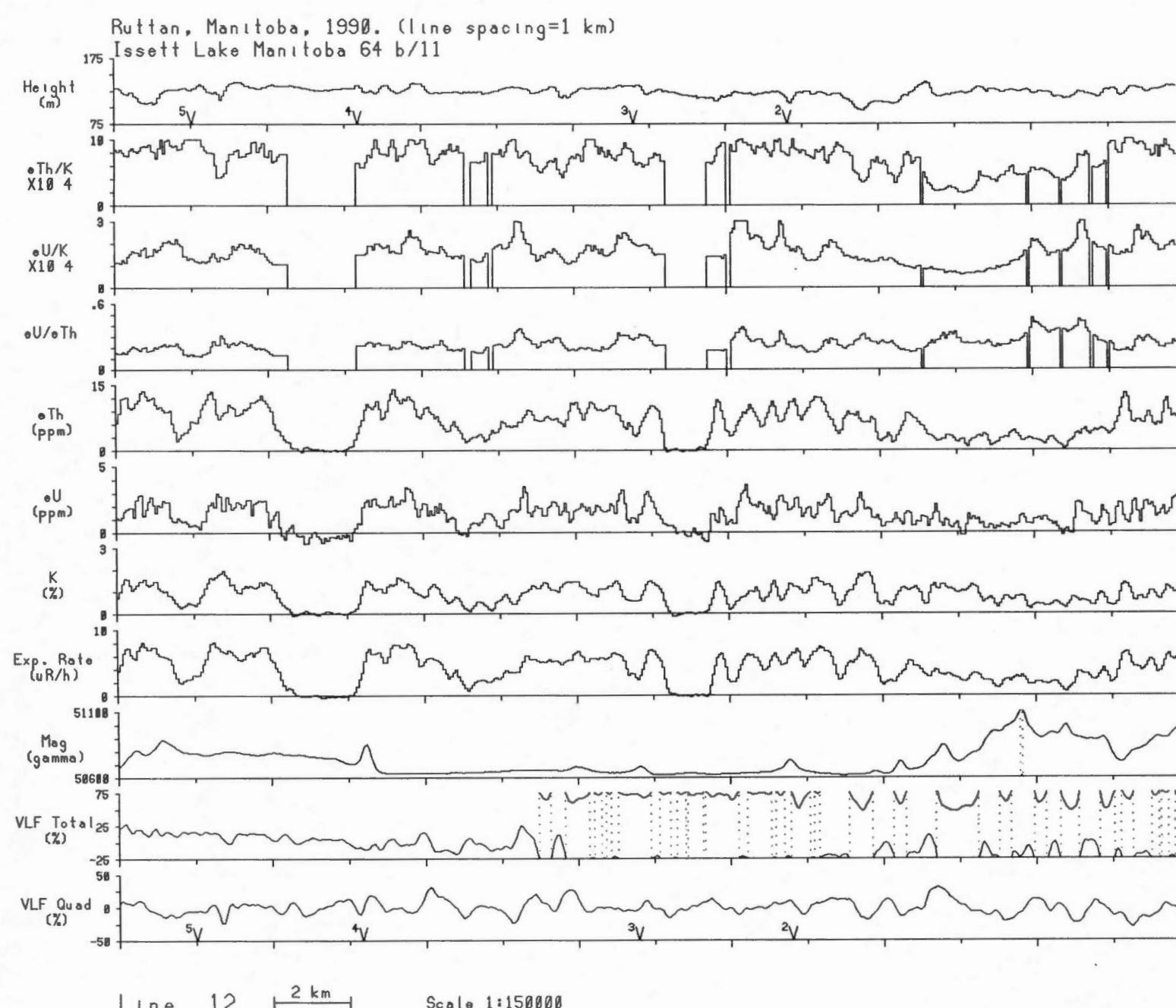
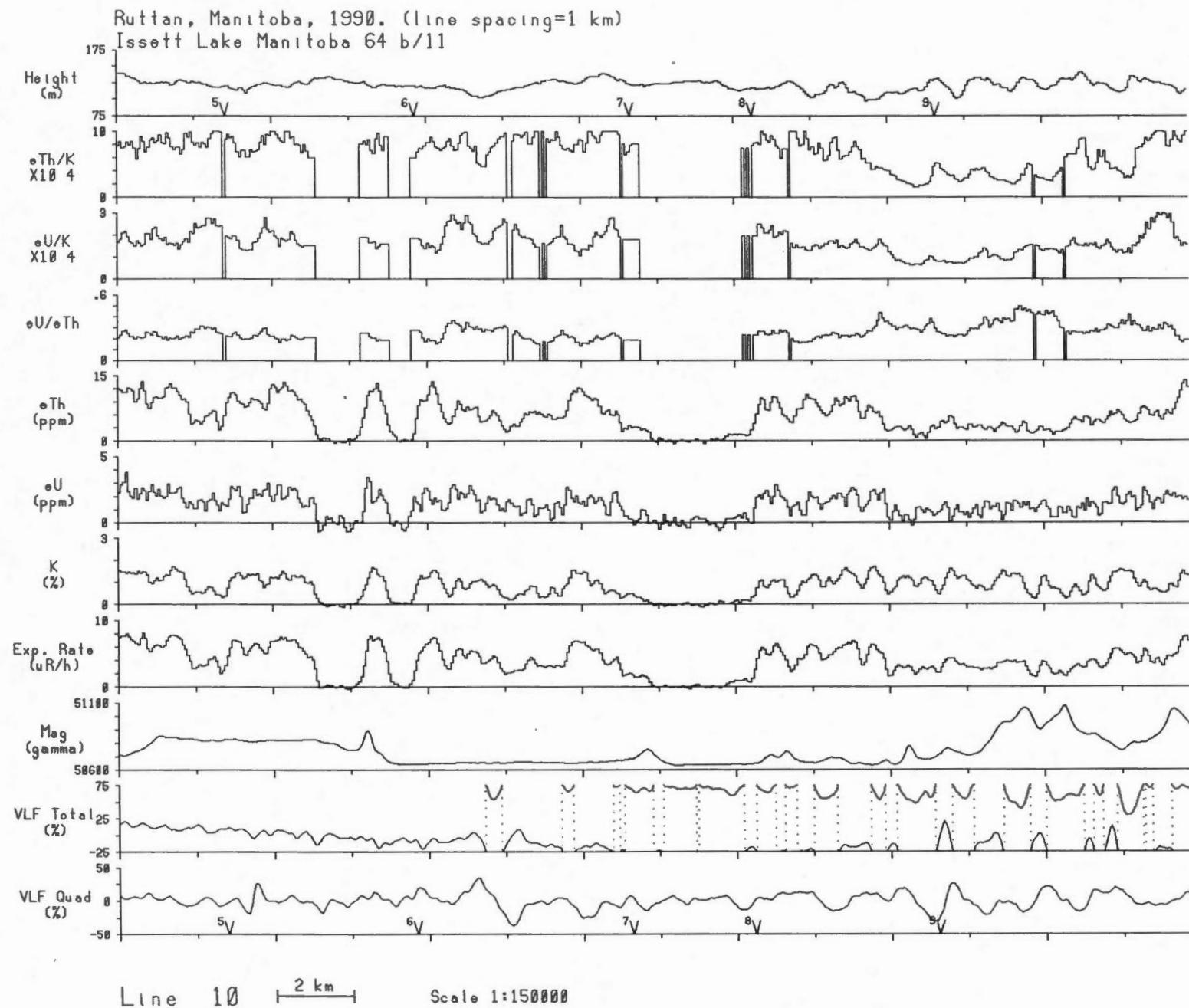


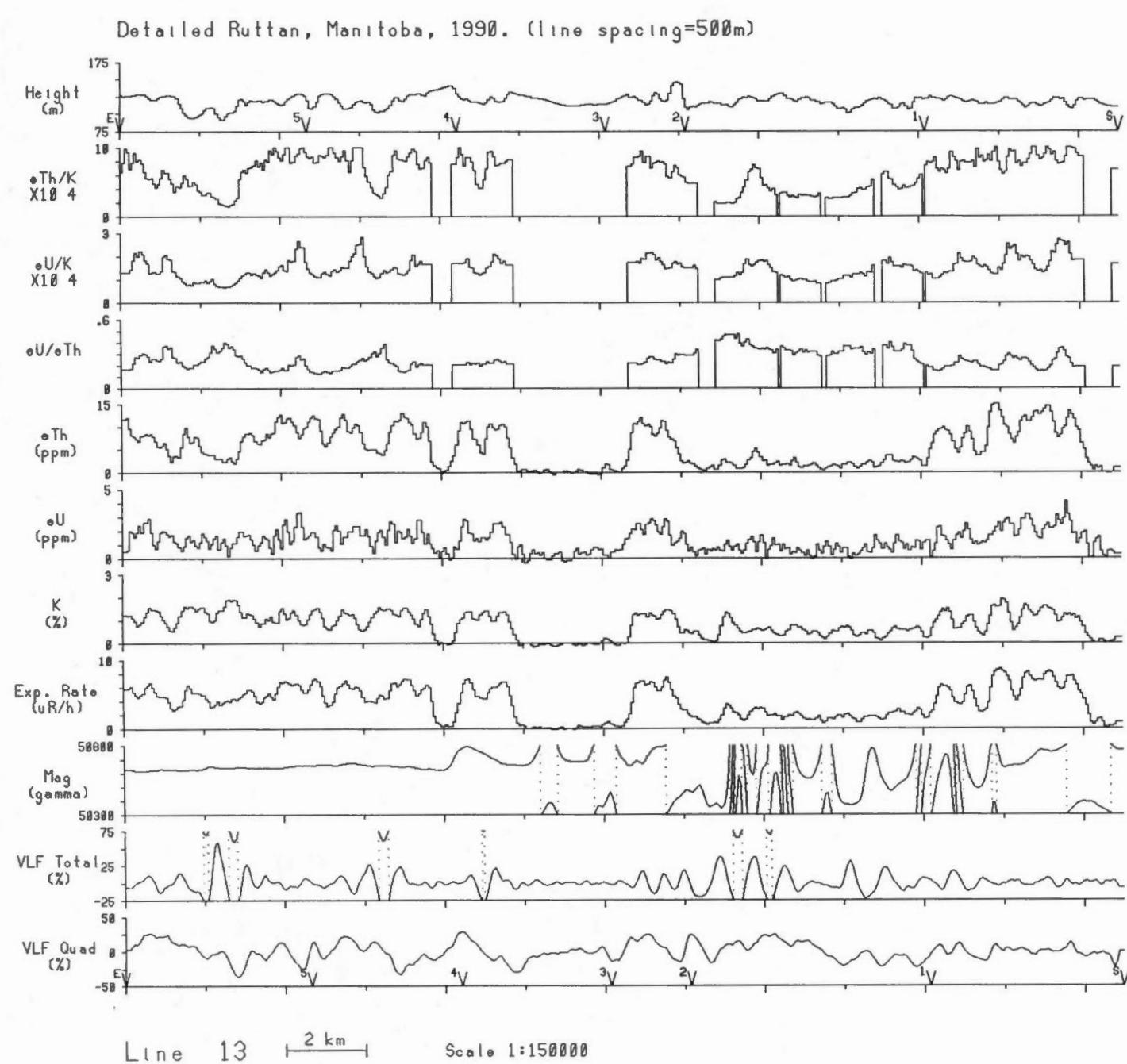
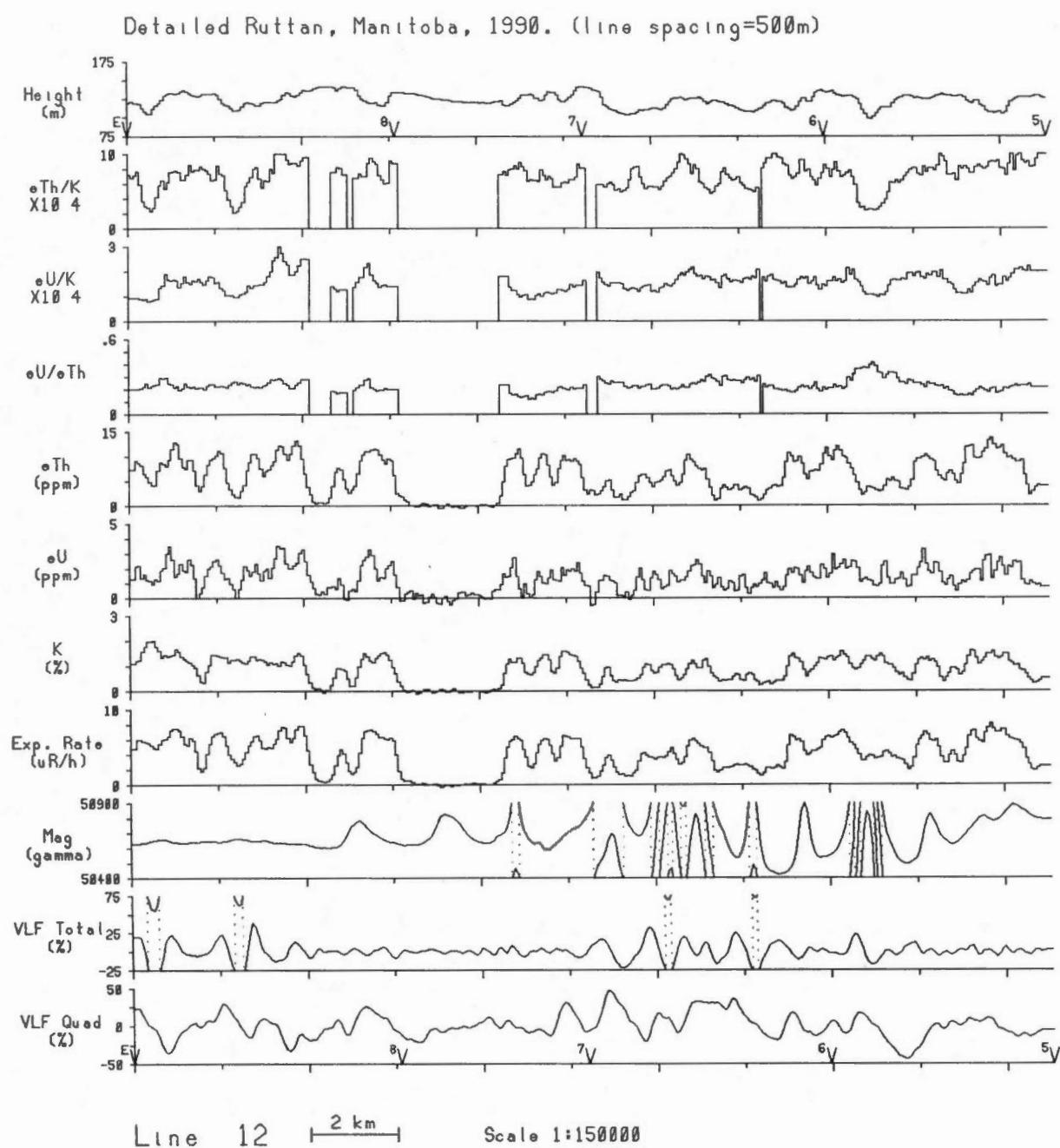


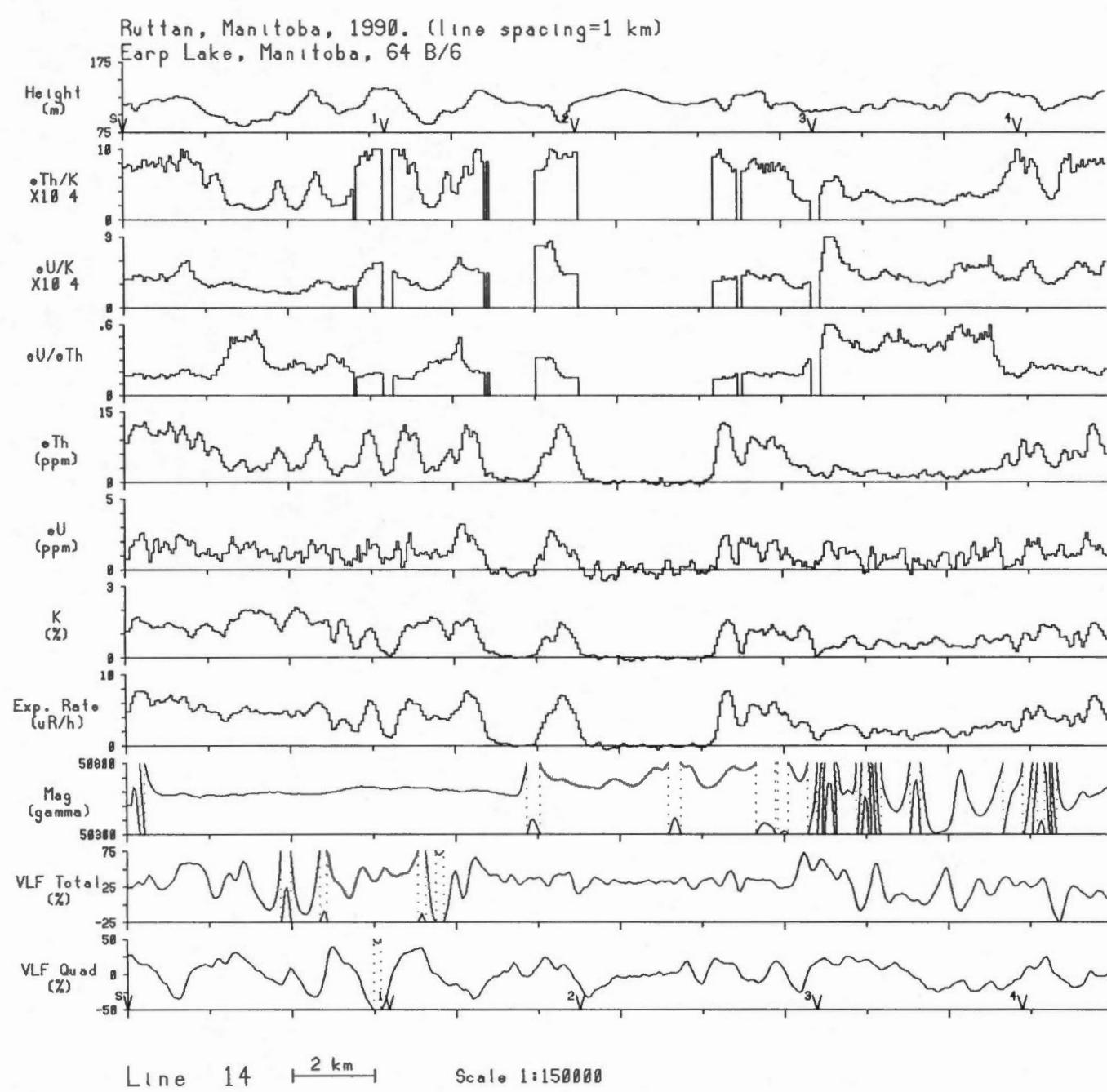
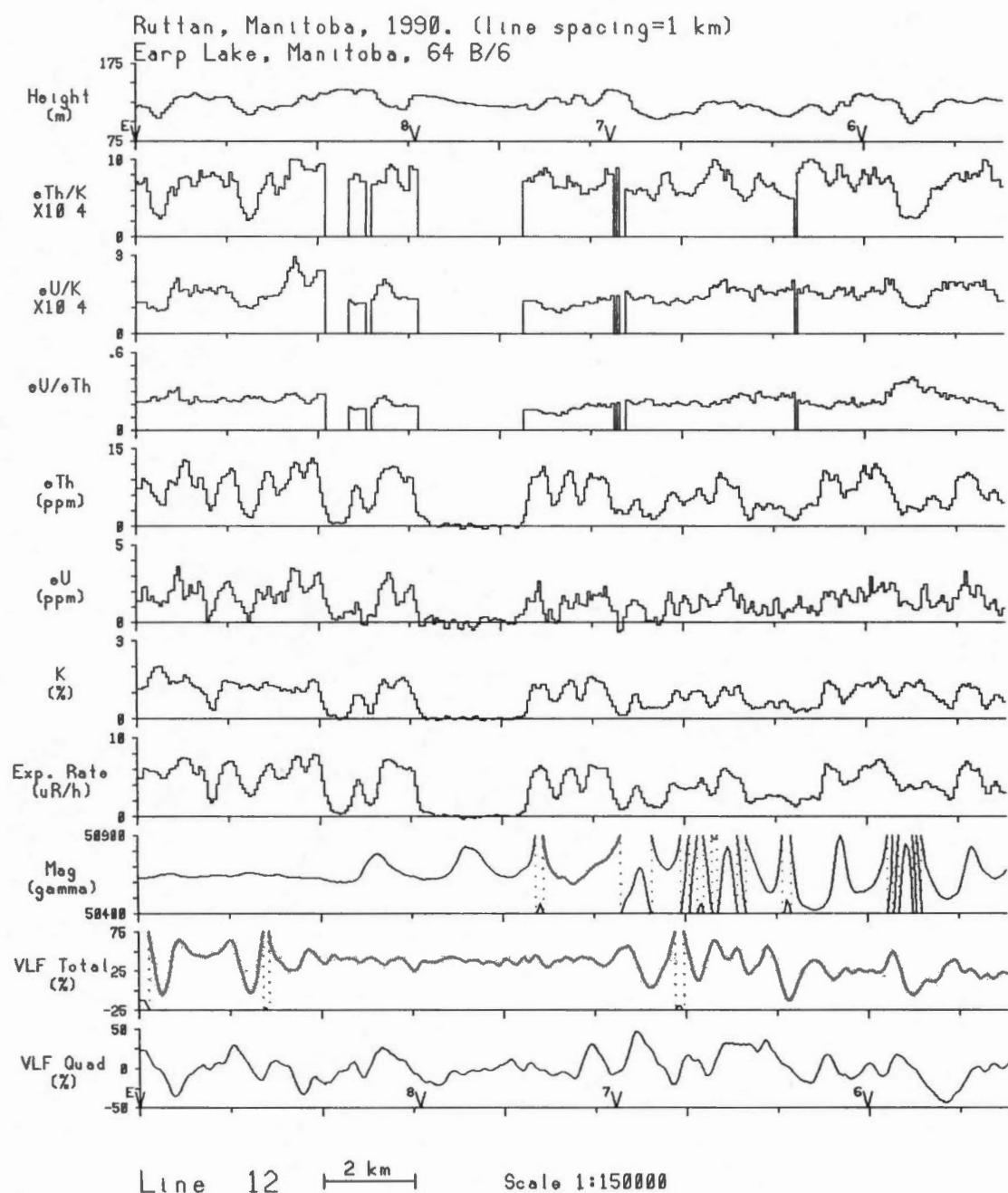
Line 10 2 km Scale 1:150000

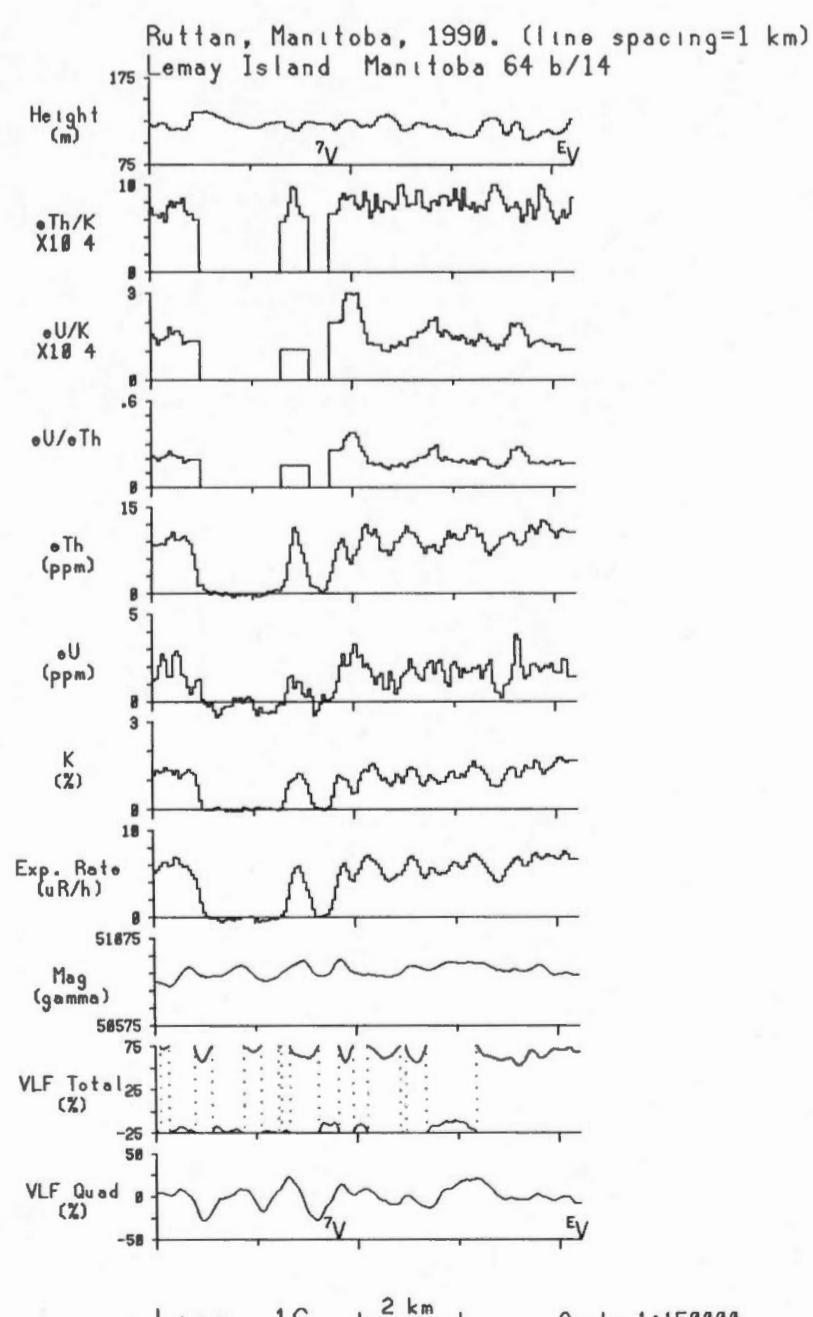
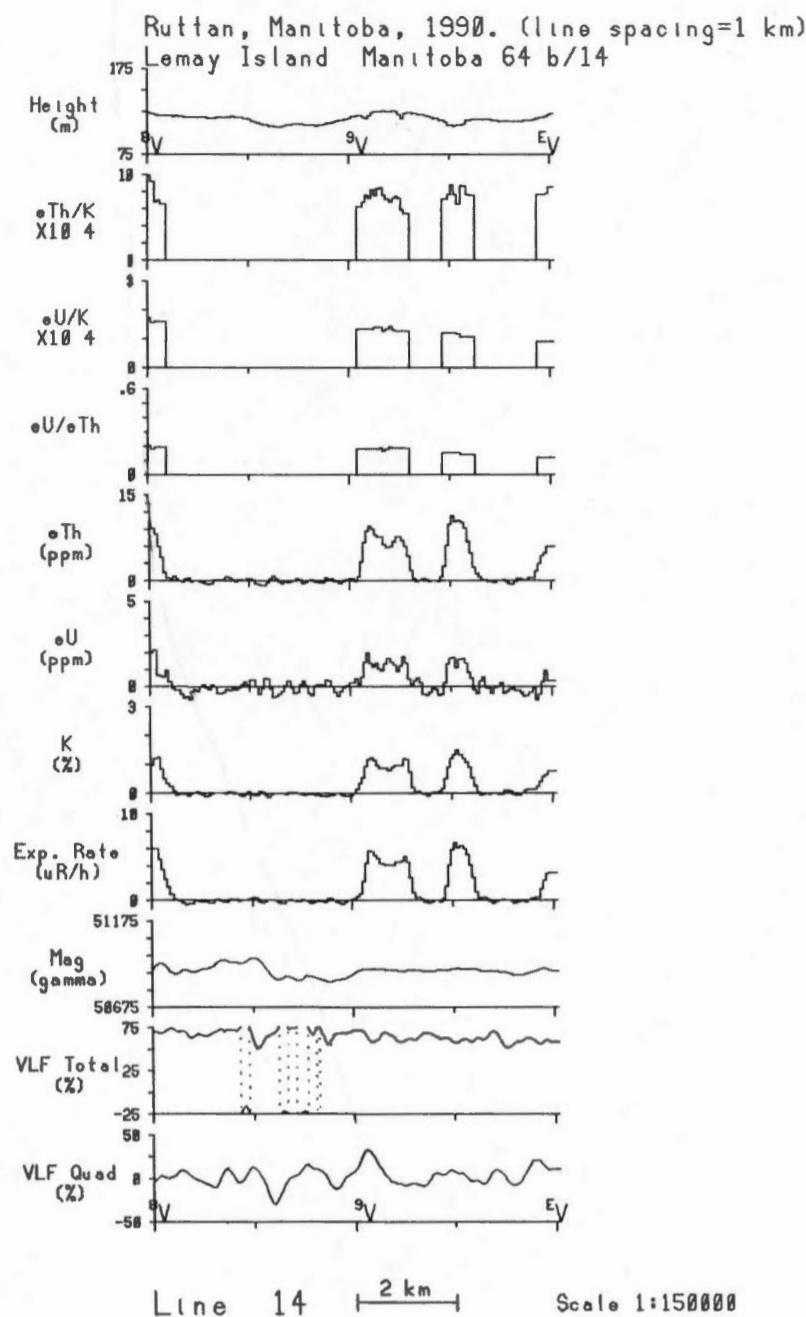


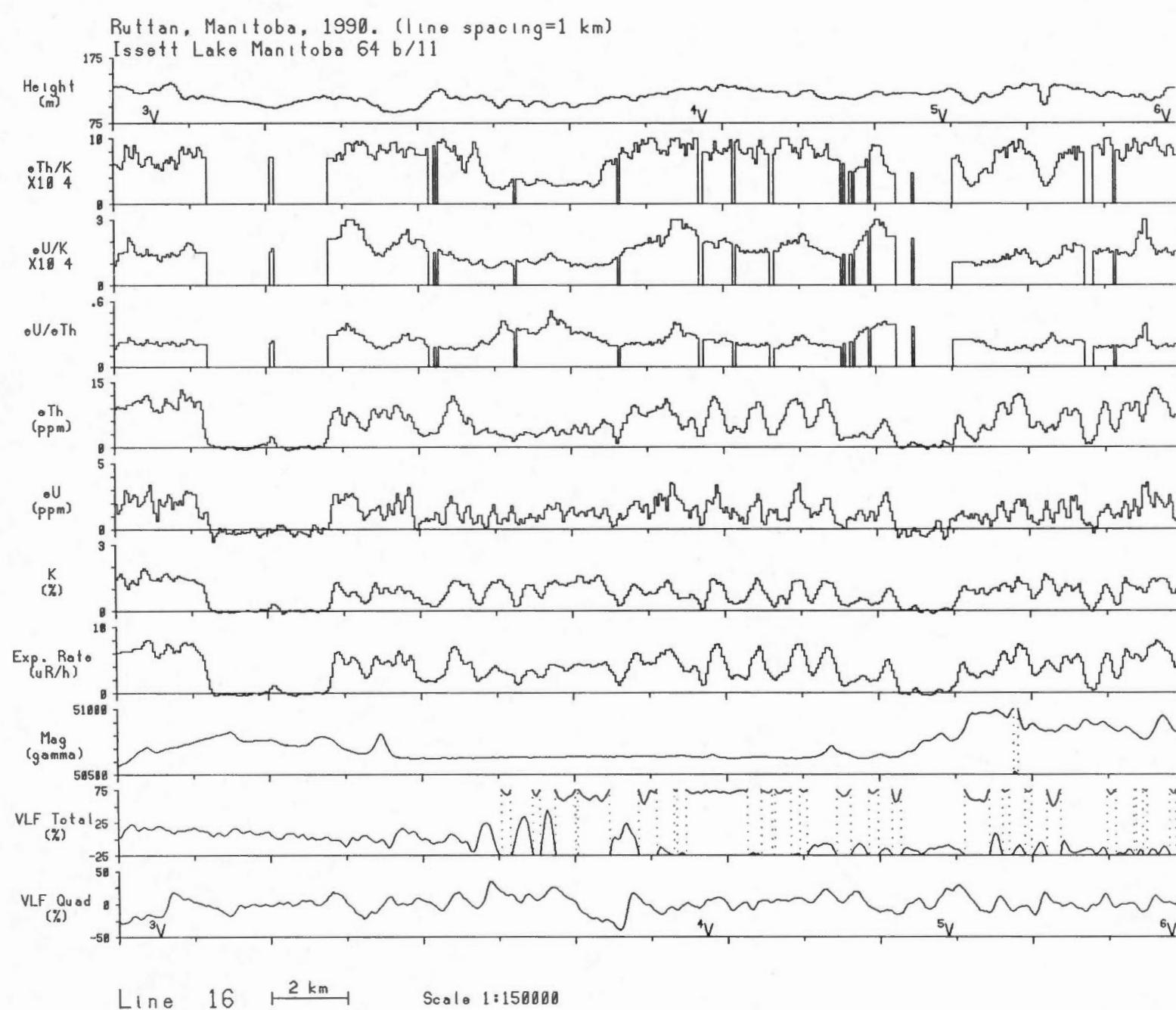
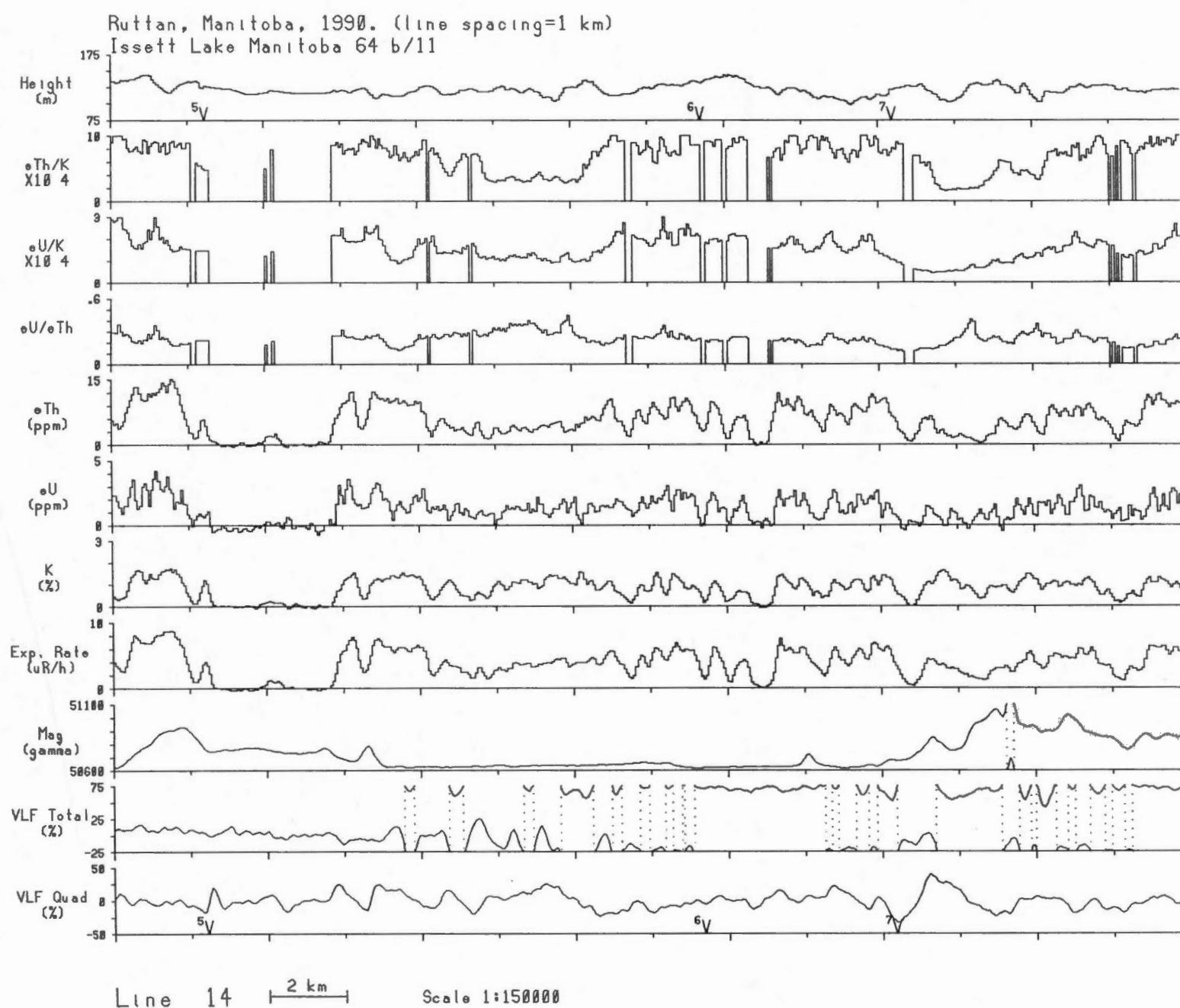
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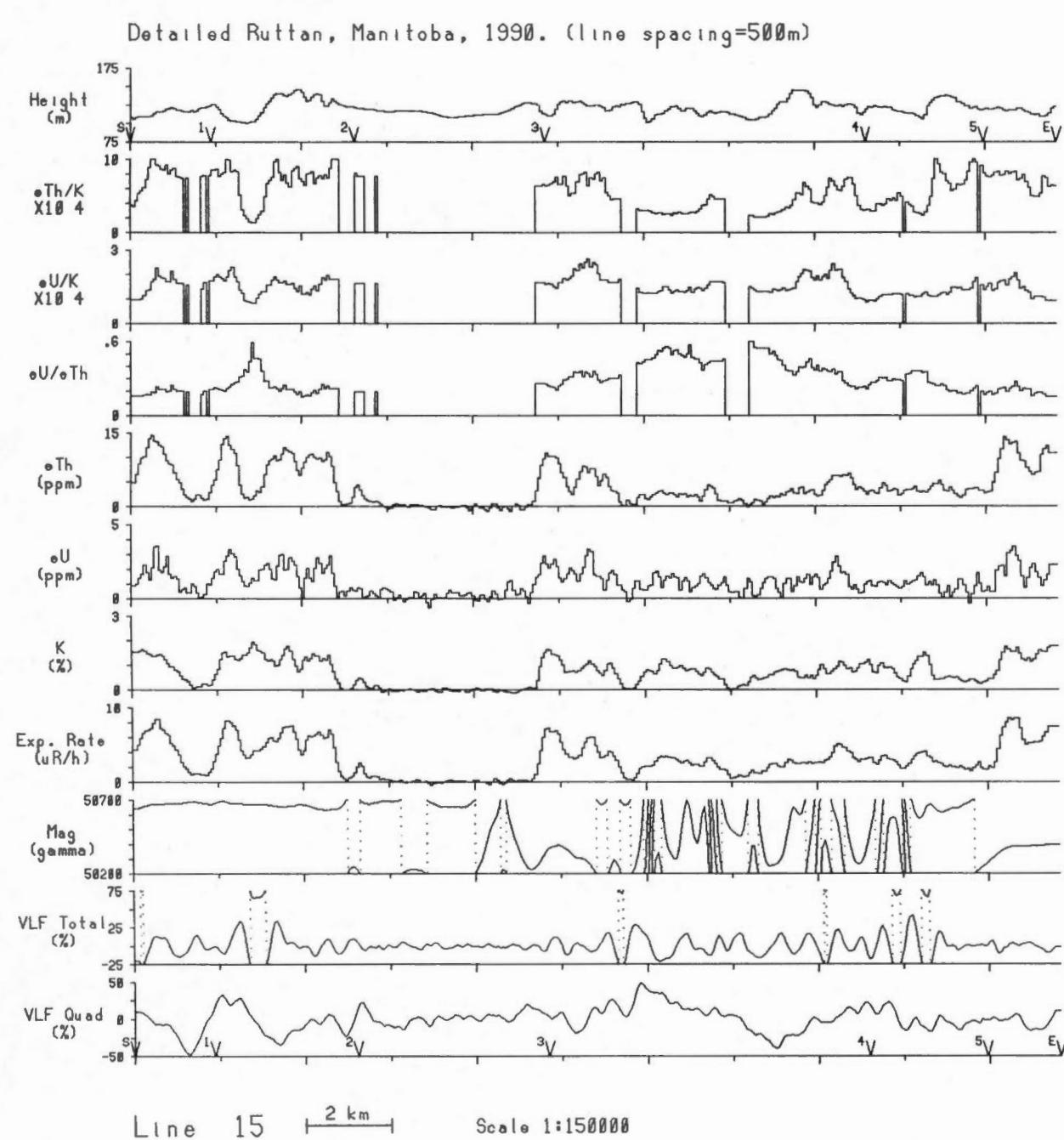
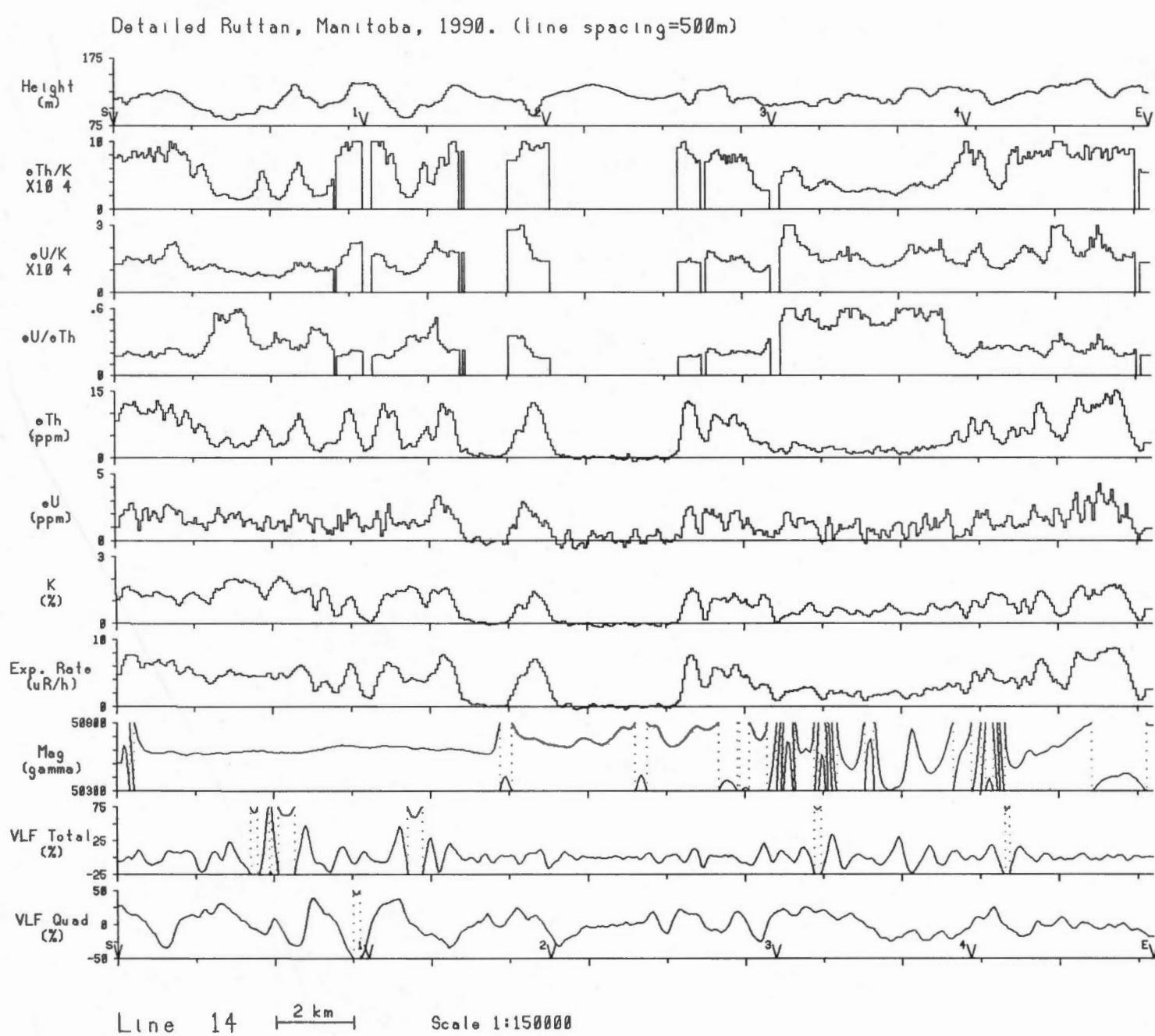


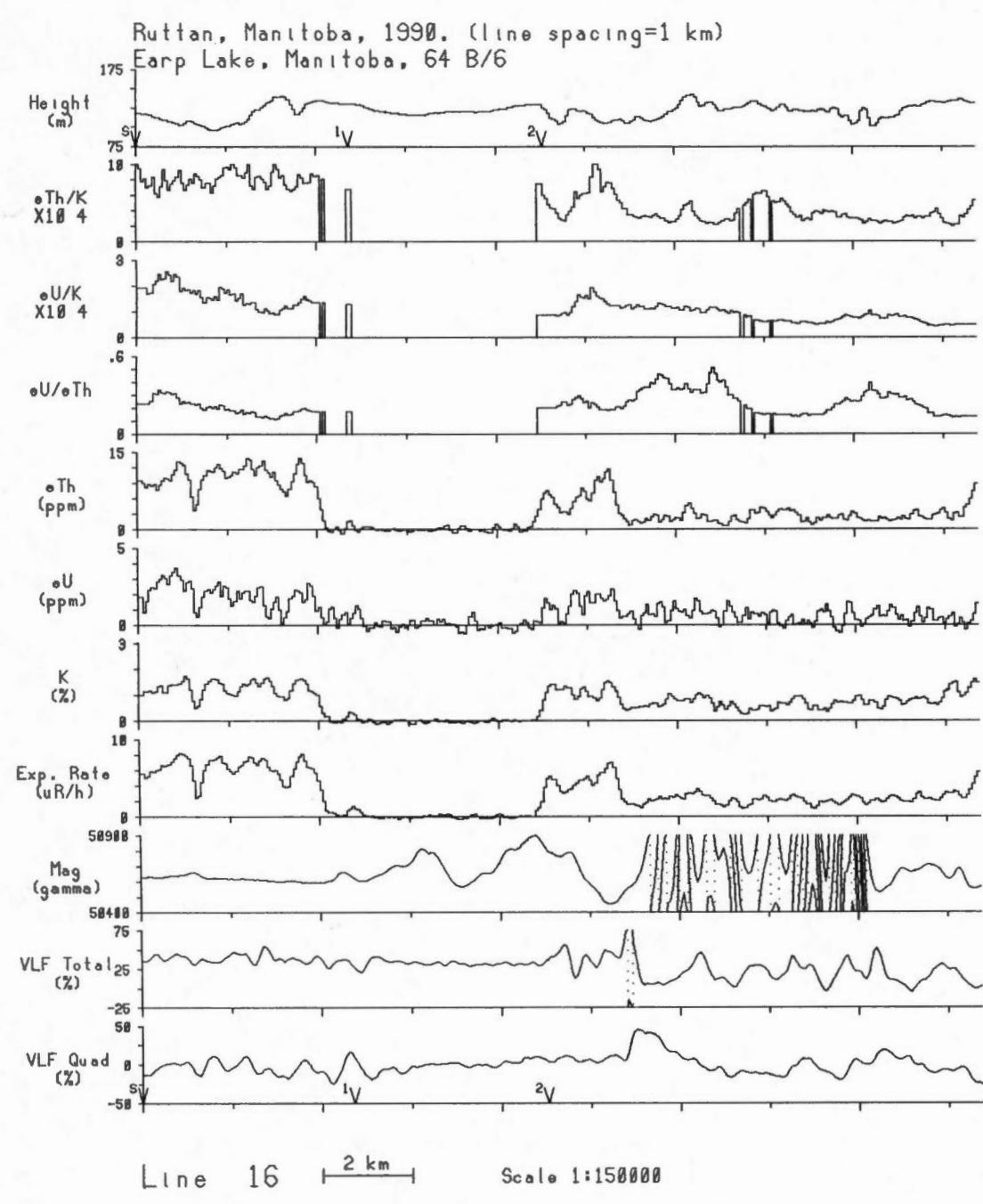


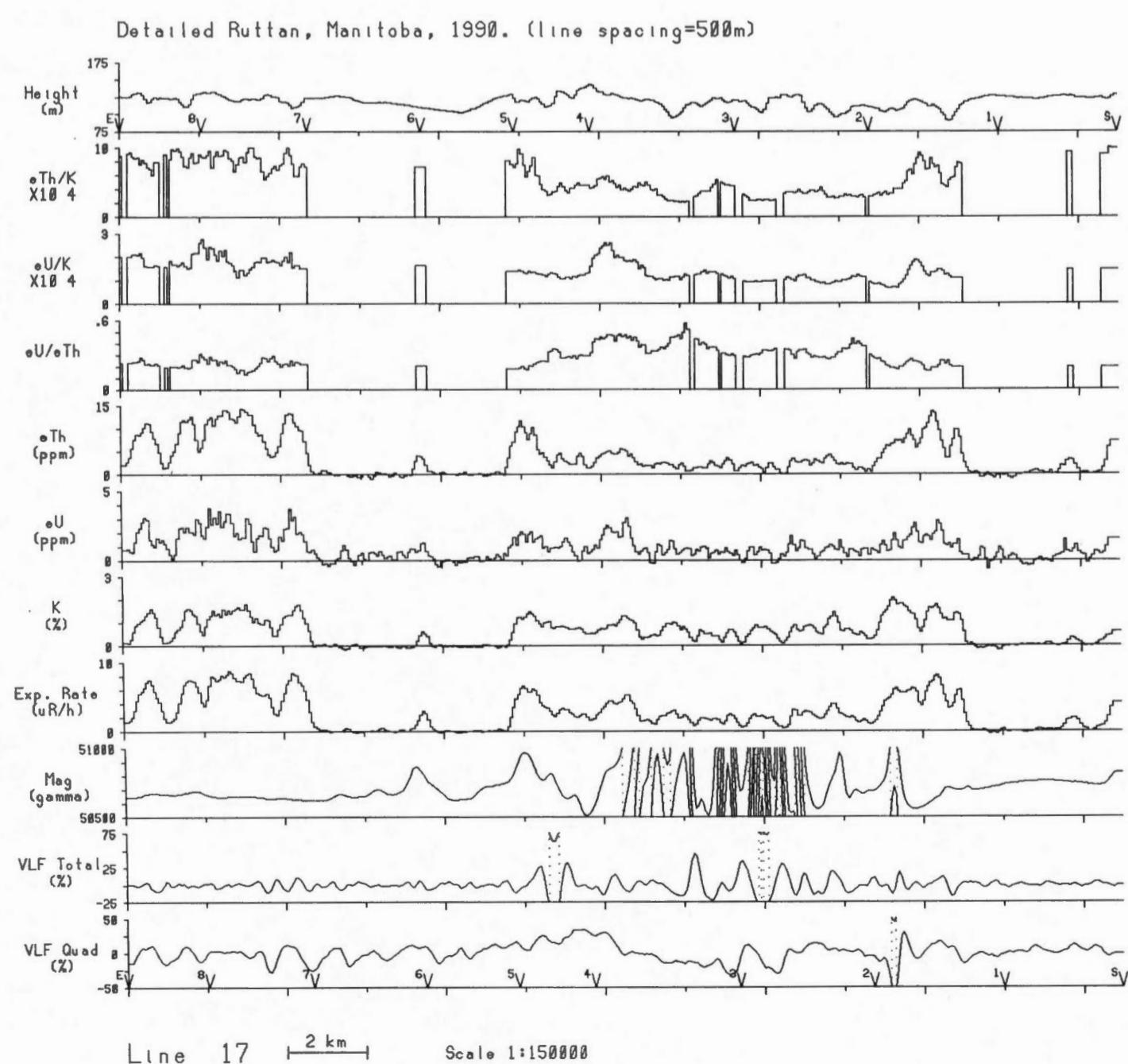
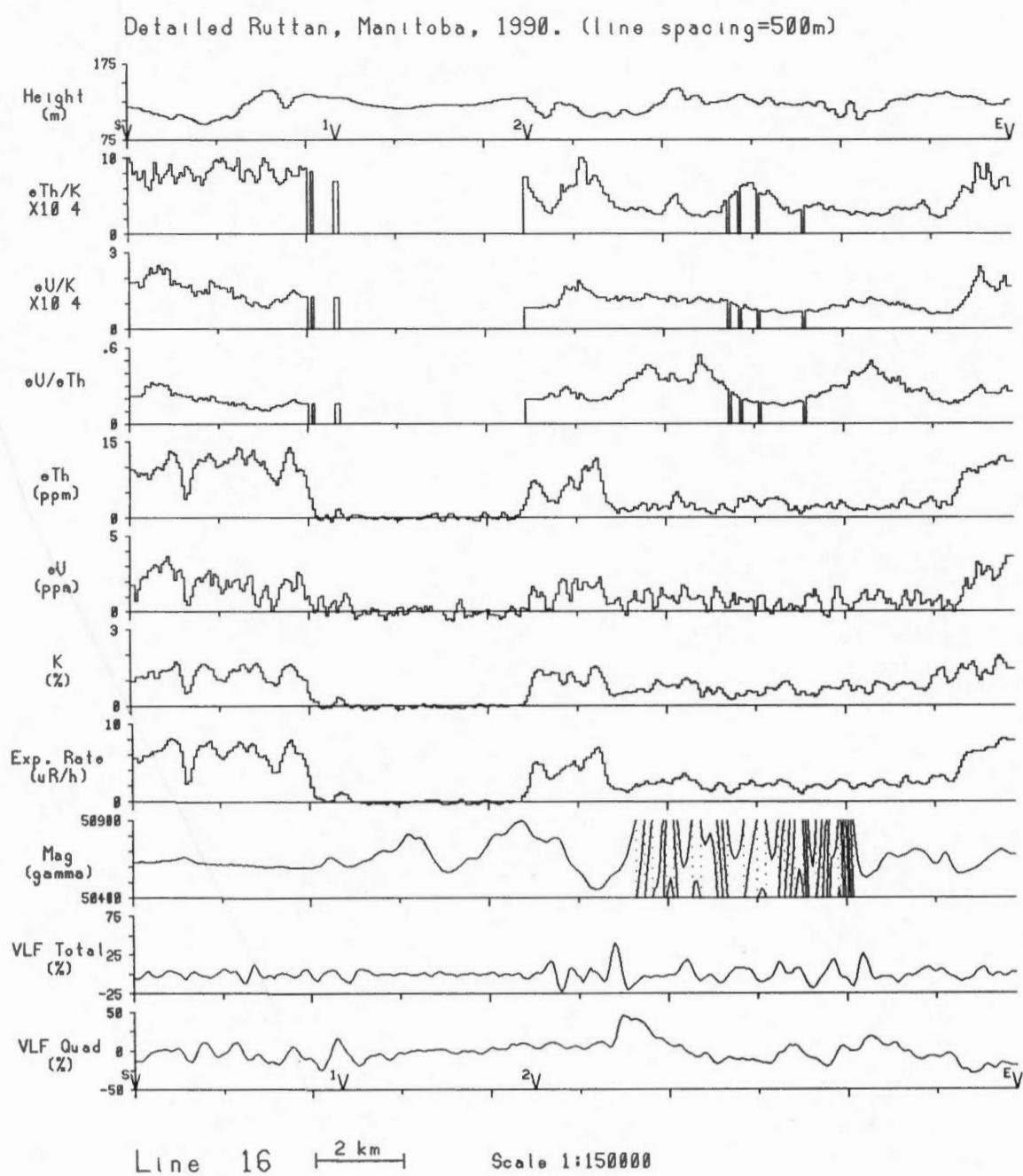


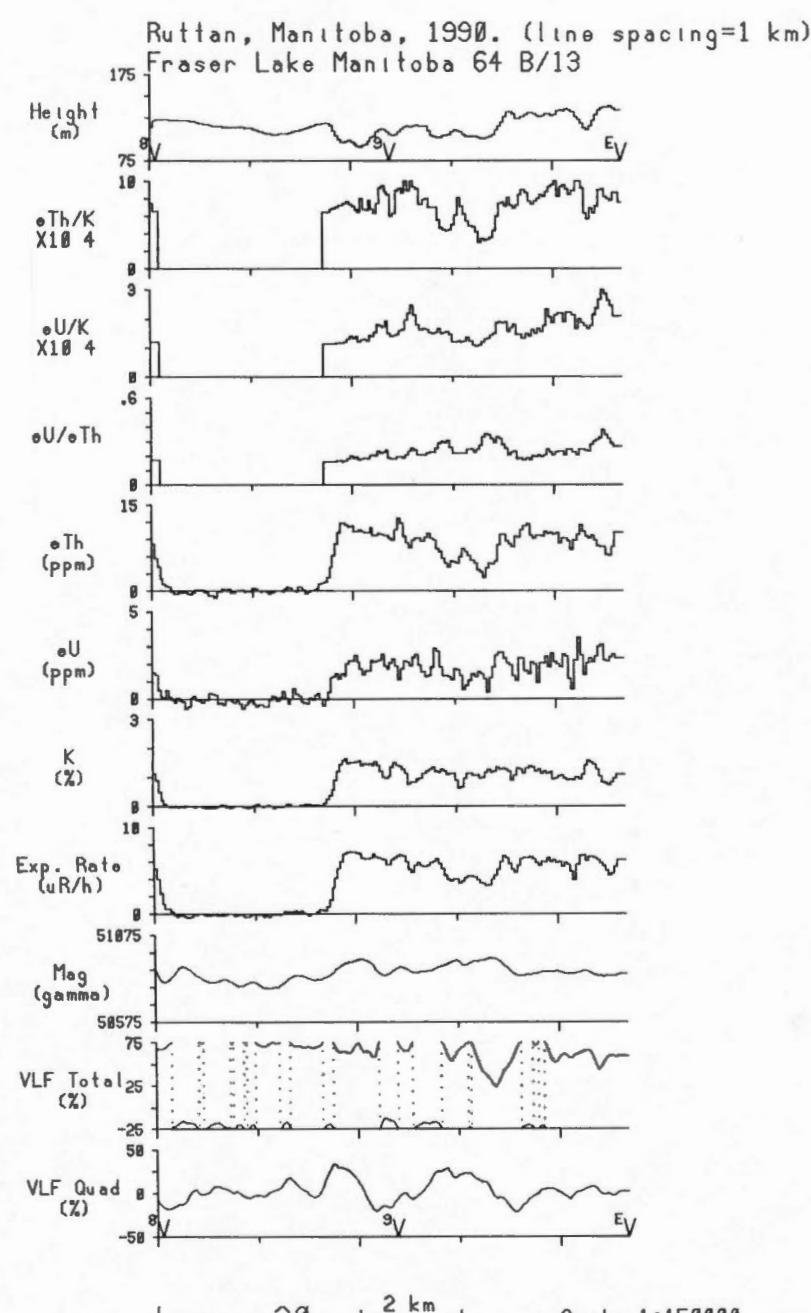
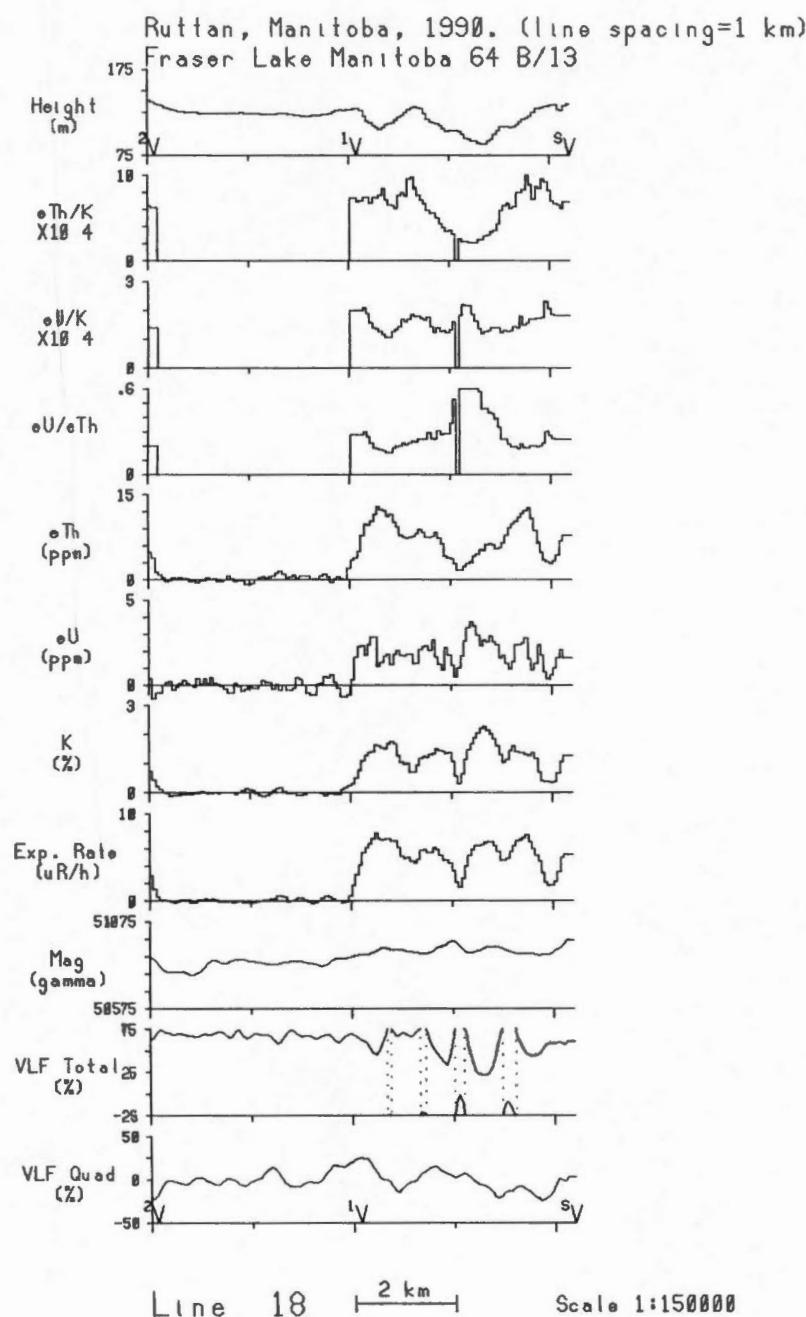


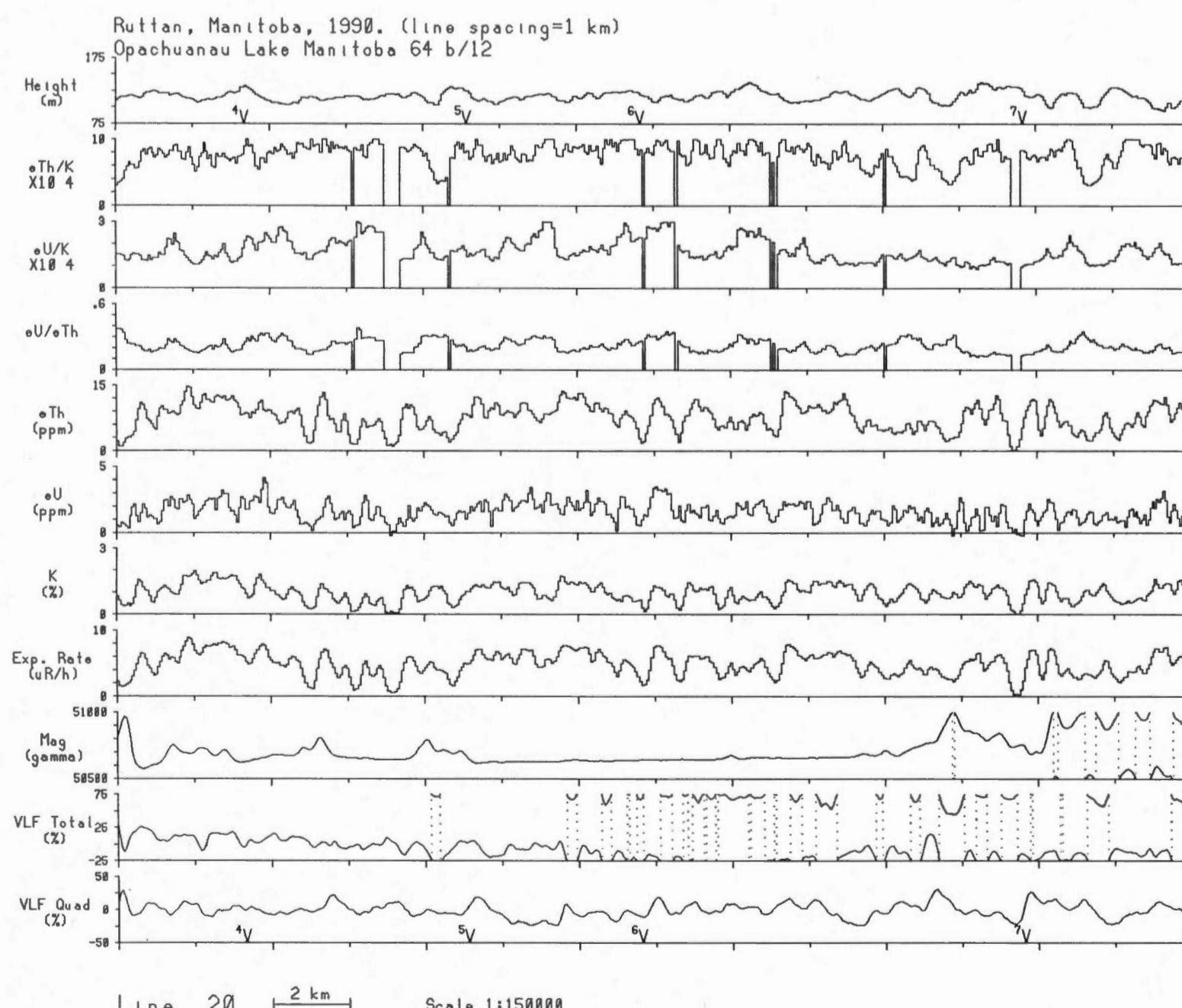
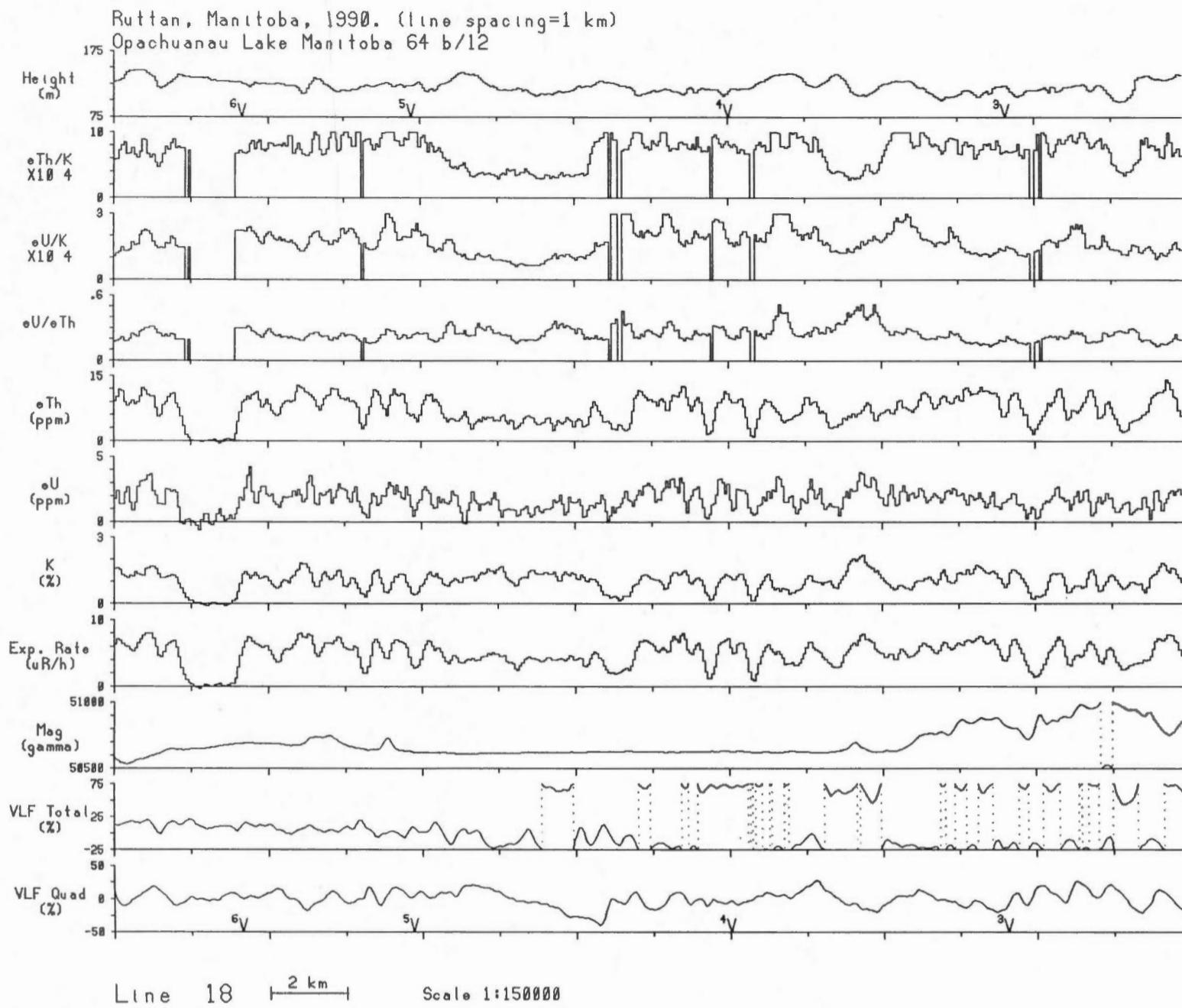


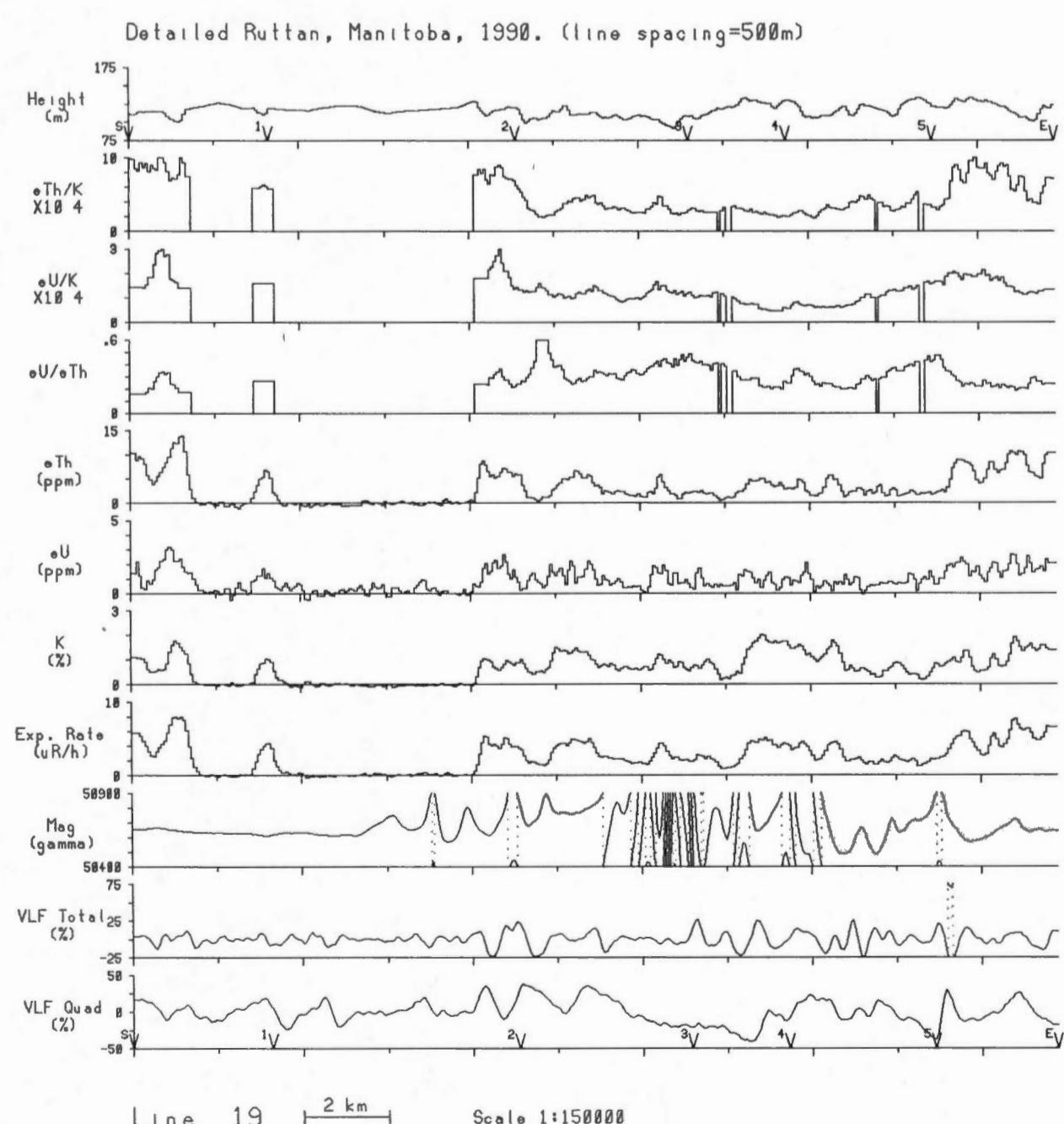
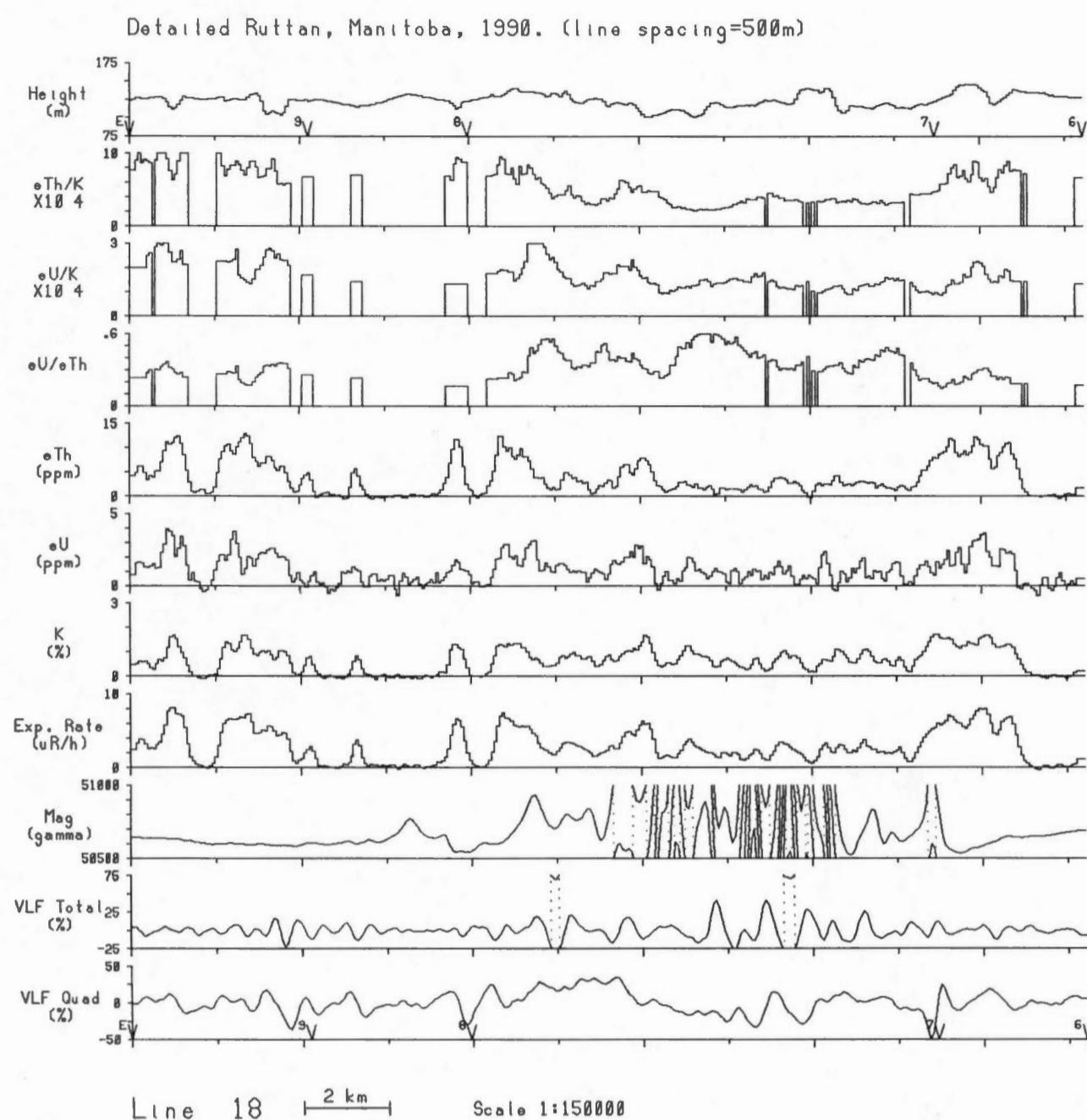


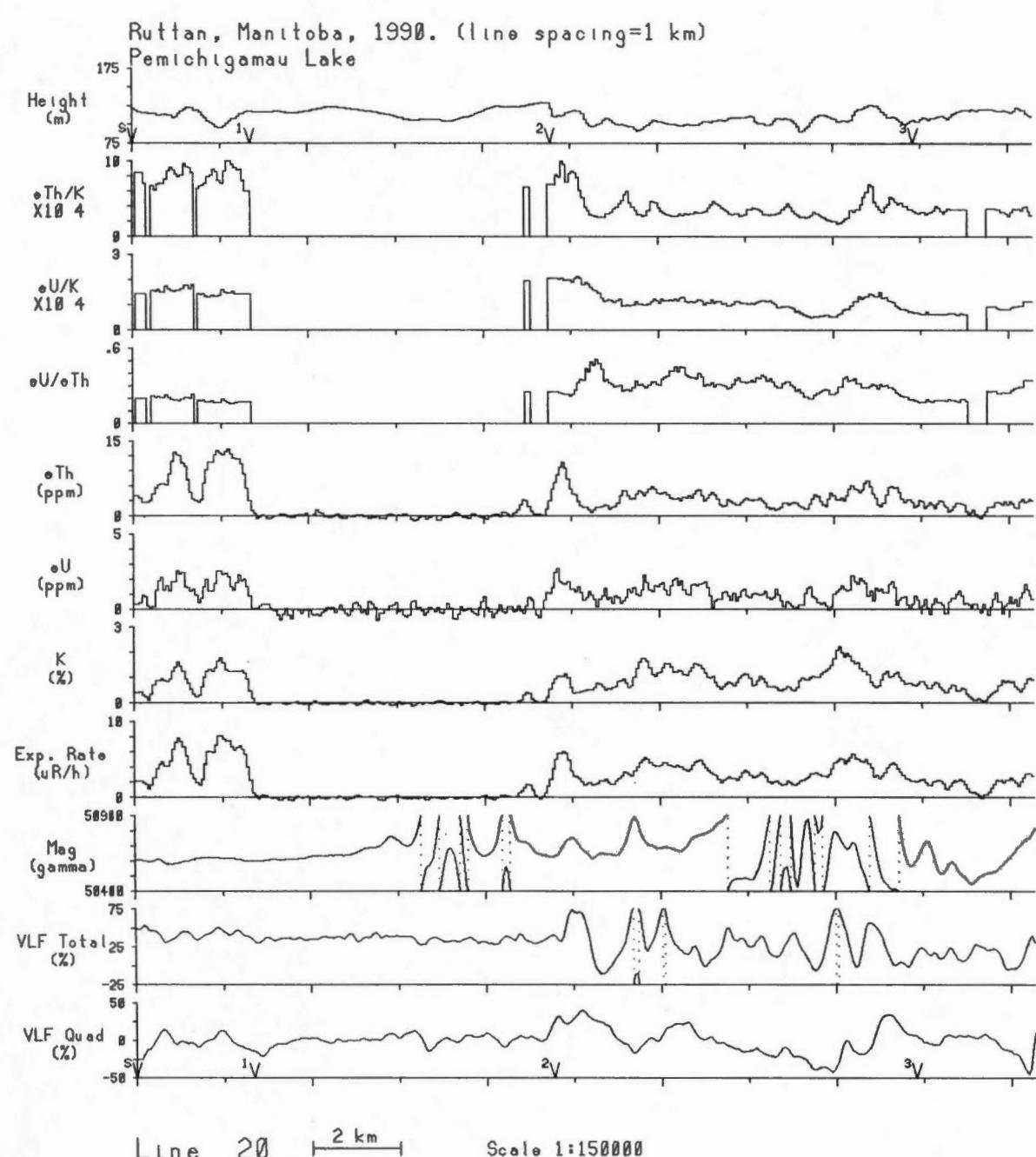
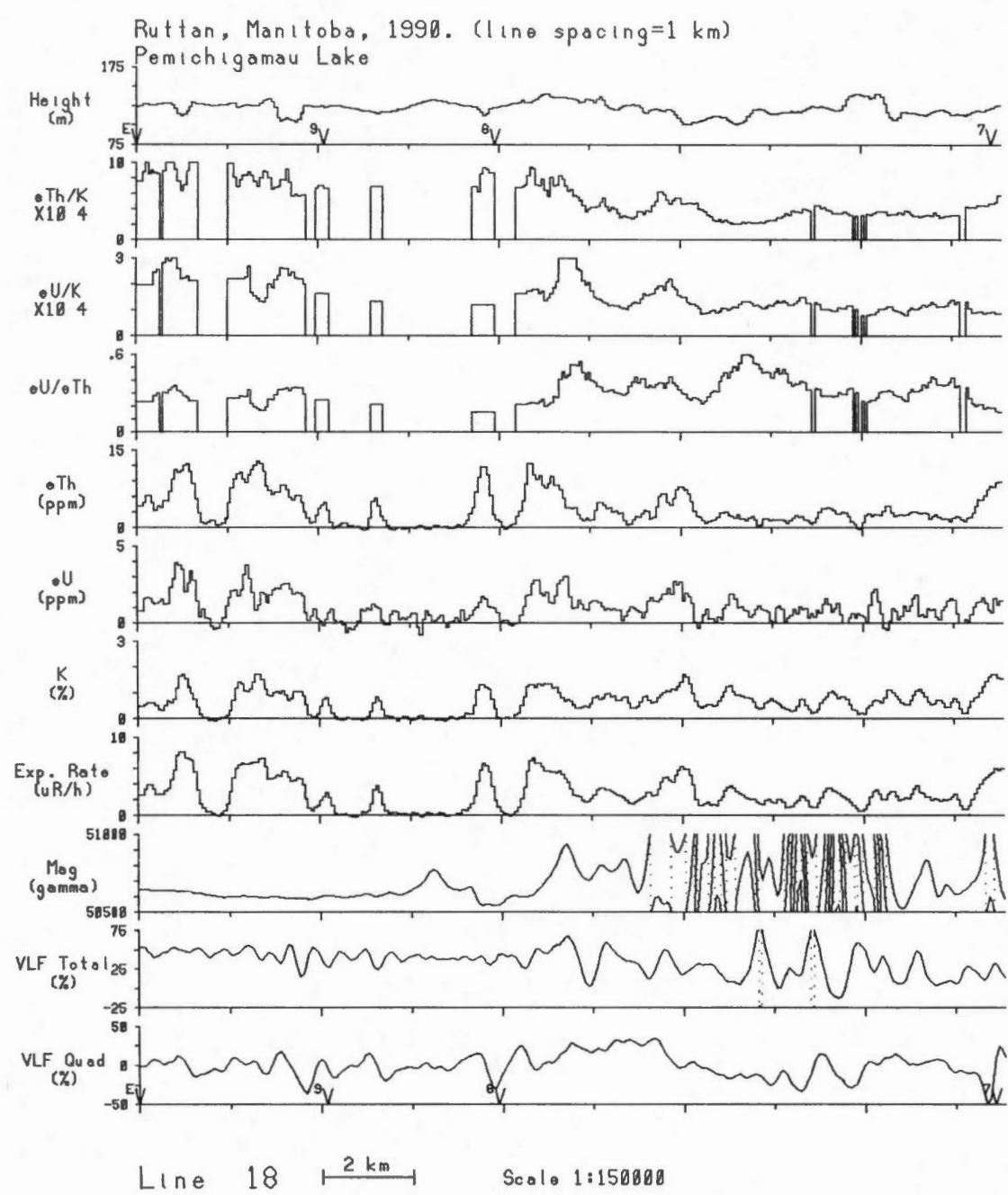


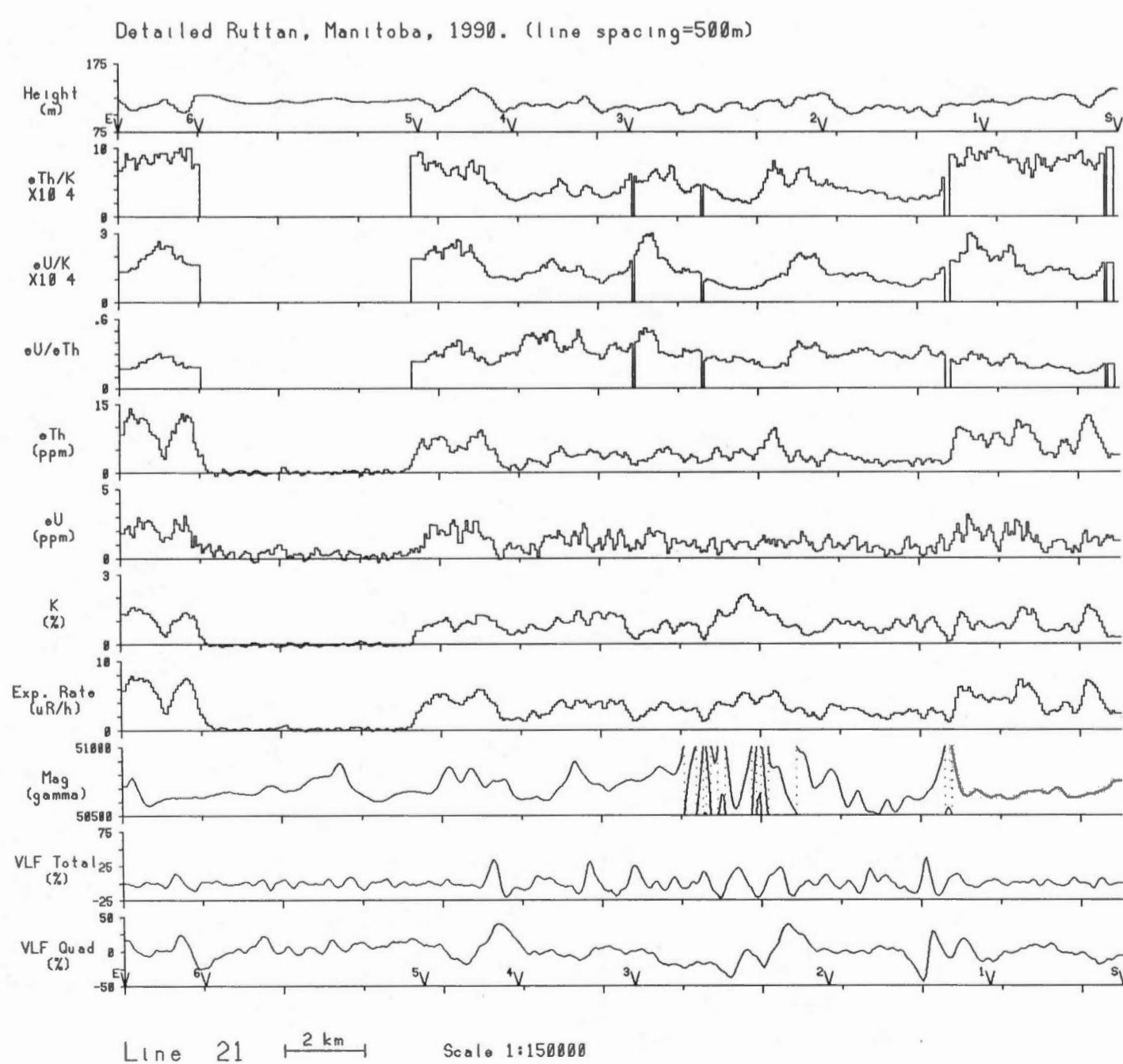
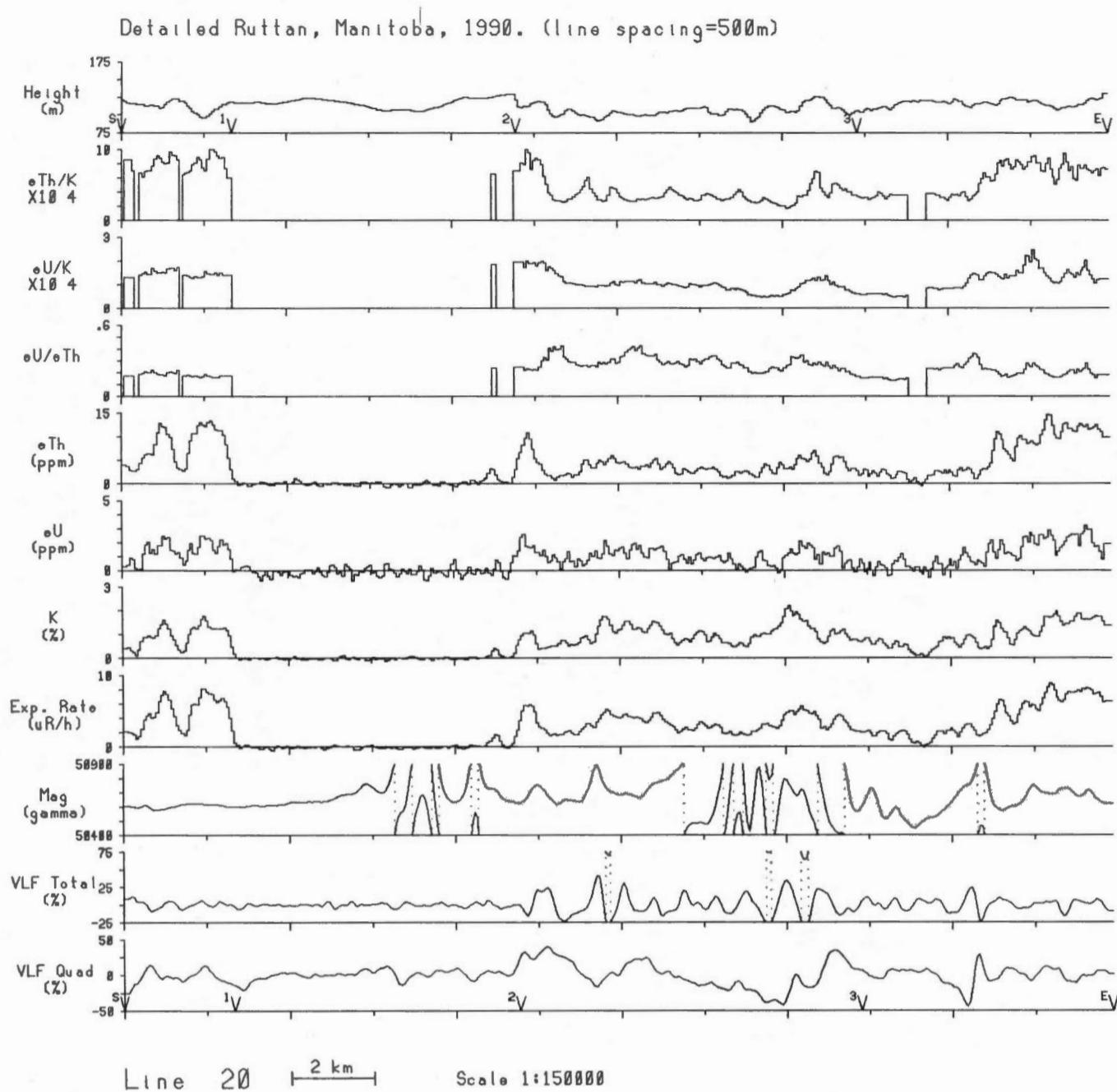


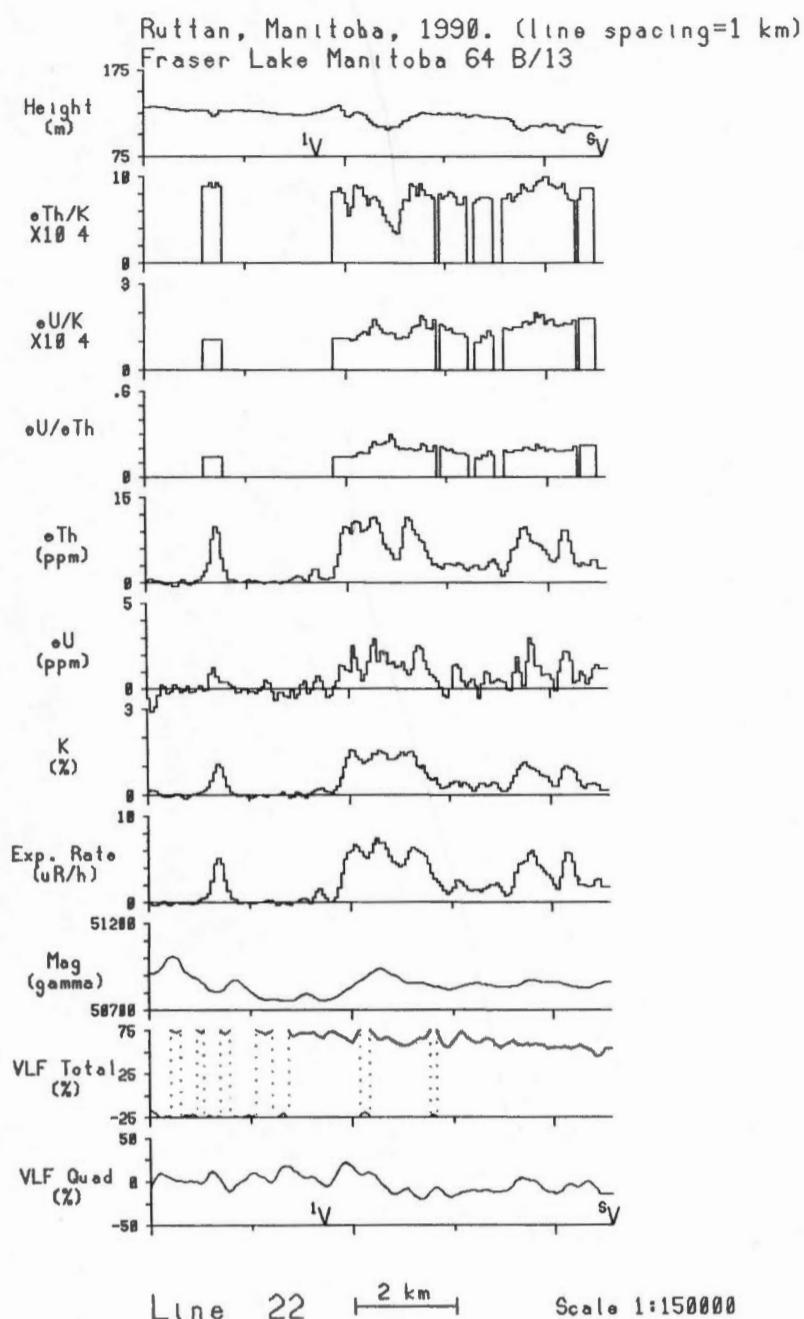




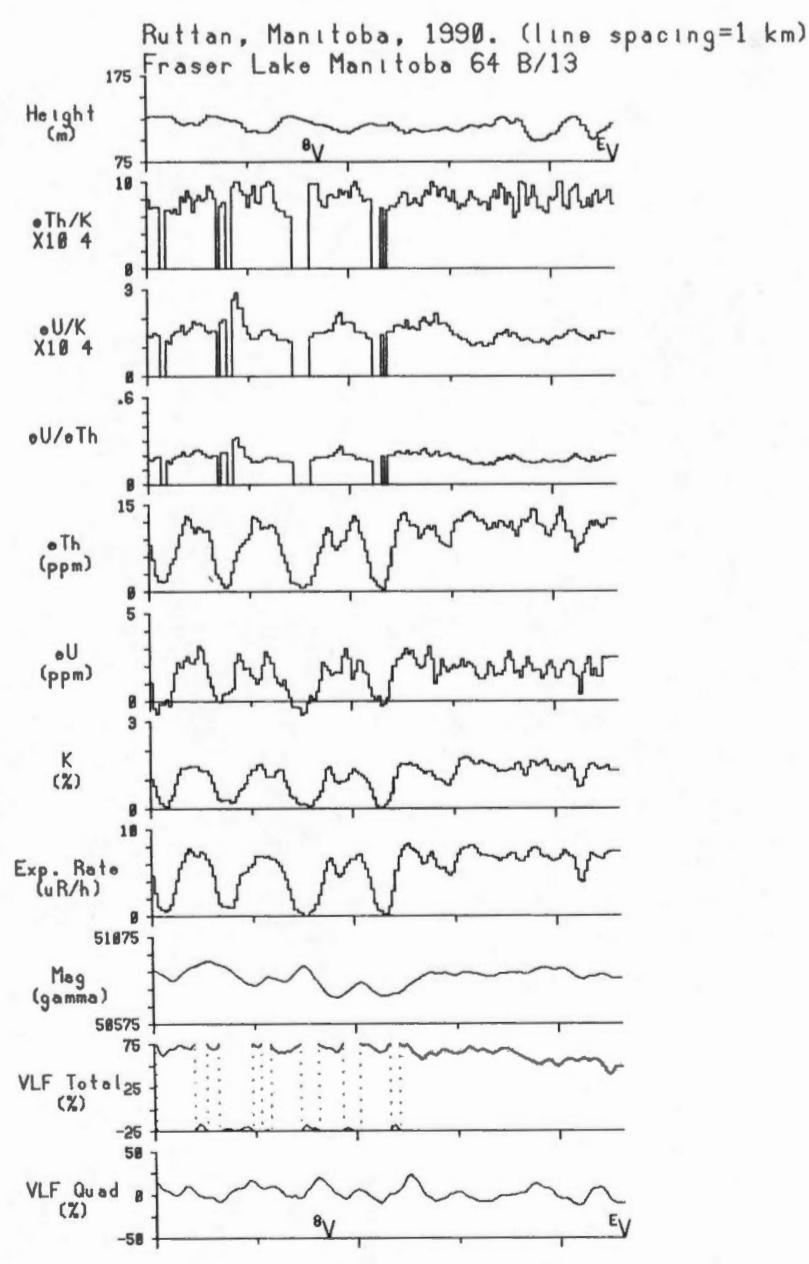




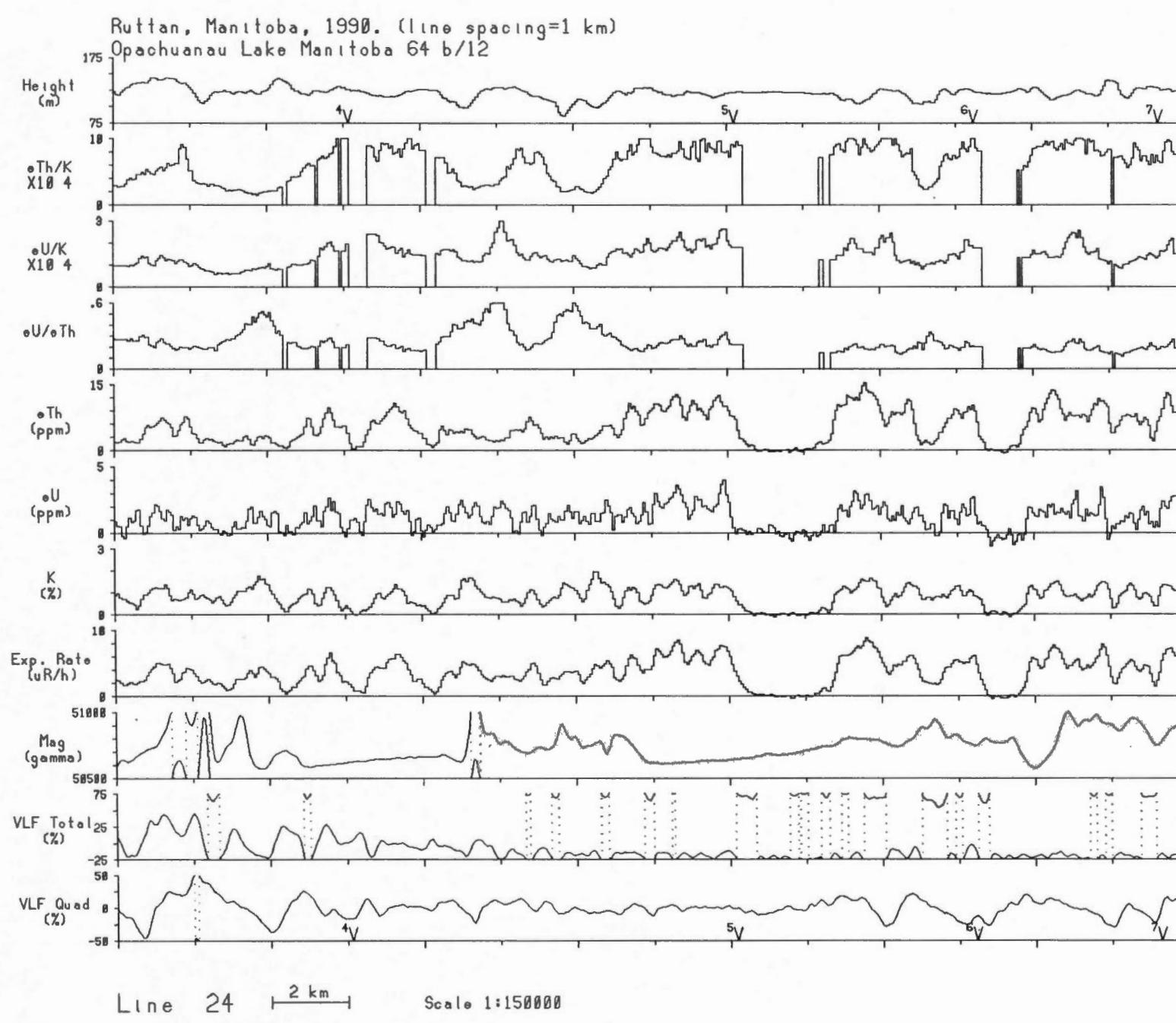
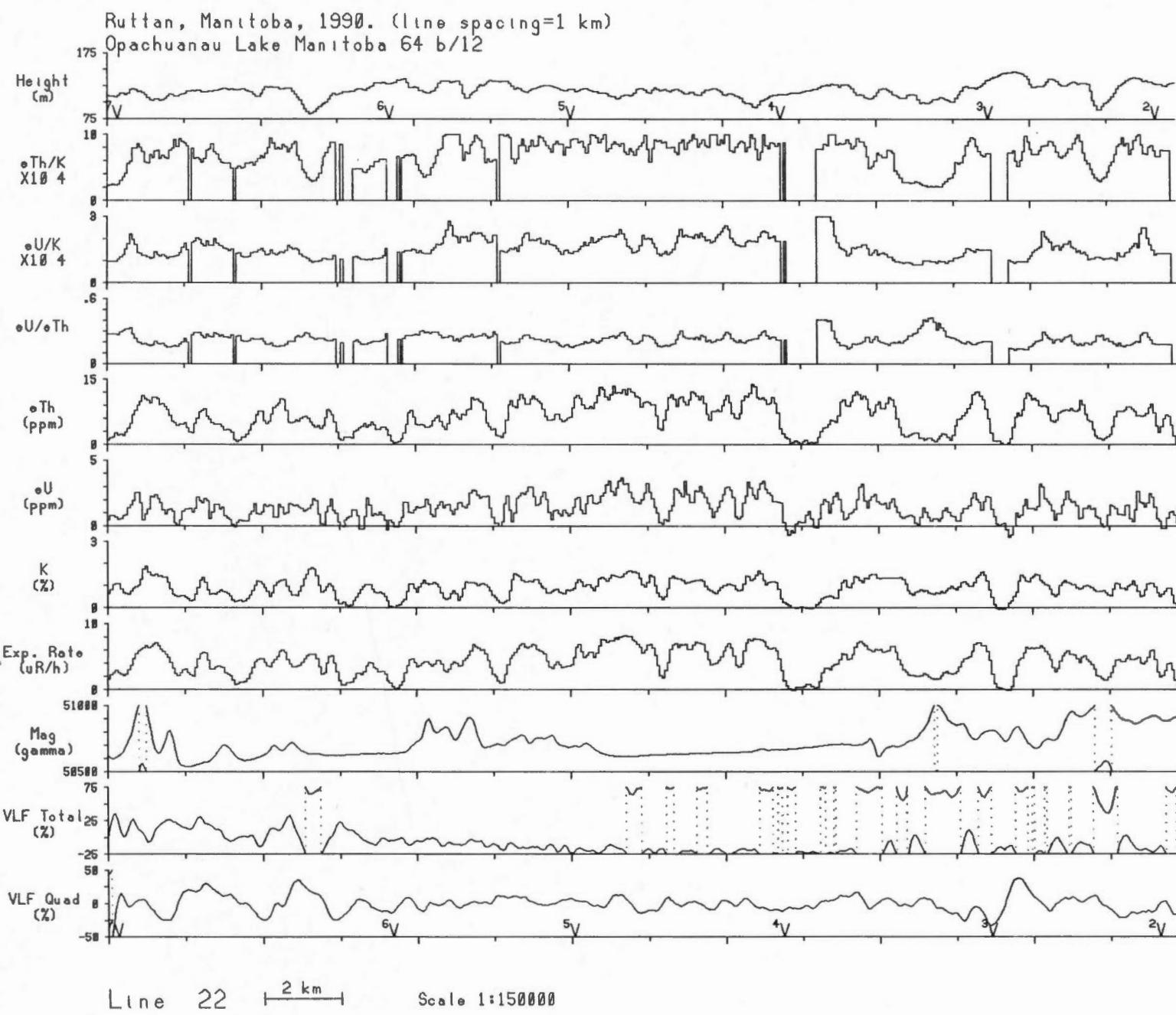




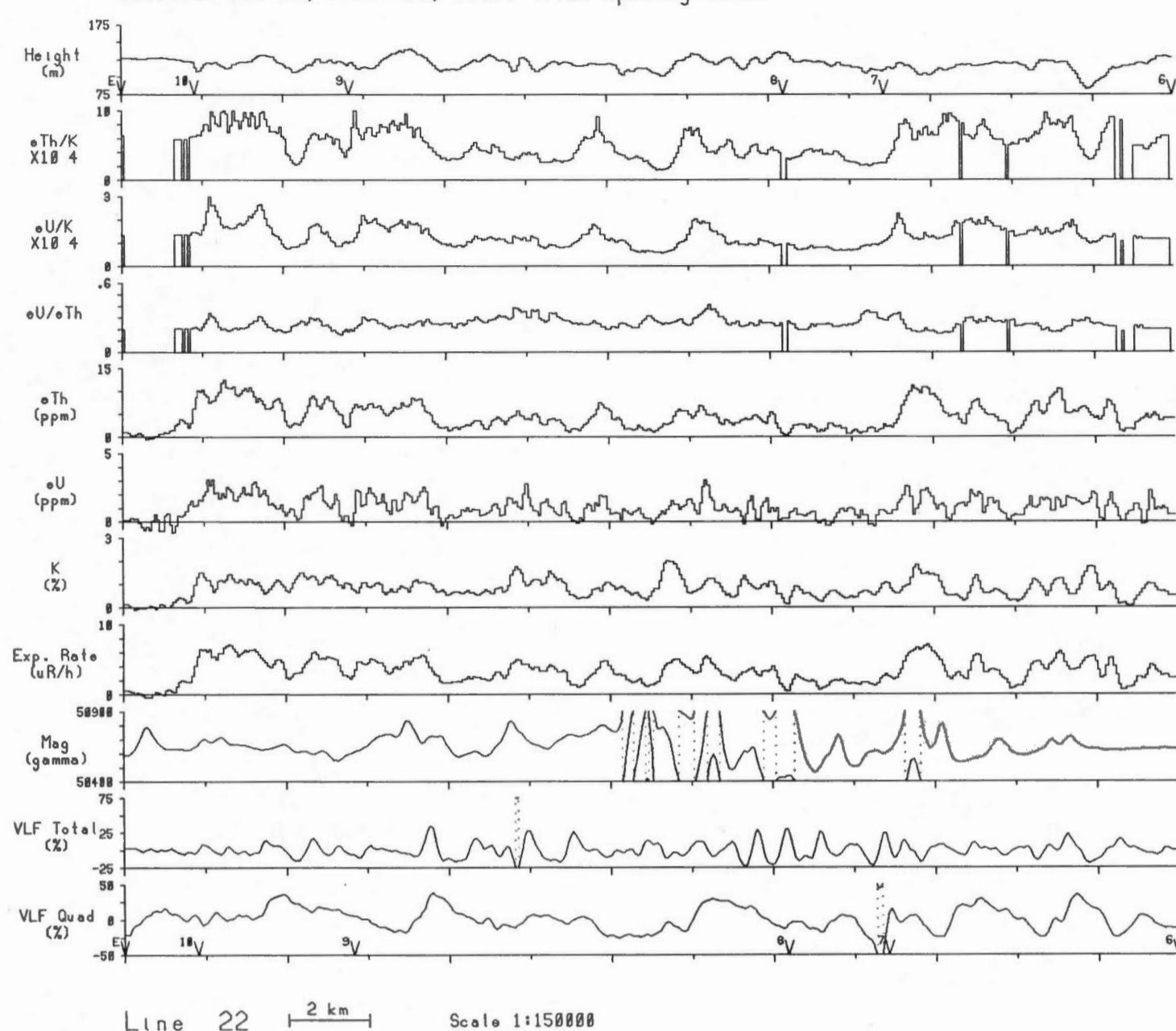
Line 22 2 km Scale 1:150000



Line 24 2 km Scale 1:150000

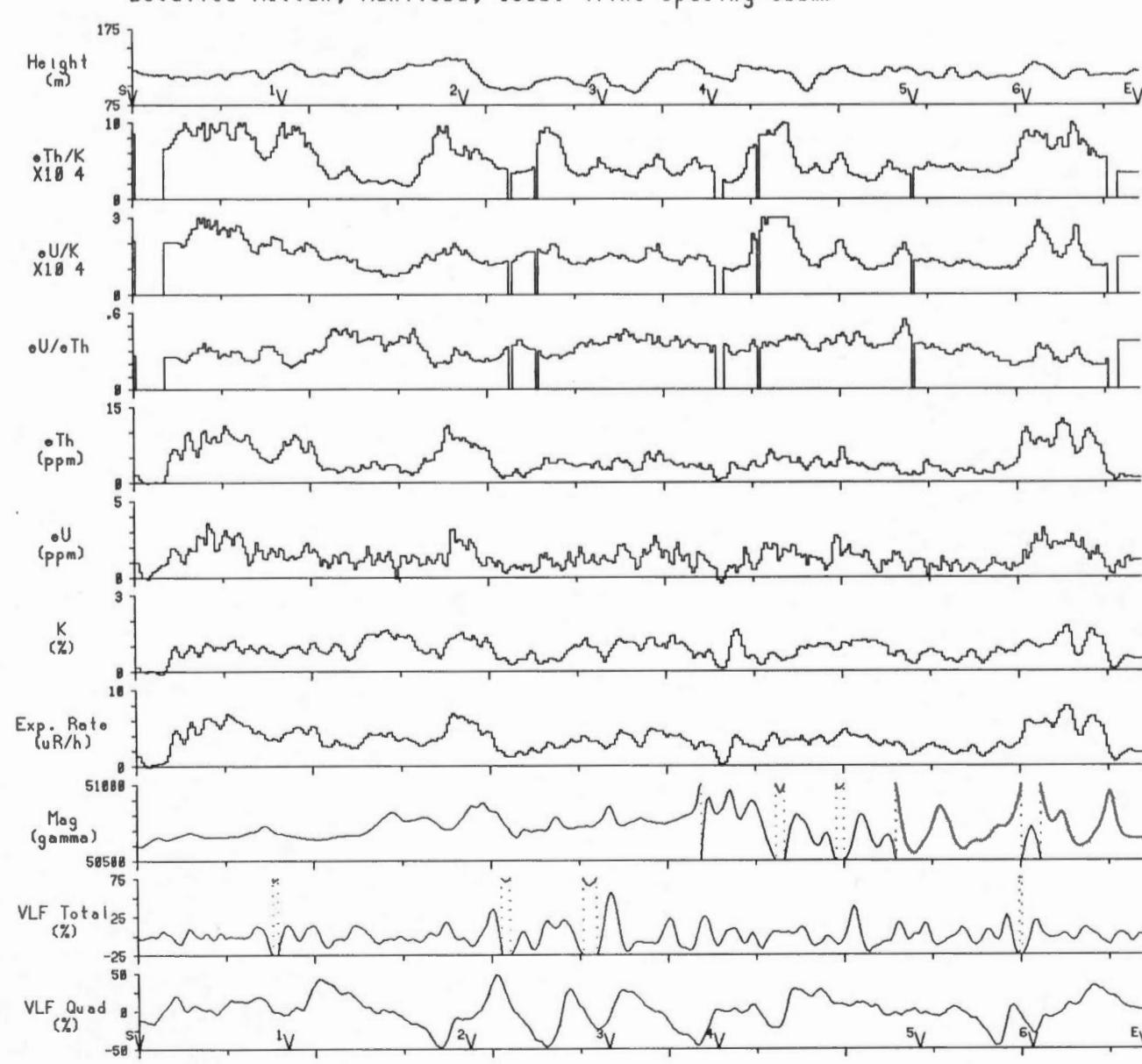


Detailed Ruttan, Manitoba, 1990. (line spacing=500m)

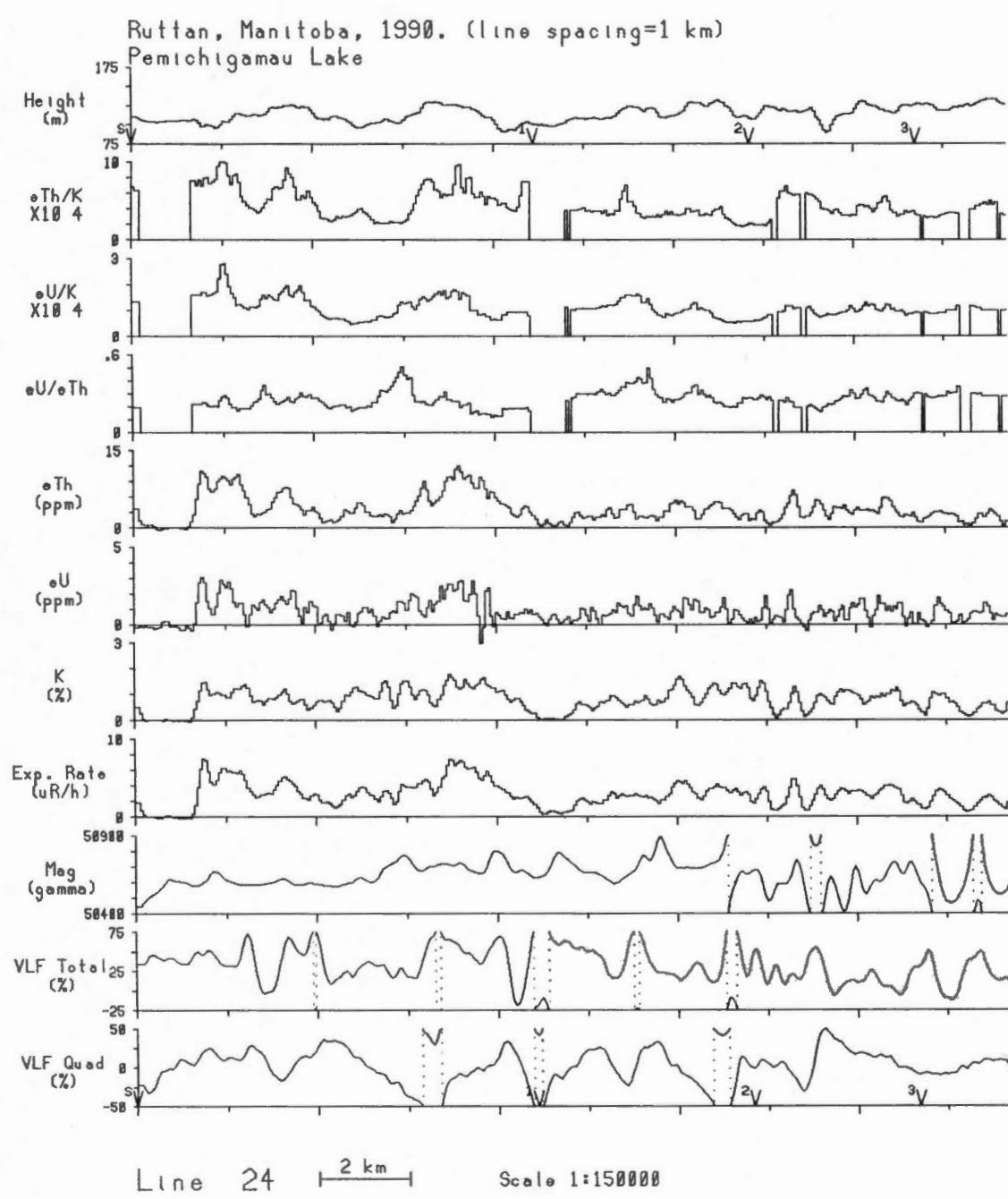
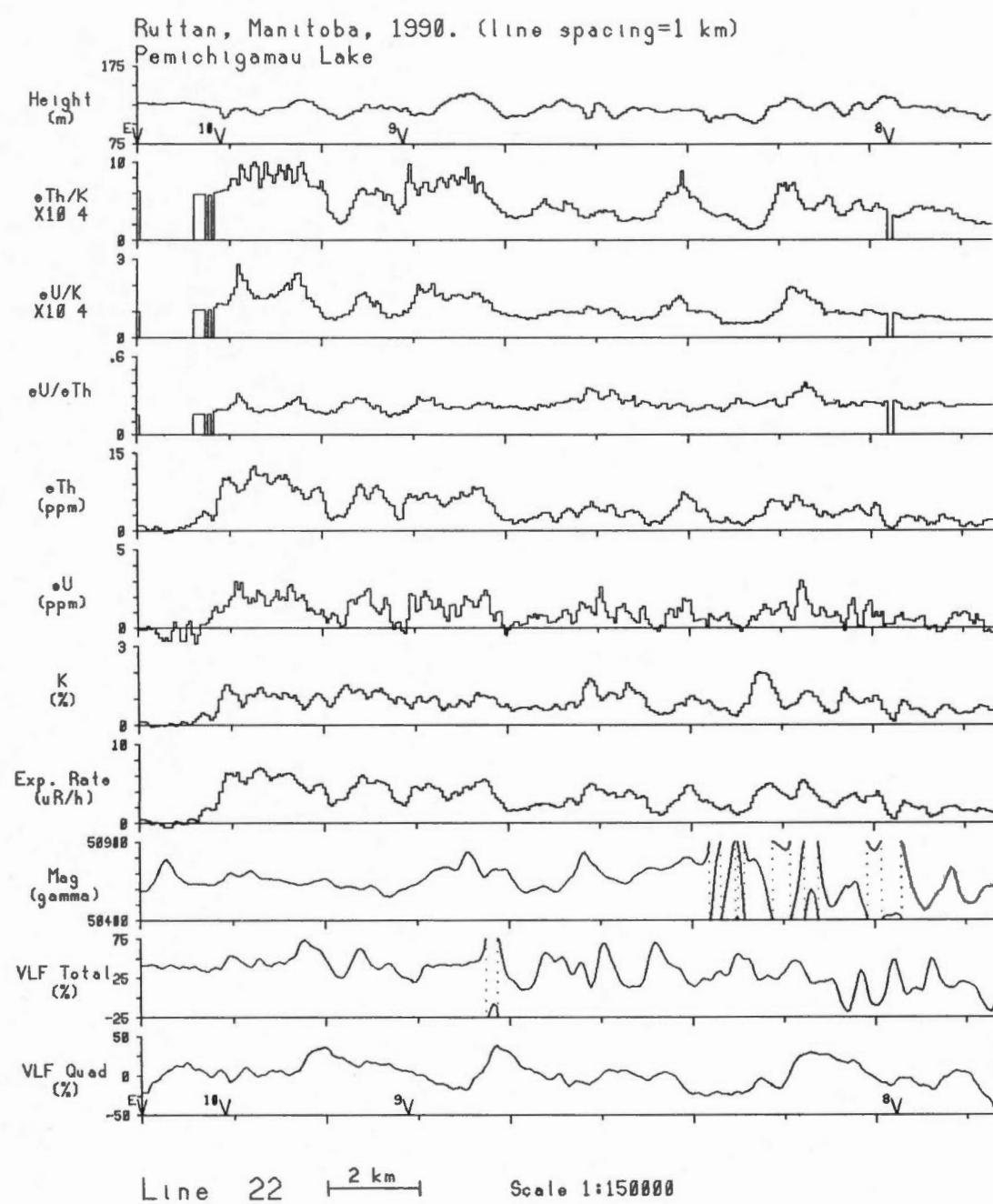


Line 22 2 km Scale 1:150000

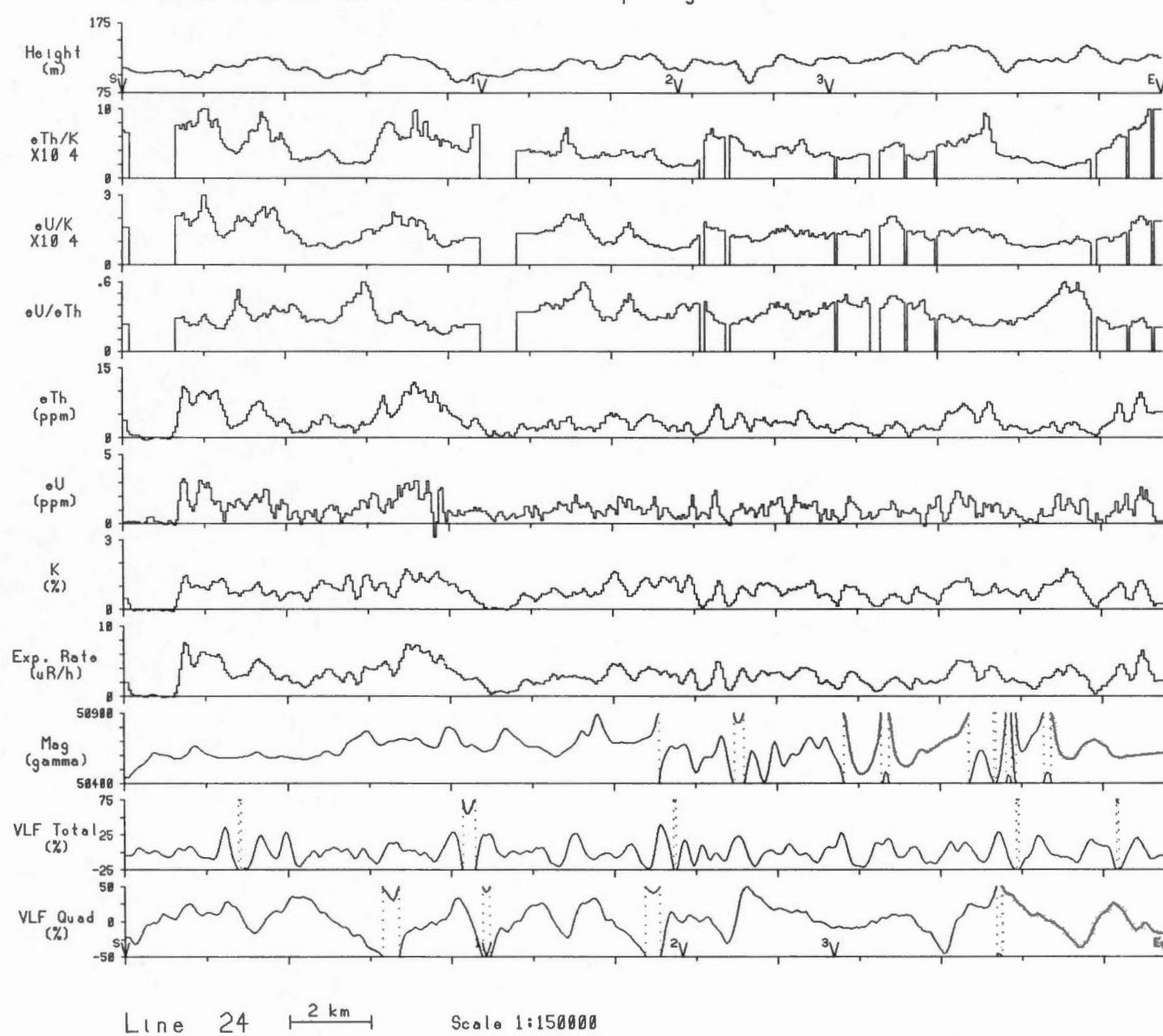
Detailed Ruttan, Manitoba, 1990. (line spacing=500m)



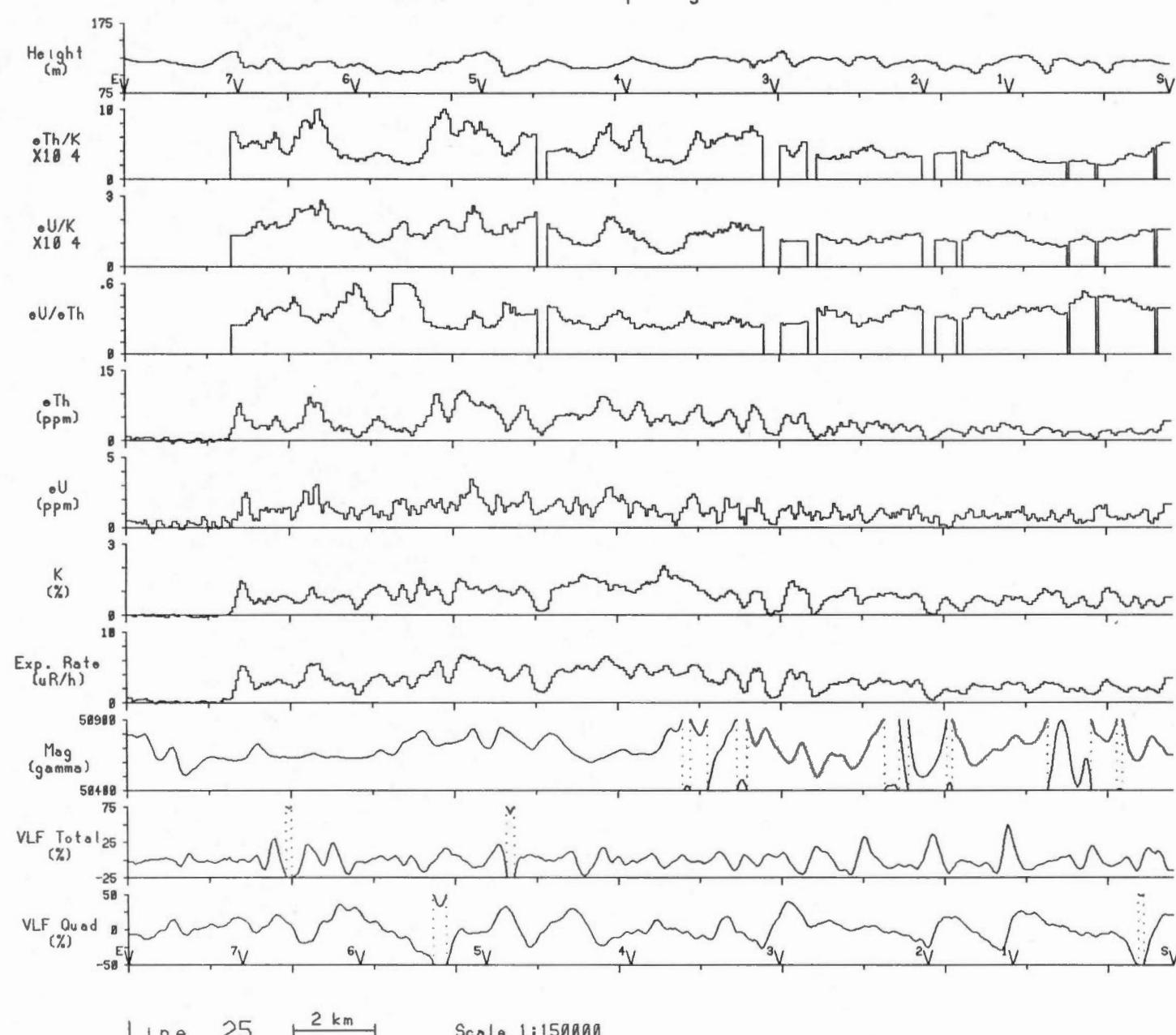
Line 23 2 km Scale 1:150000

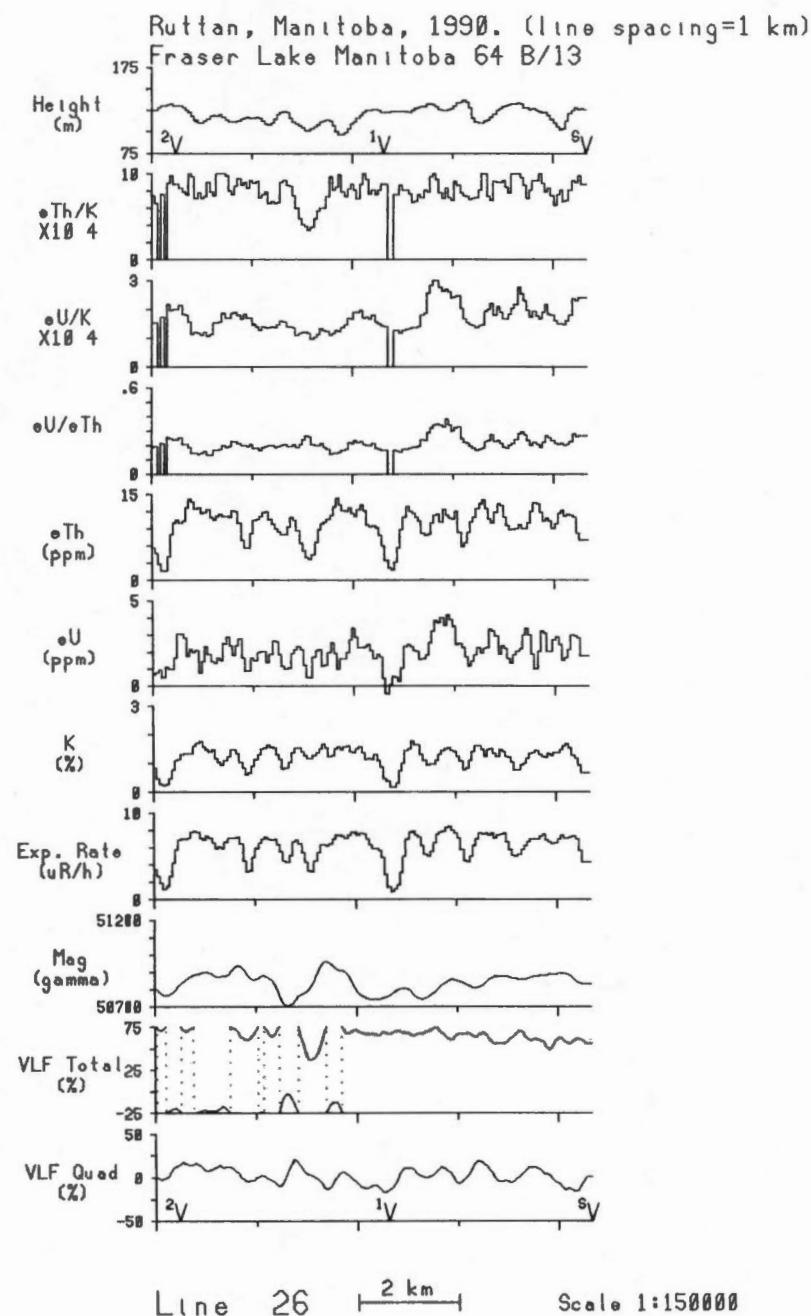


Detailed Ruttan, Manitoba, 1990. (line spacing=500m)

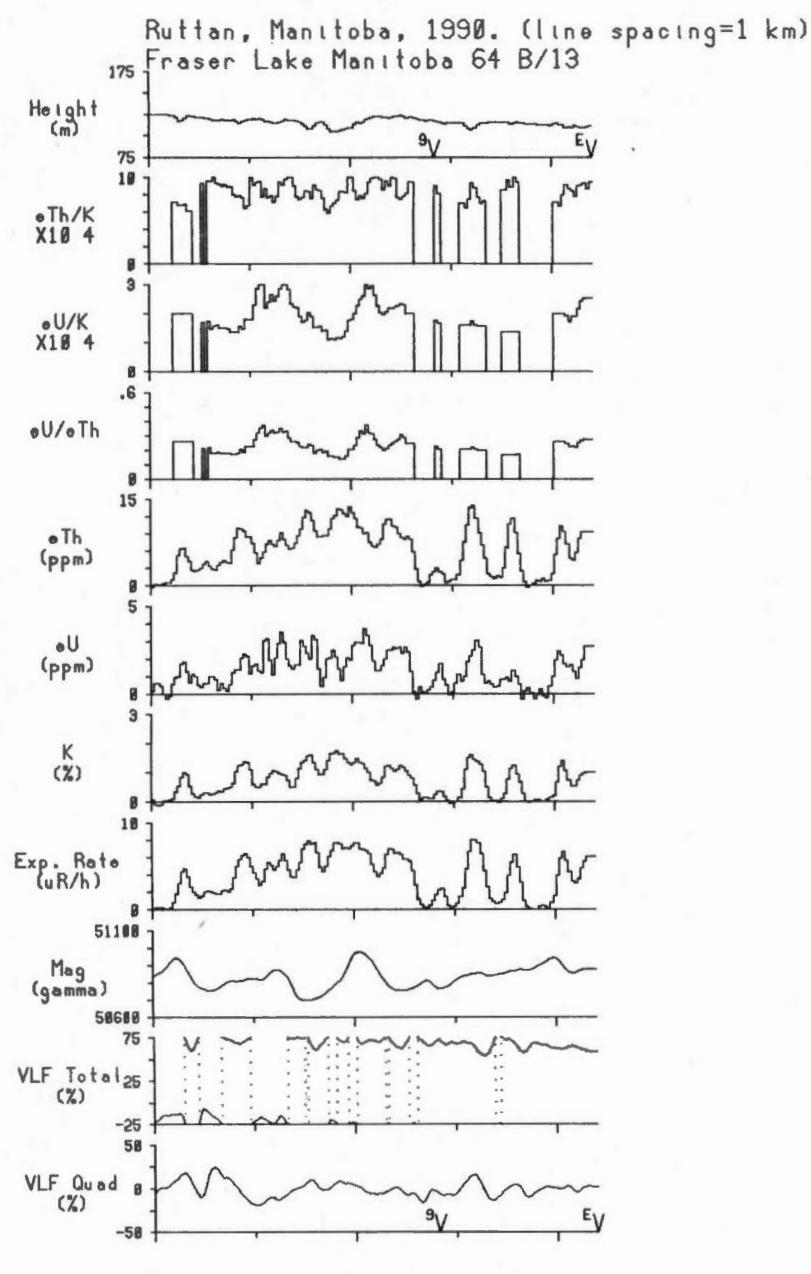


Detailed Ruttan, Manitoba, 1990. (line spacing=500m)

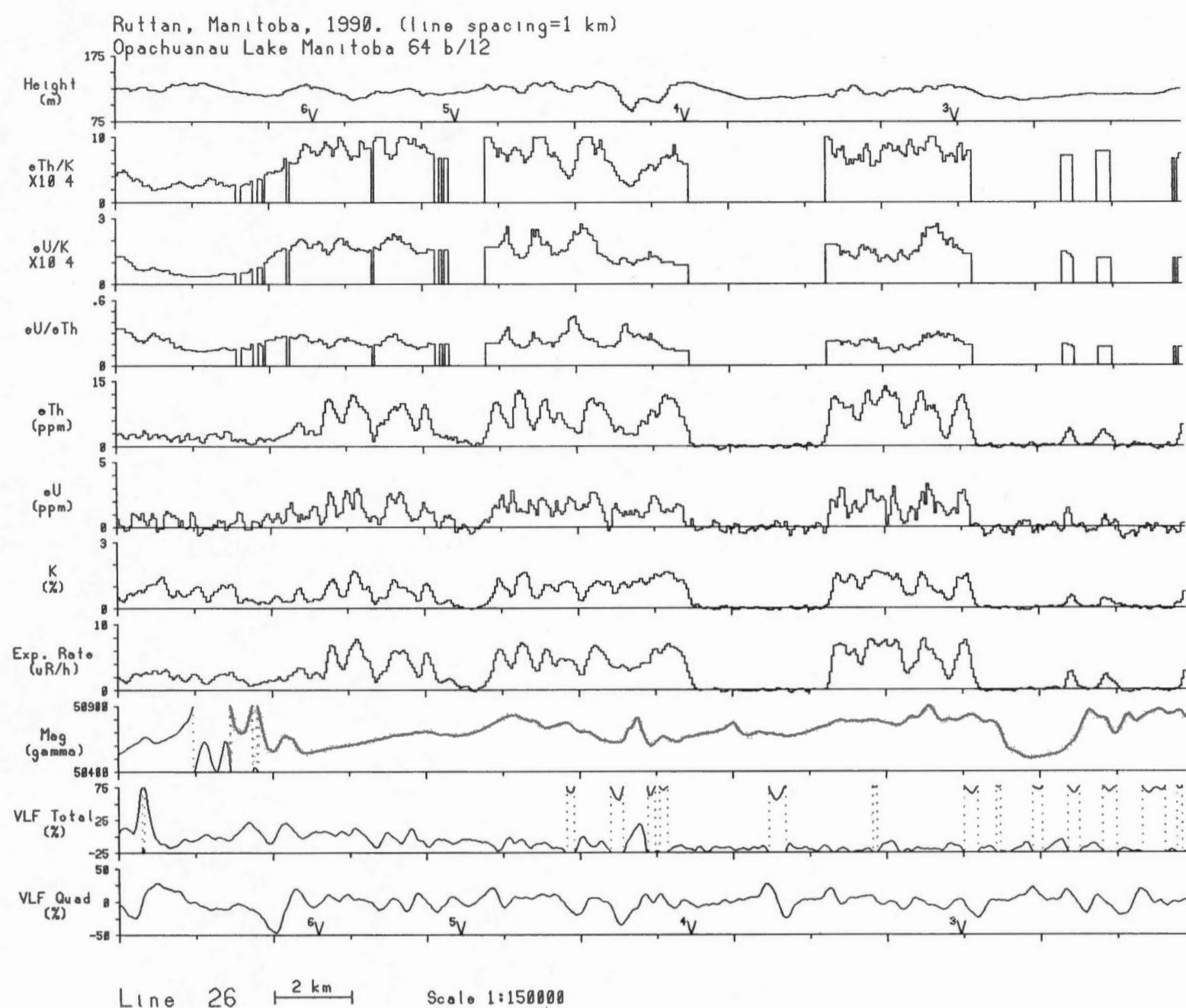




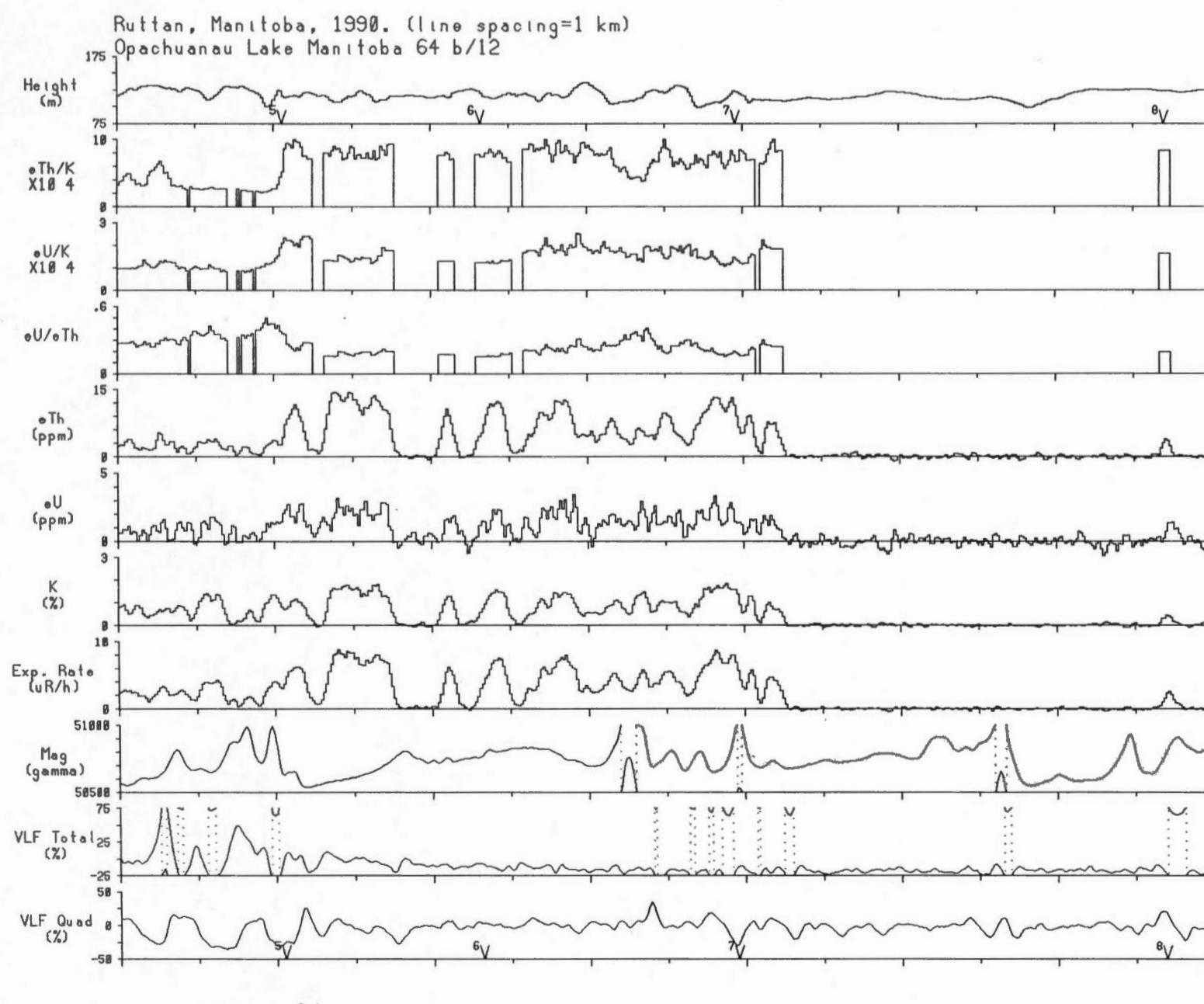
Line 26 2 km Scale 1:150000



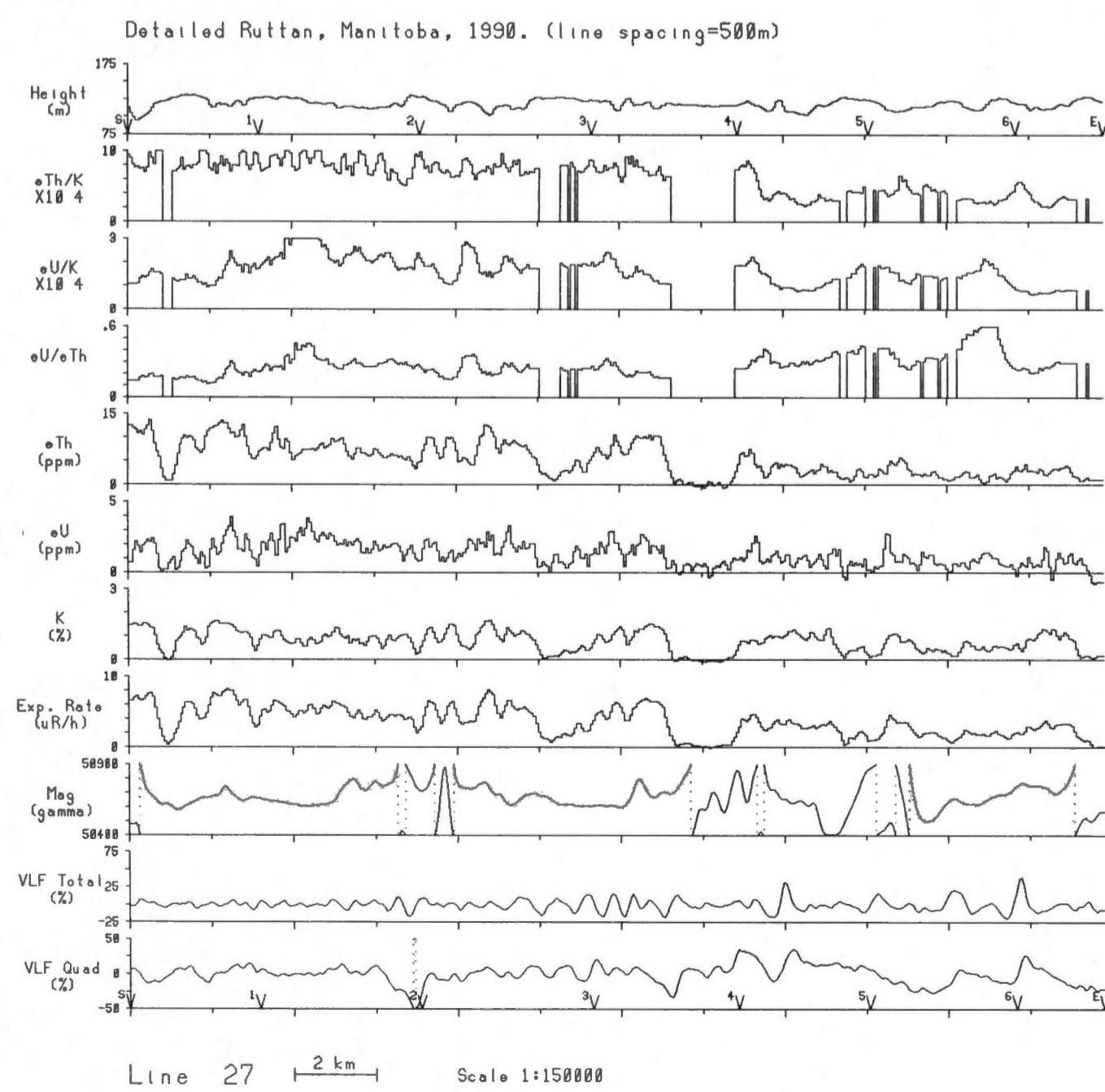
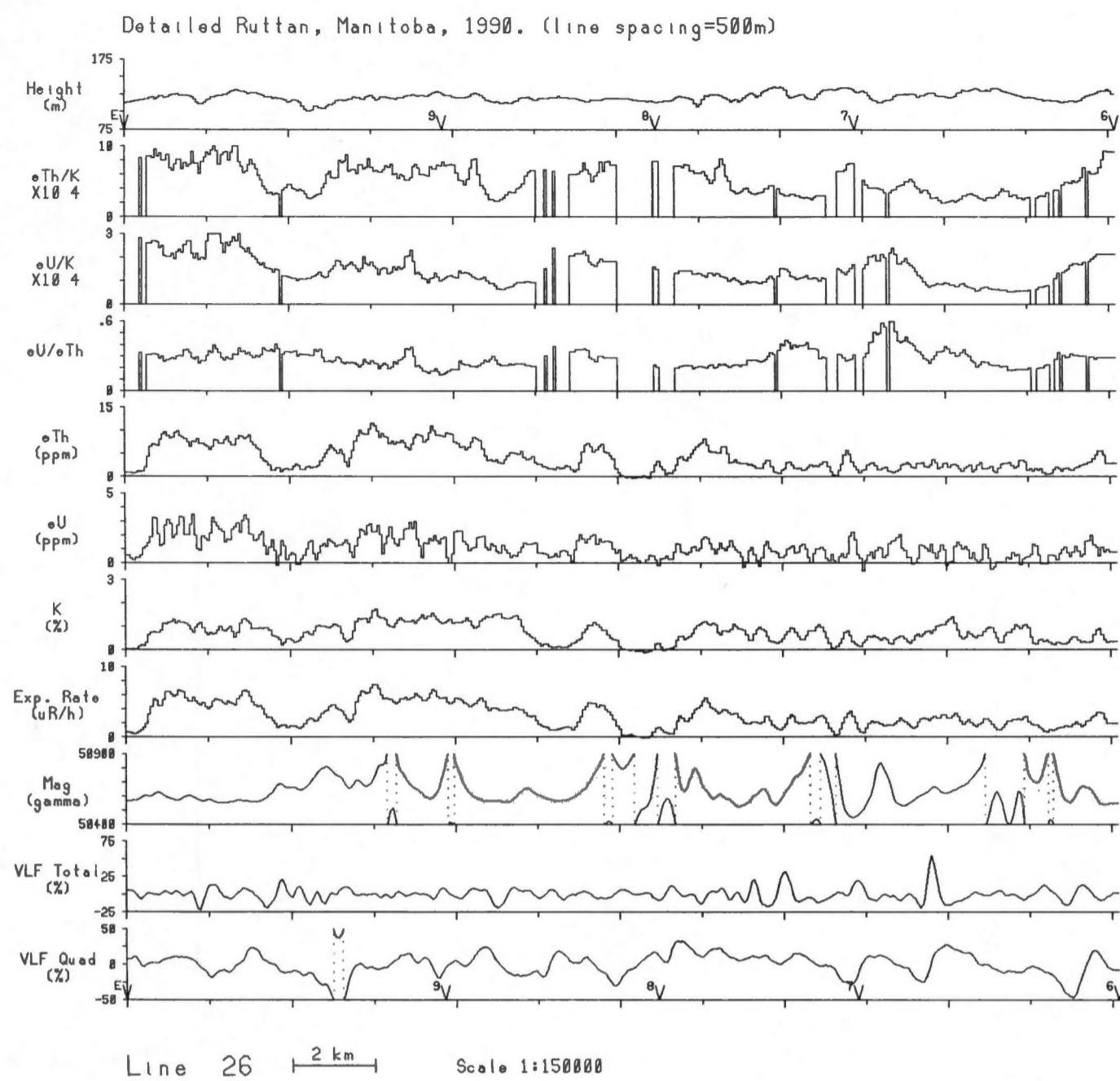
Line 28 2 km Scale 1:150000

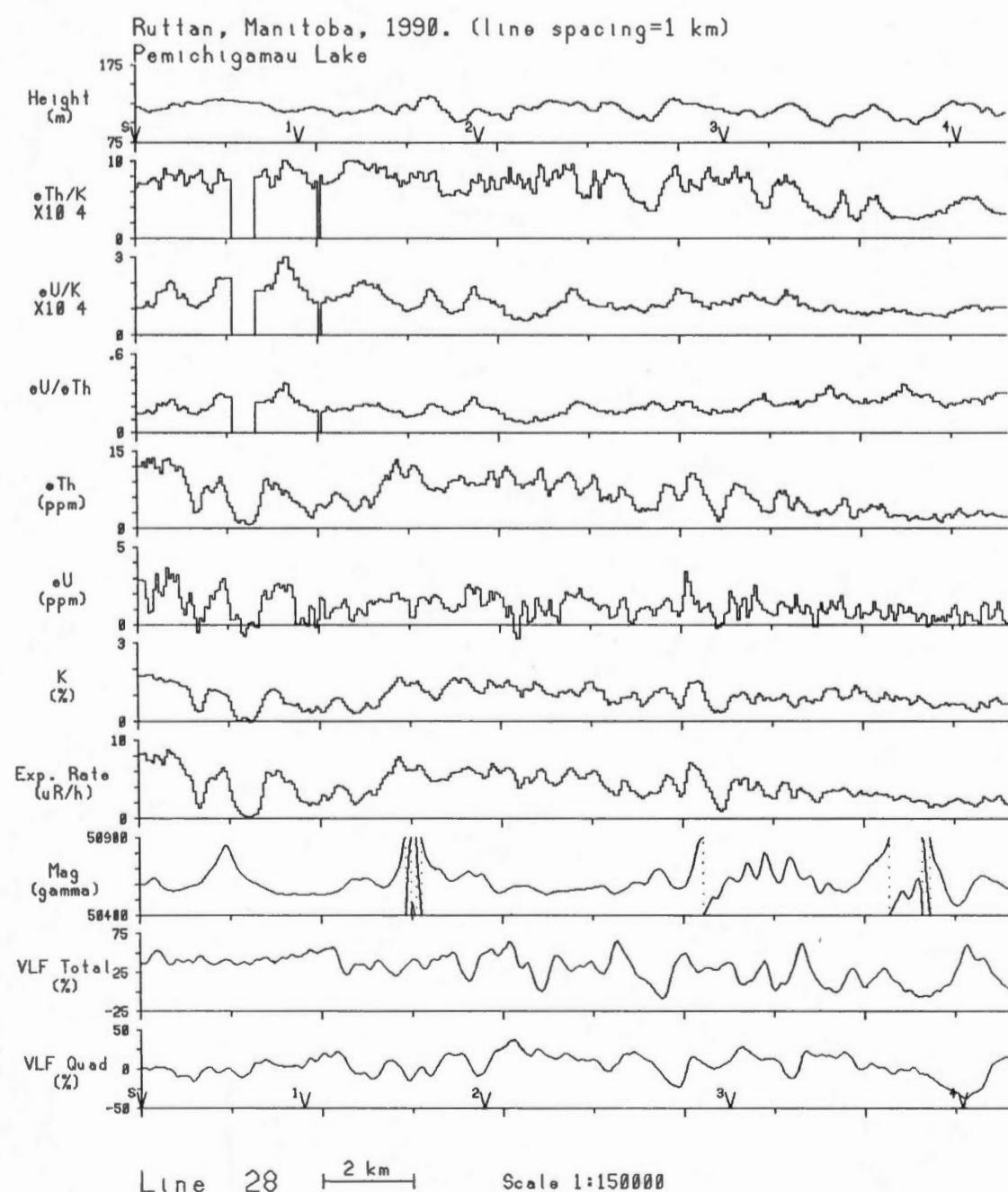
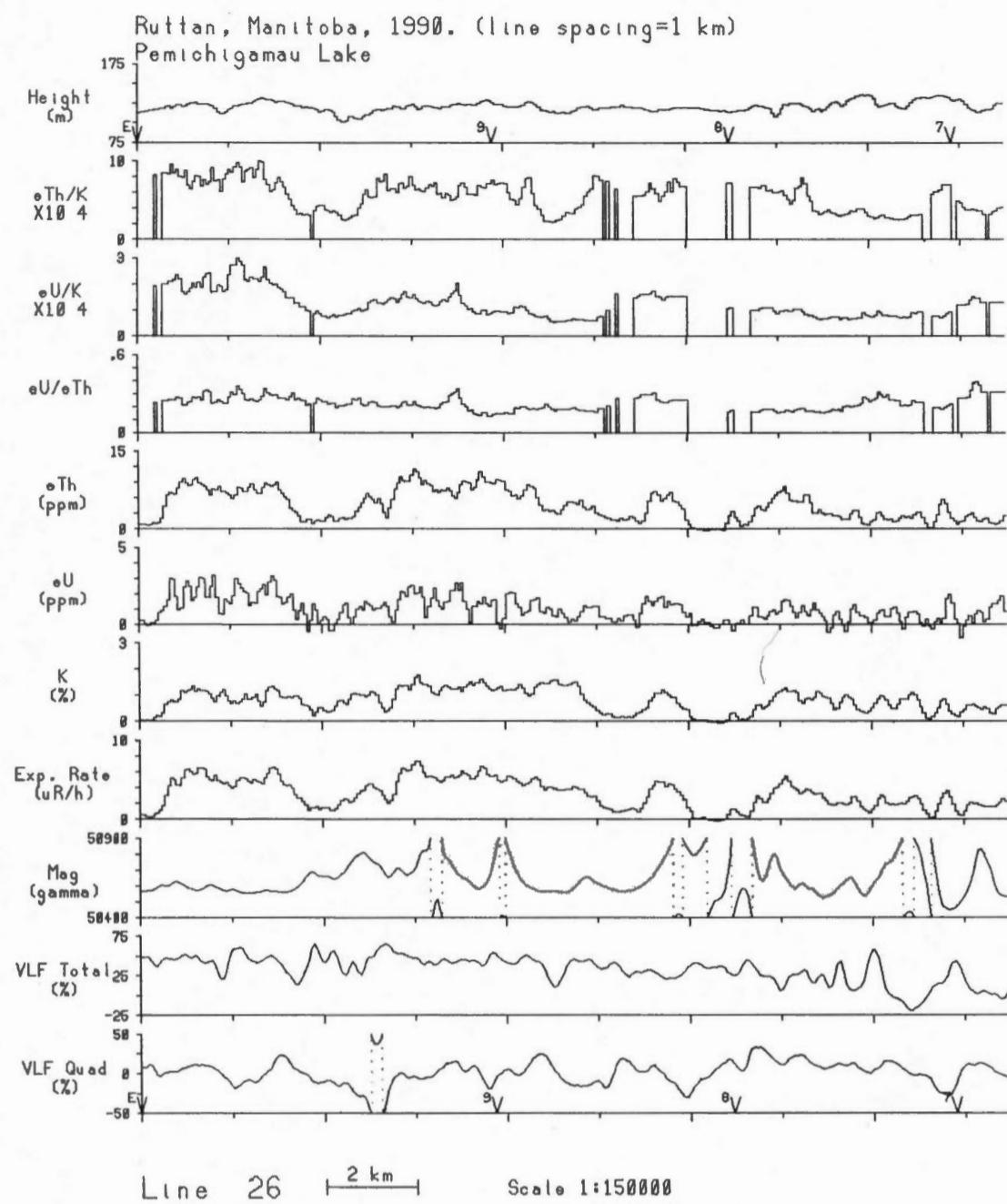


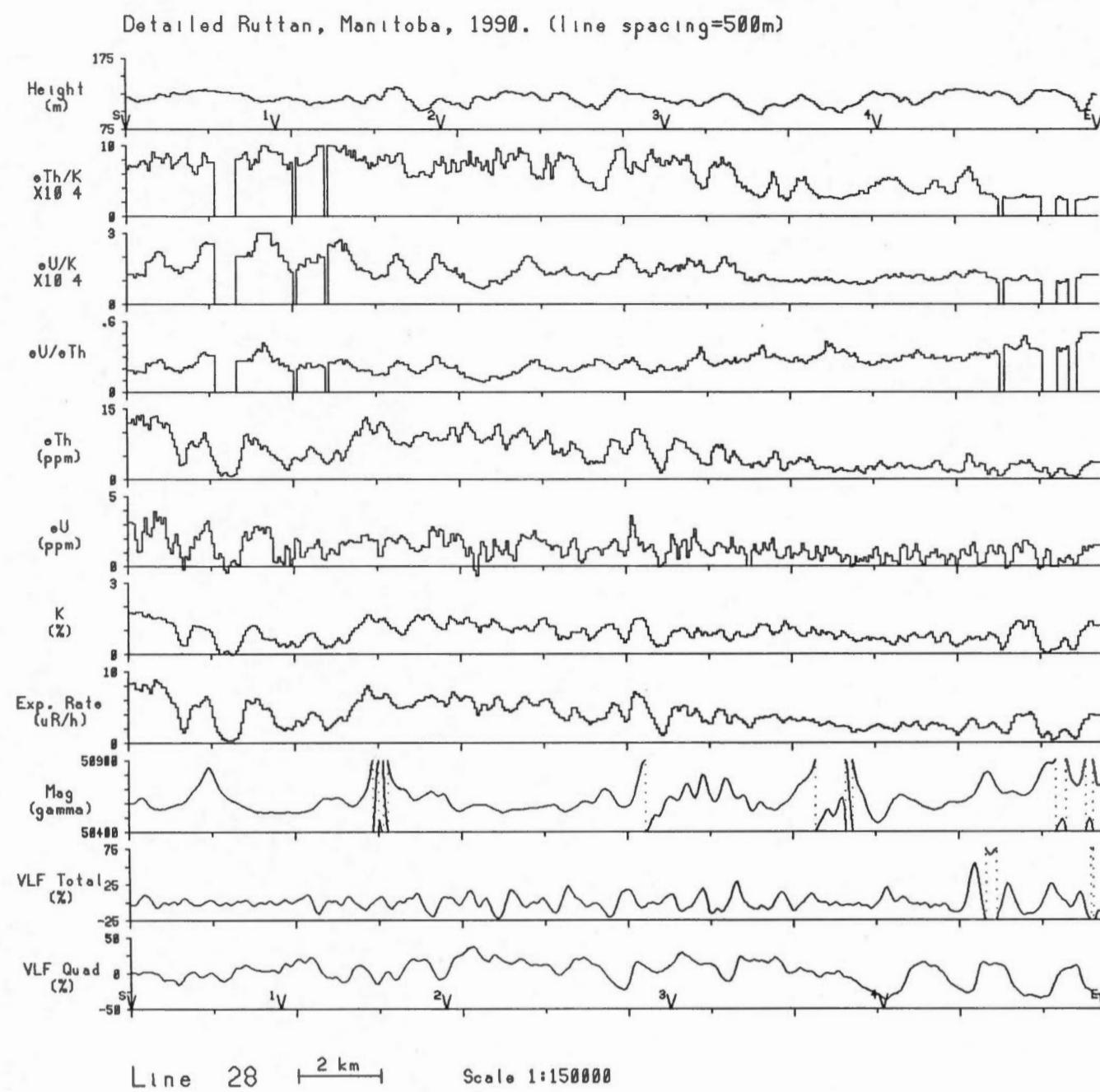
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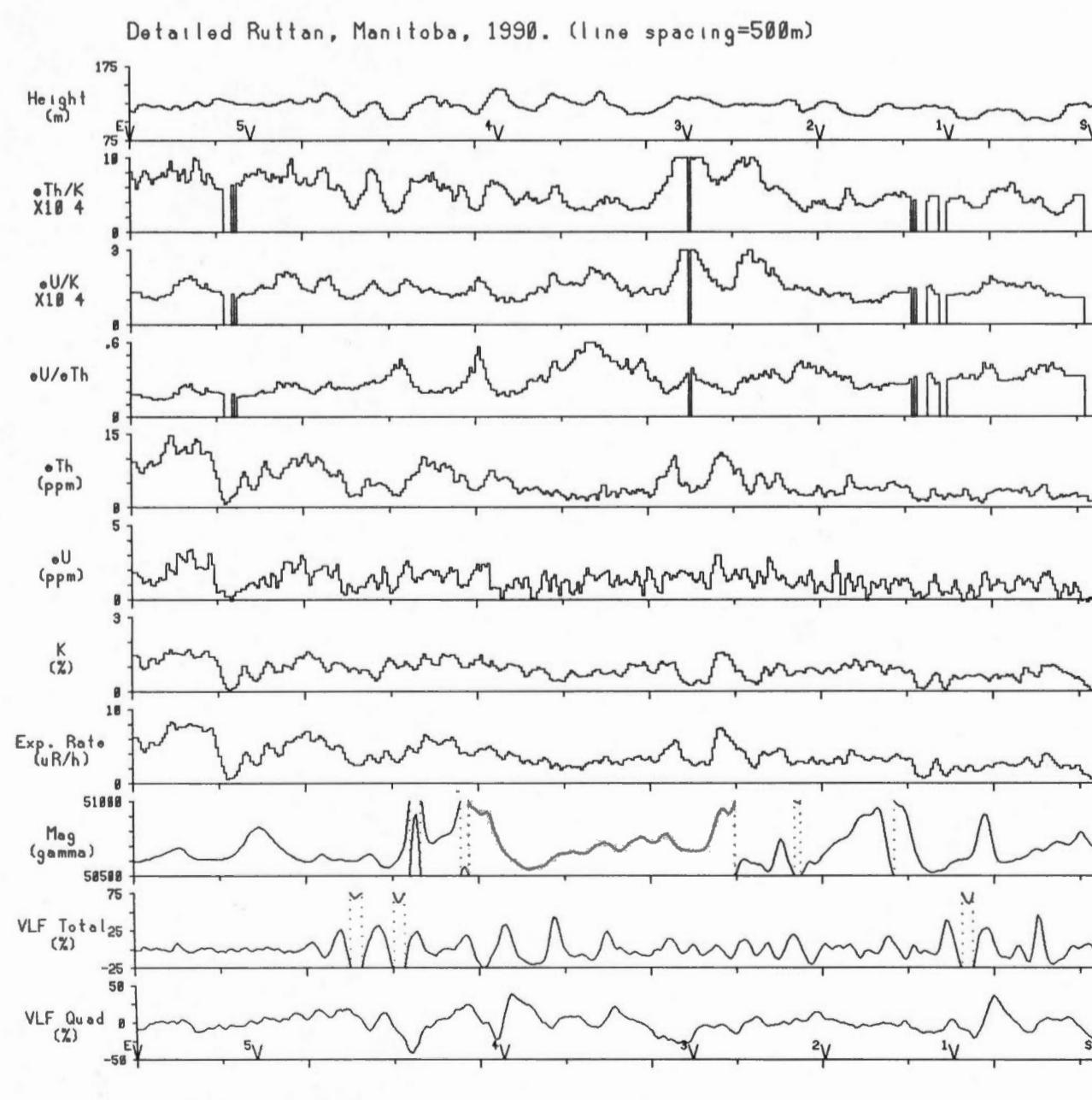
Line 28 2 km Scale 1:150000



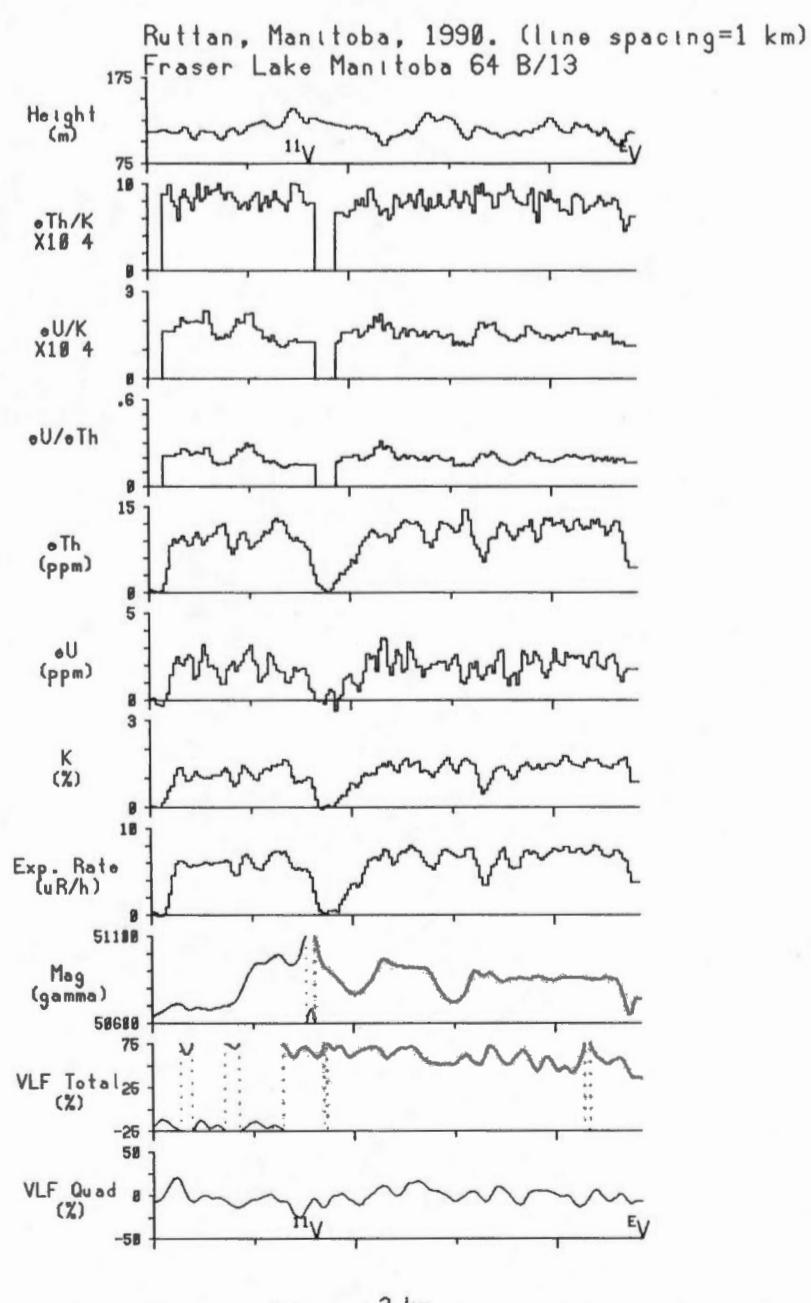
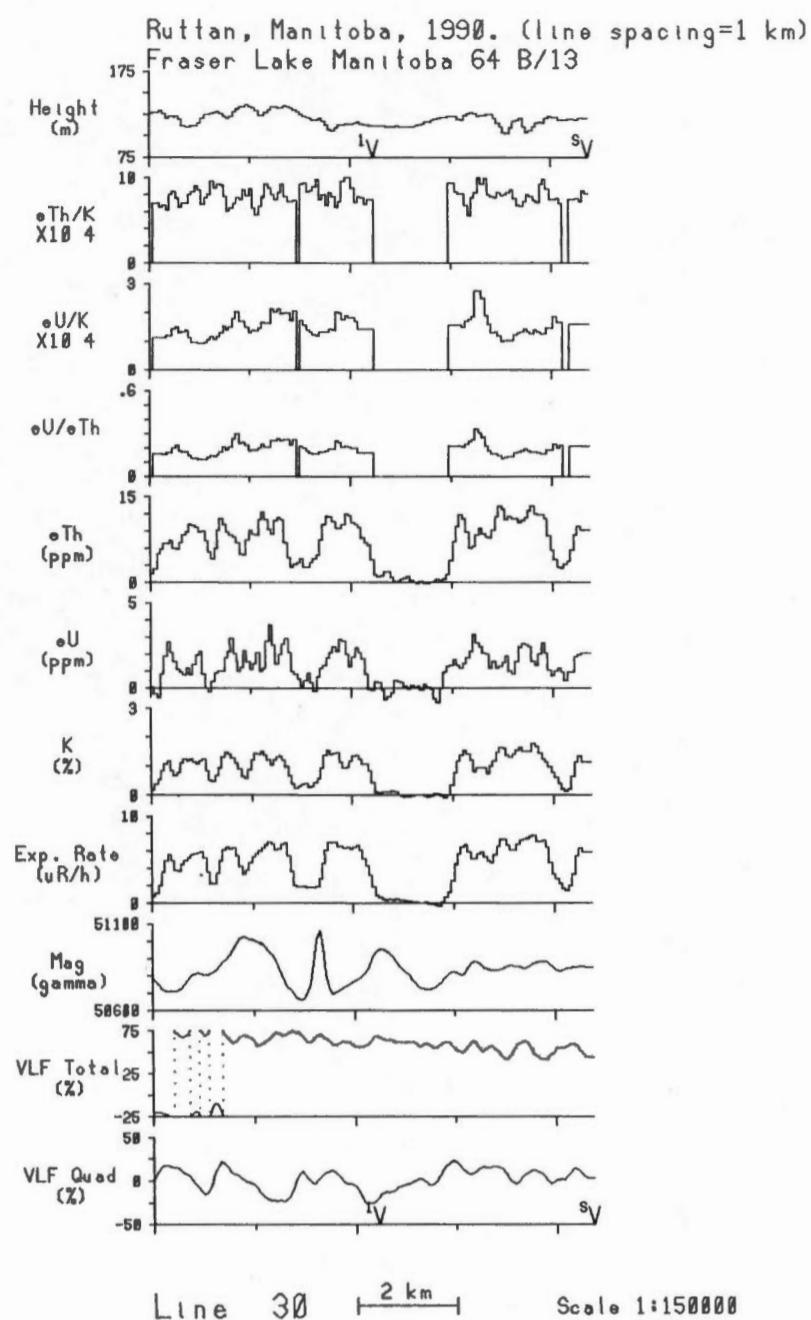


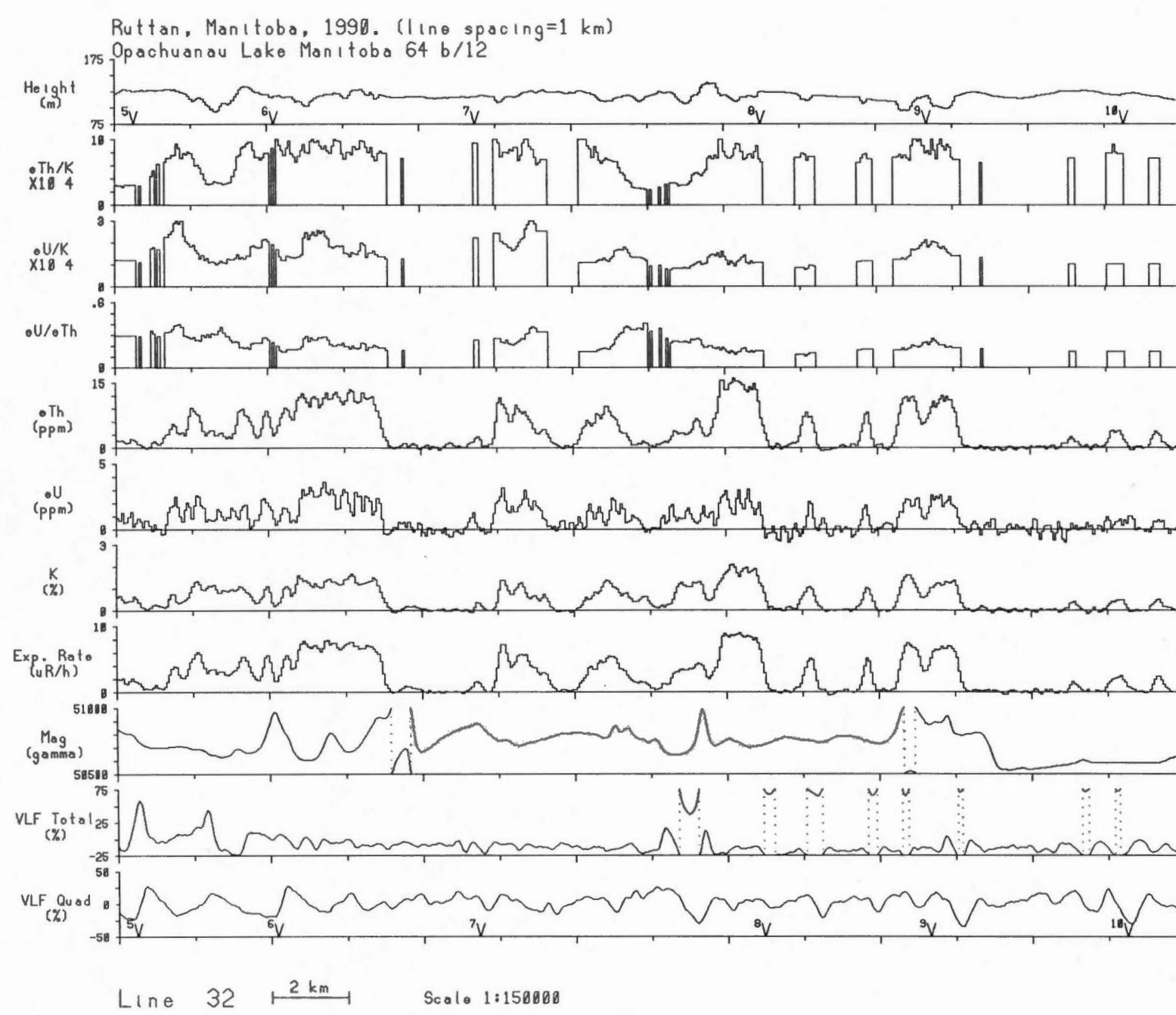
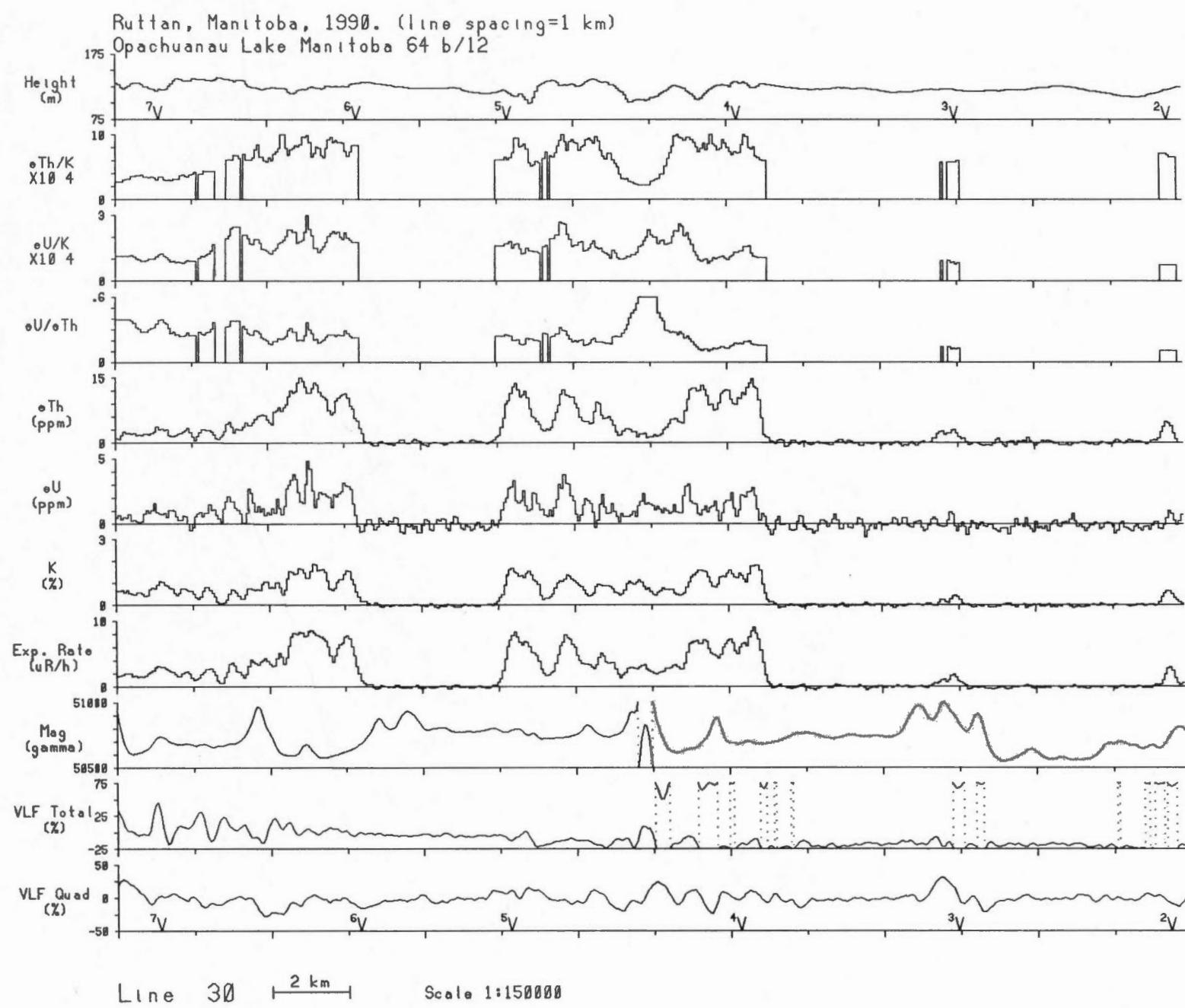


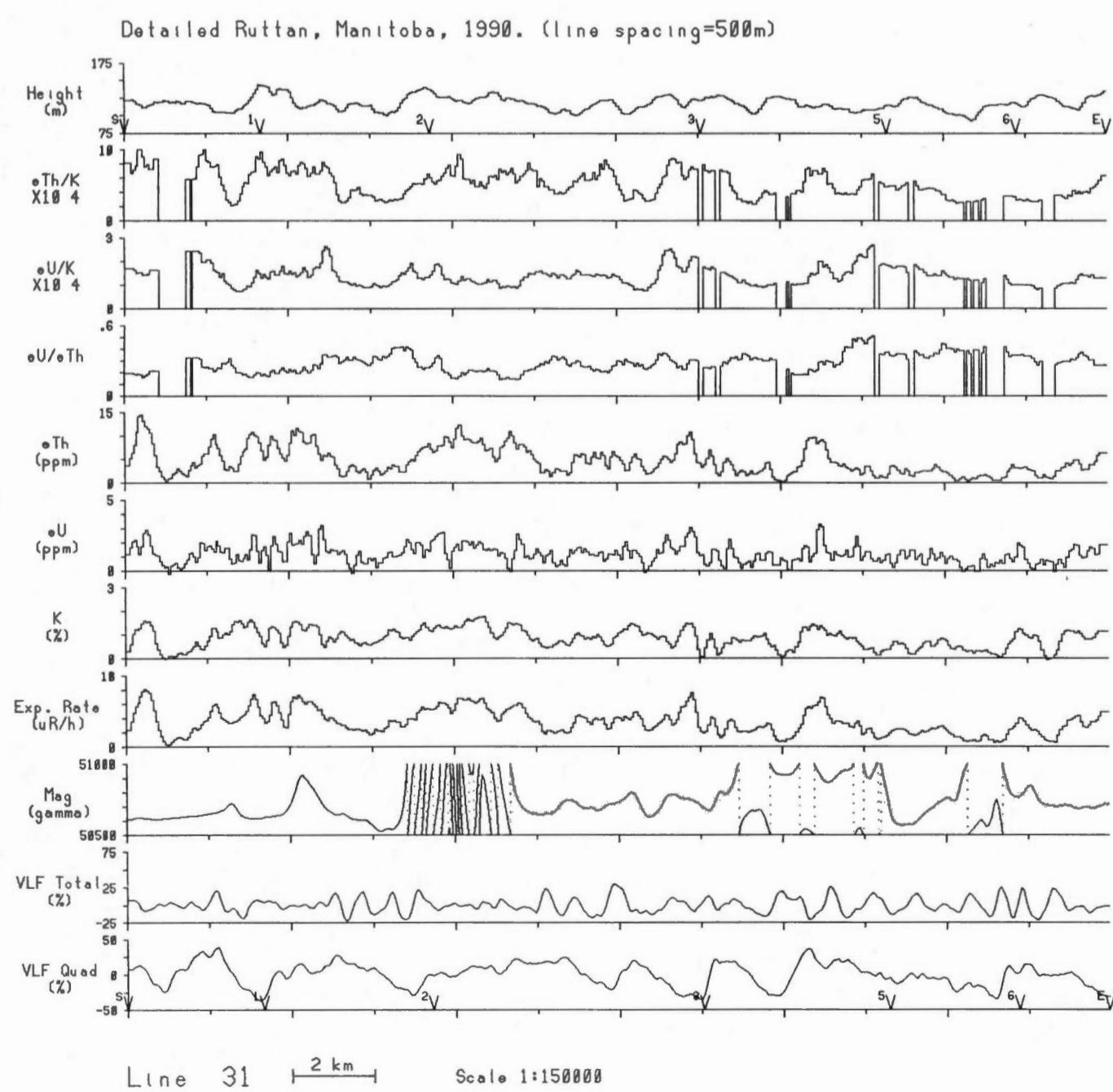
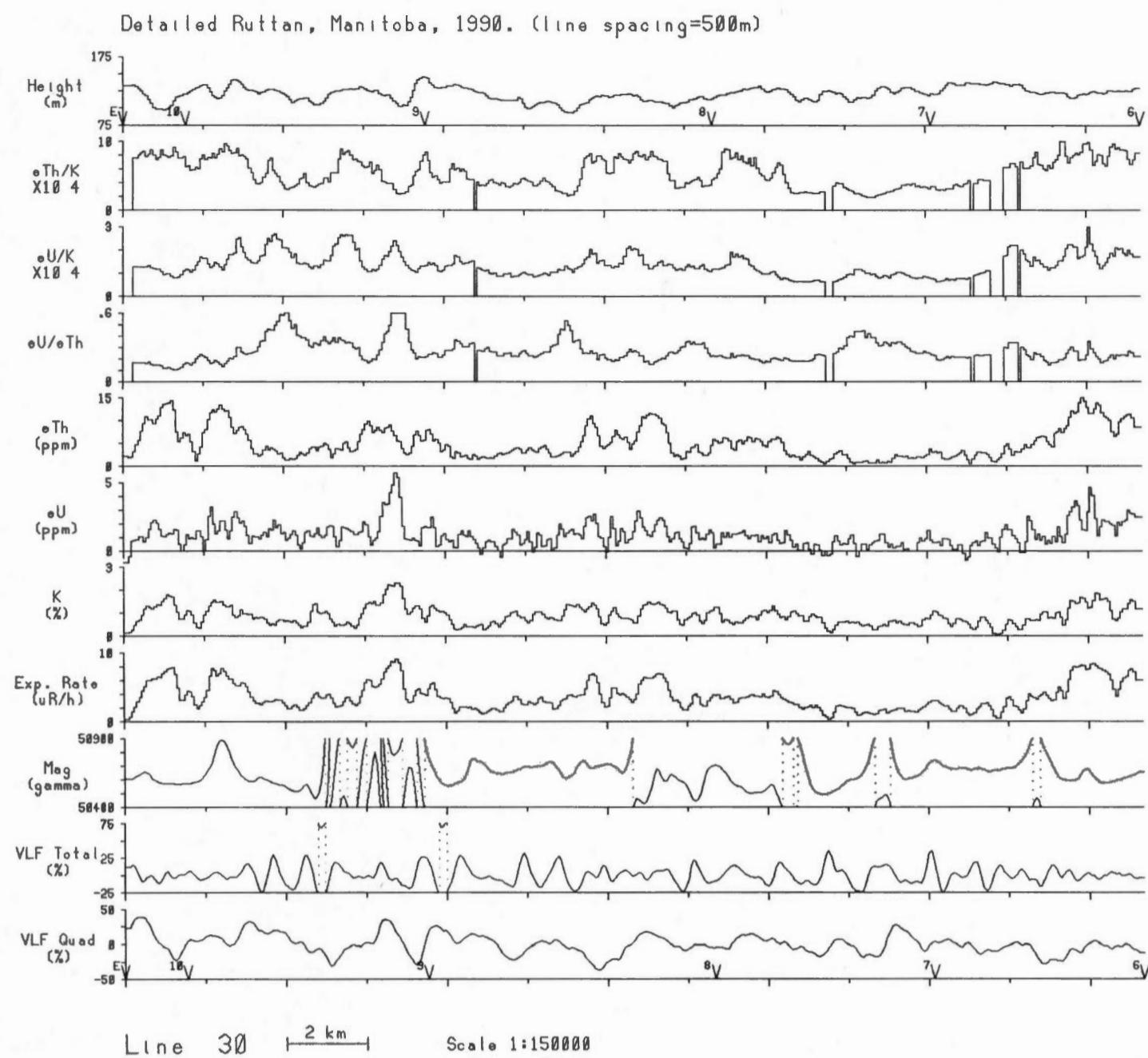
Line 28 2 km Scale 1:150000

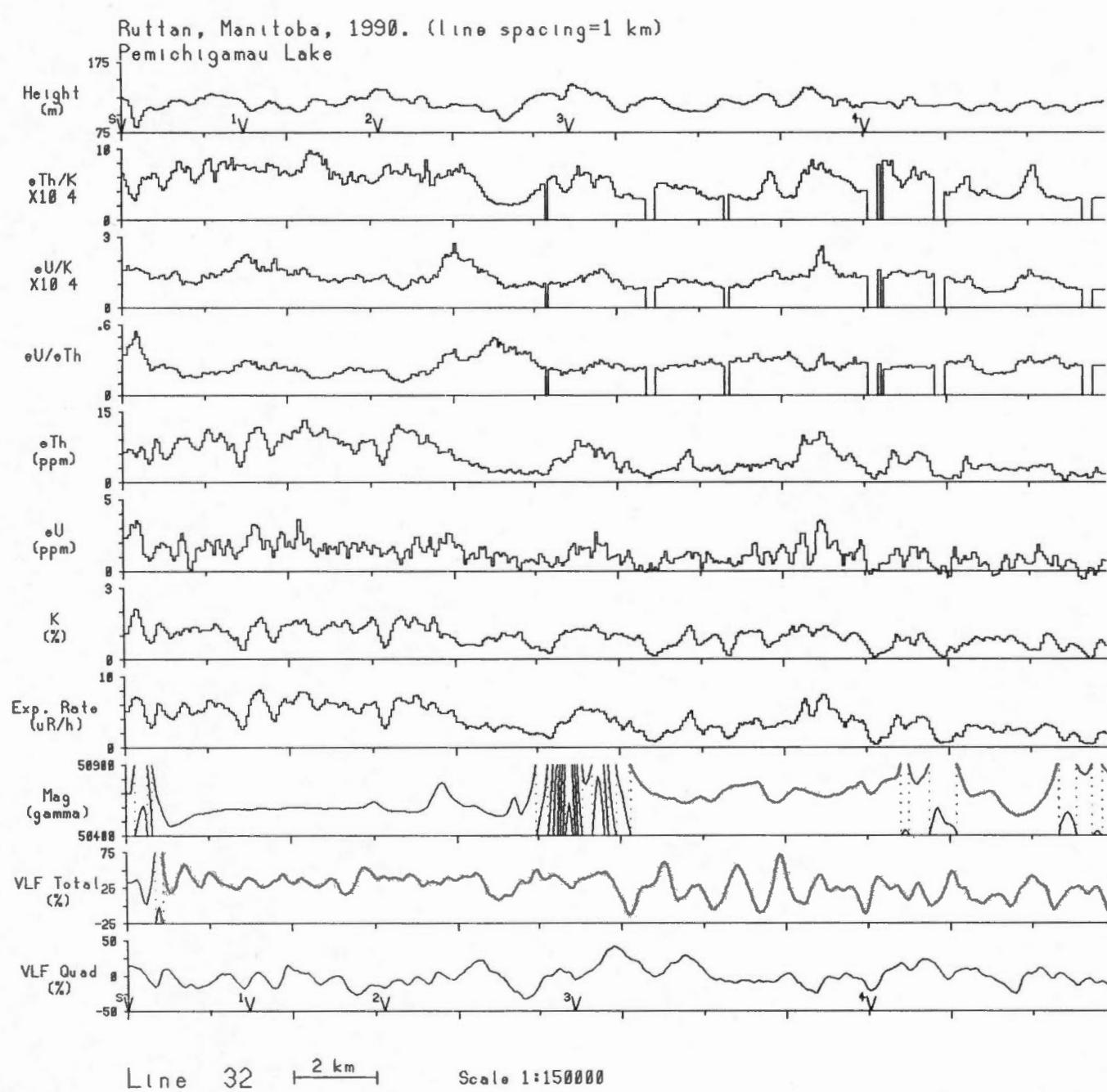
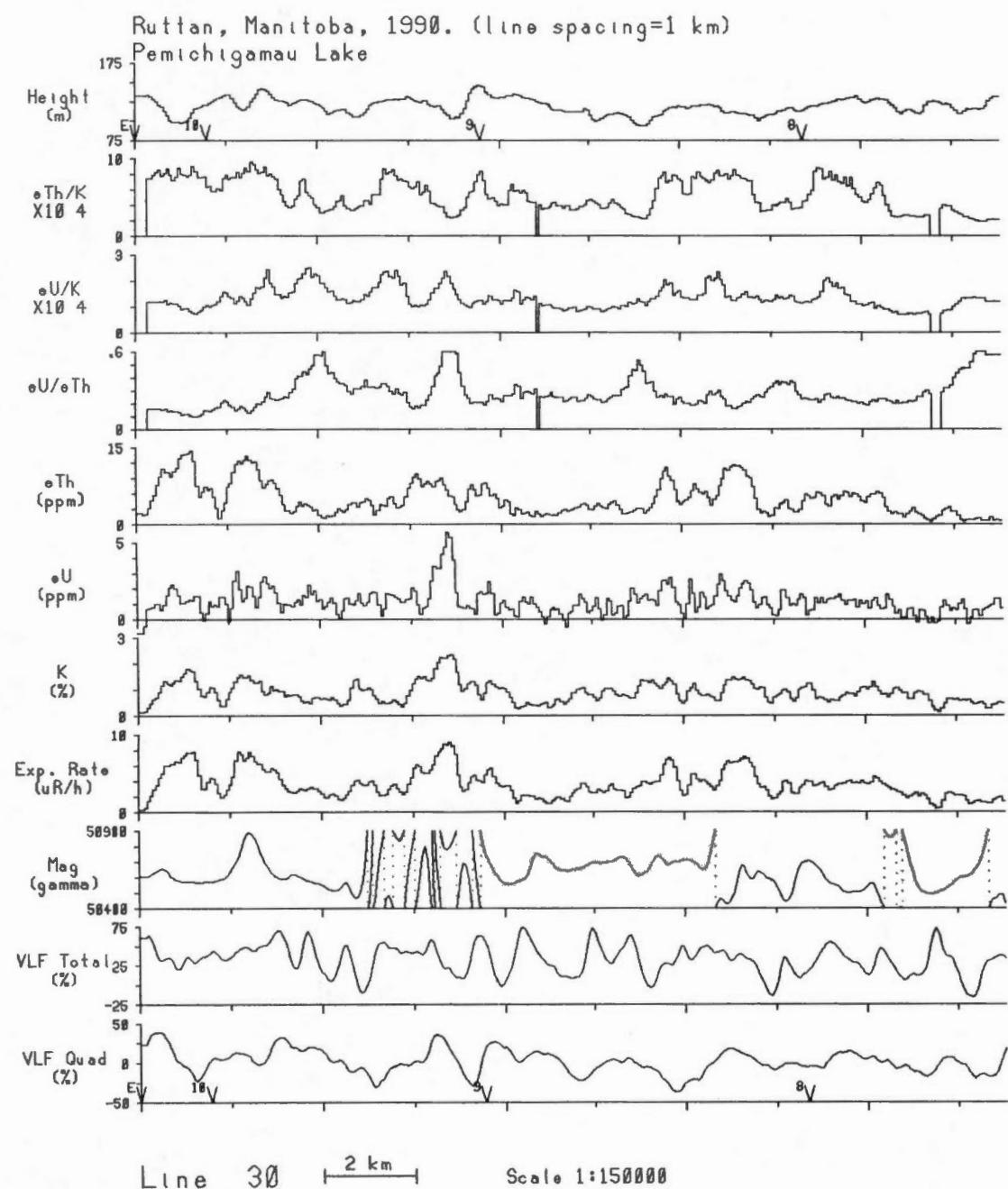


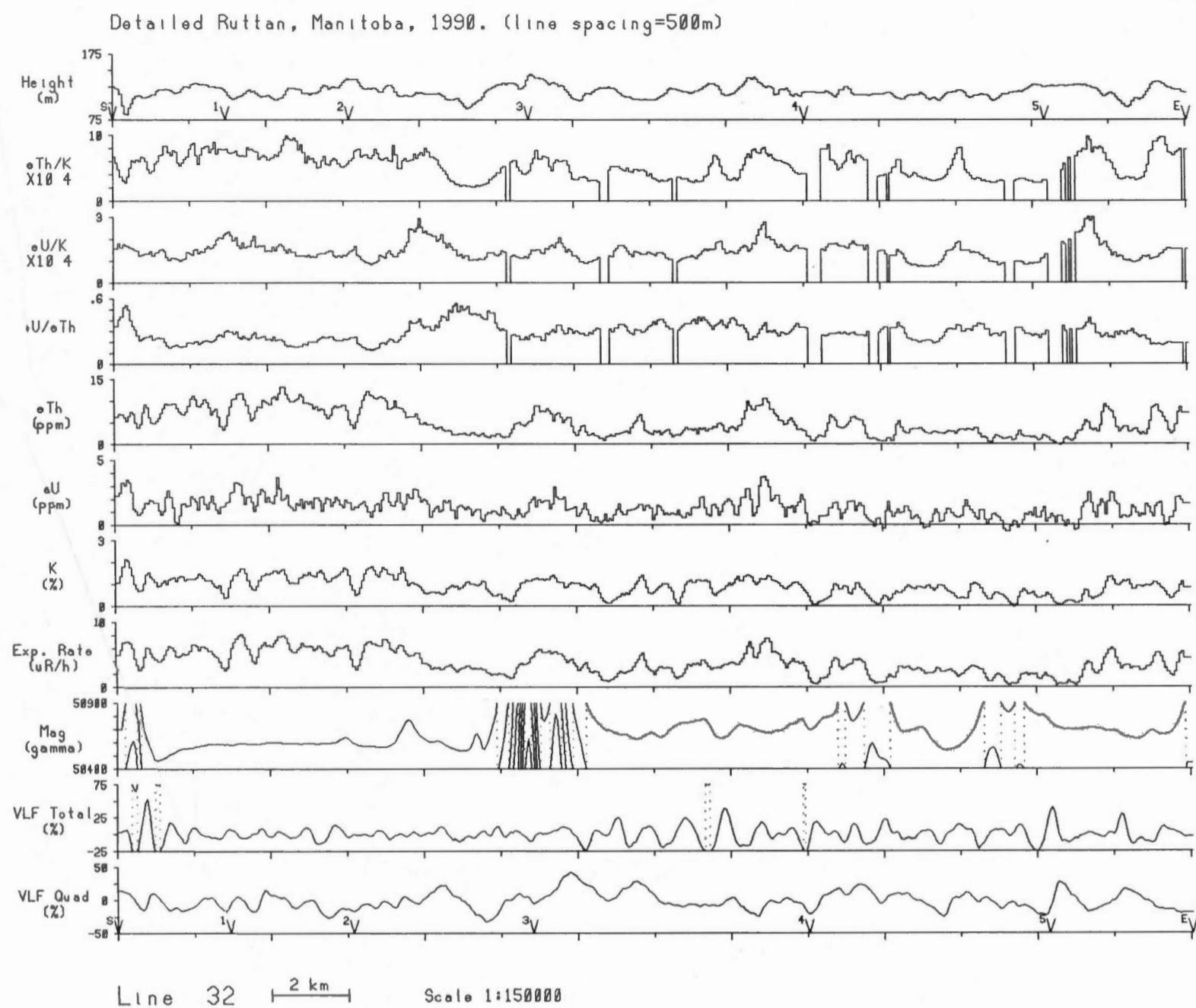
Line 29 2 km Scale 1:150000



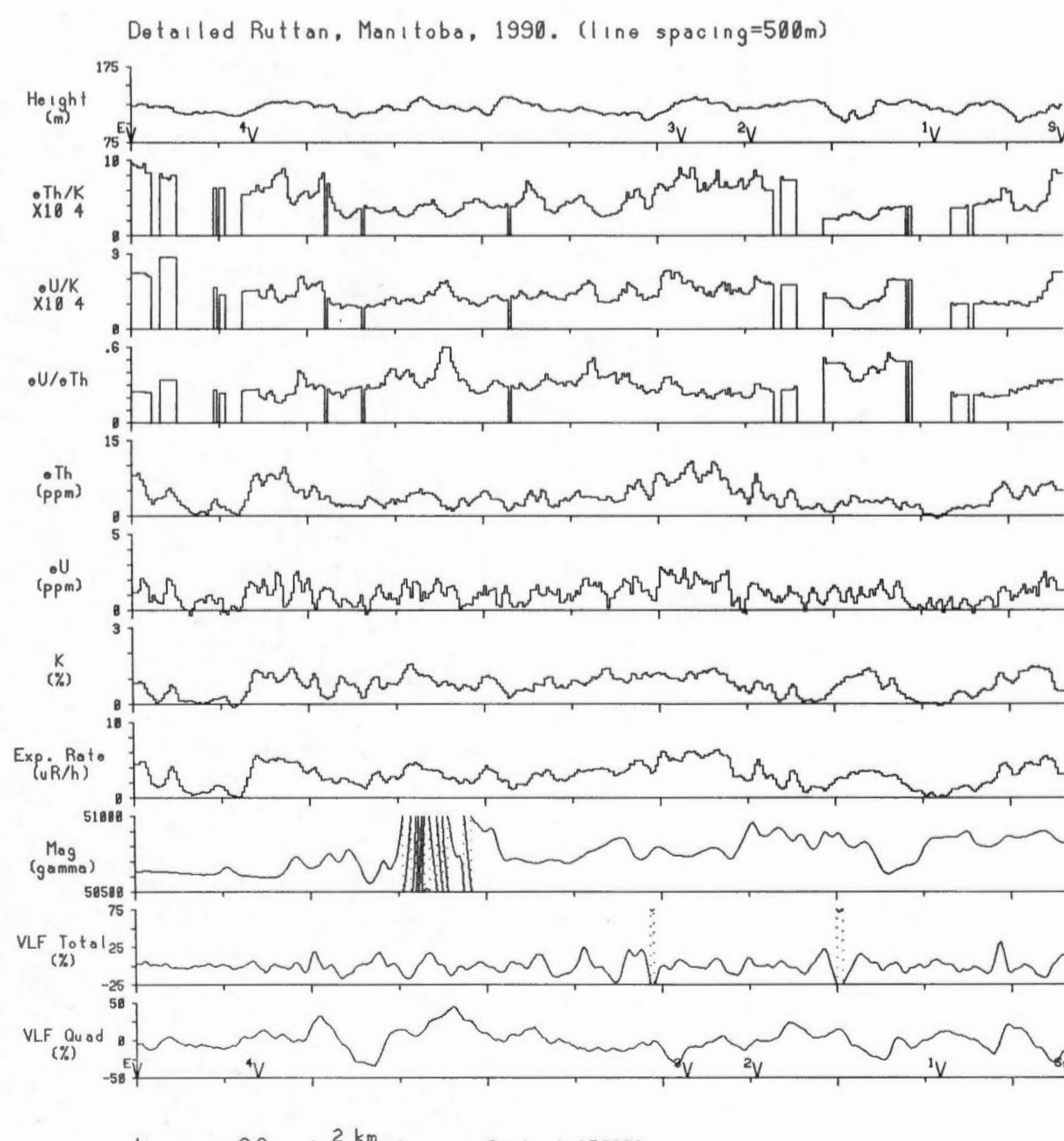




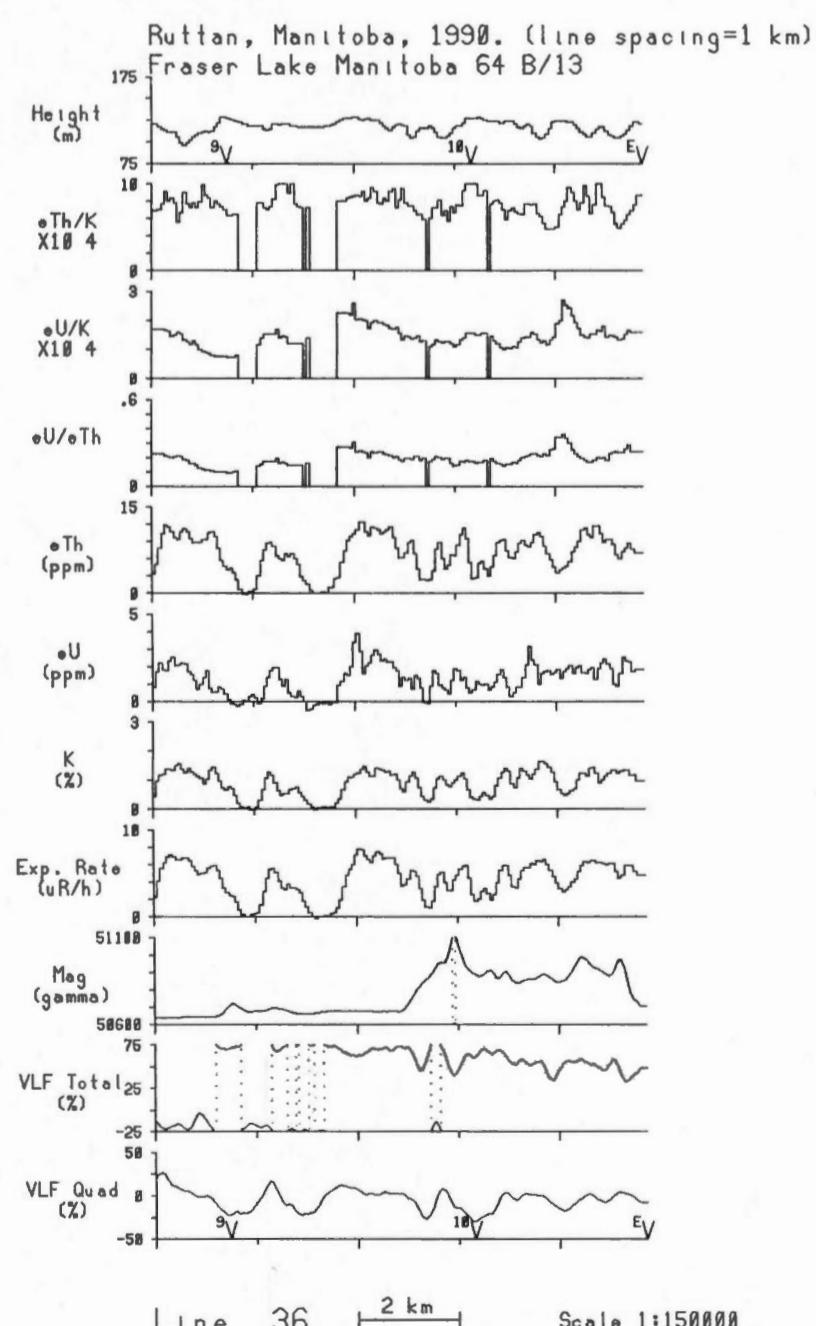
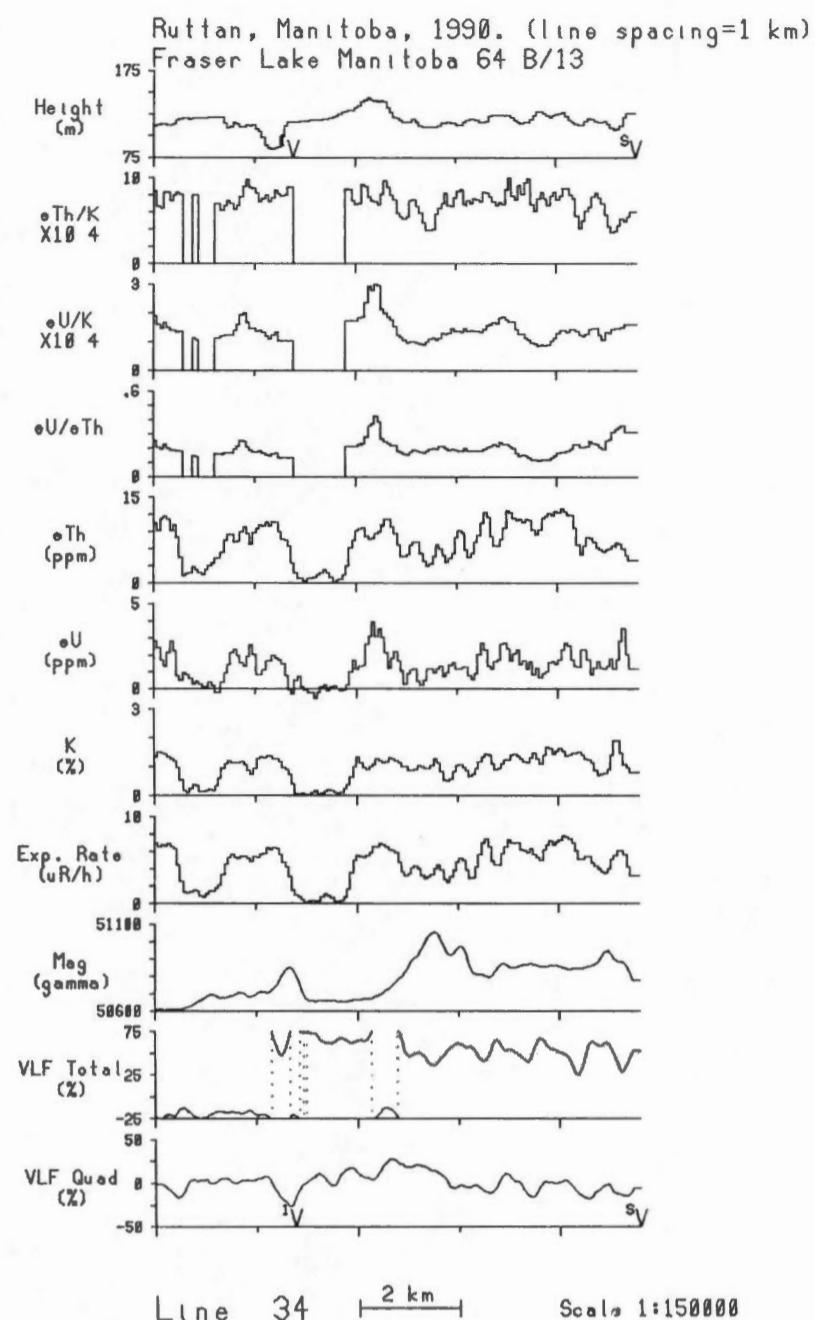


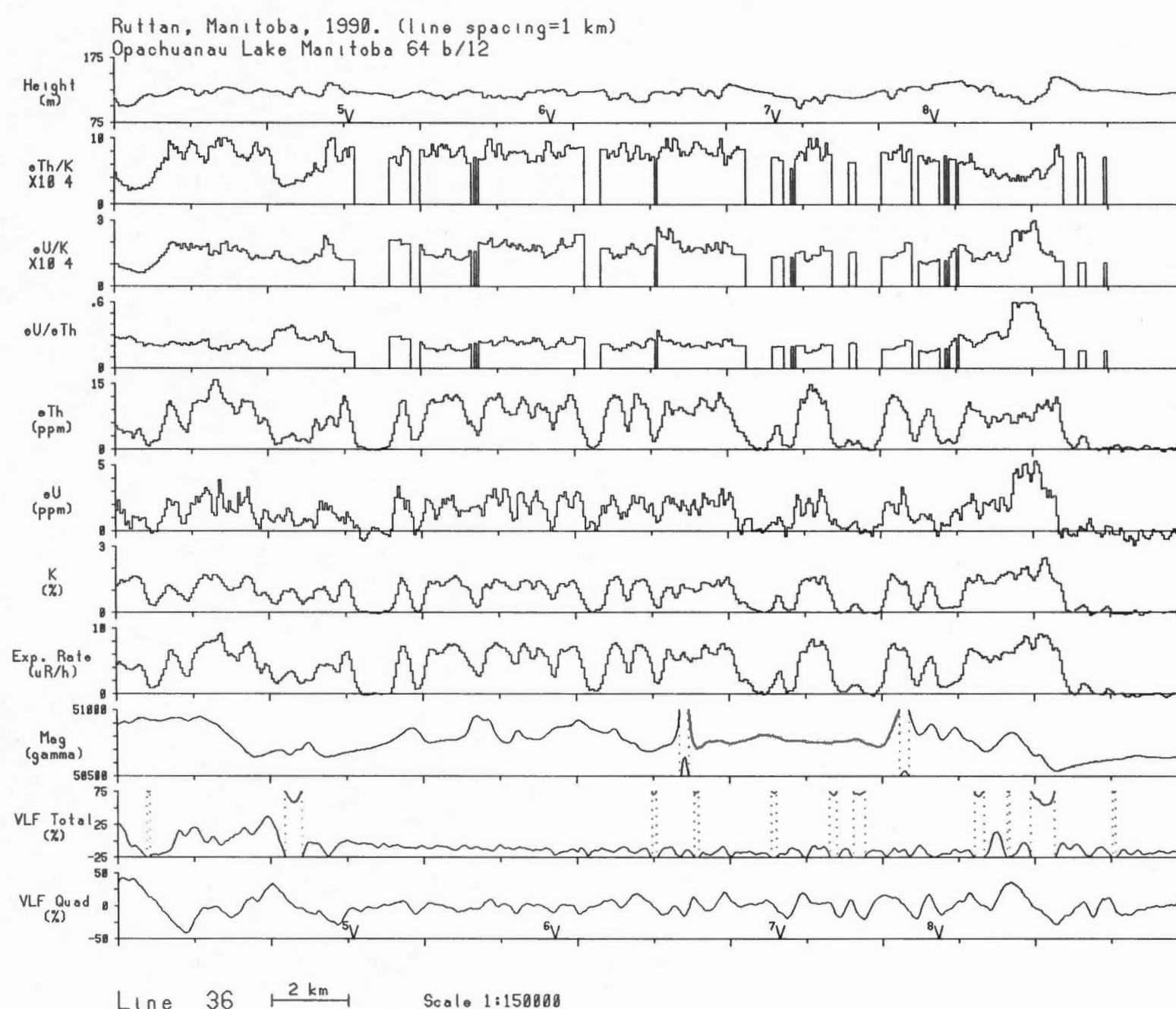
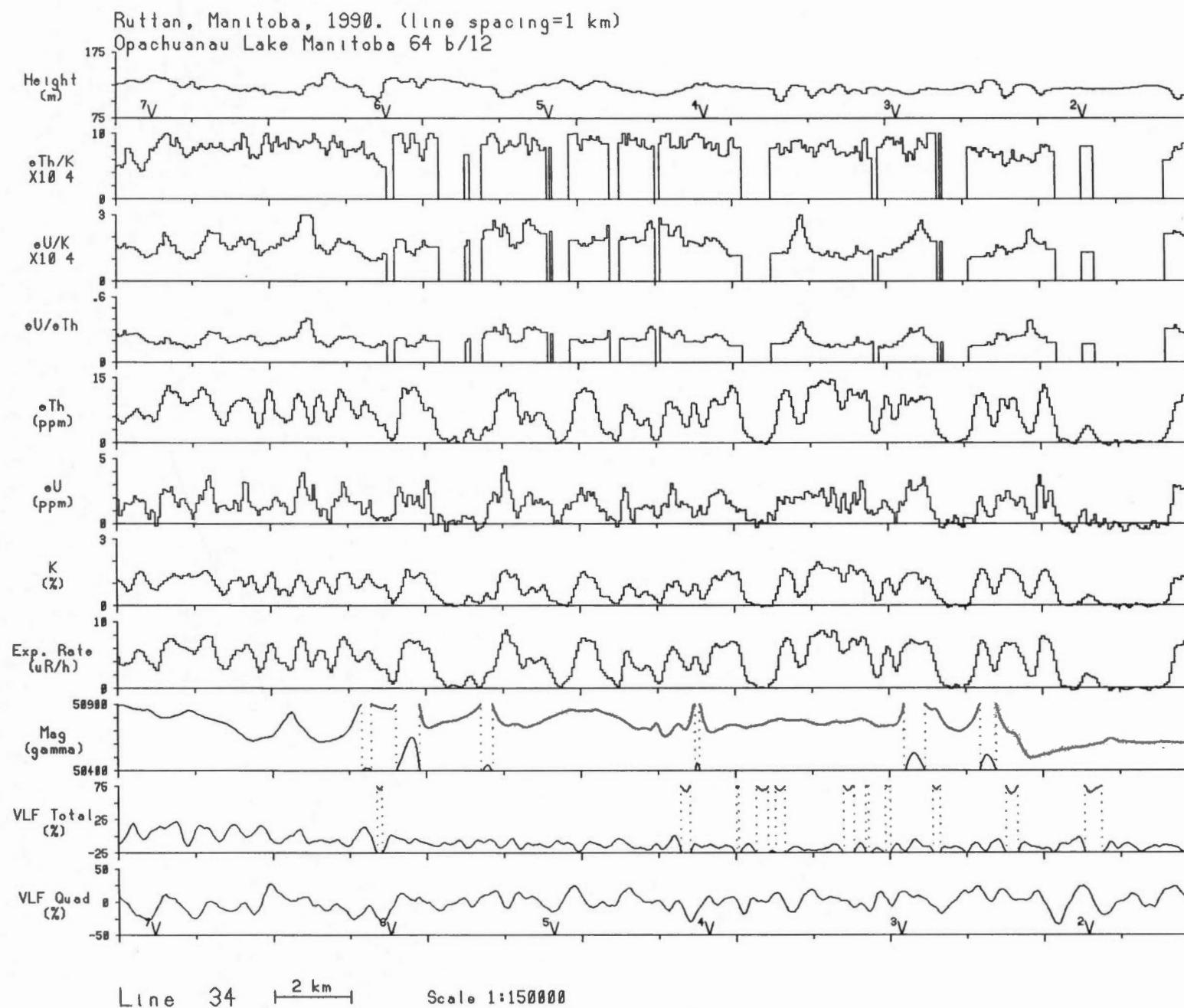


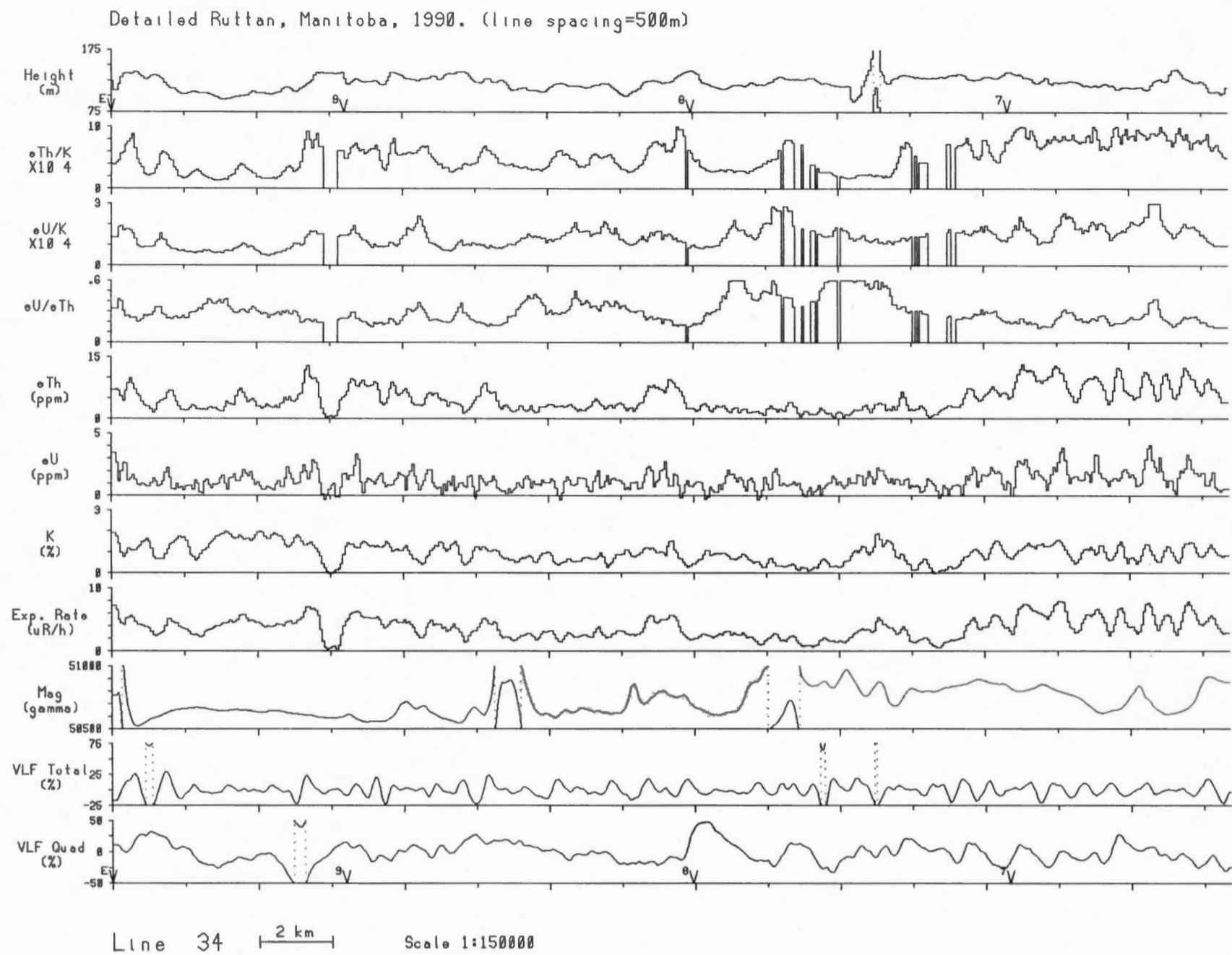
Line 32 2 km Scale 1:150000



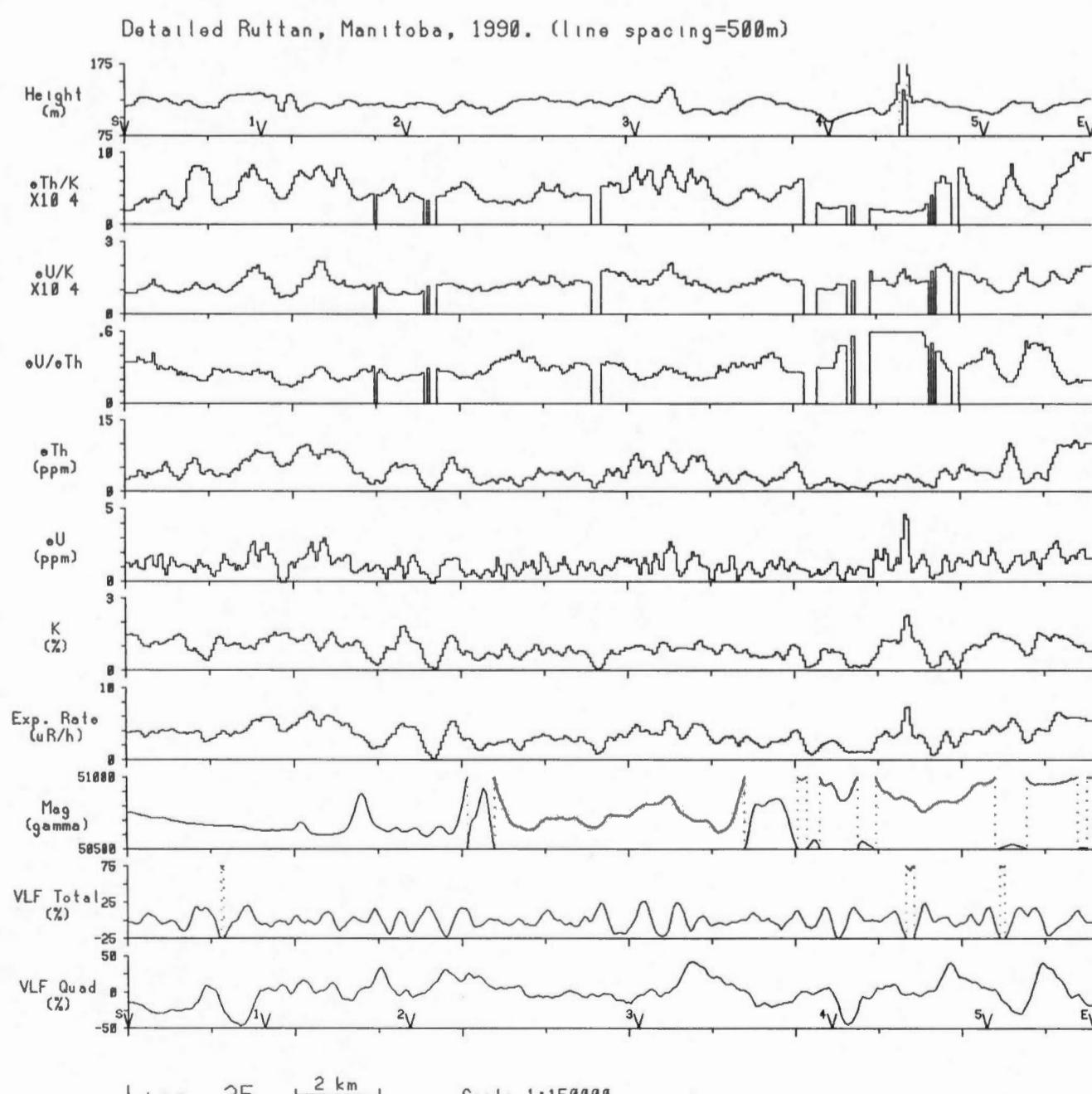
Line 33 2 km Scale 1:150000



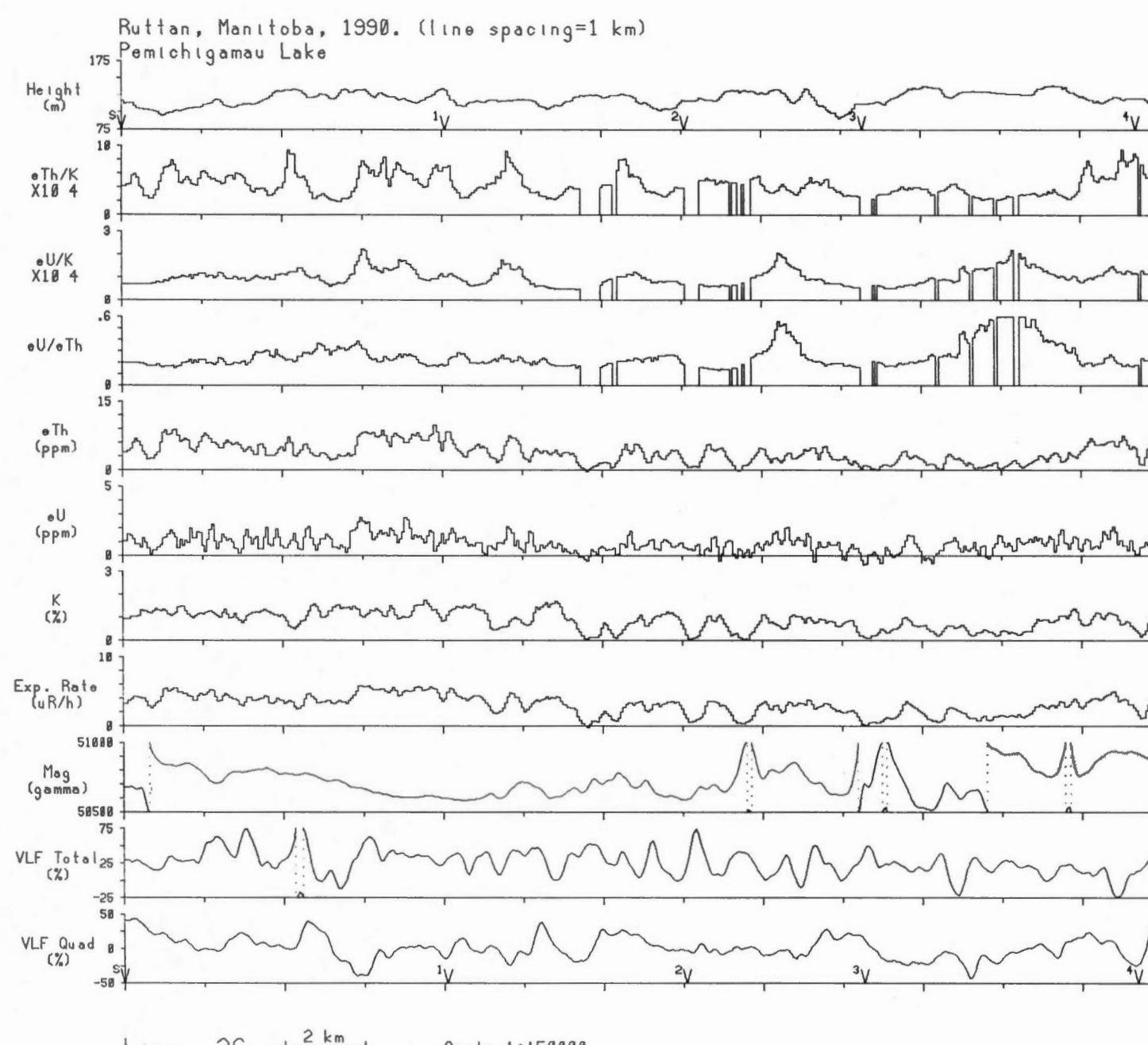
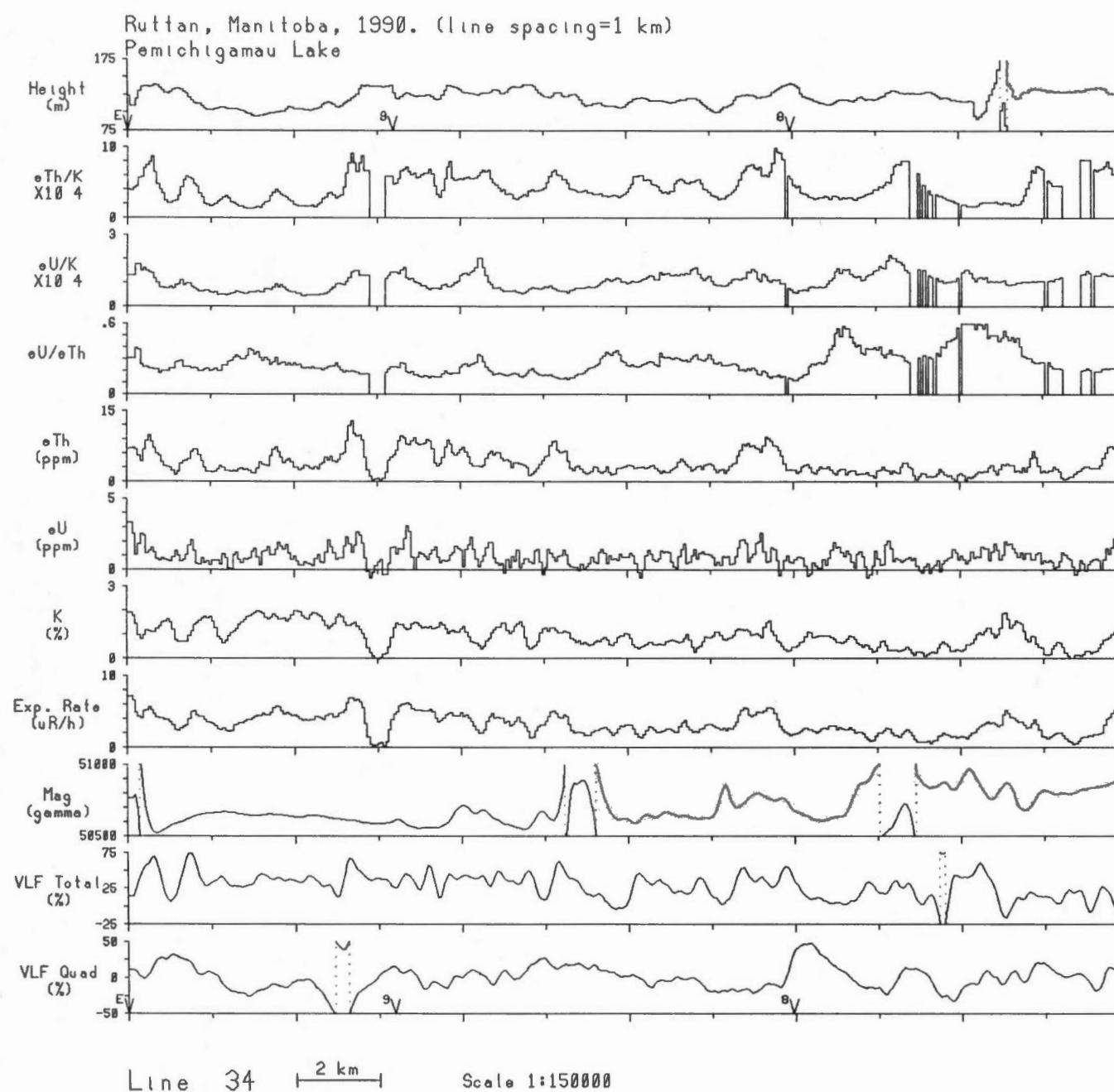


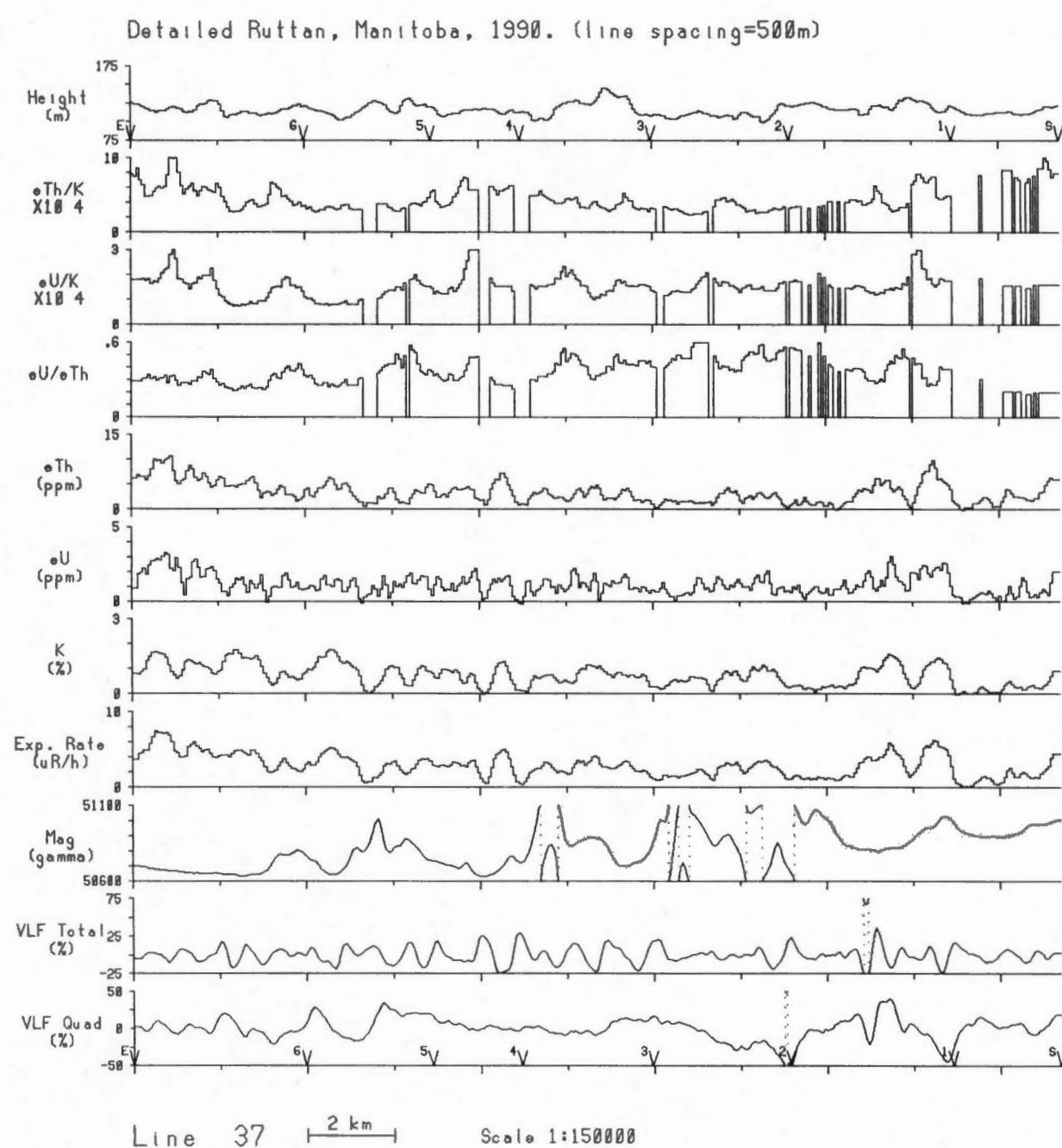
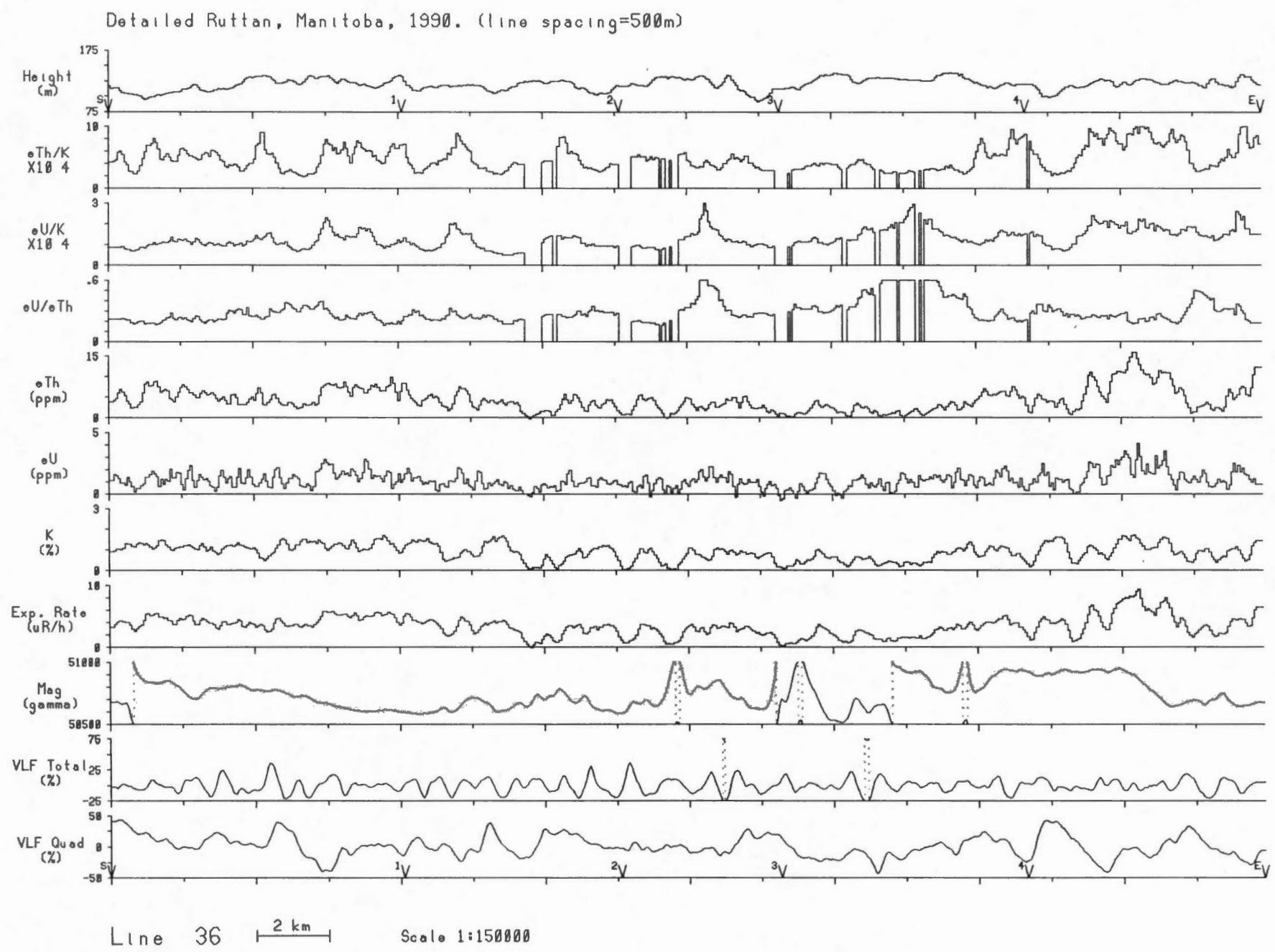


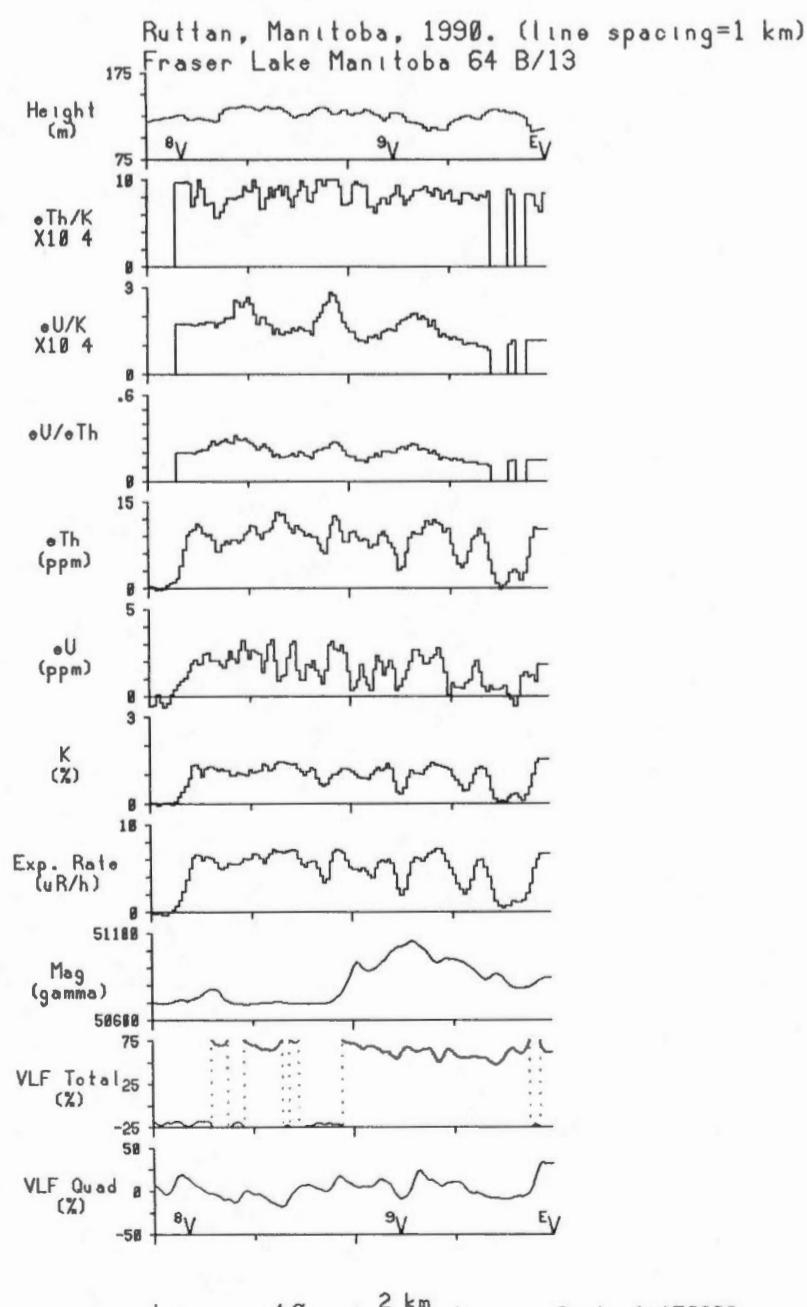
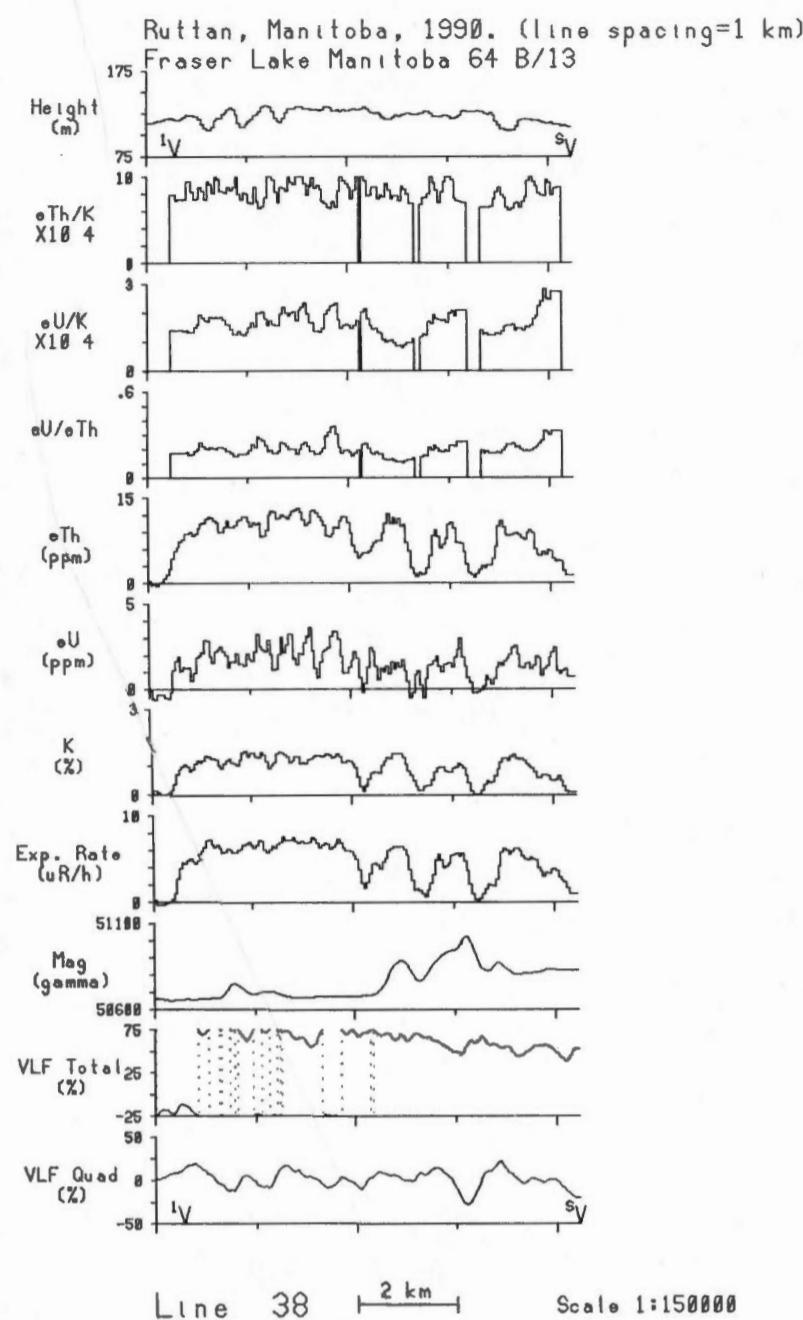
Line 34 2 km Scale 1:150000

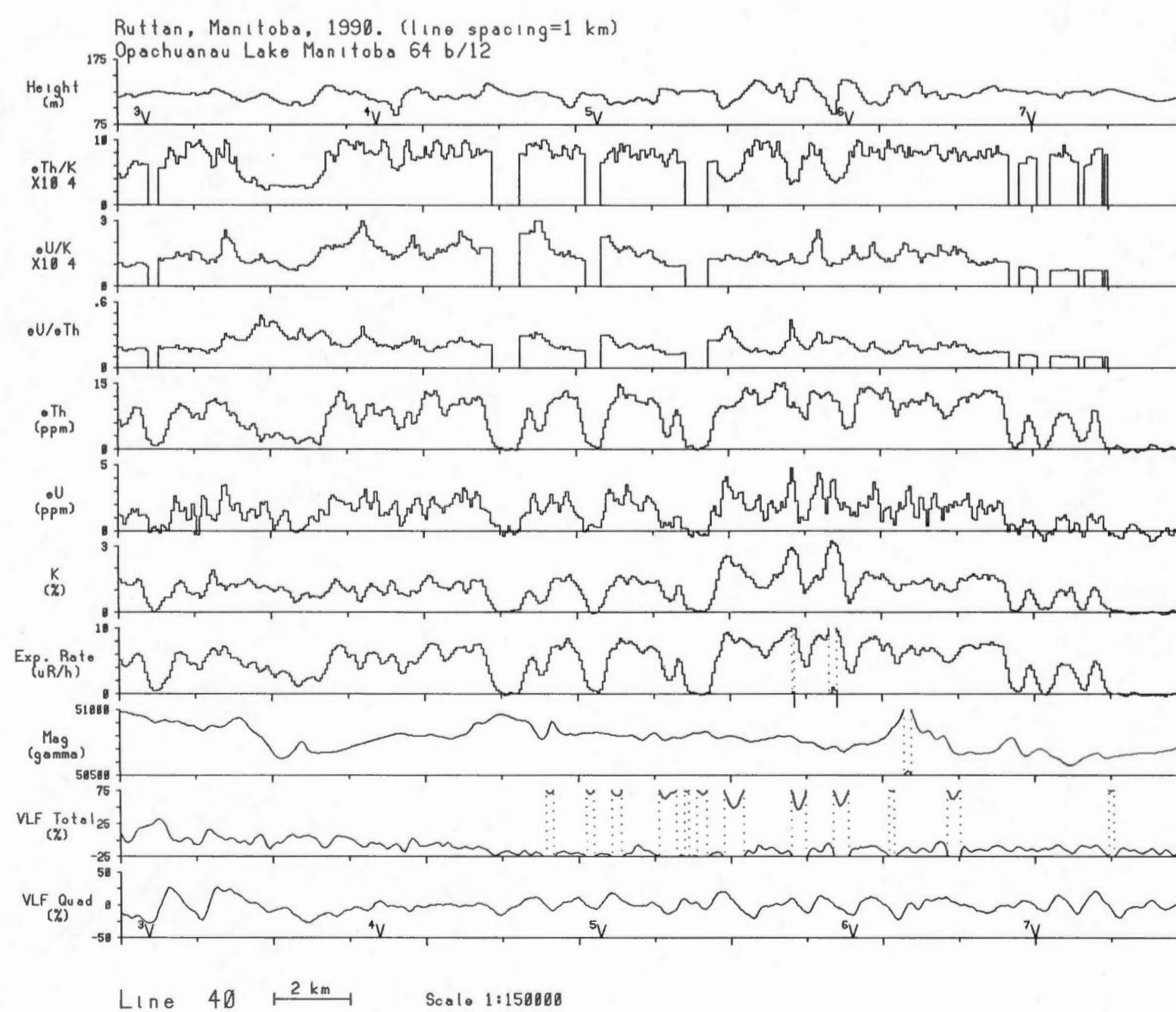
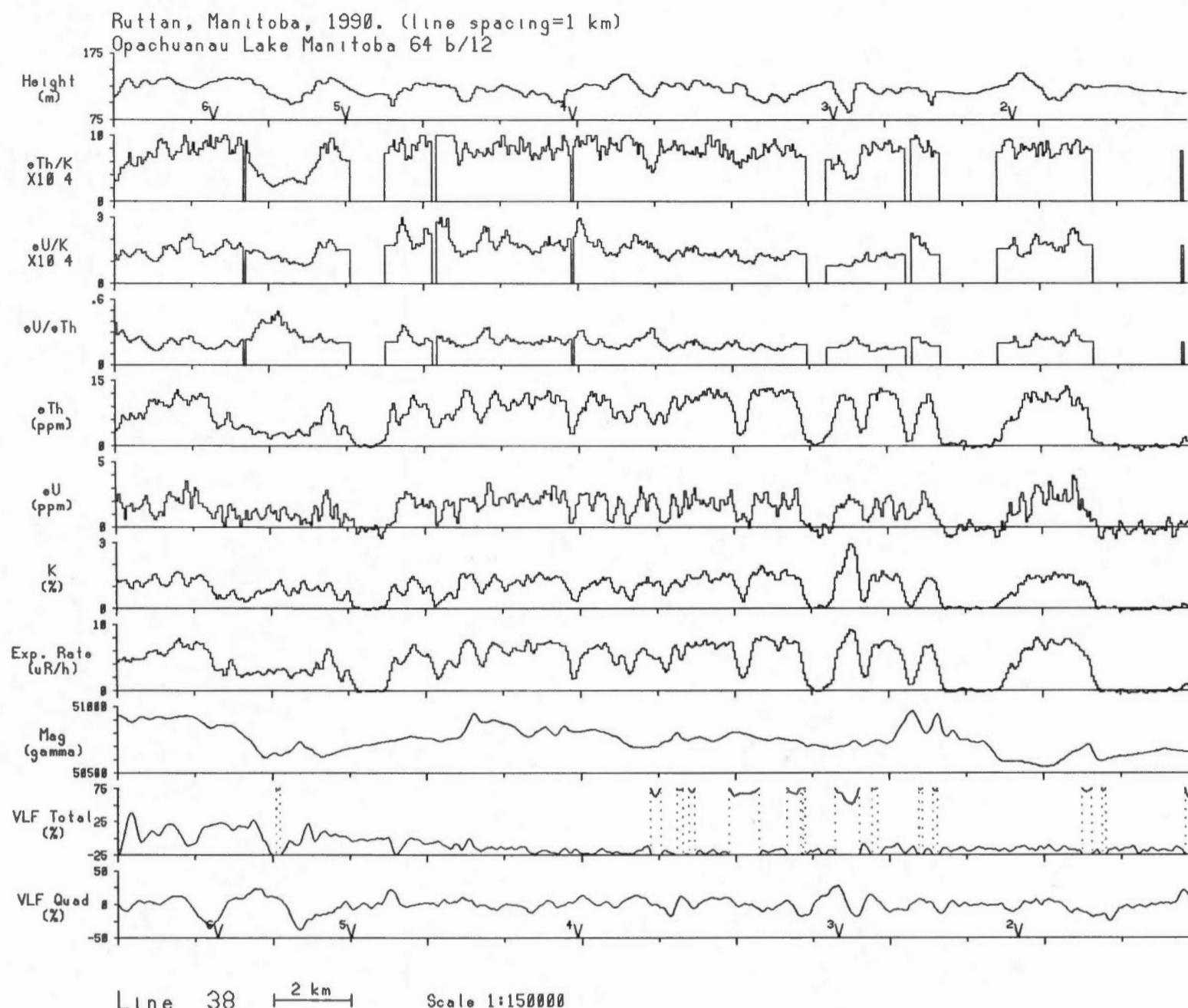


Line 35 2 km Scale 1:150000

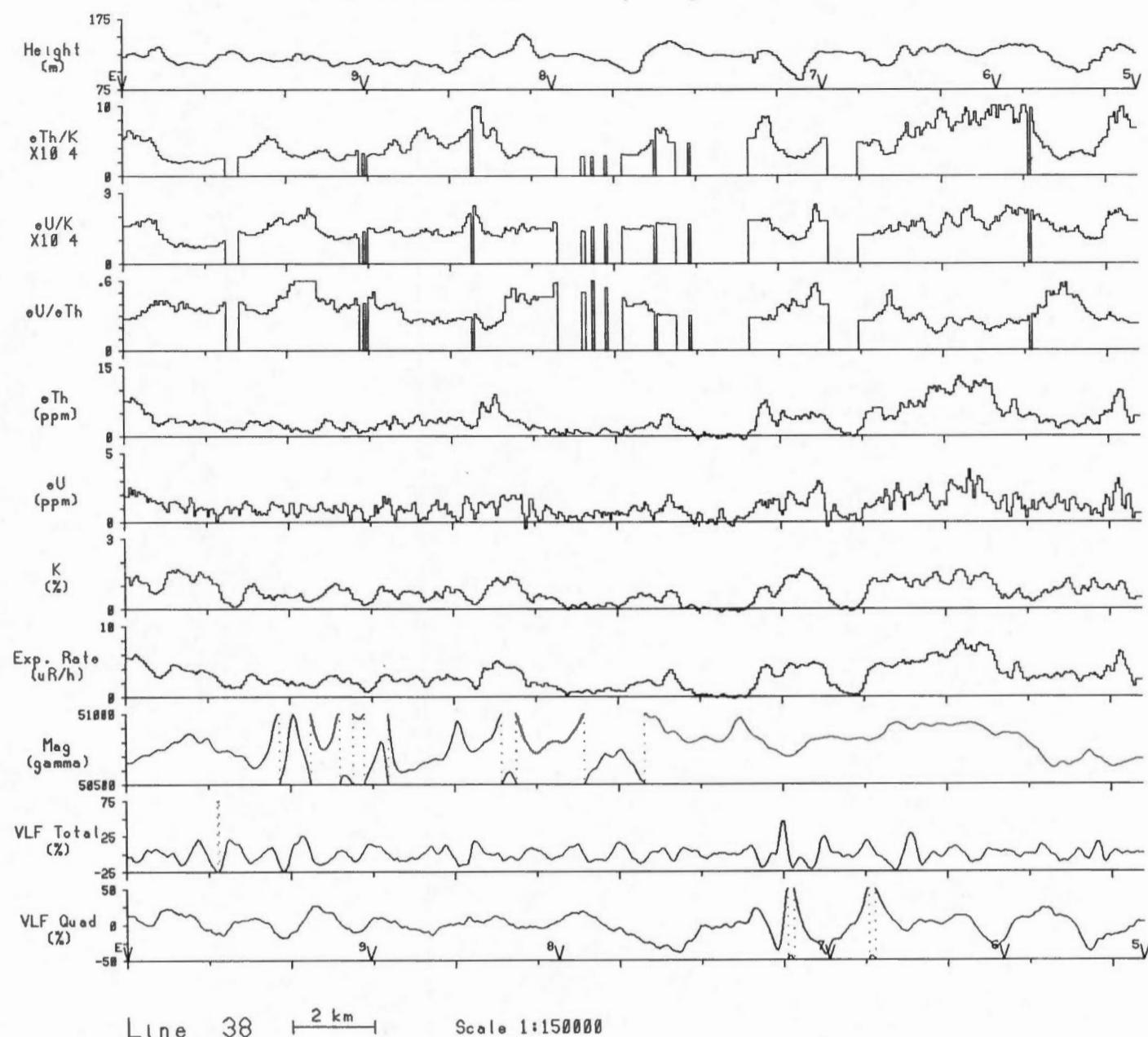


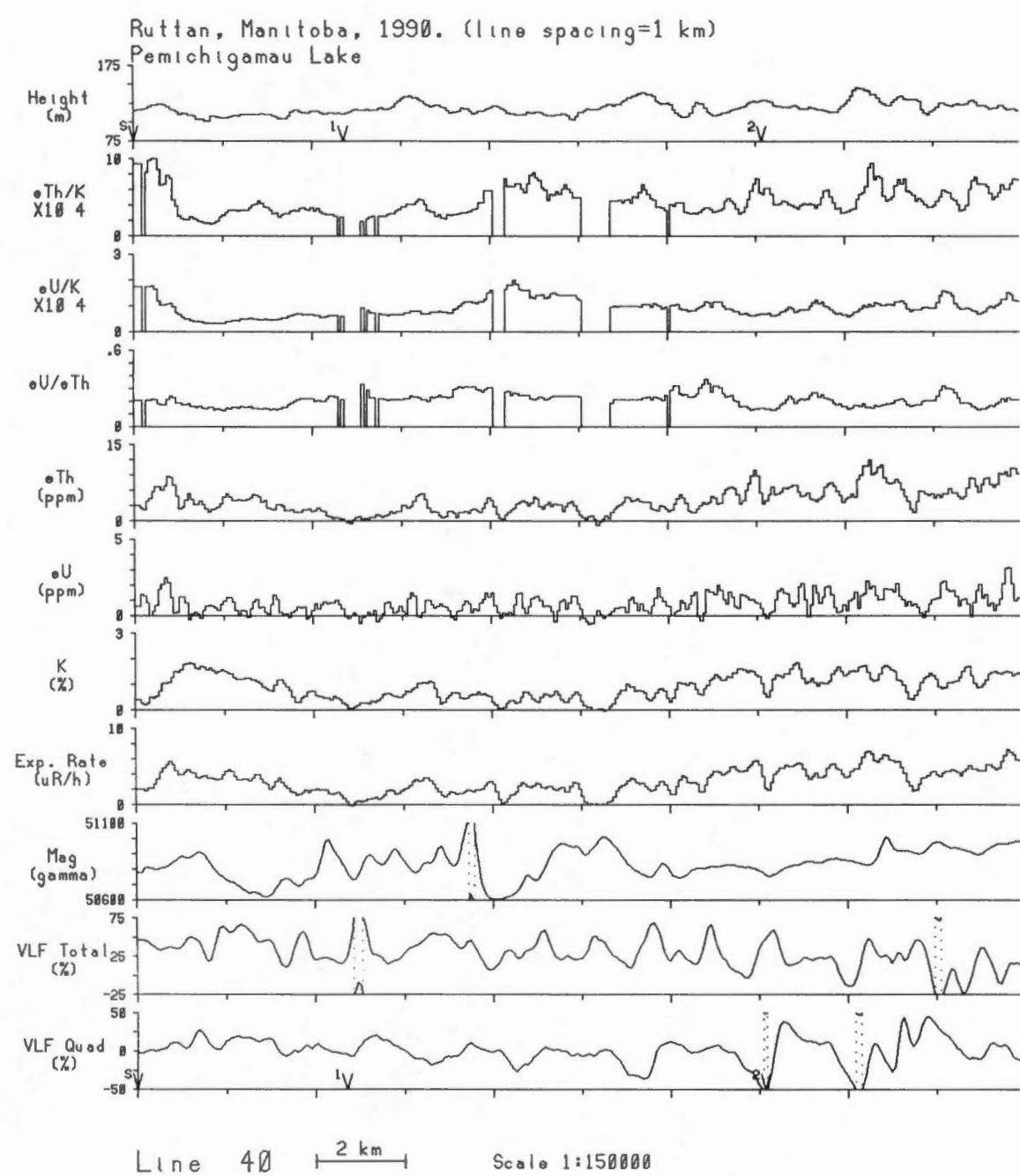
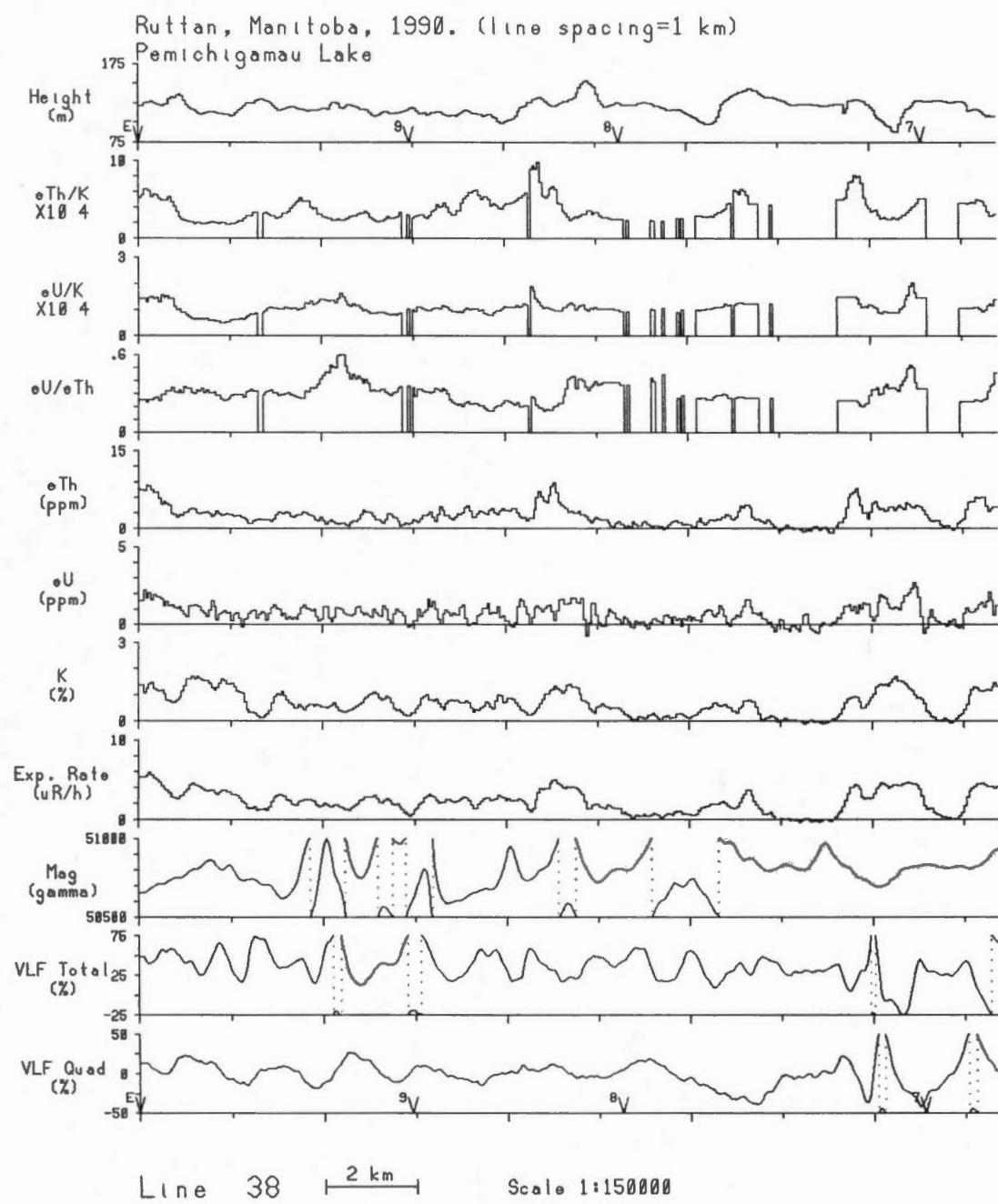


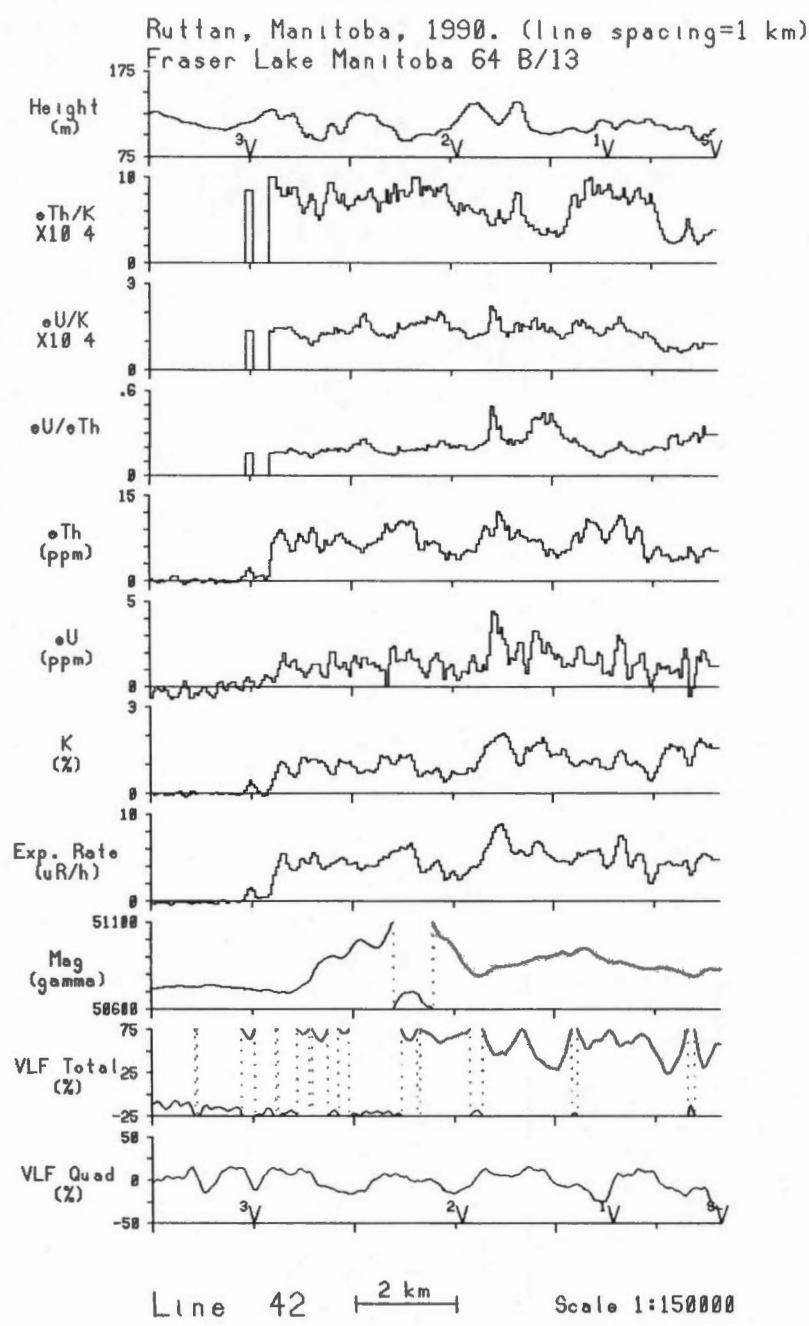




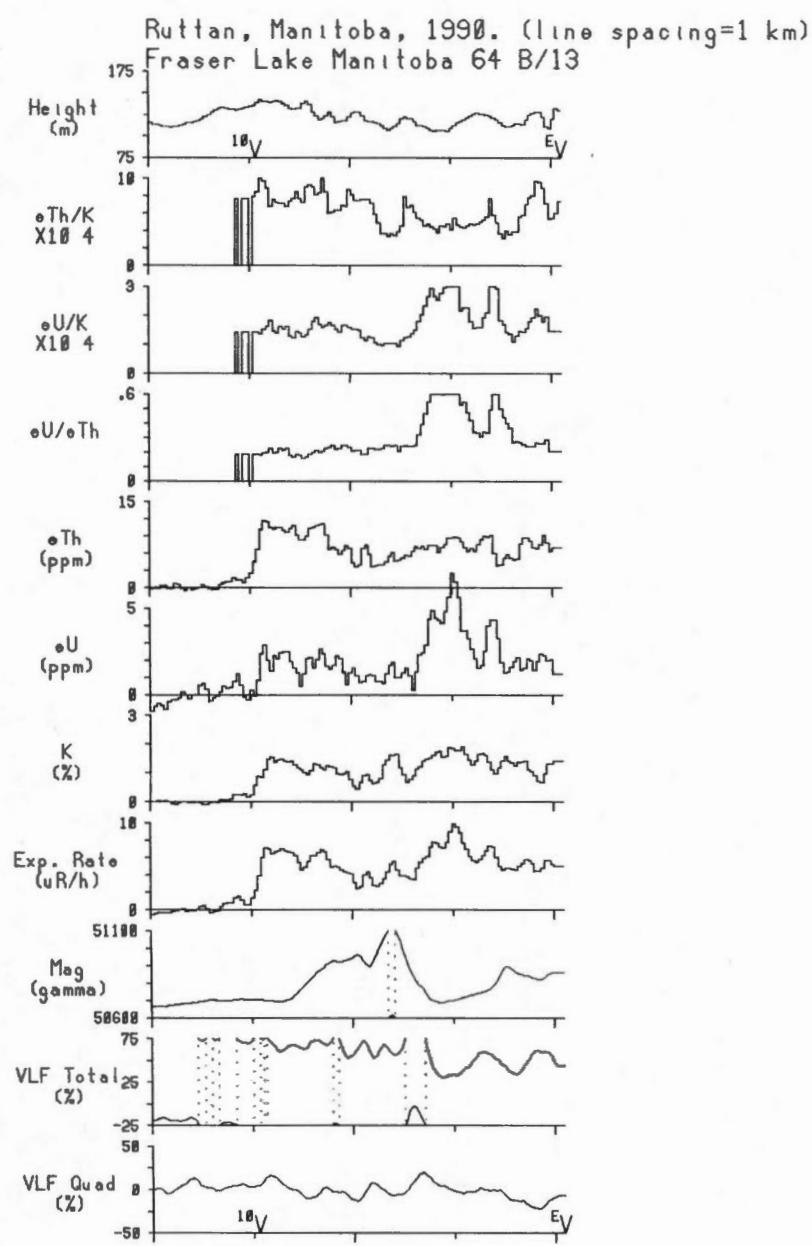
Detailed Ruttan, Manitoba, 1990. (line spacing=500m)



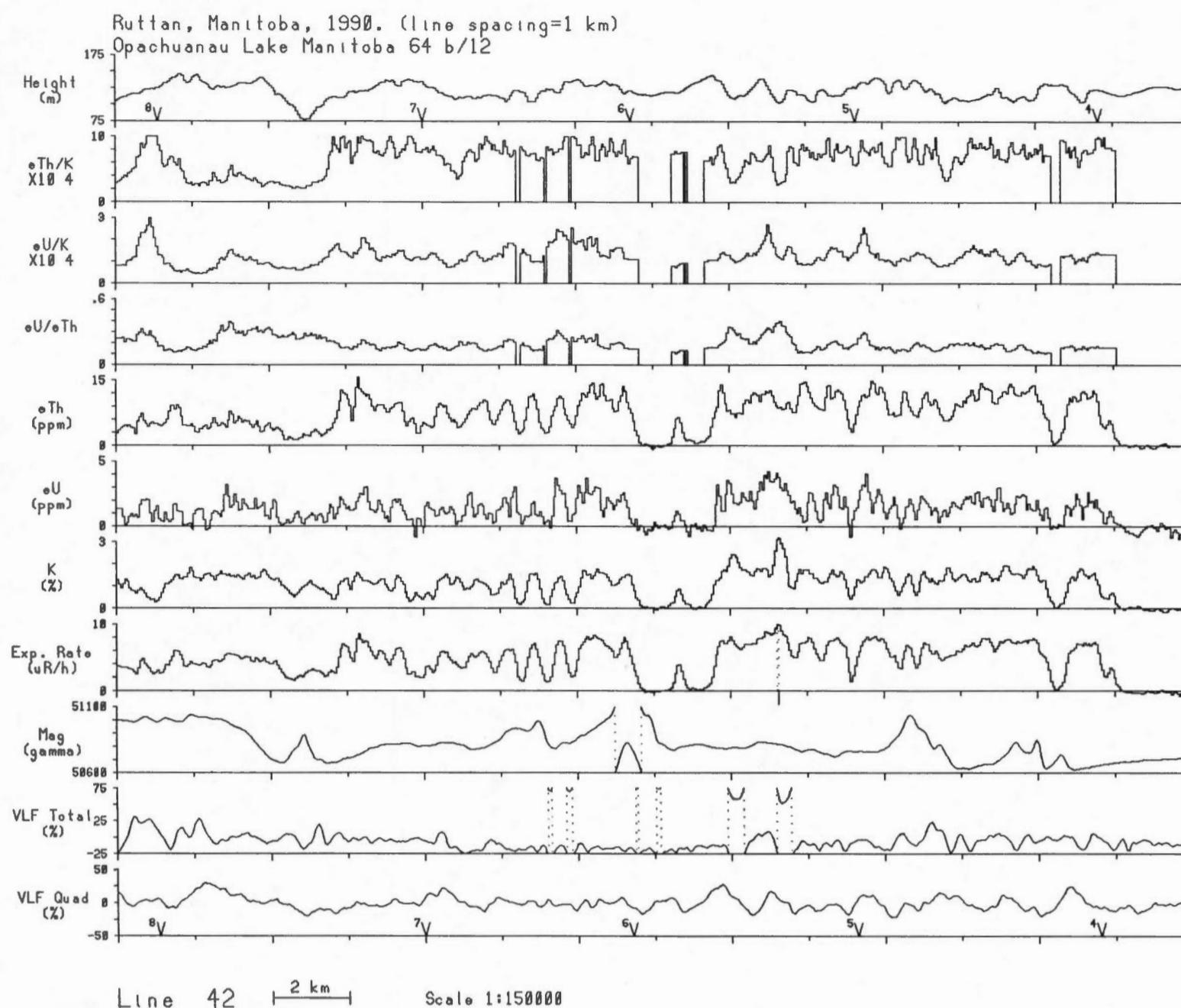




Line 42 2 km Scale 1:150000



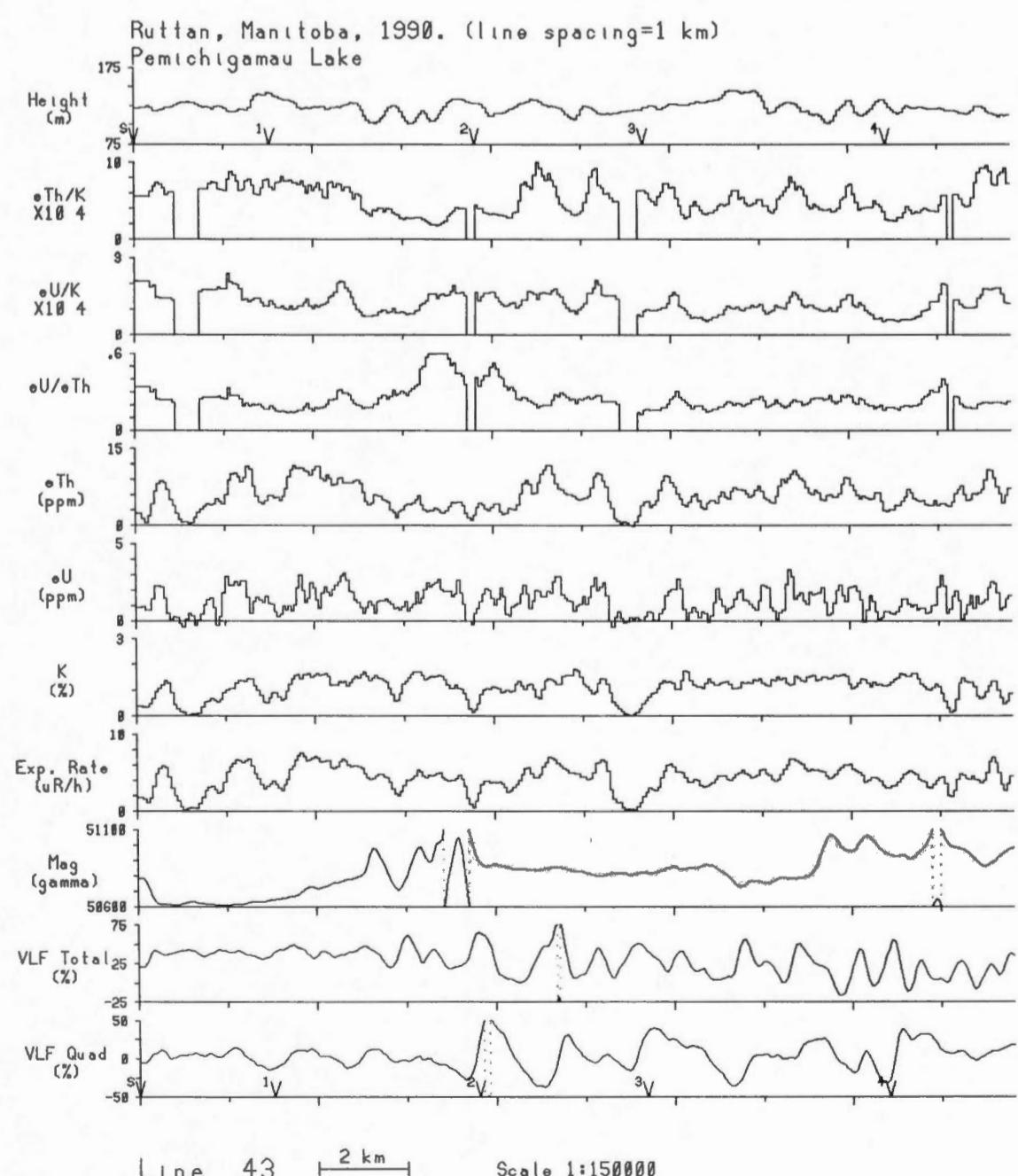
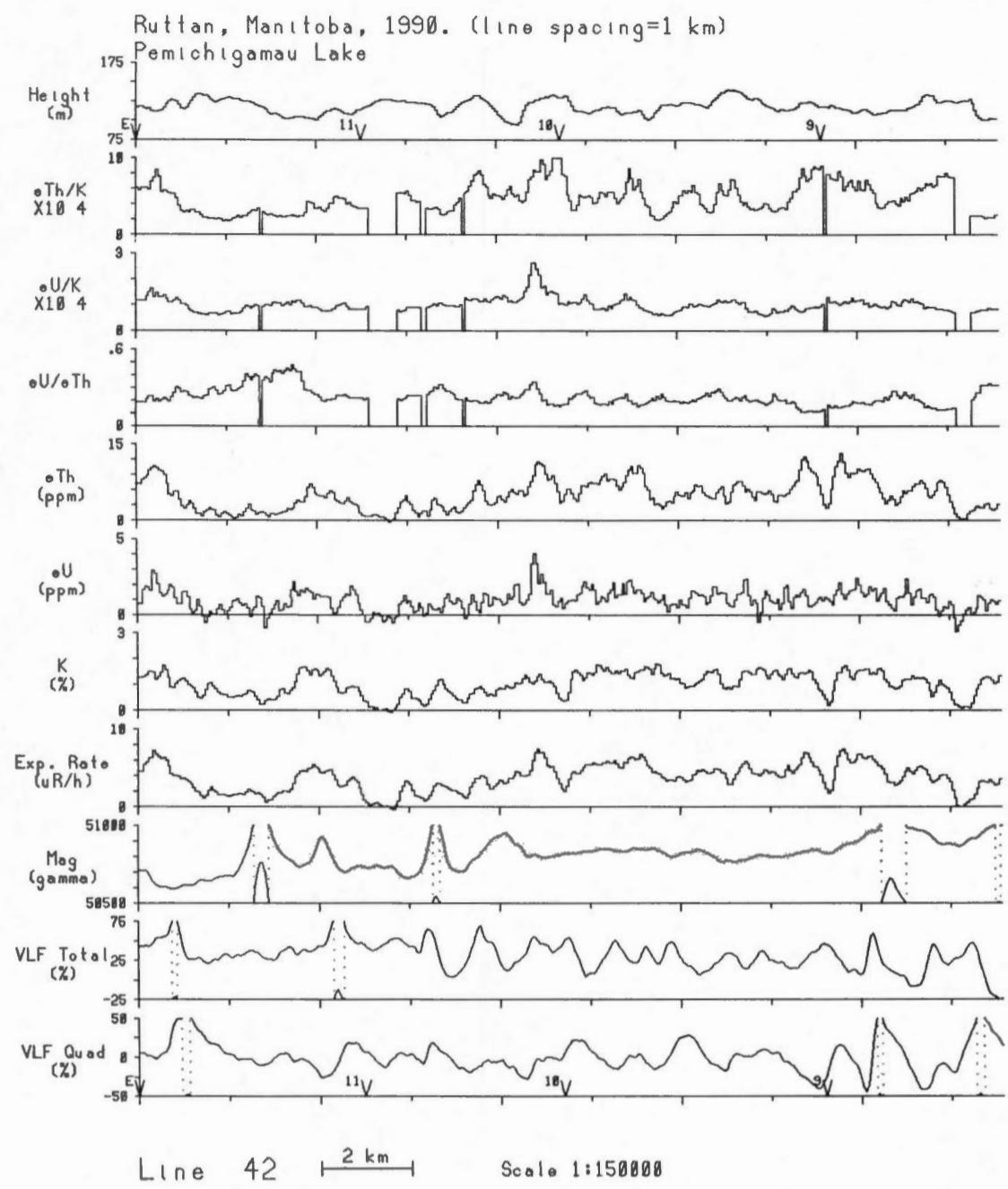
Line 43 2 km Scale 1:150000



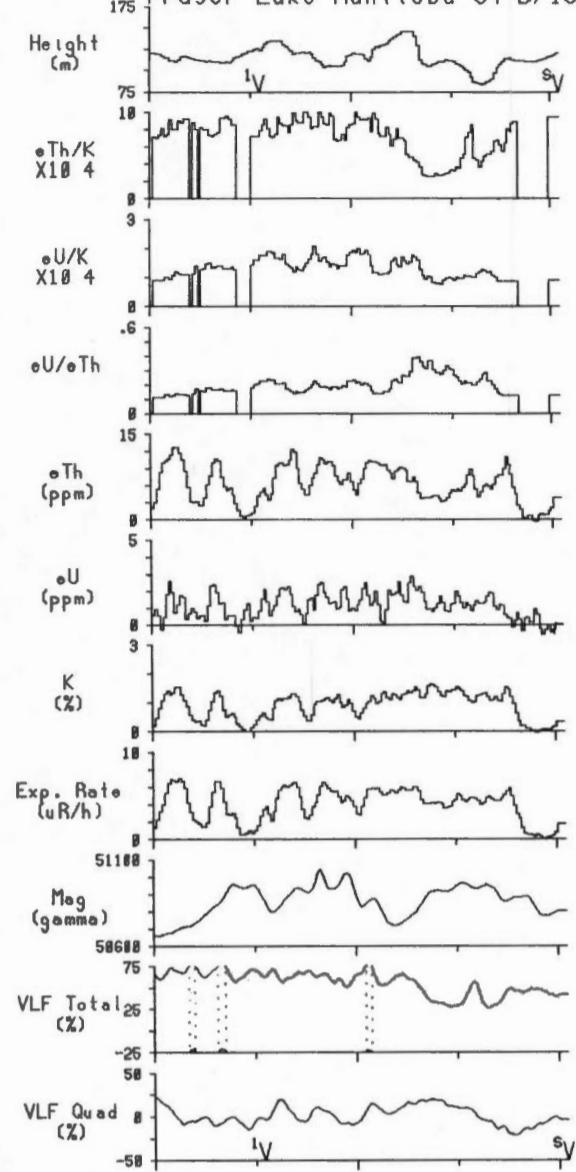
Line 42 2 km Scale 1:150000



Line 43 2 km Scale 1:150000

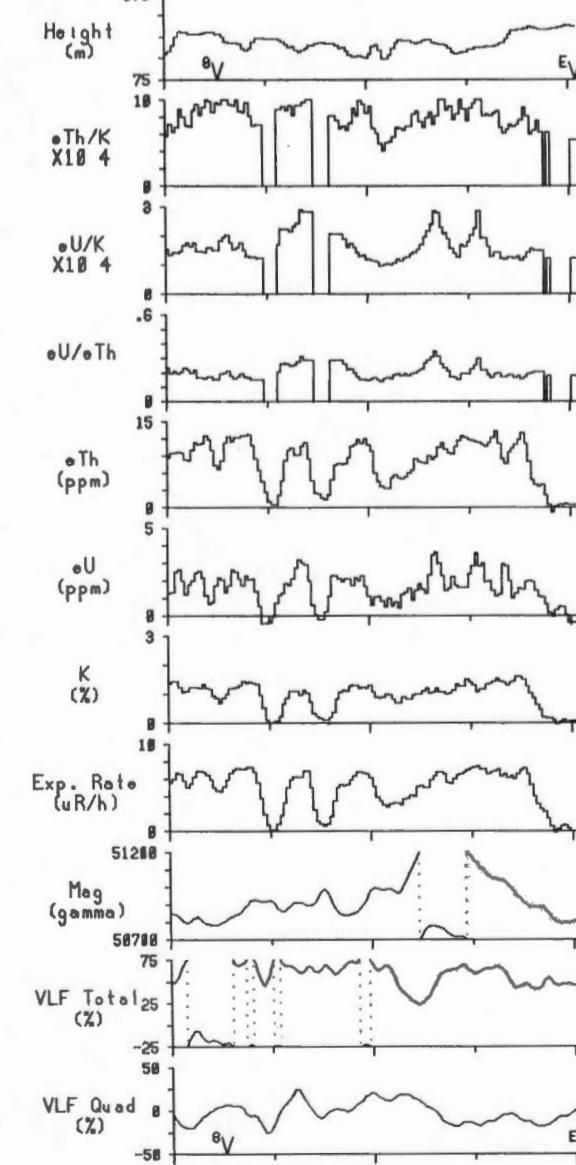


Rutian, Manitoba, 1990. (line spacing=1 km)
Fraser Lake Manitoba 64 B/13

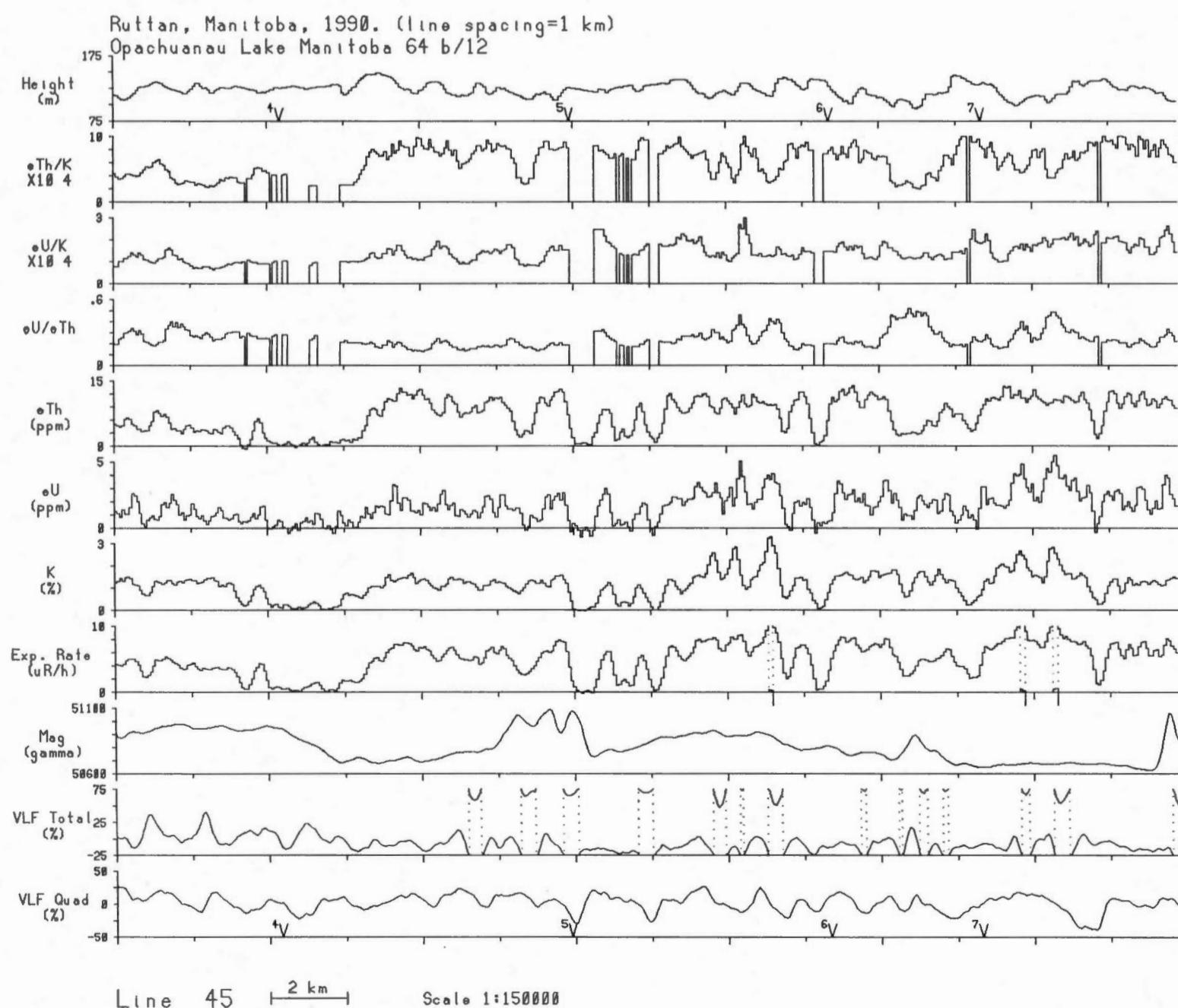
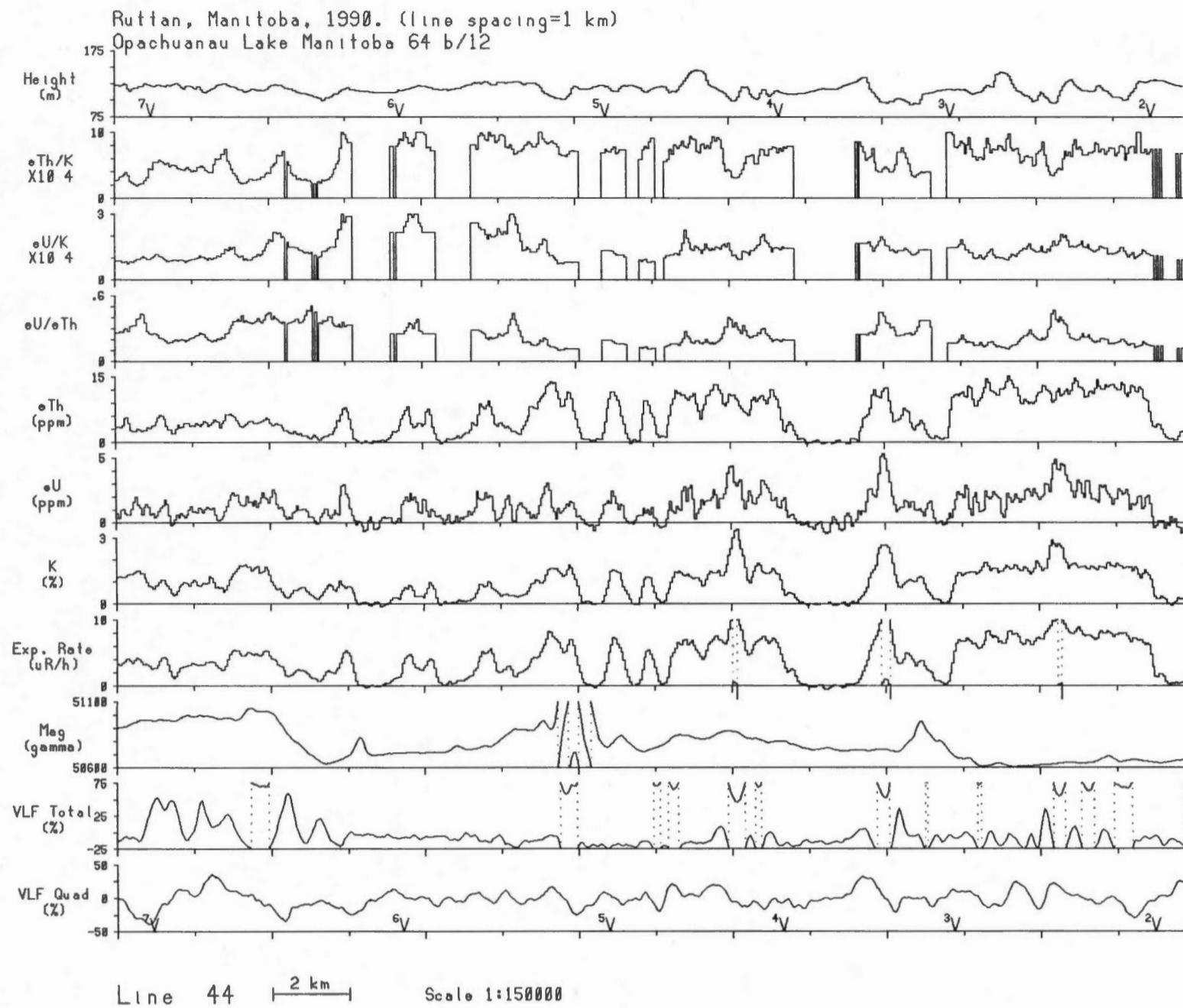


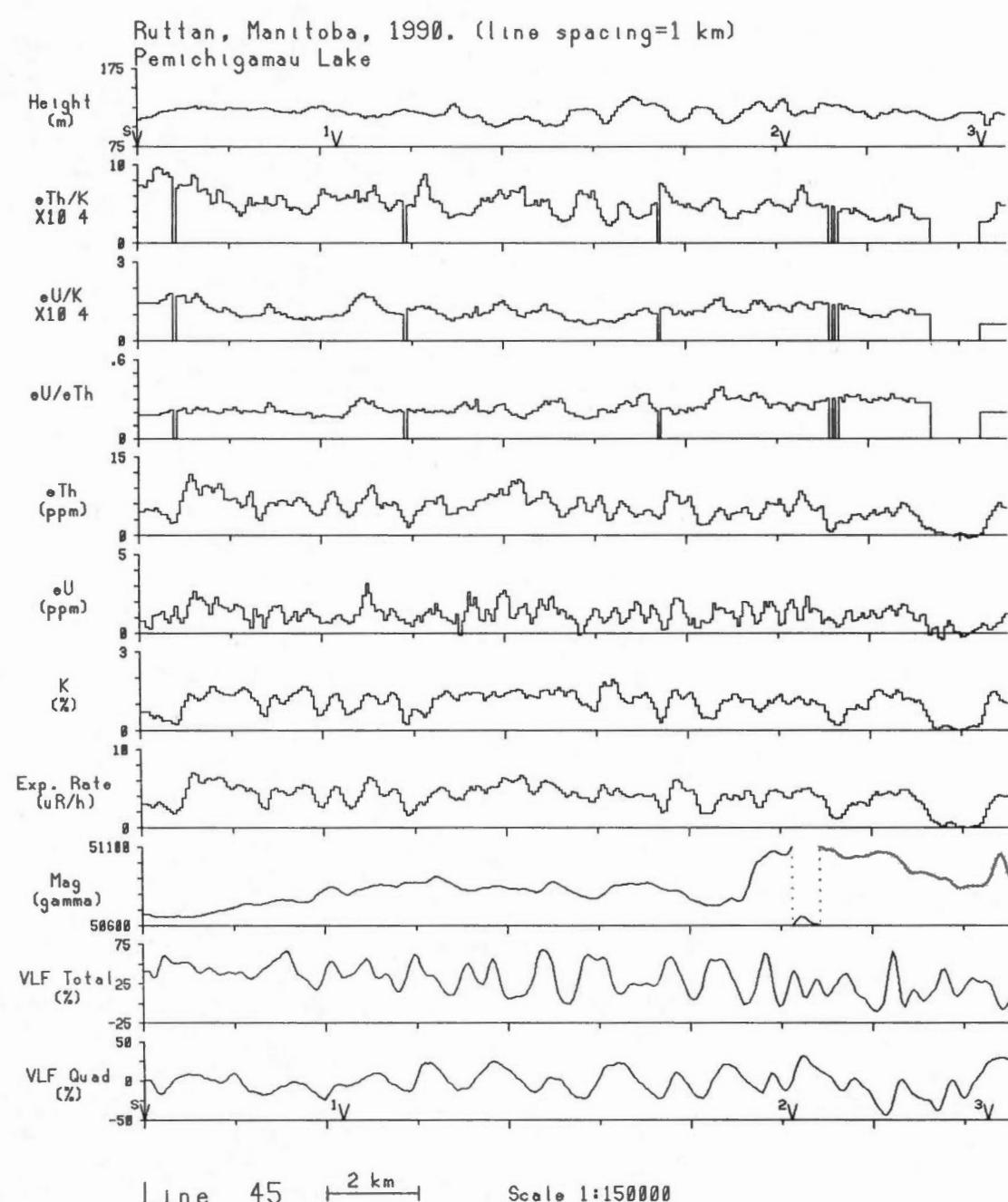
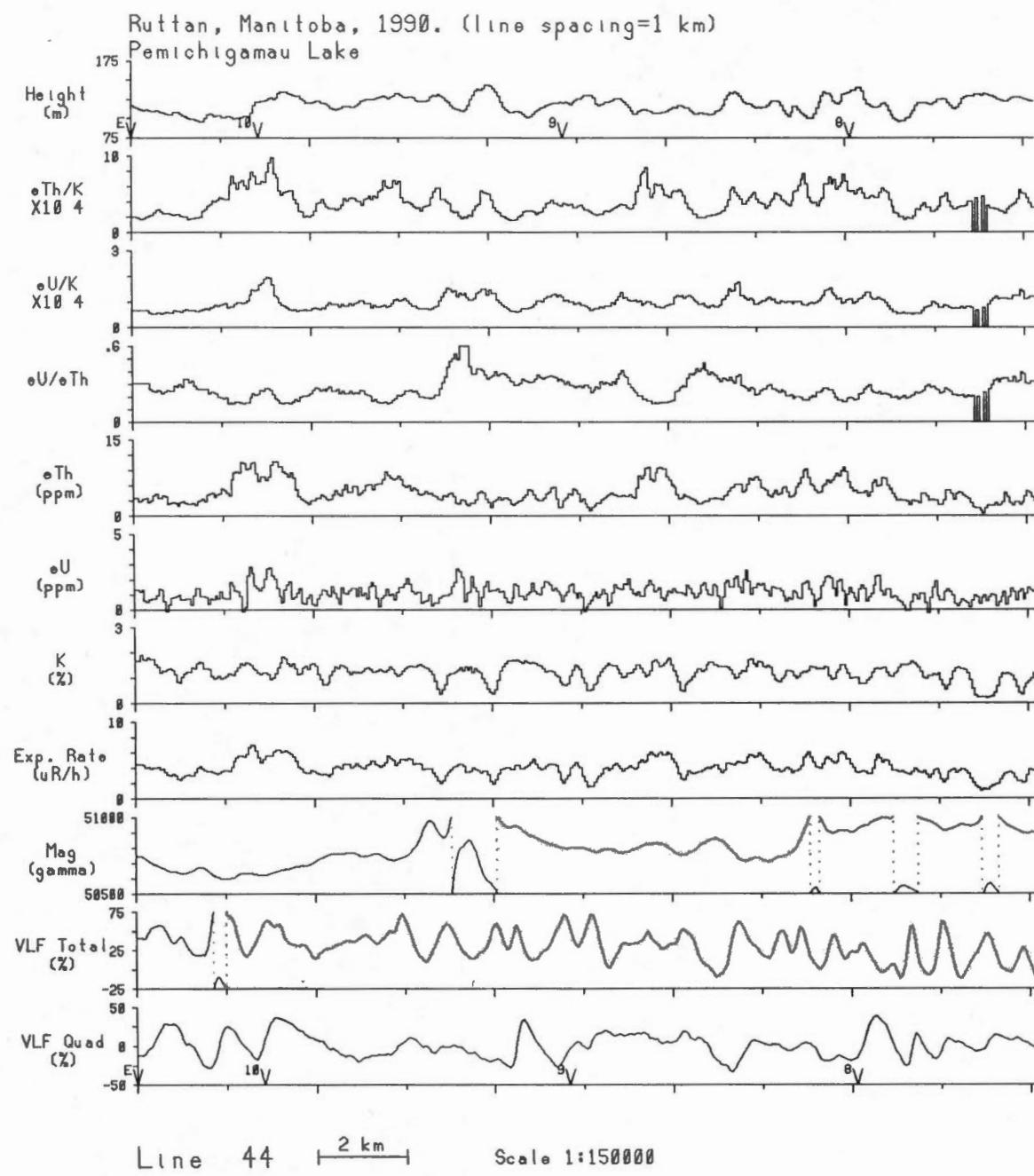
Line 44 2 km Scale 1:150000

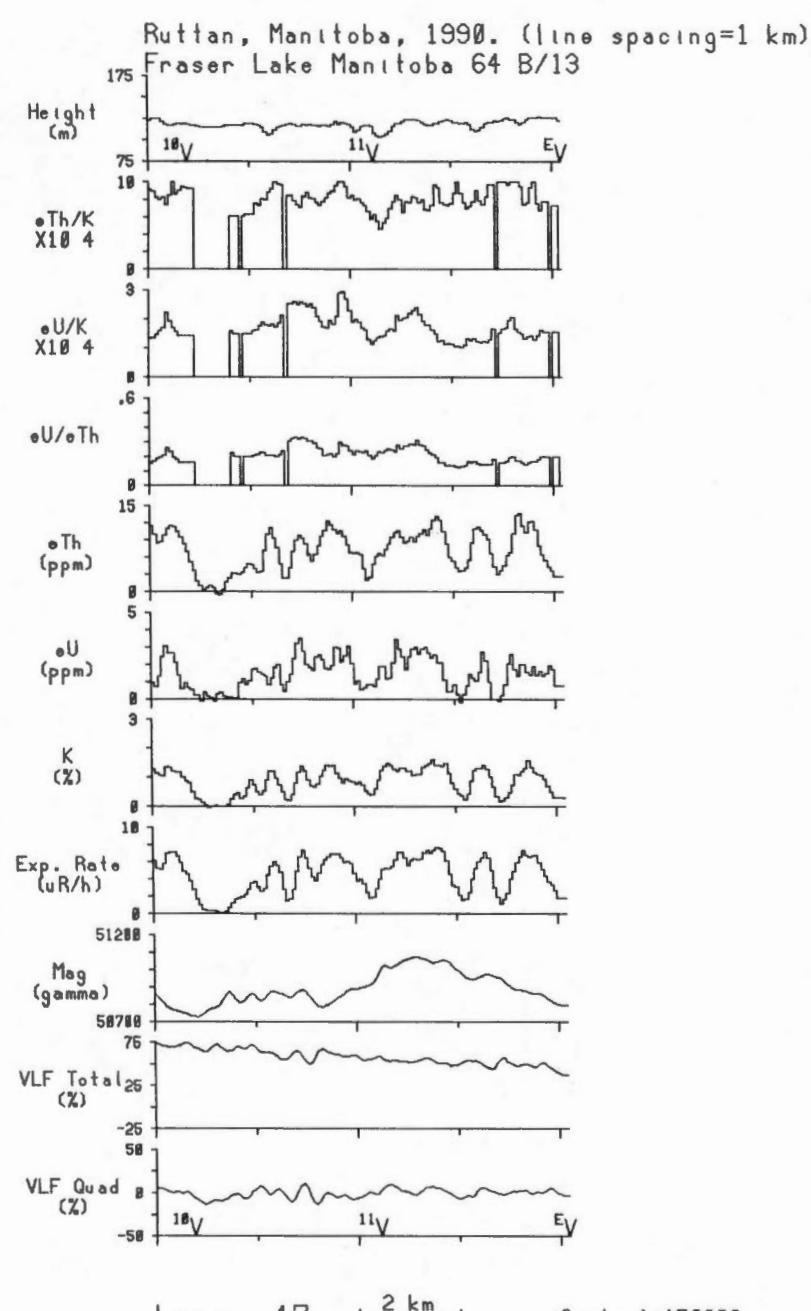
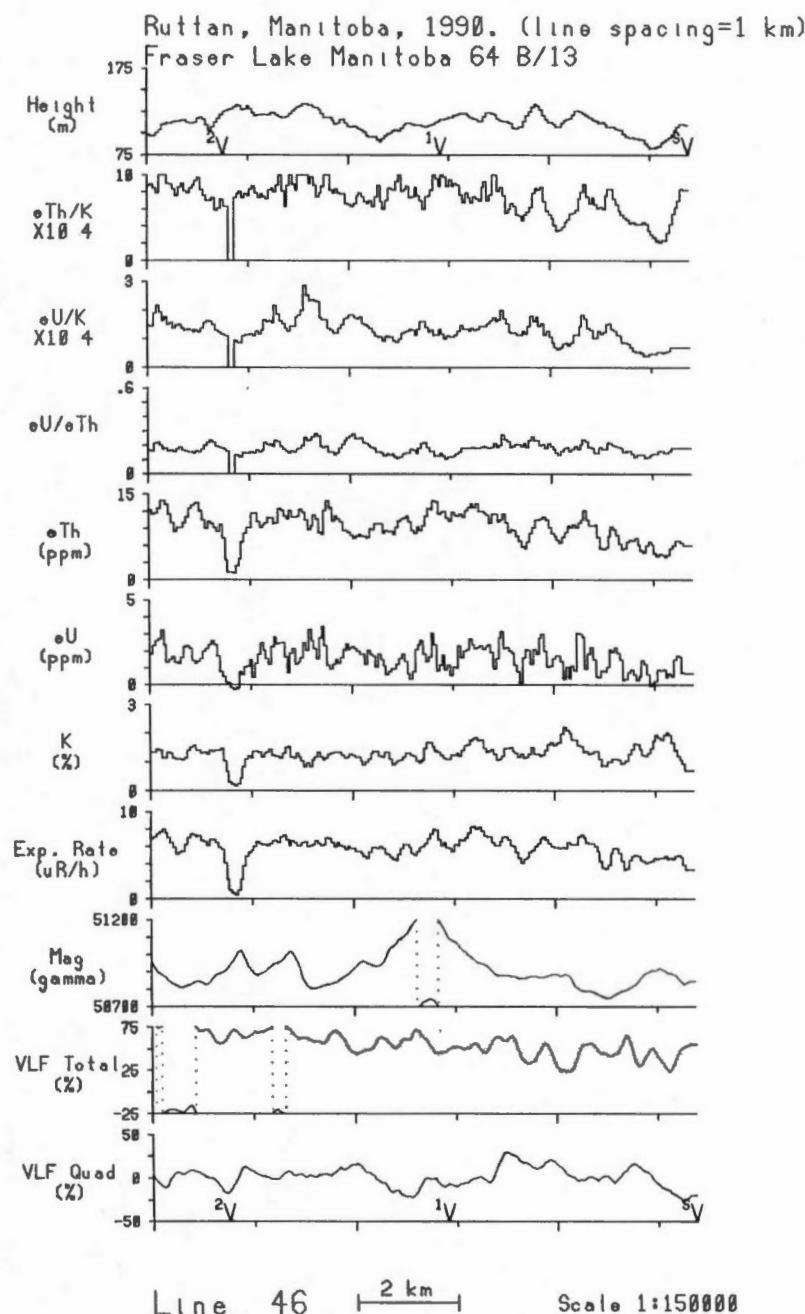
Rutian, Manitoba, 1990. (line spacing=1 km)
Fraser Lake Manitoba 64 B/13

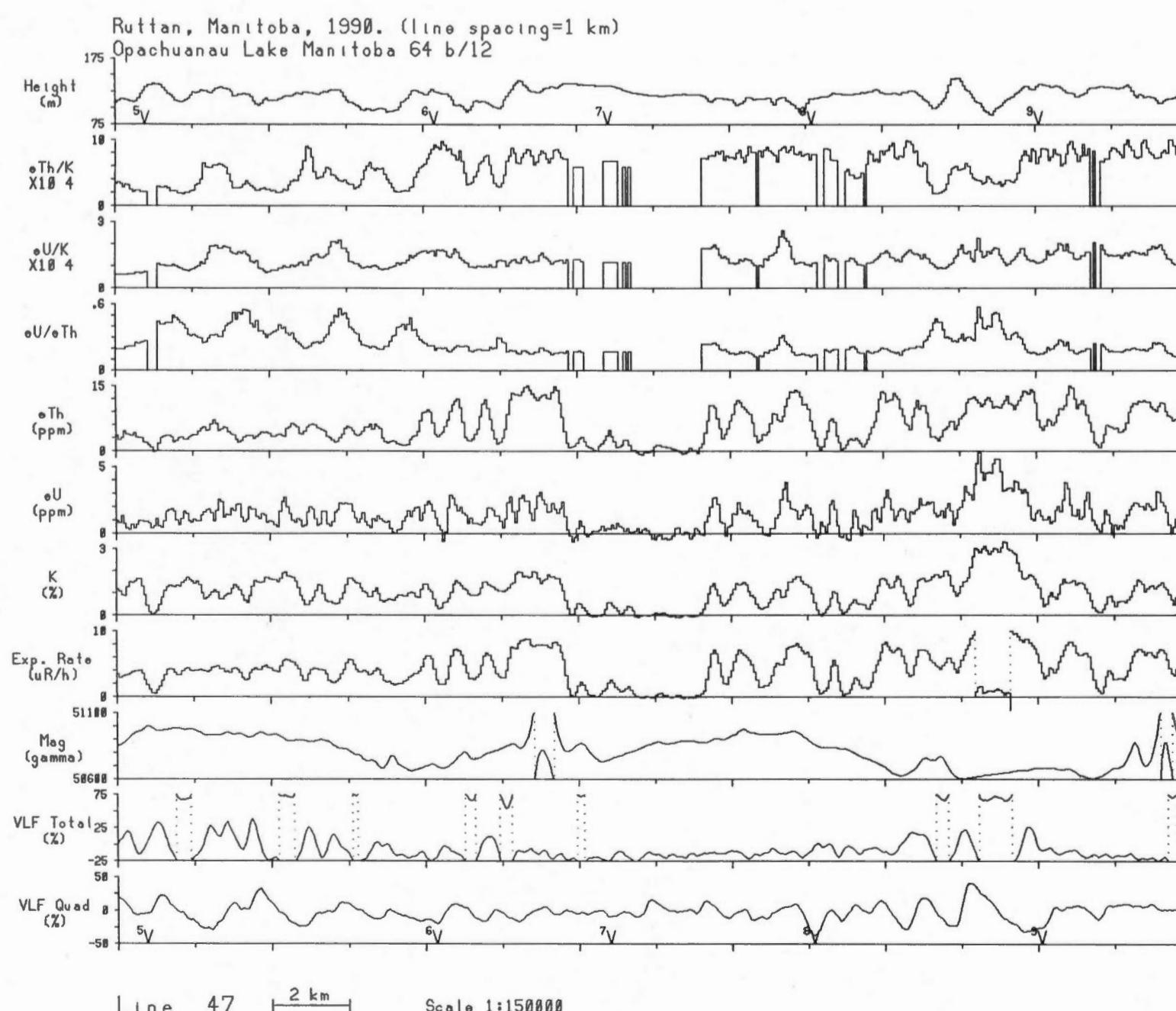
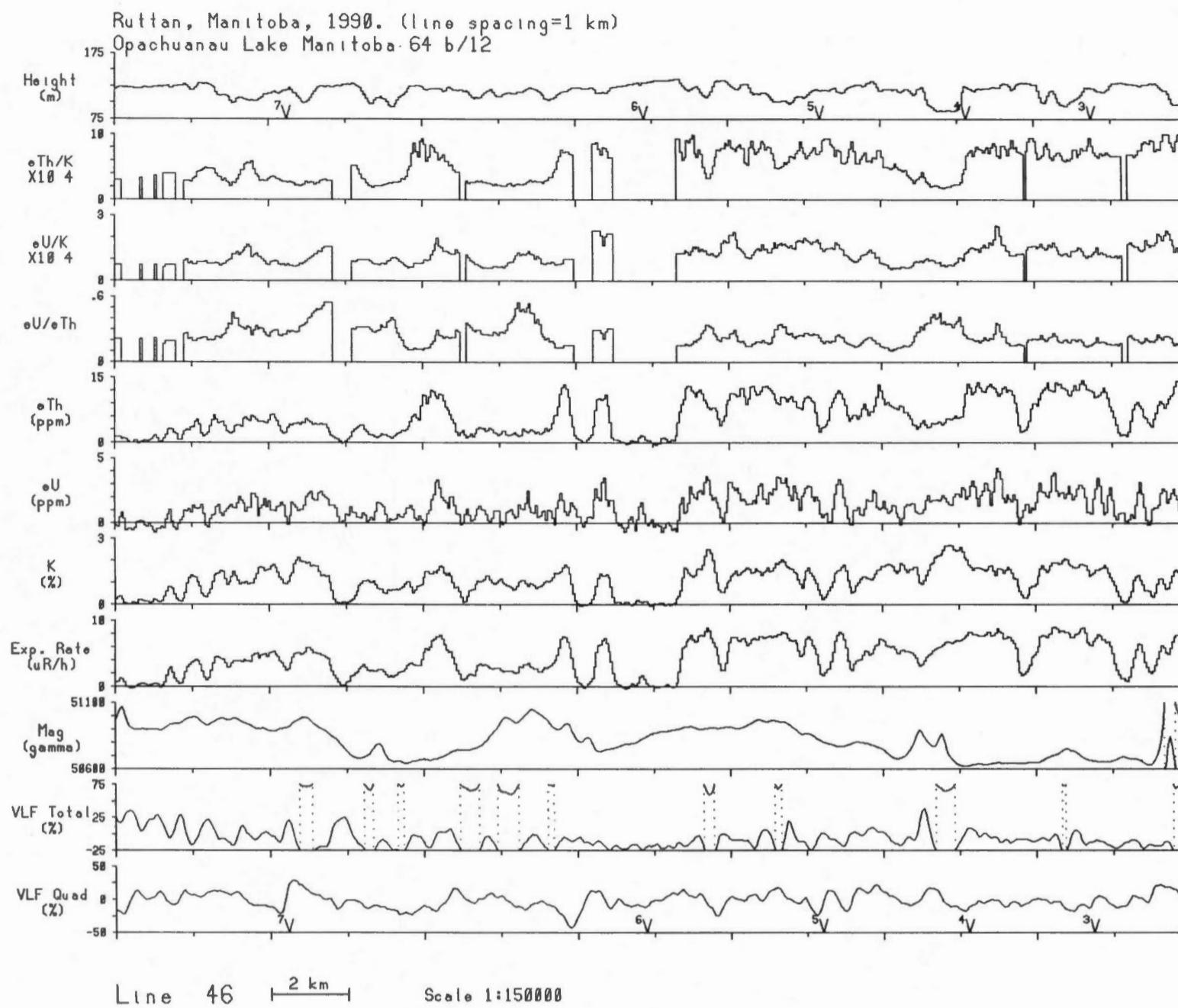


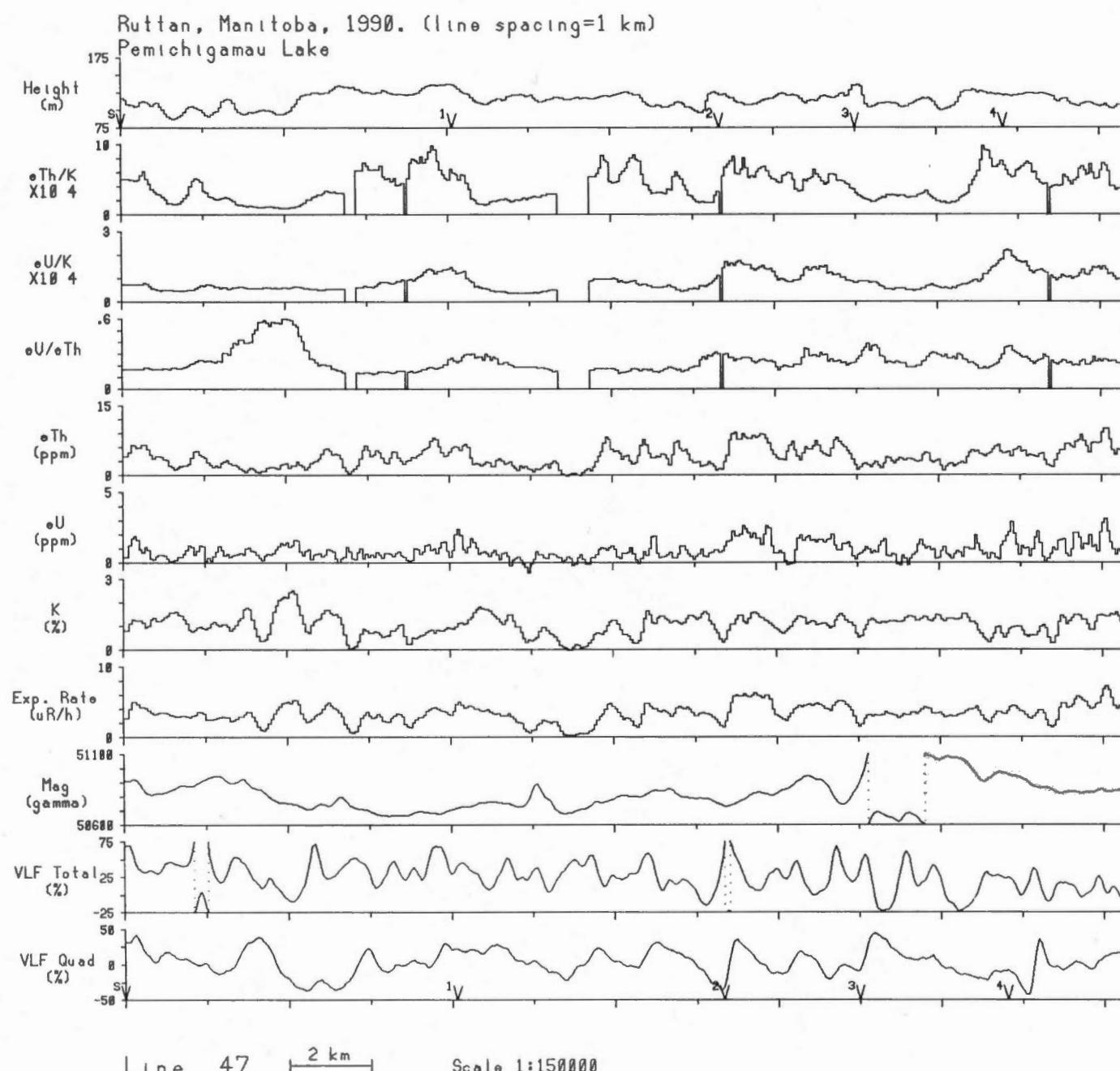
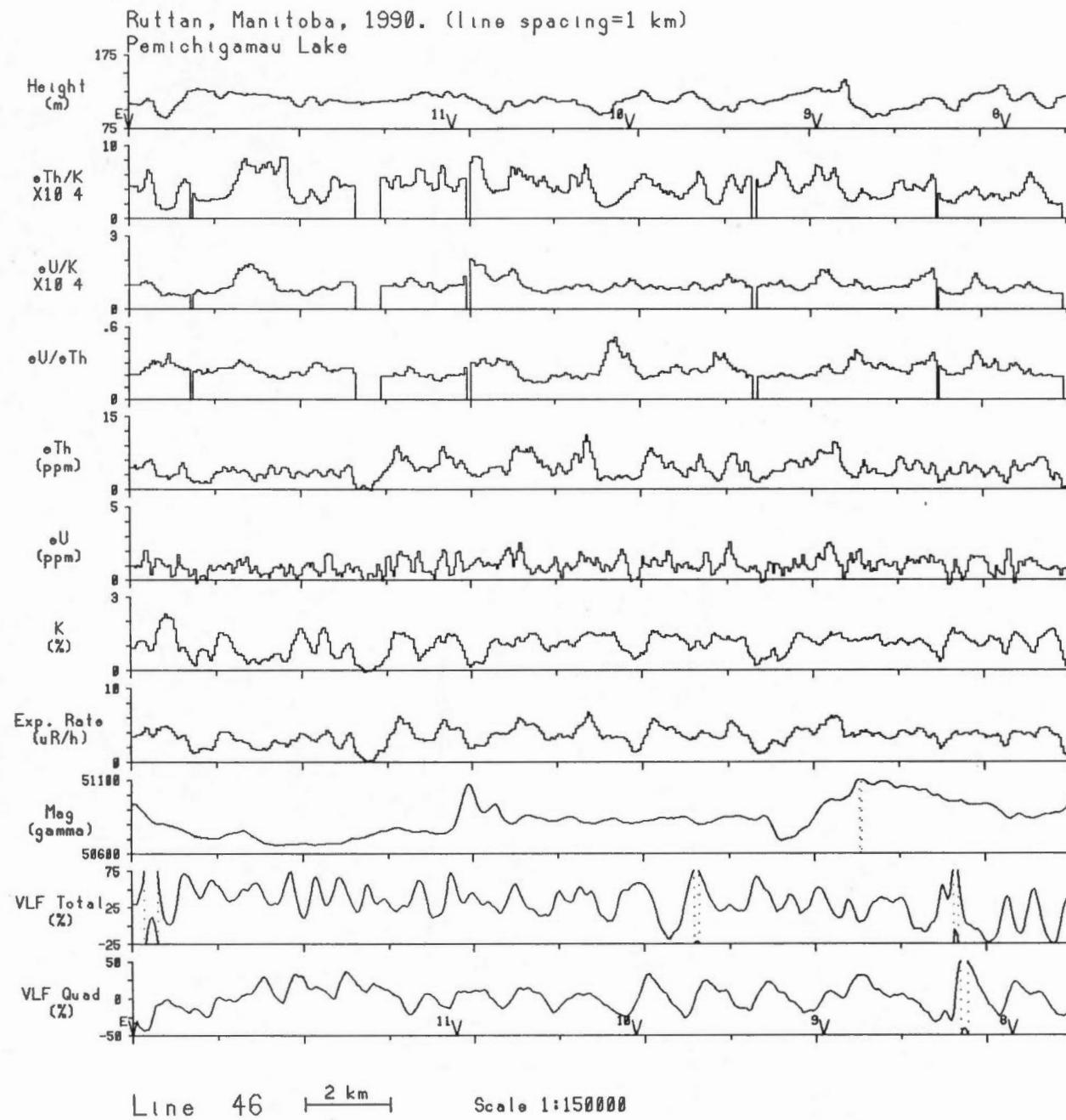
Line 45 2 km Scale 1:150000

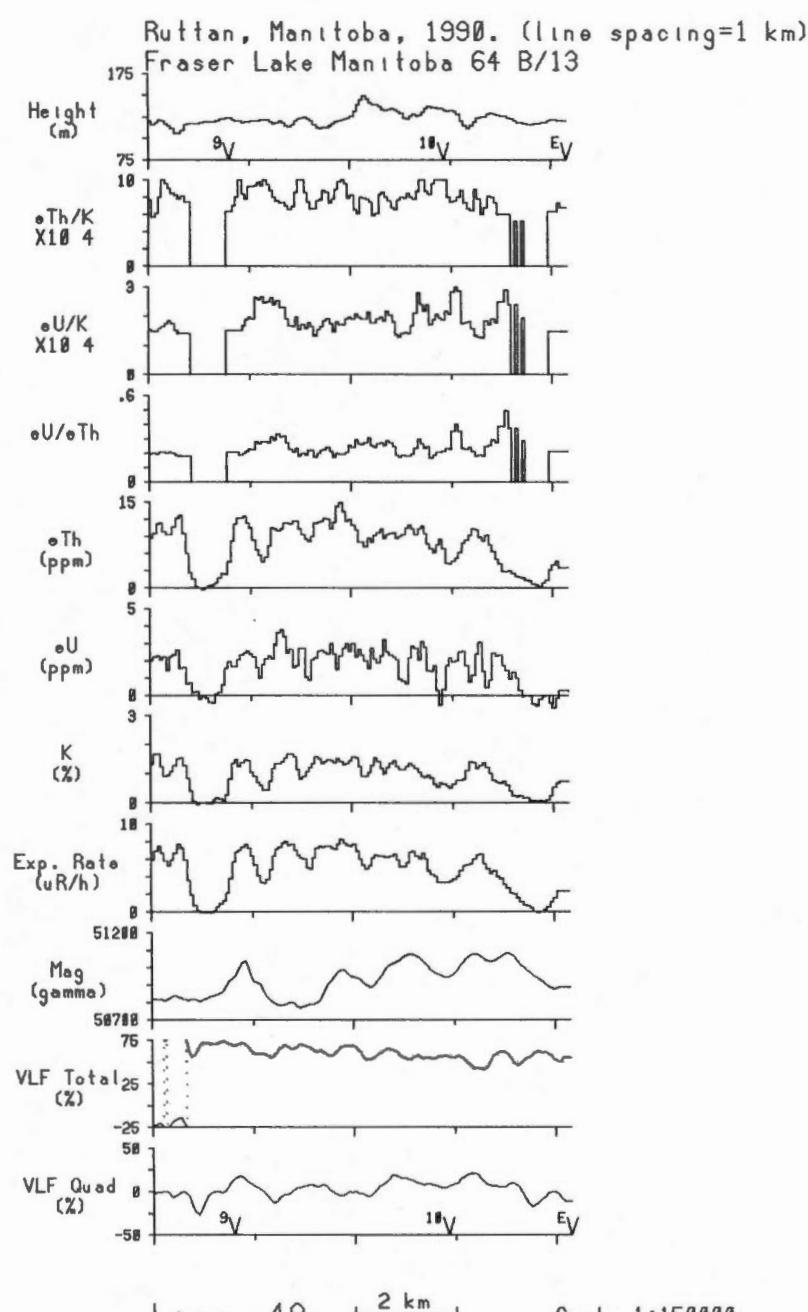
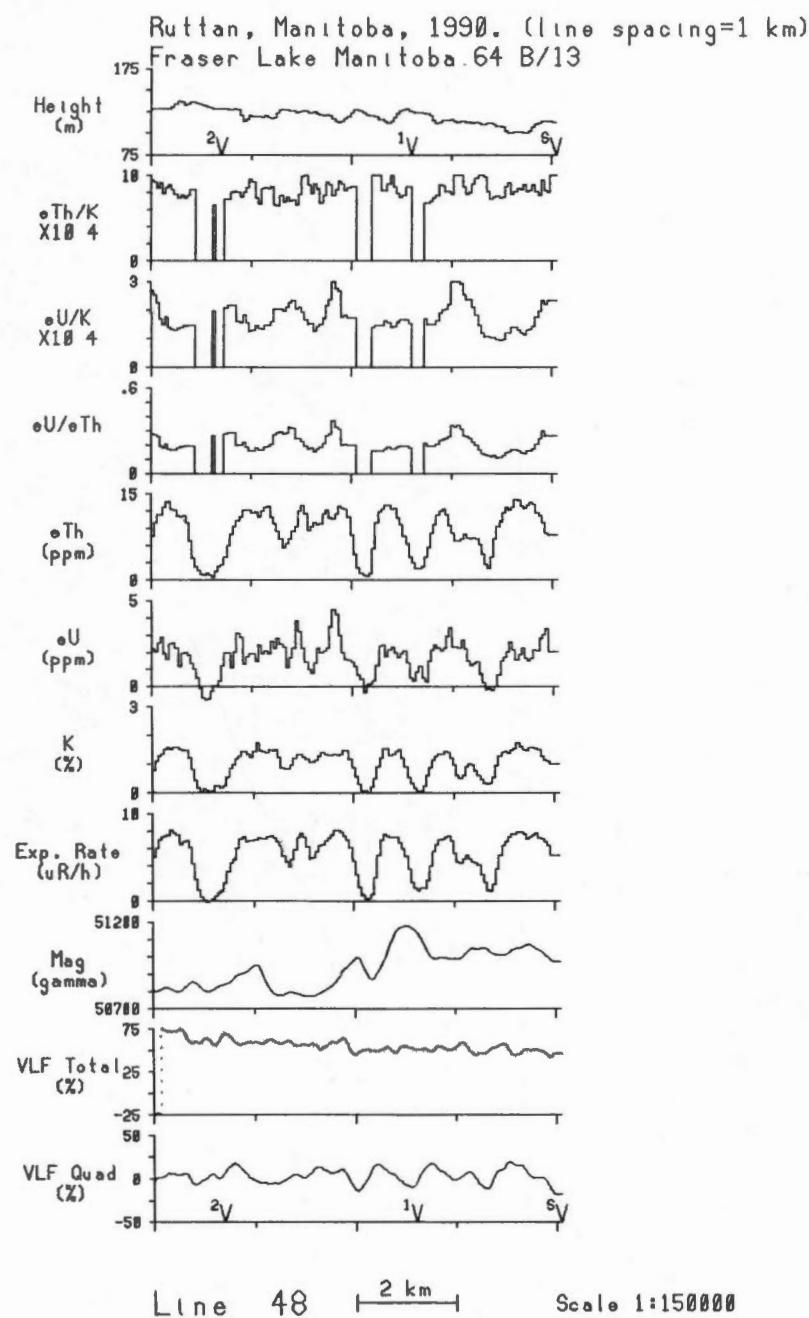


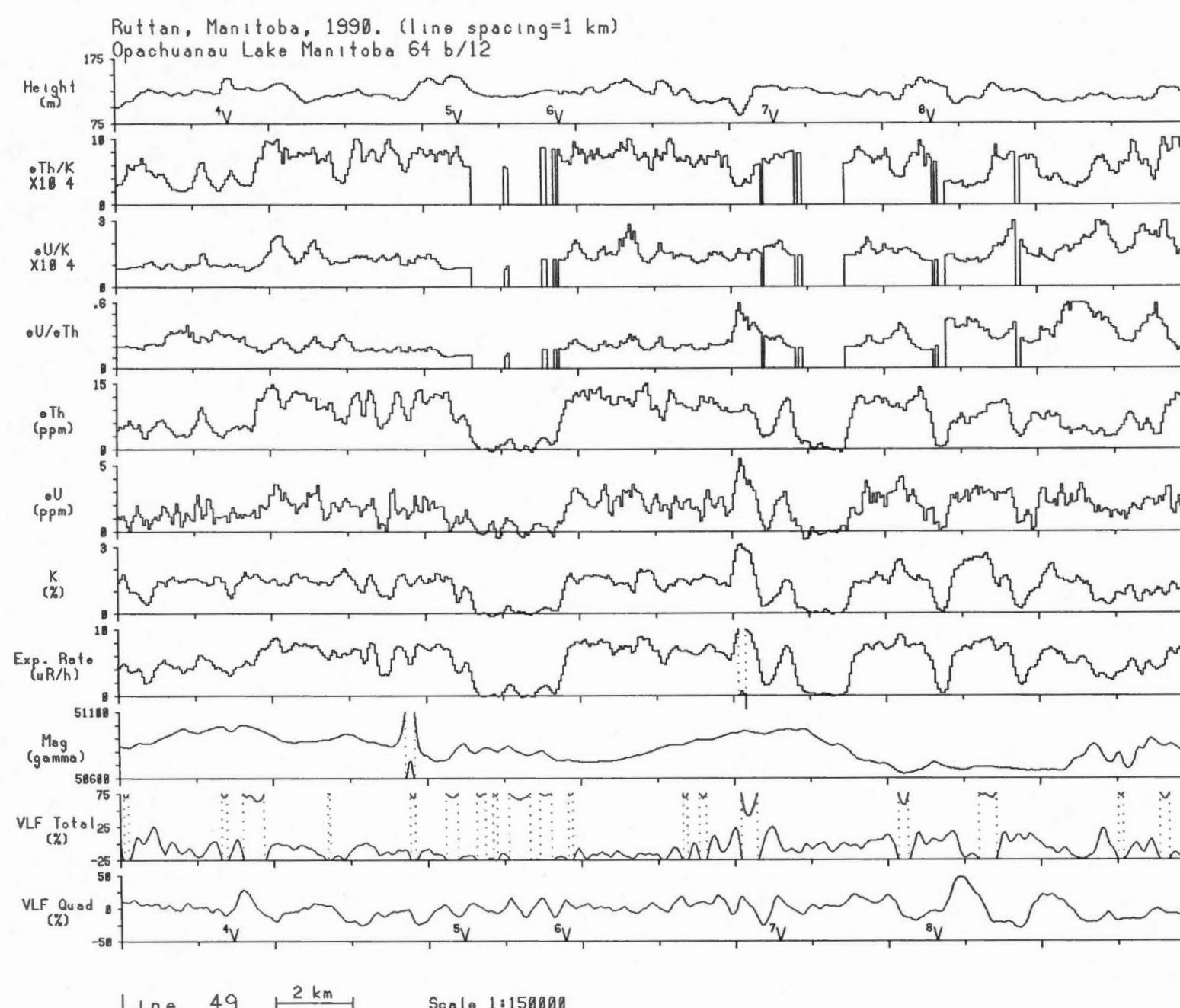
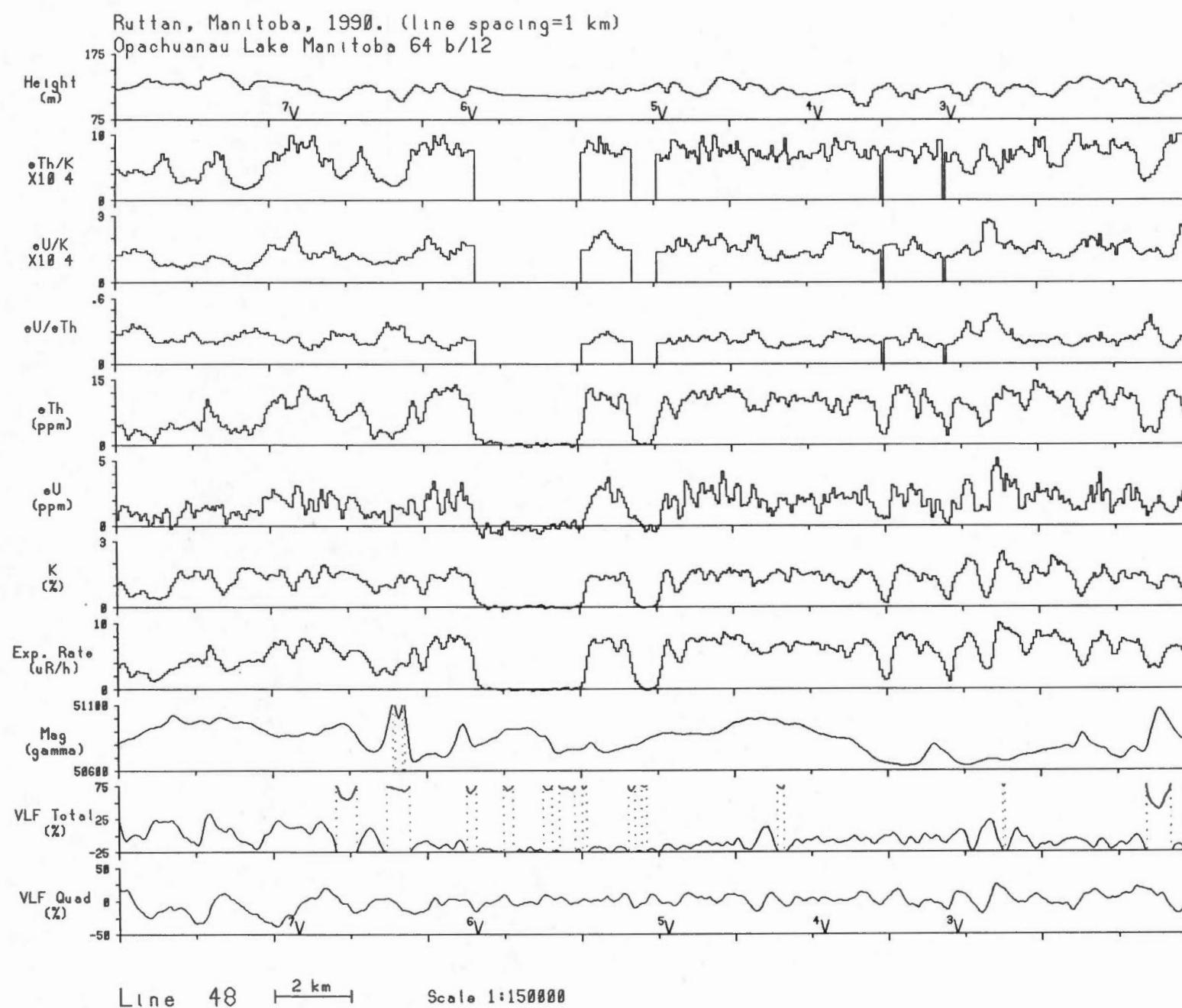


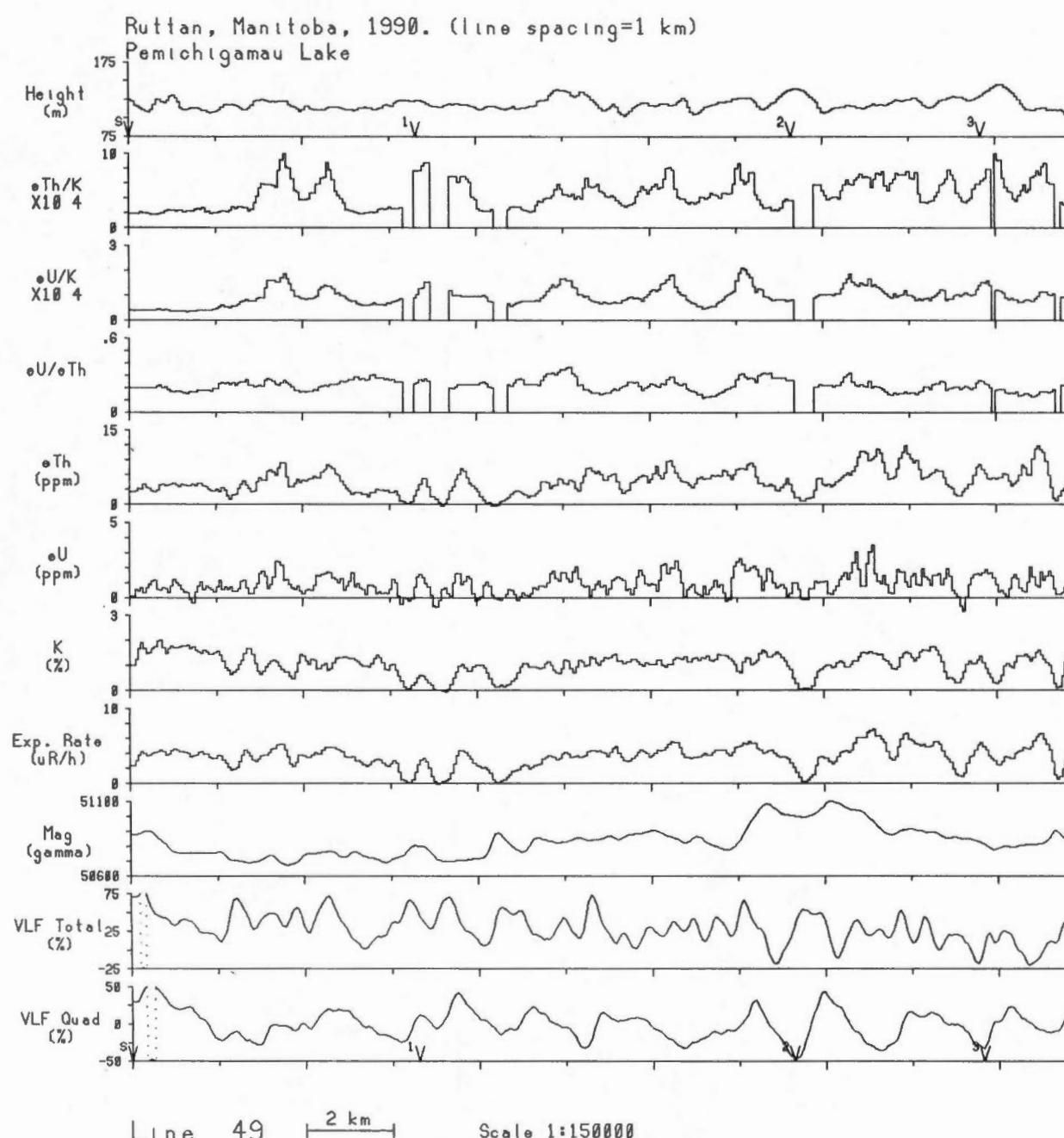
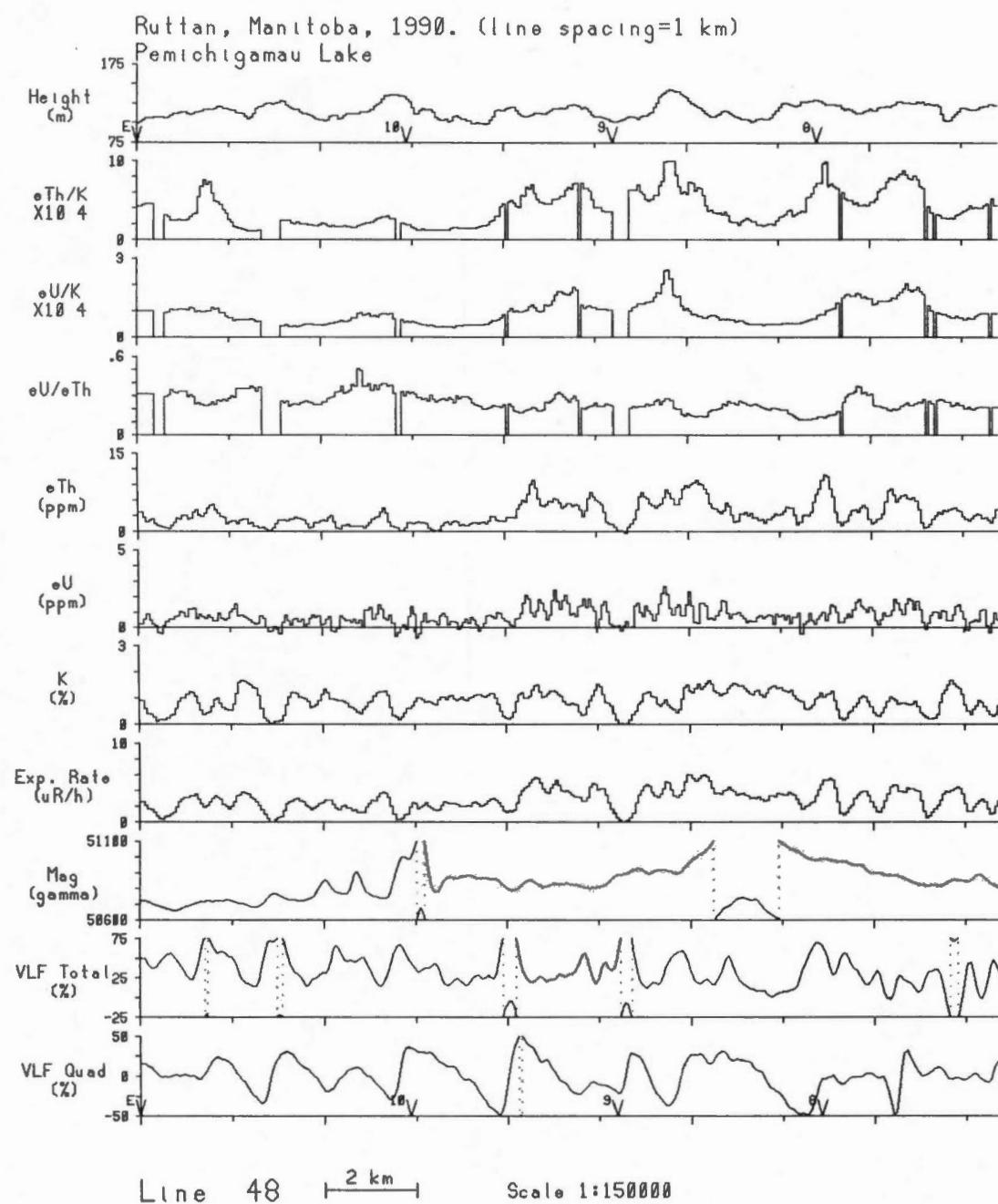


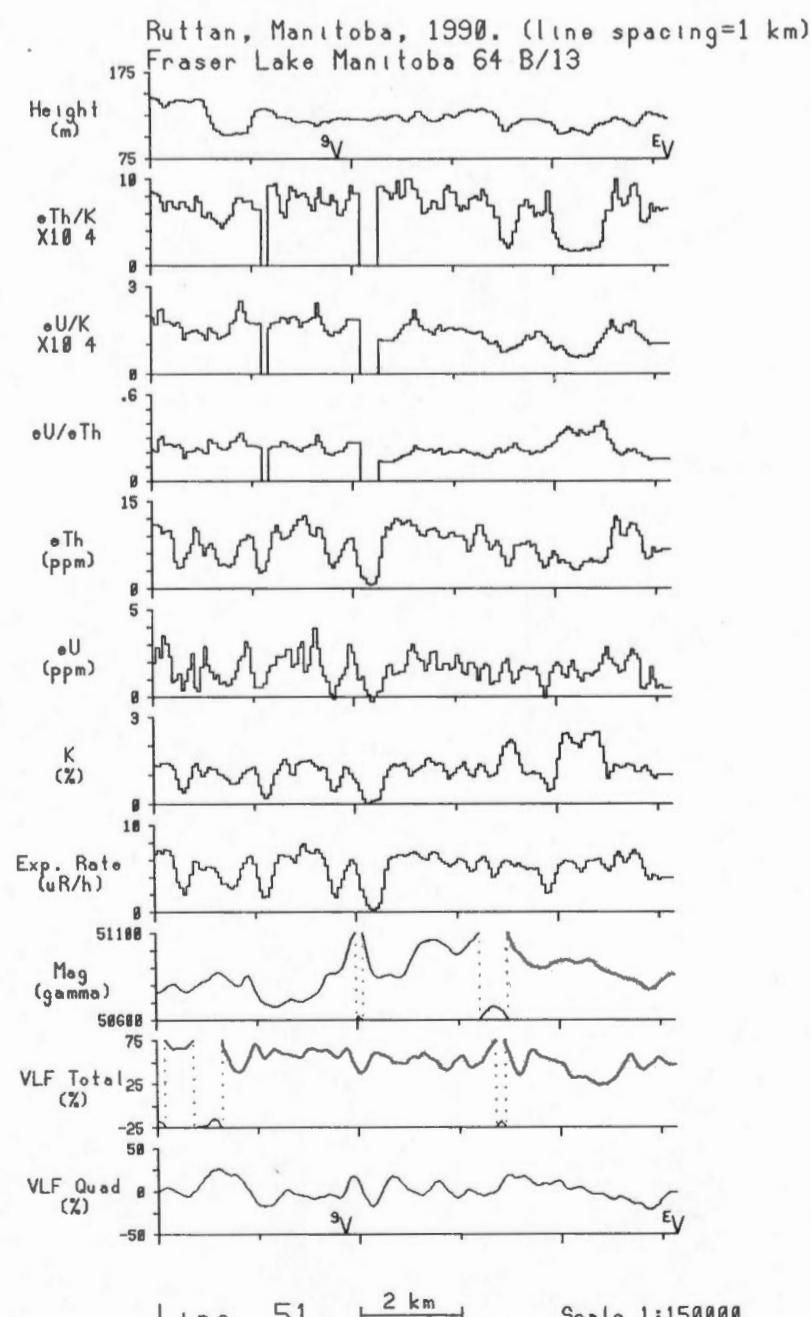
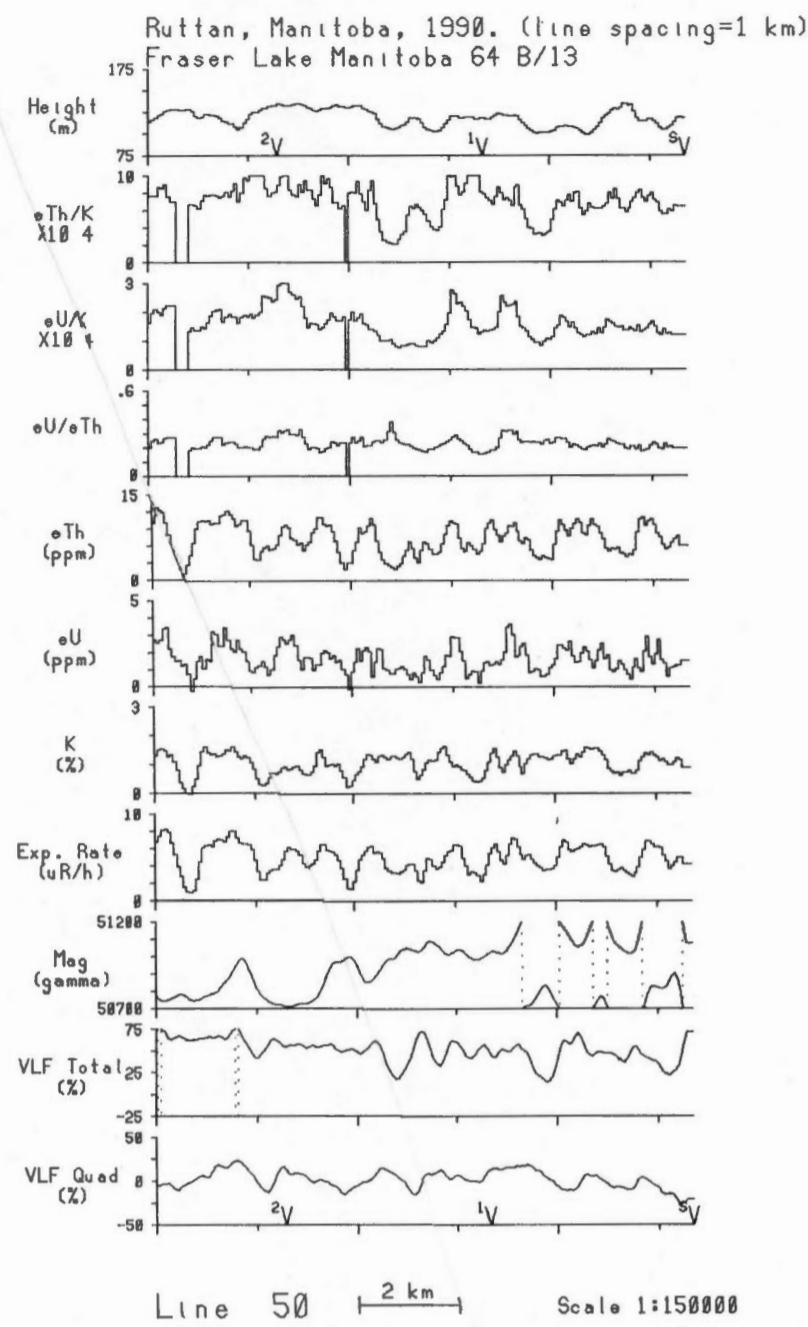


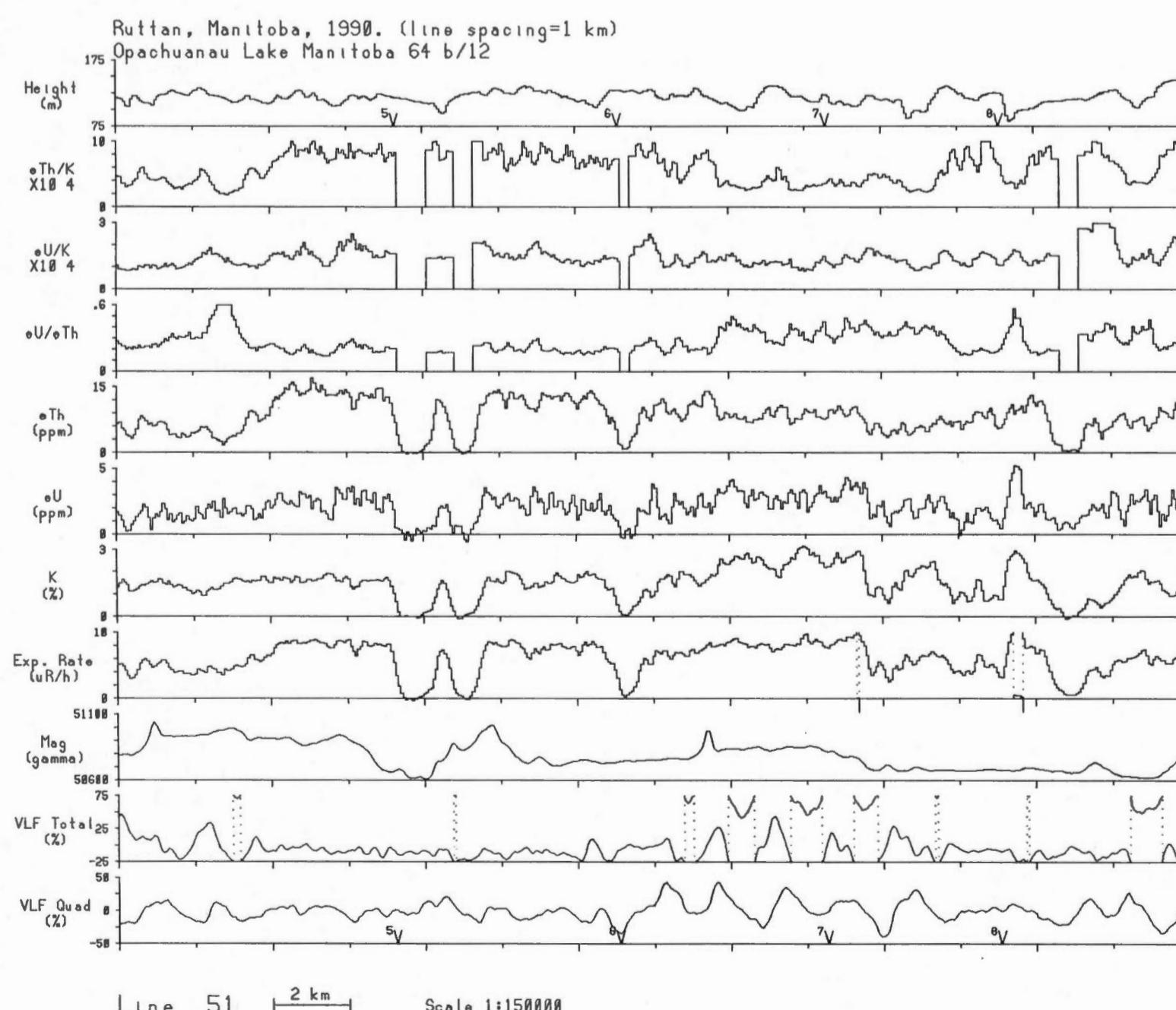
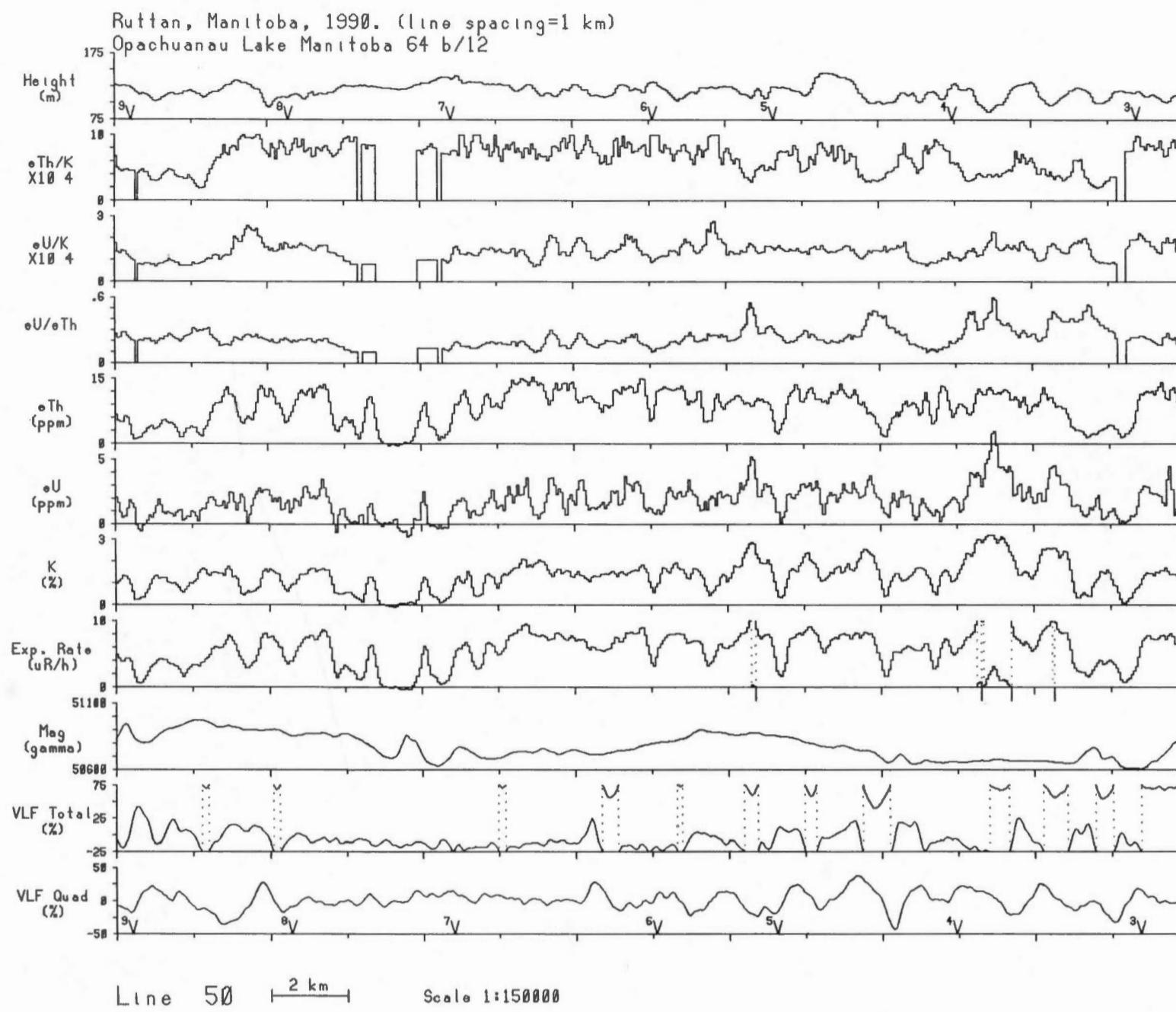


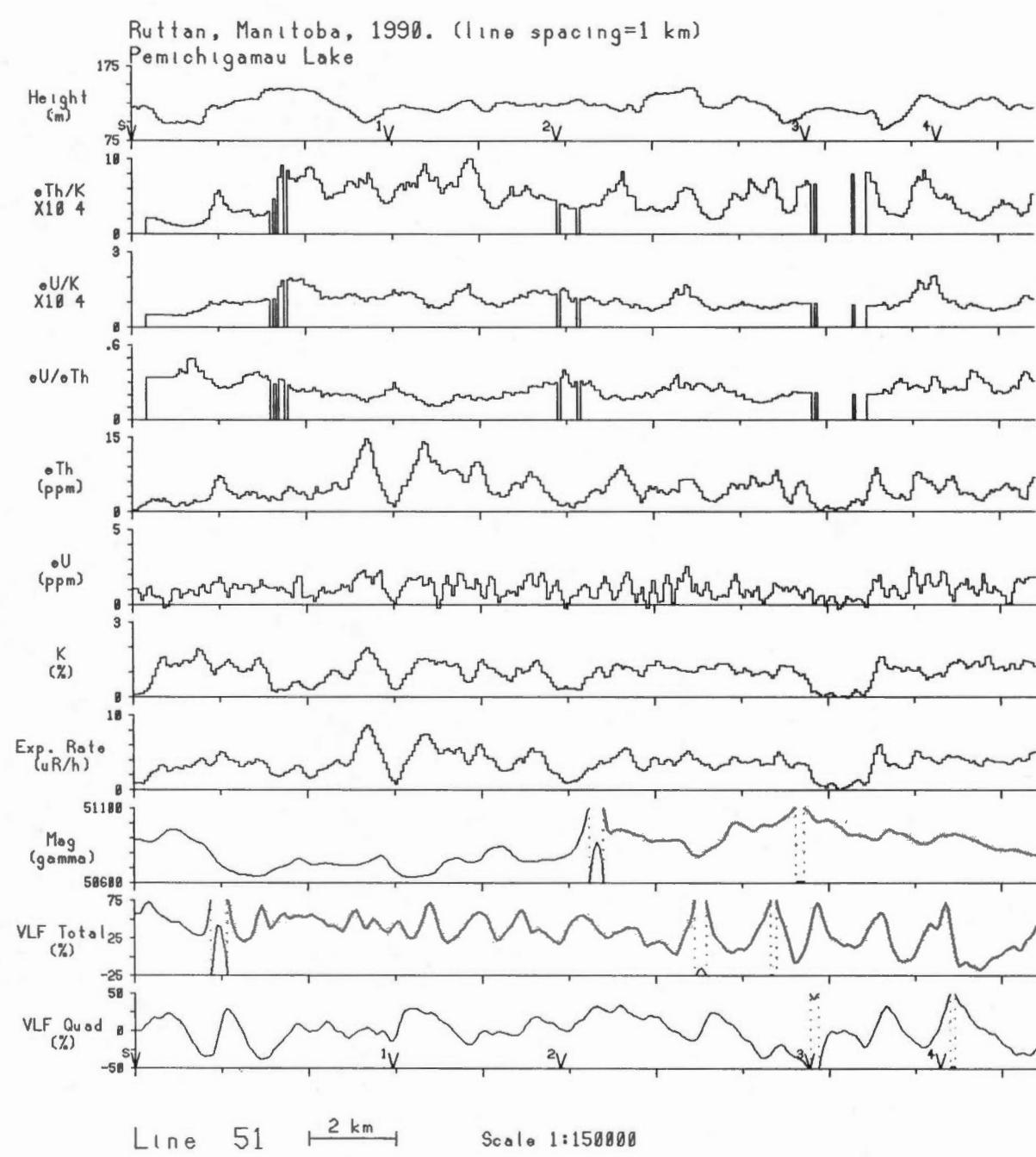
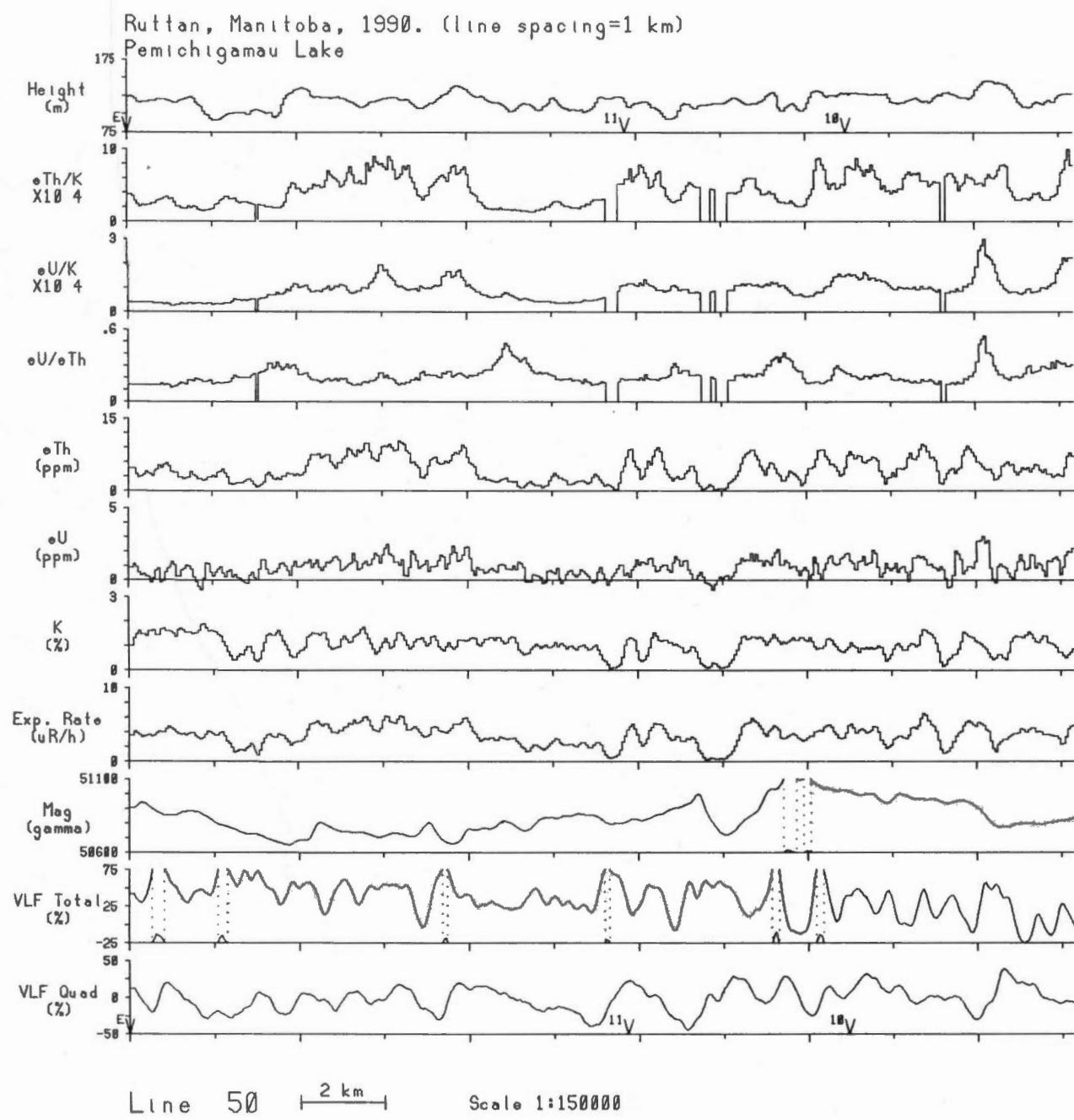


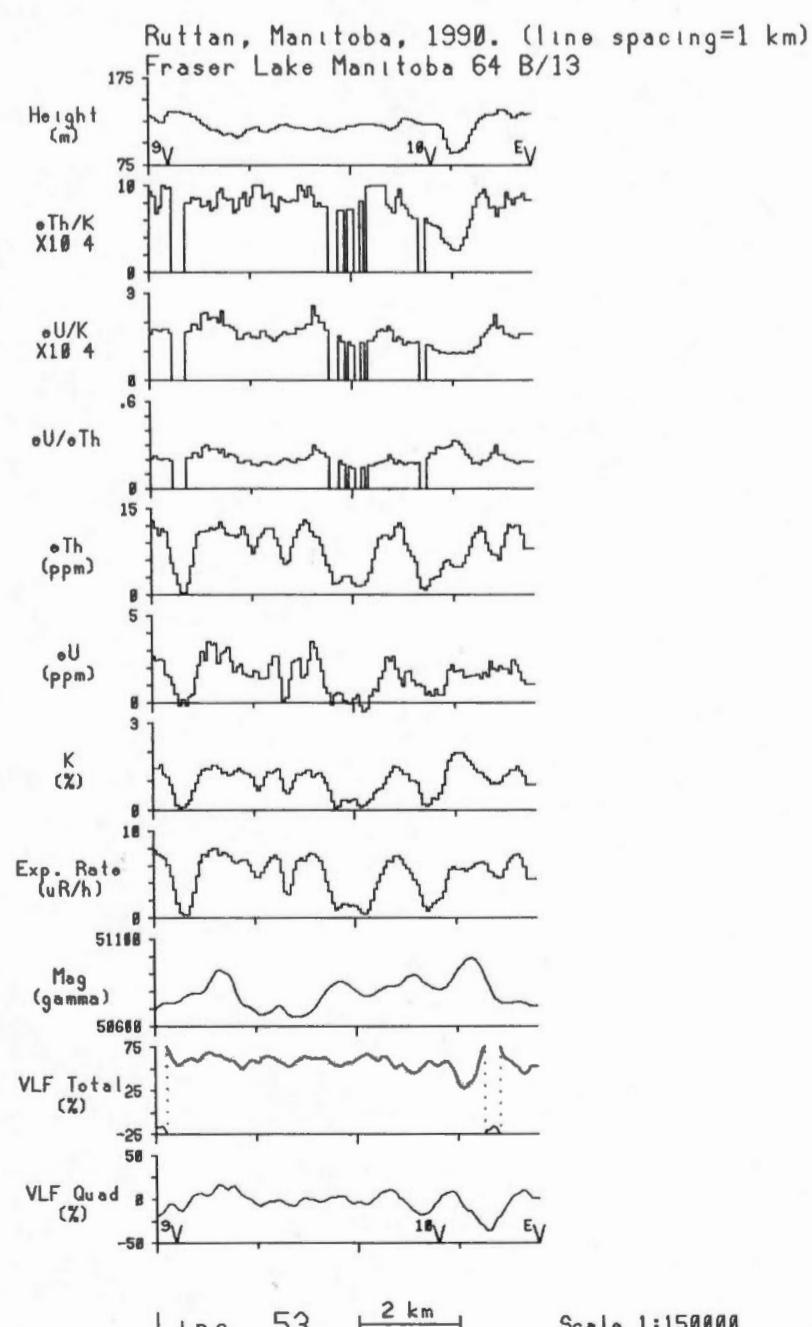
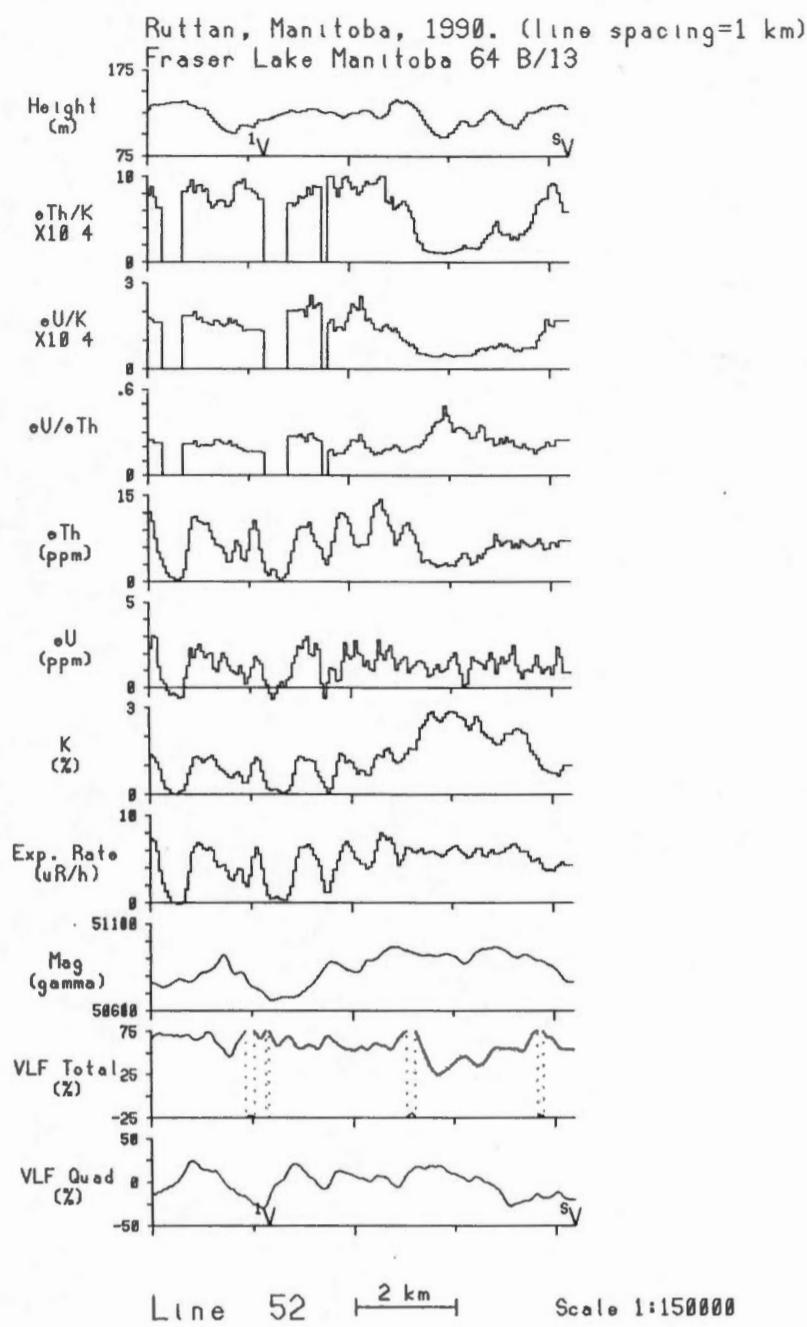


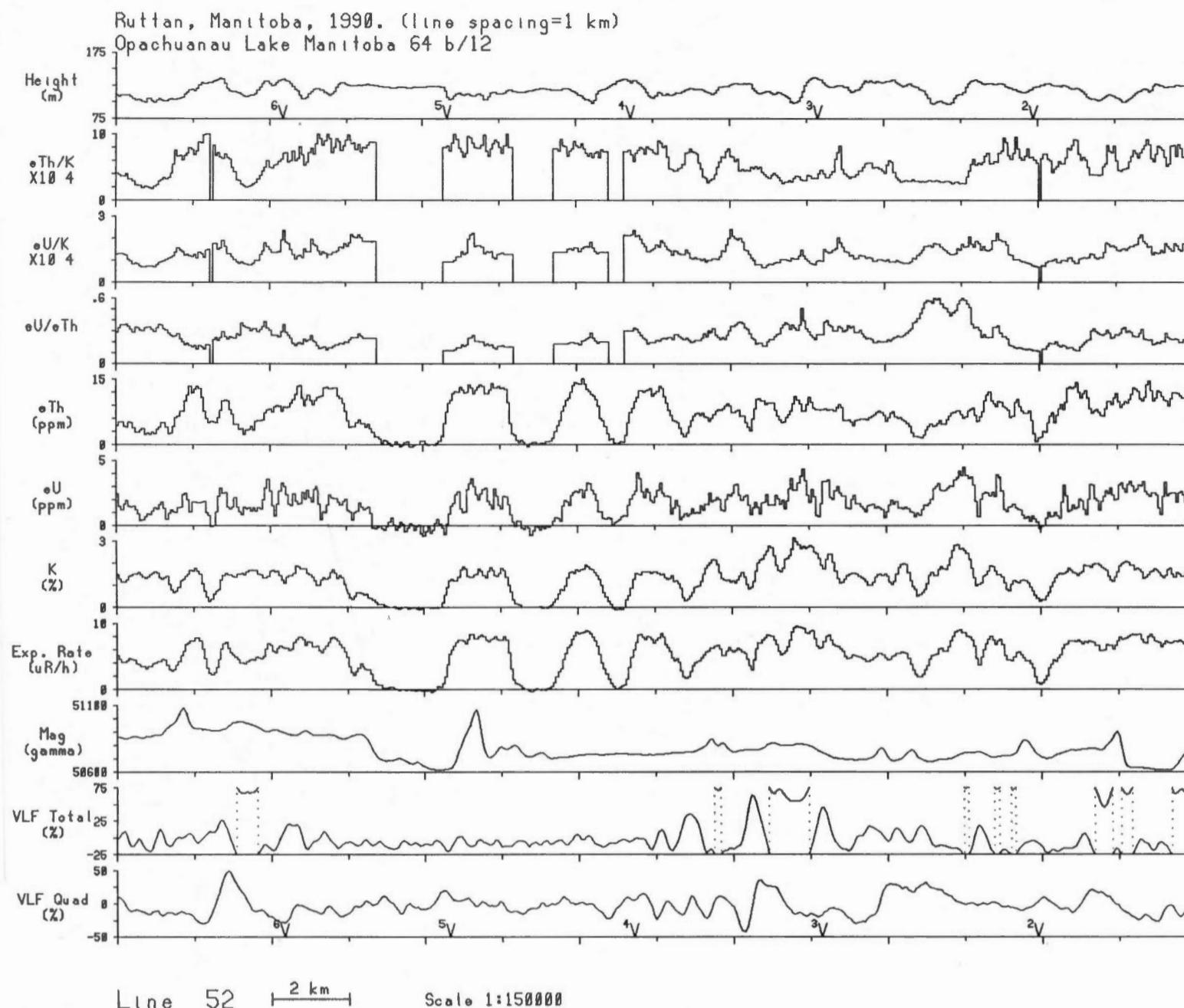




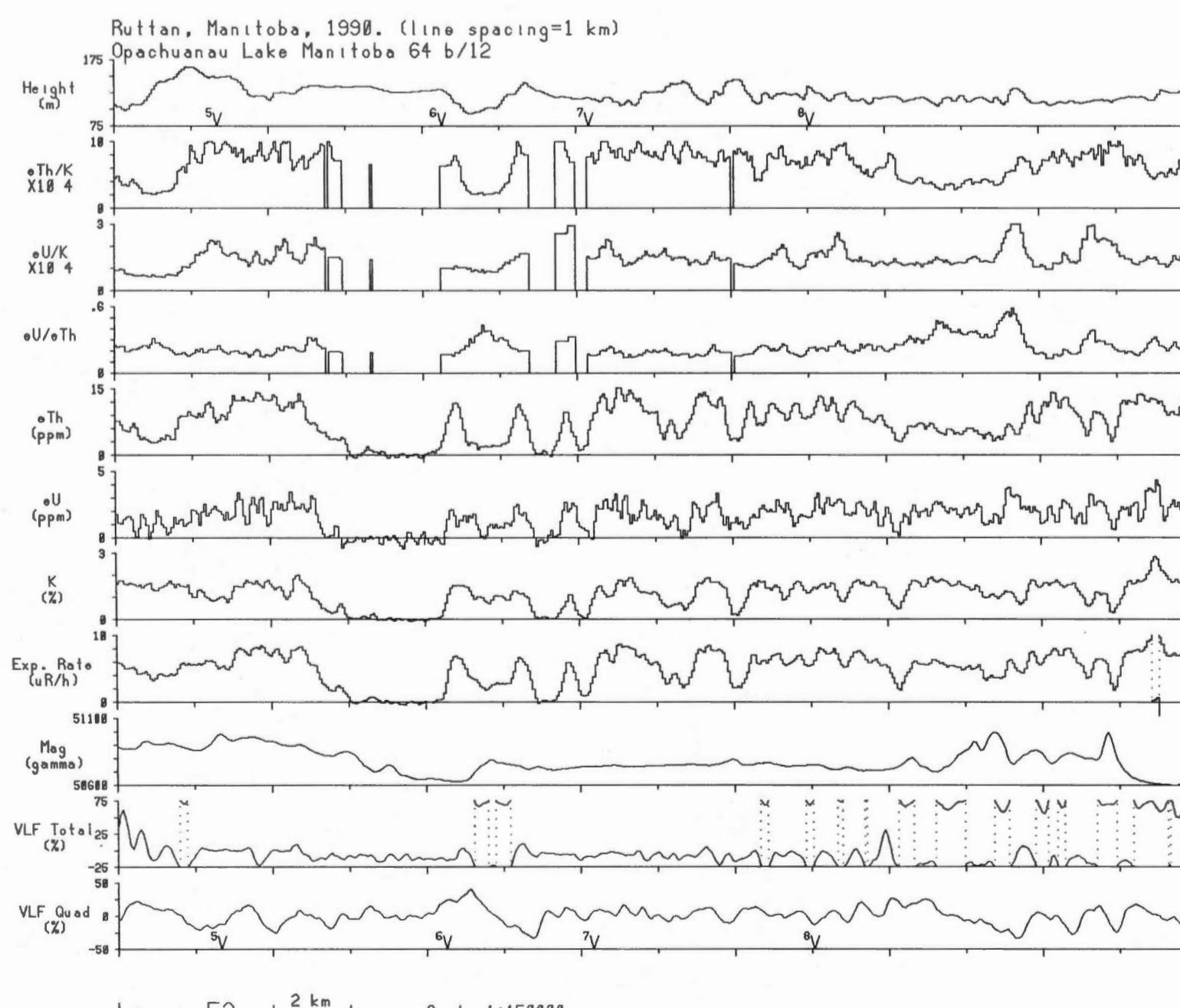




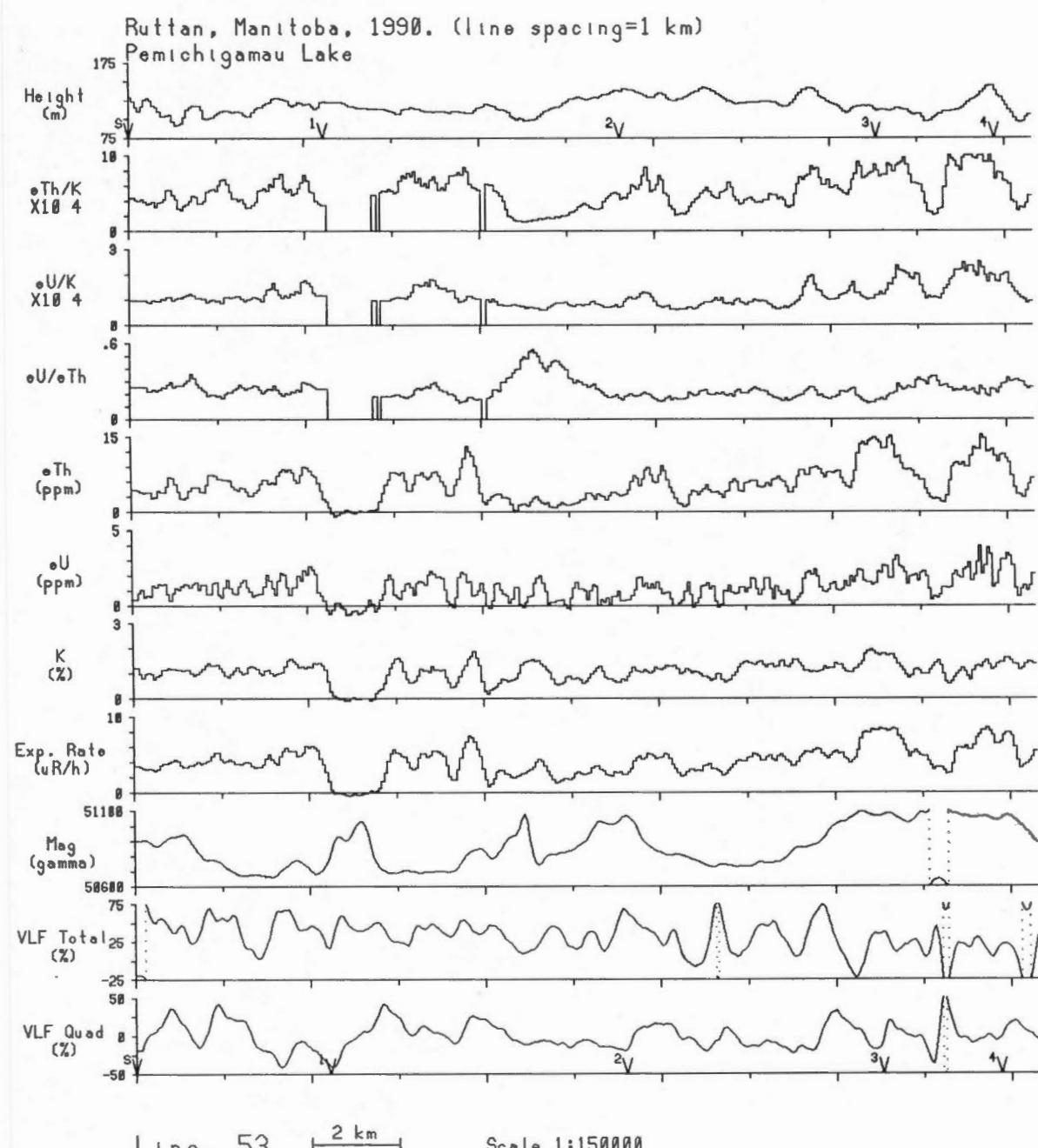
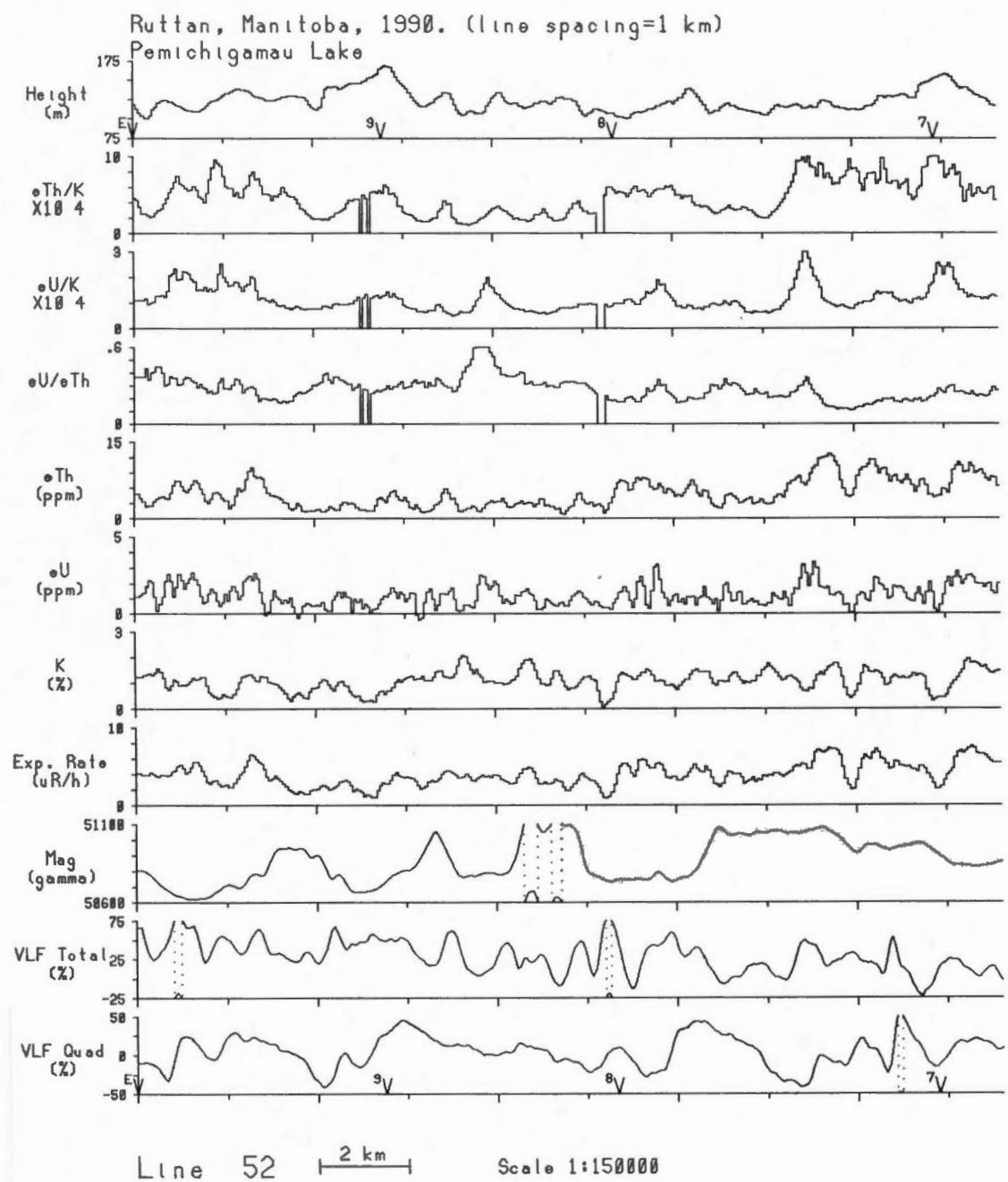


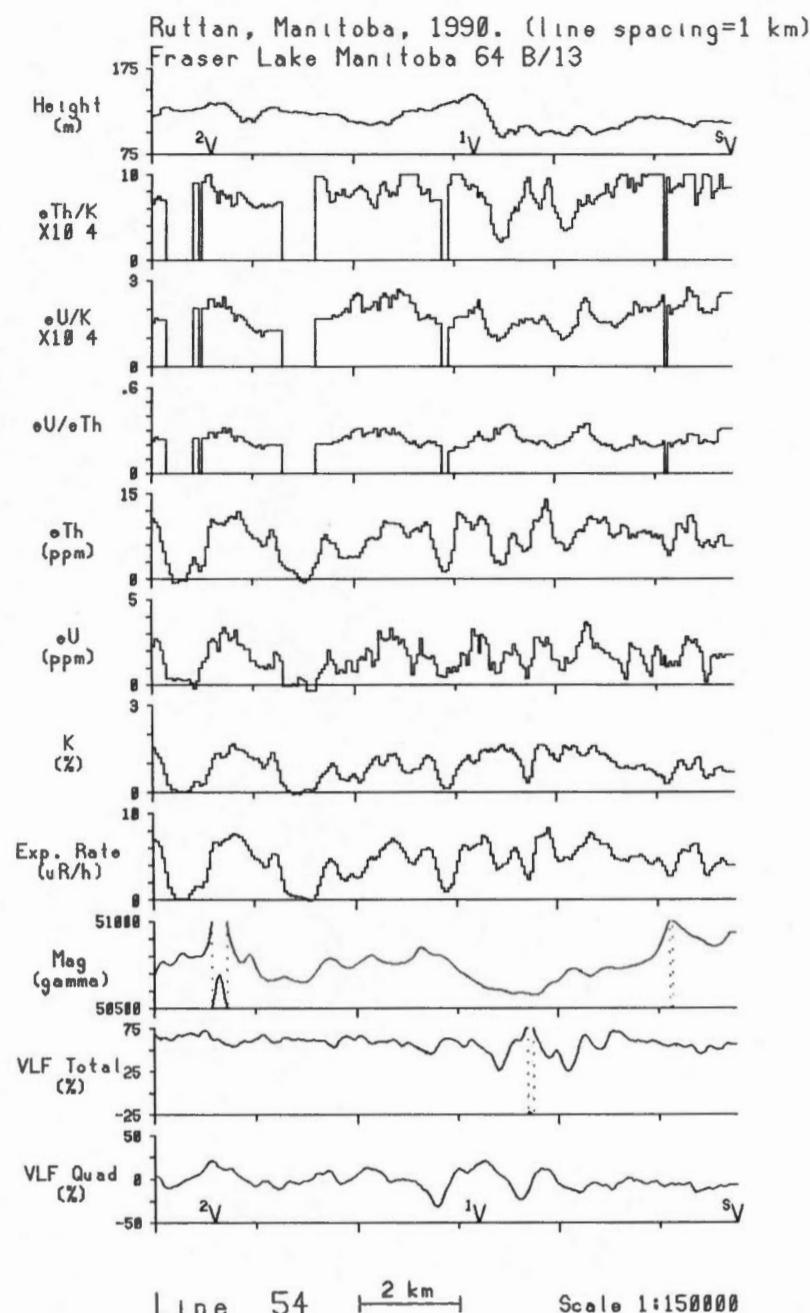


Line 52 2 km Scale 1:150000

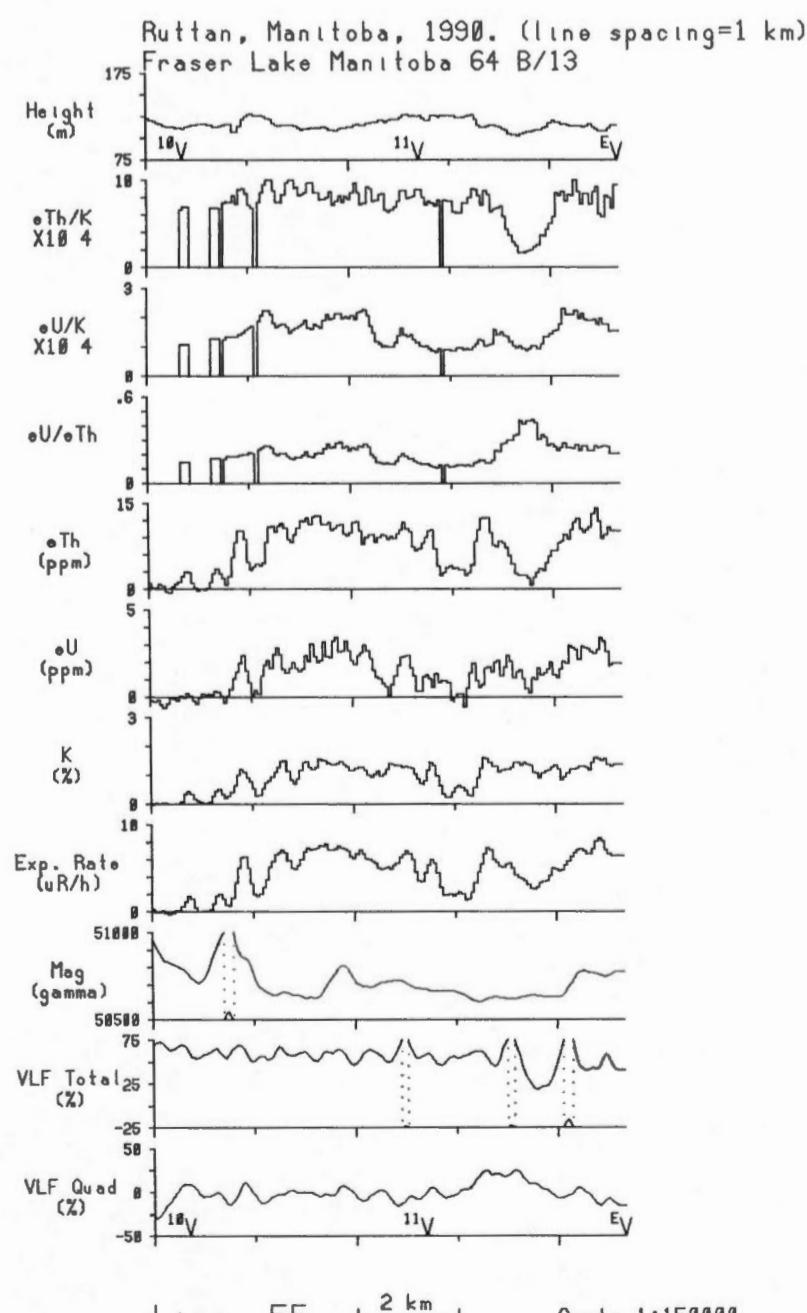


Line 53 2 km Scale 1:150000

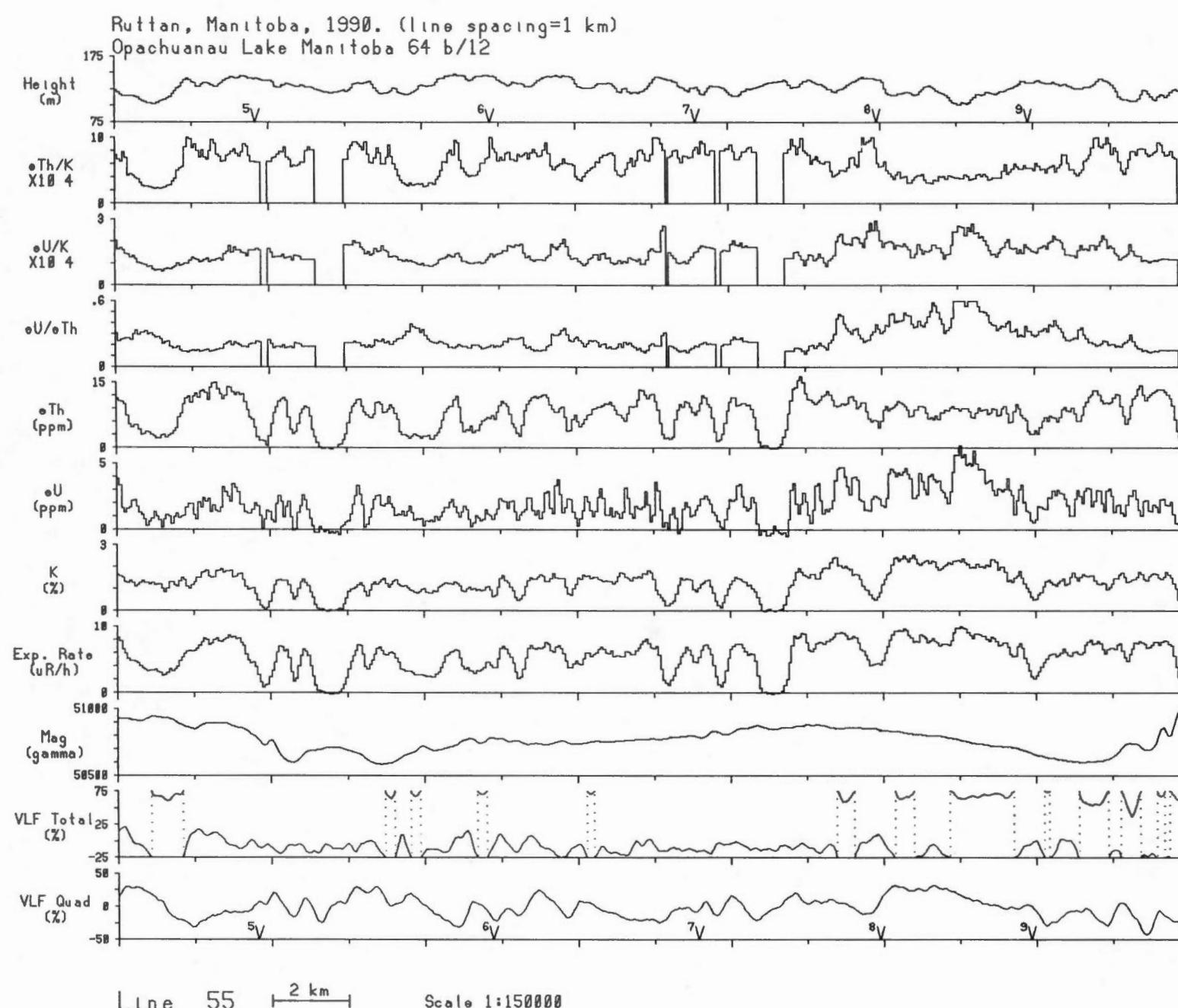
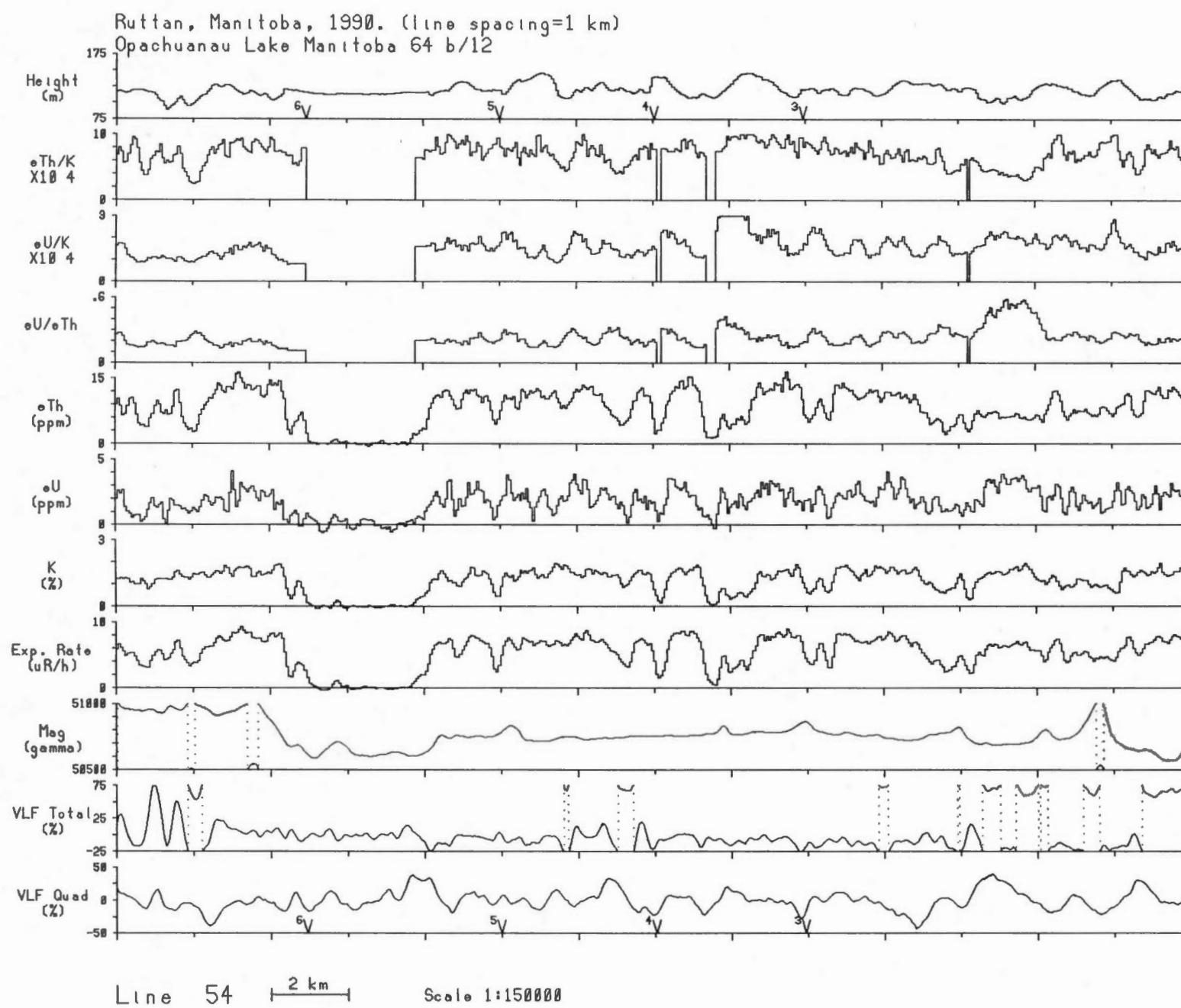


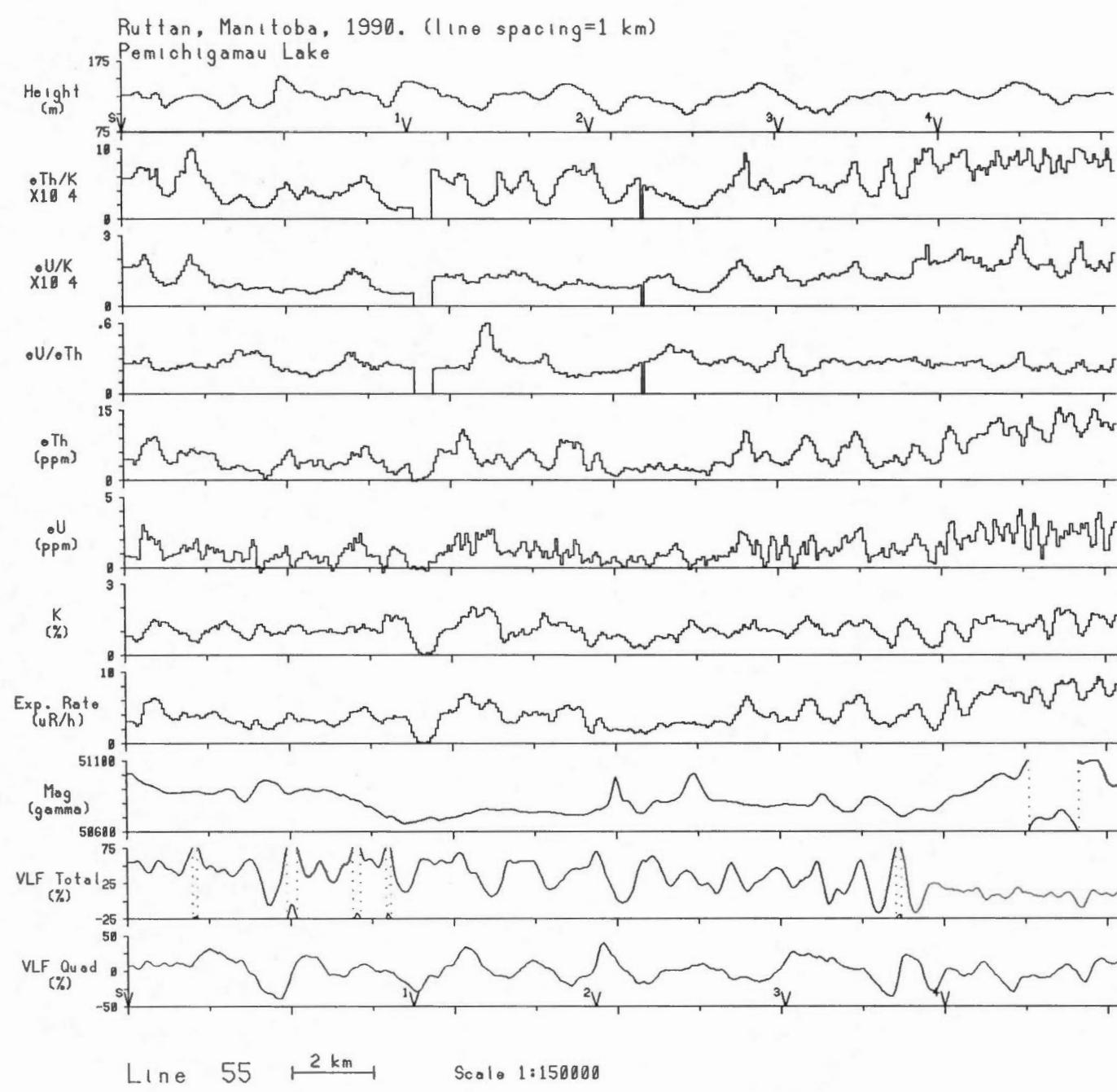
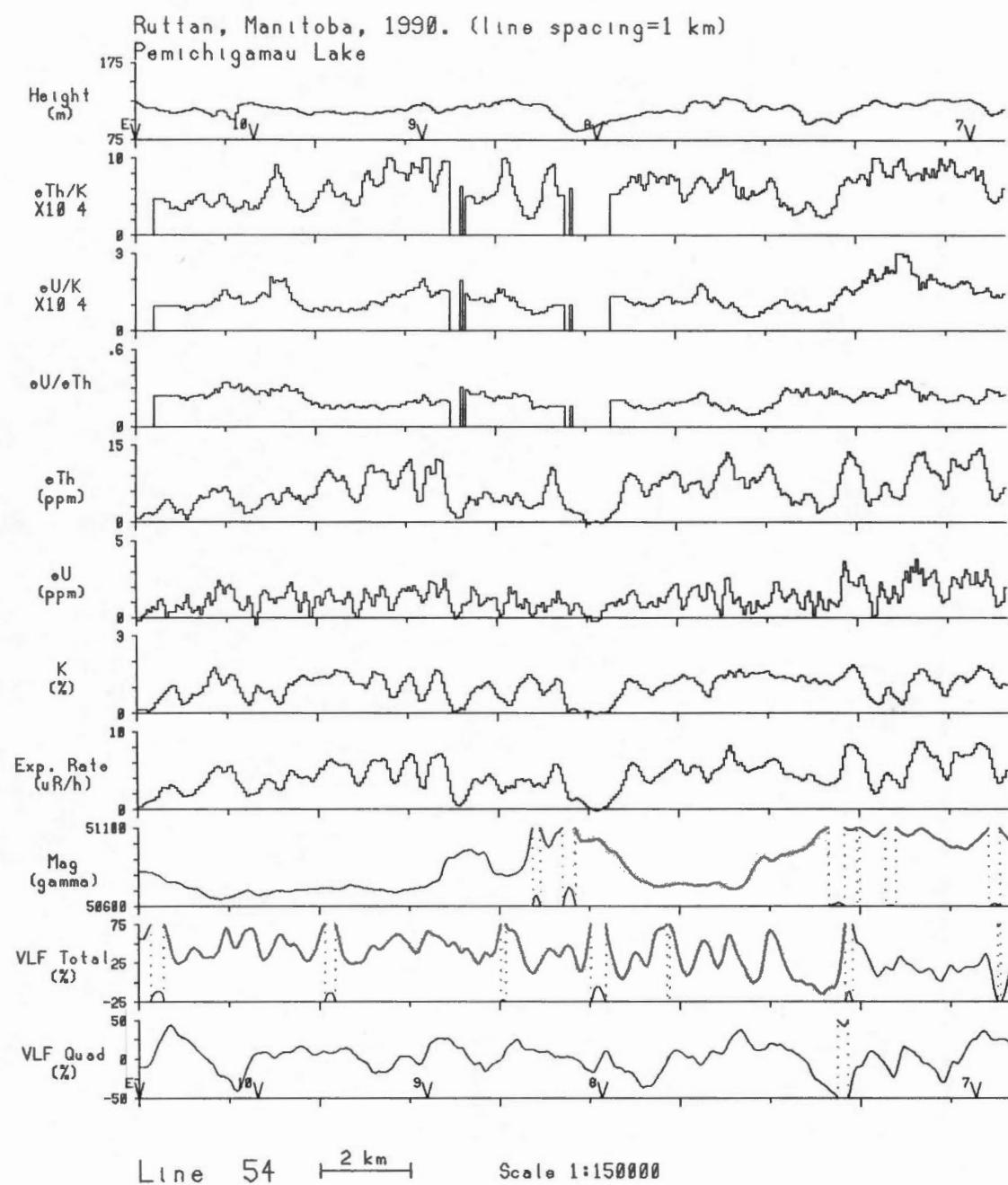


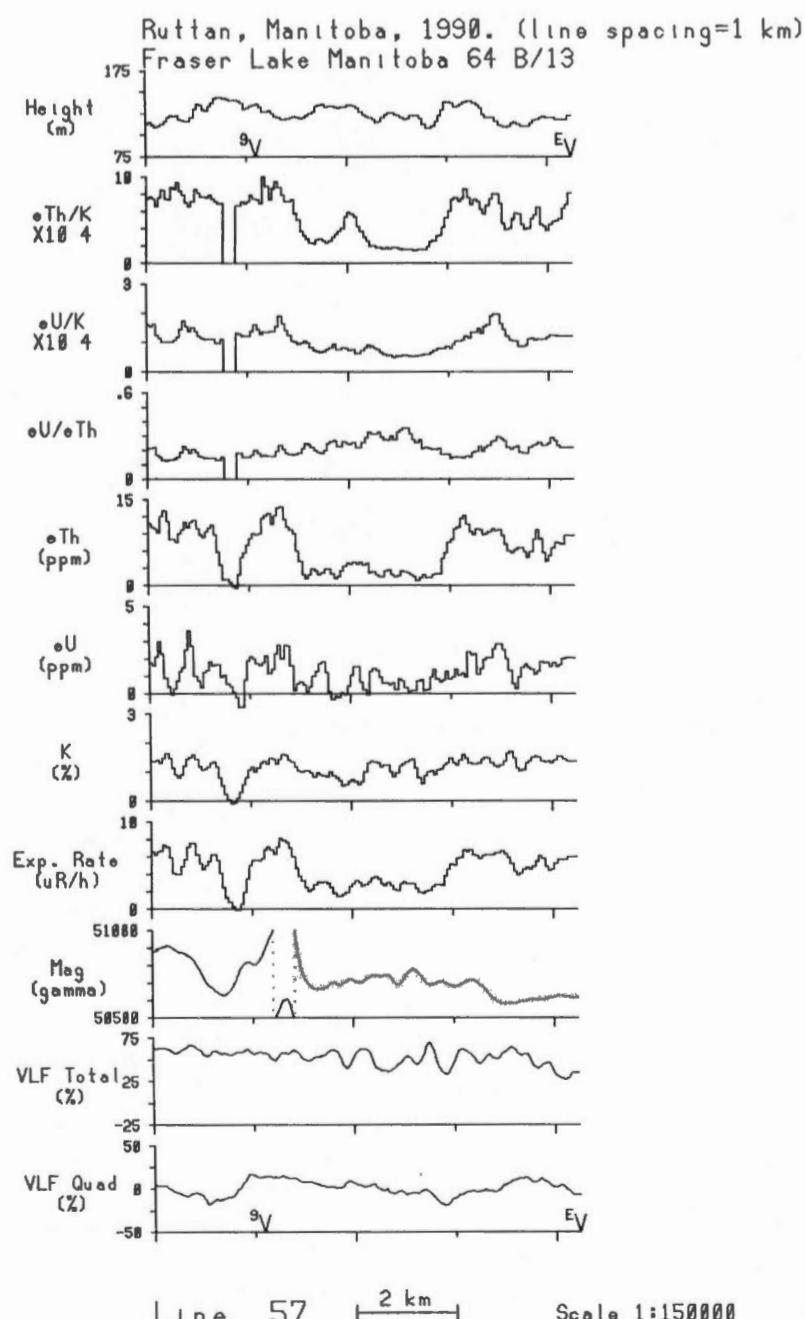
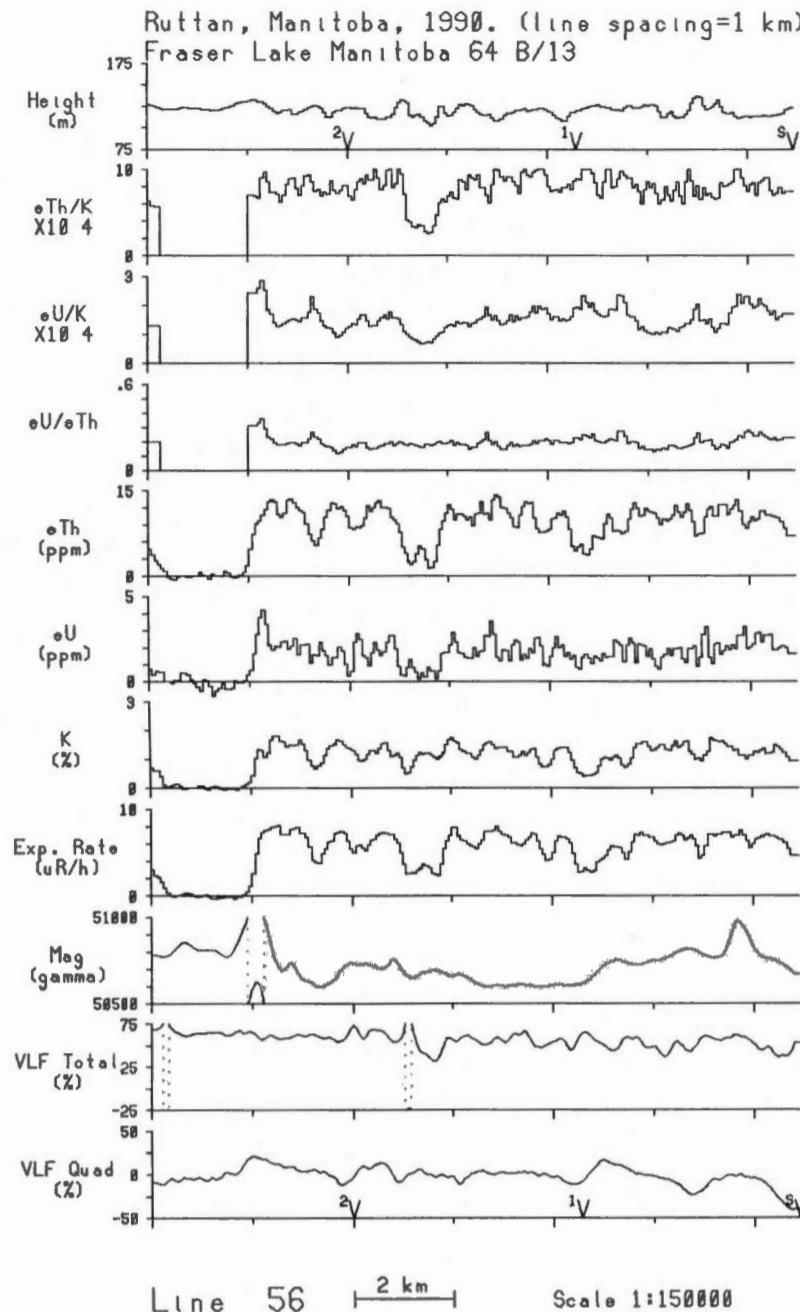
Line 54 2 km Scale 1:150000

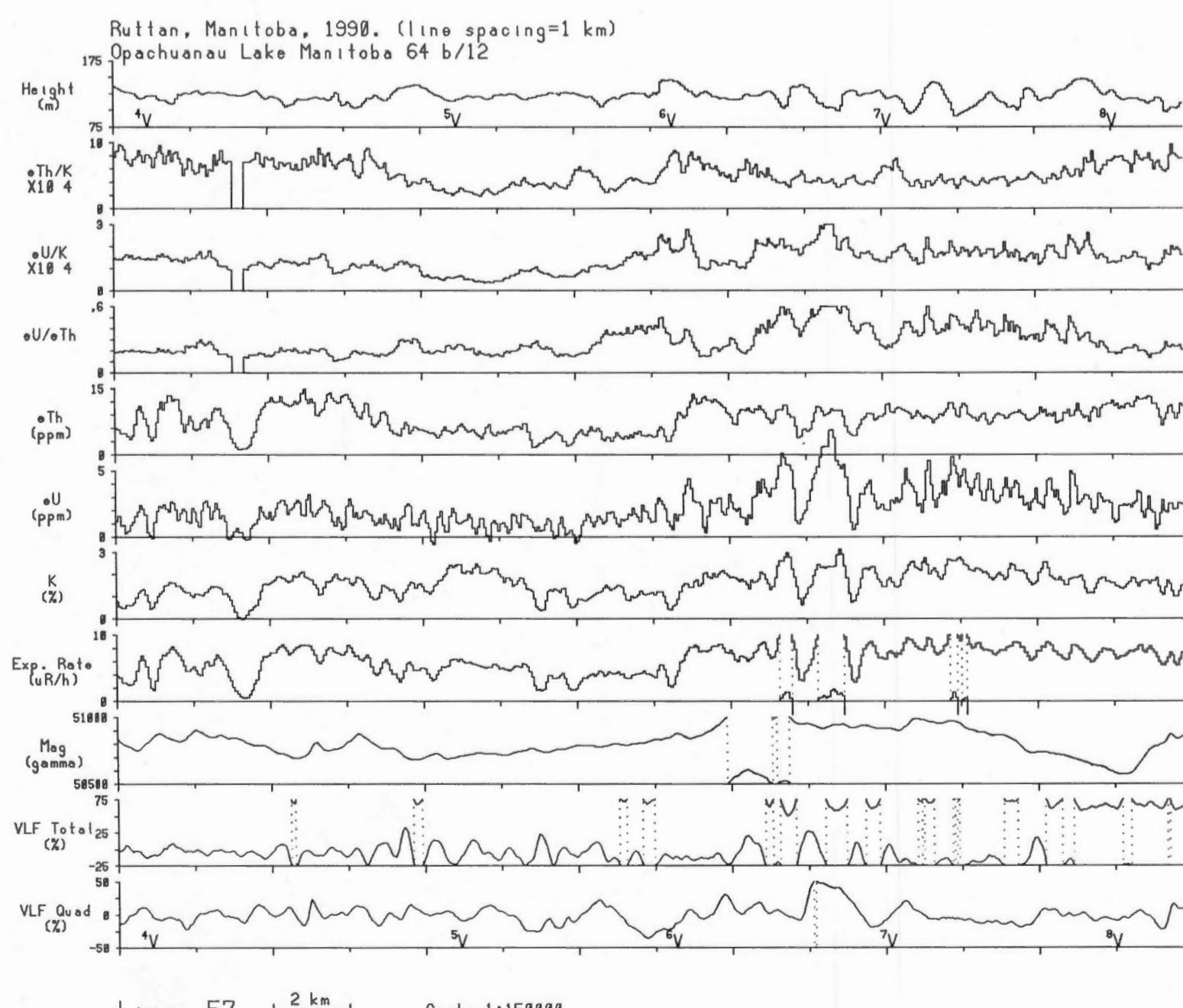
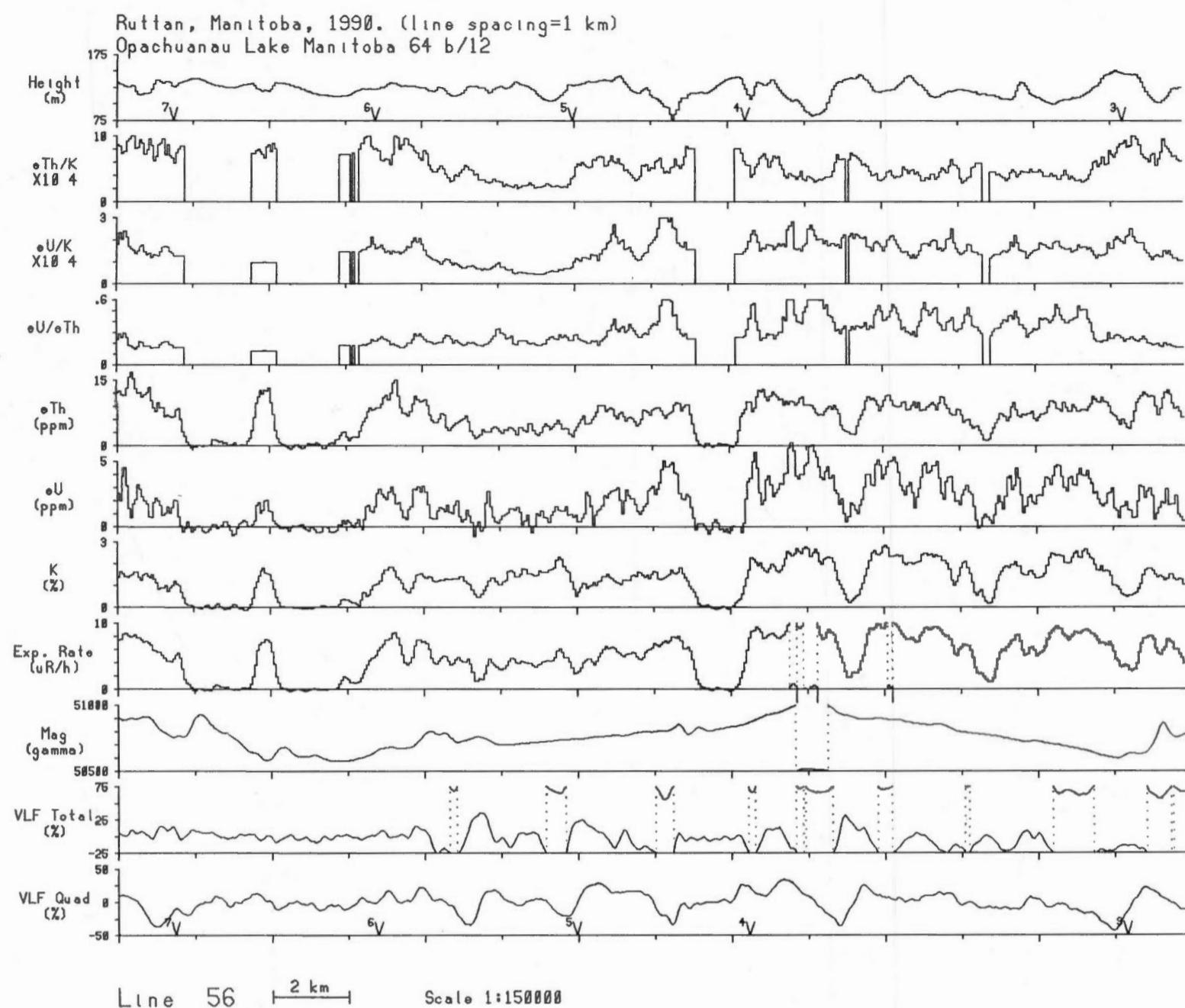


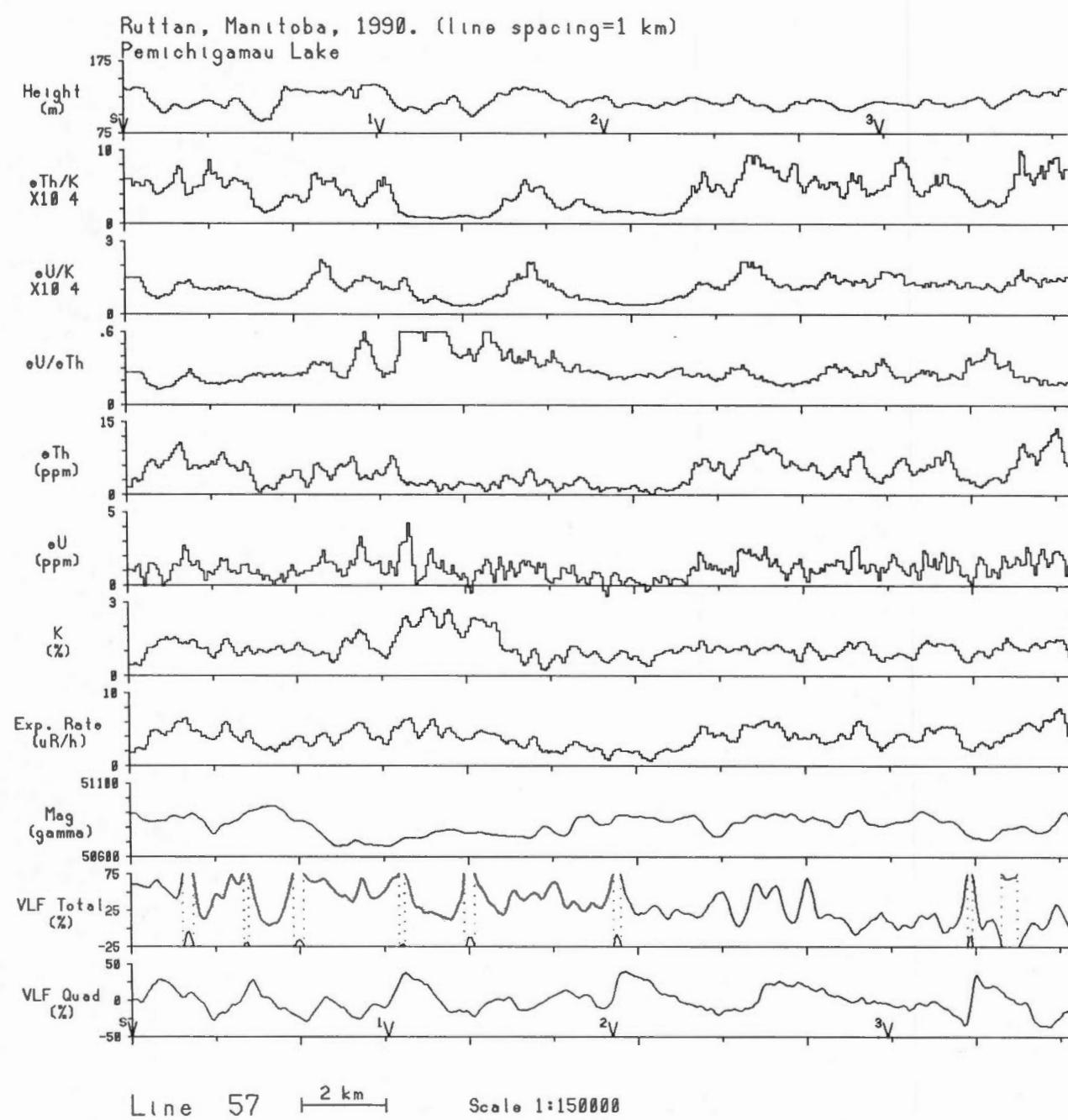
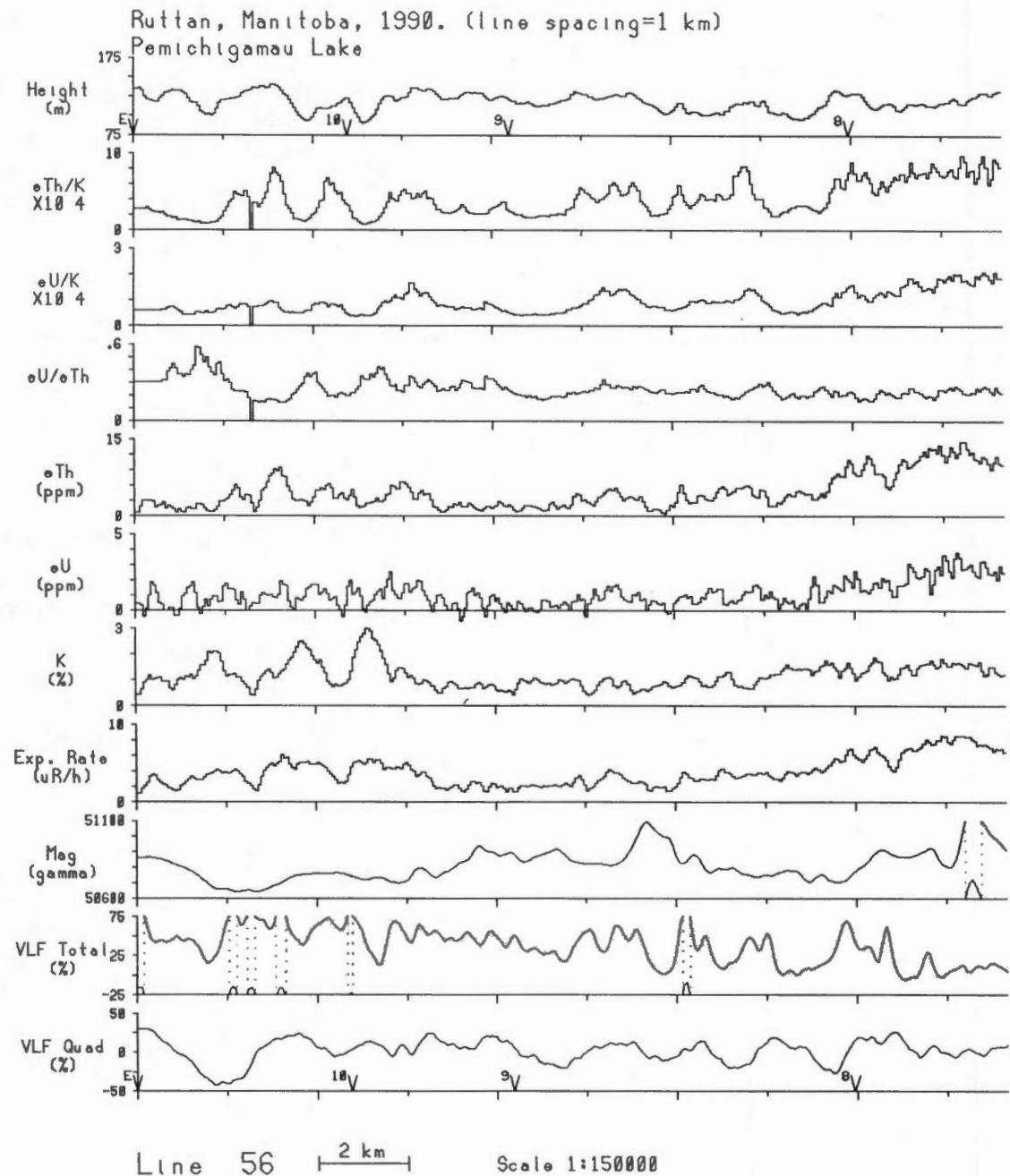
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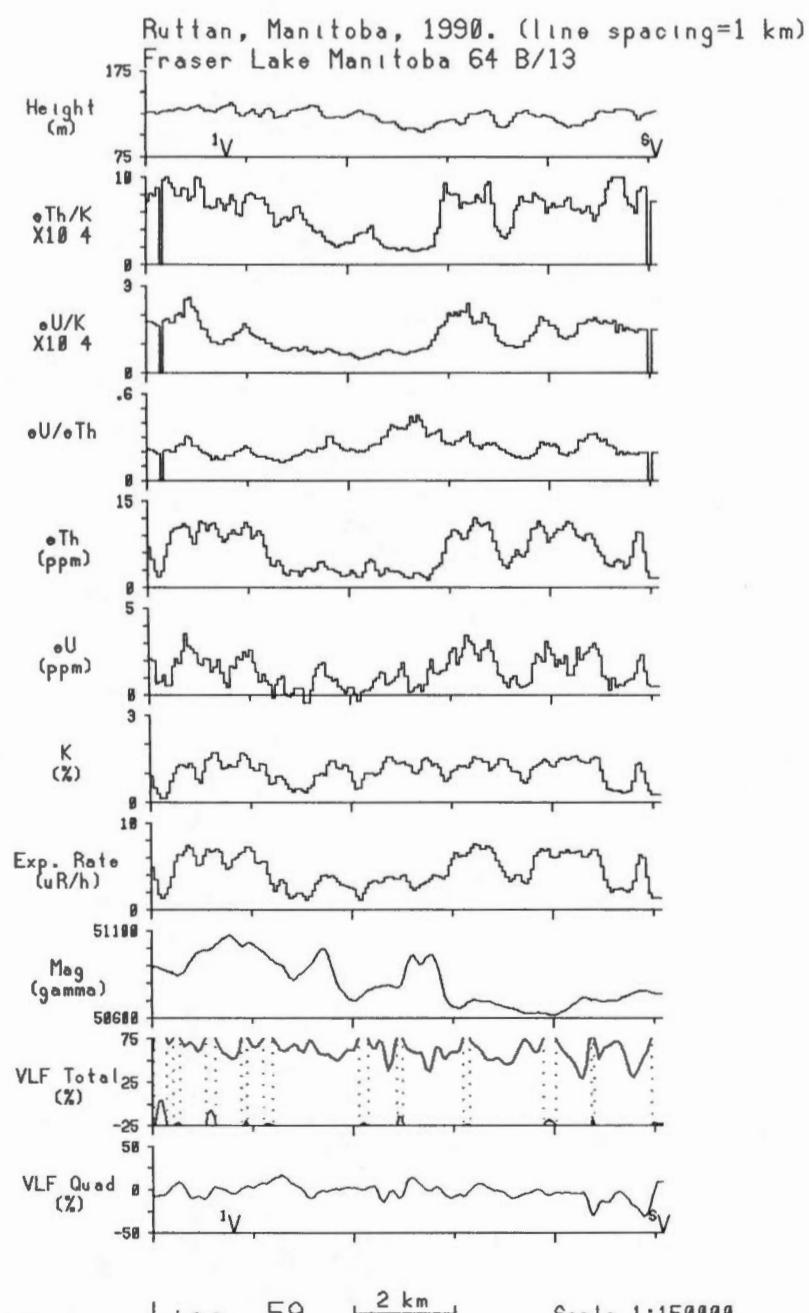
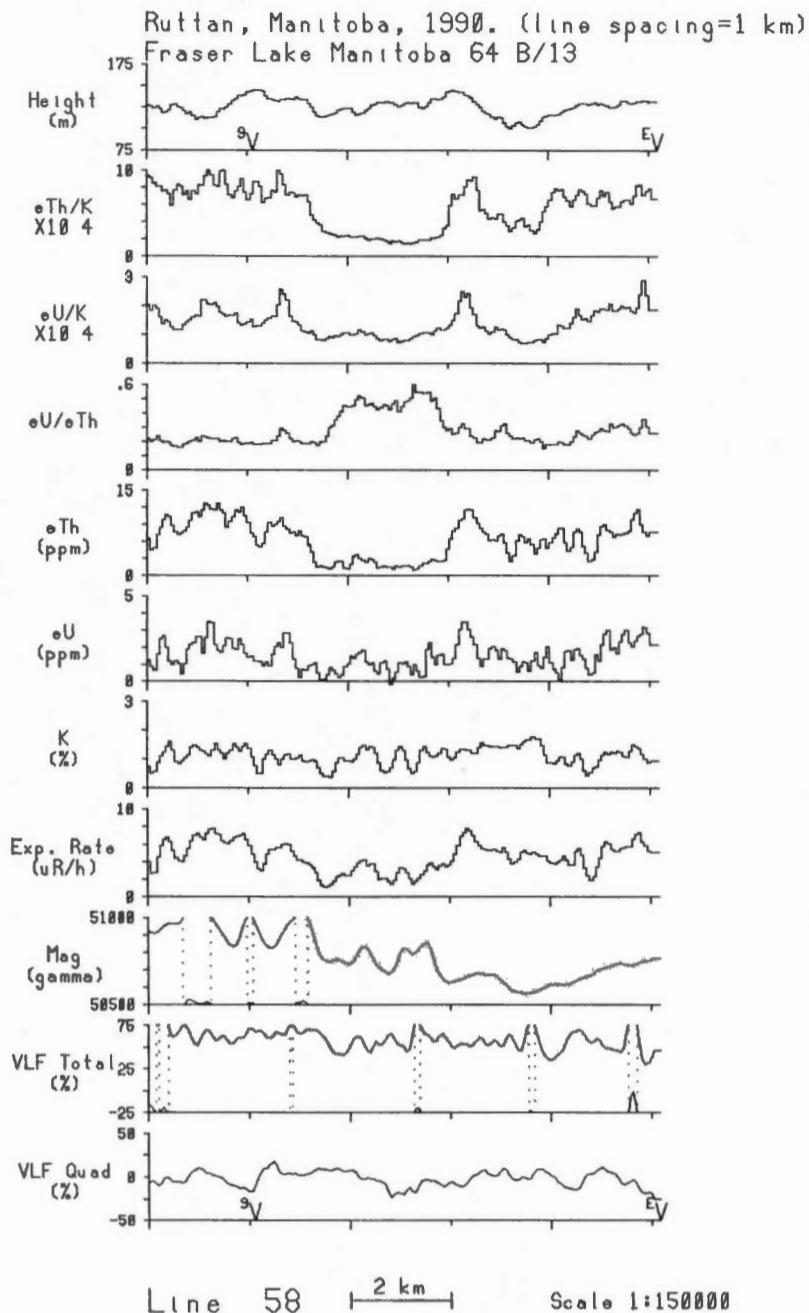


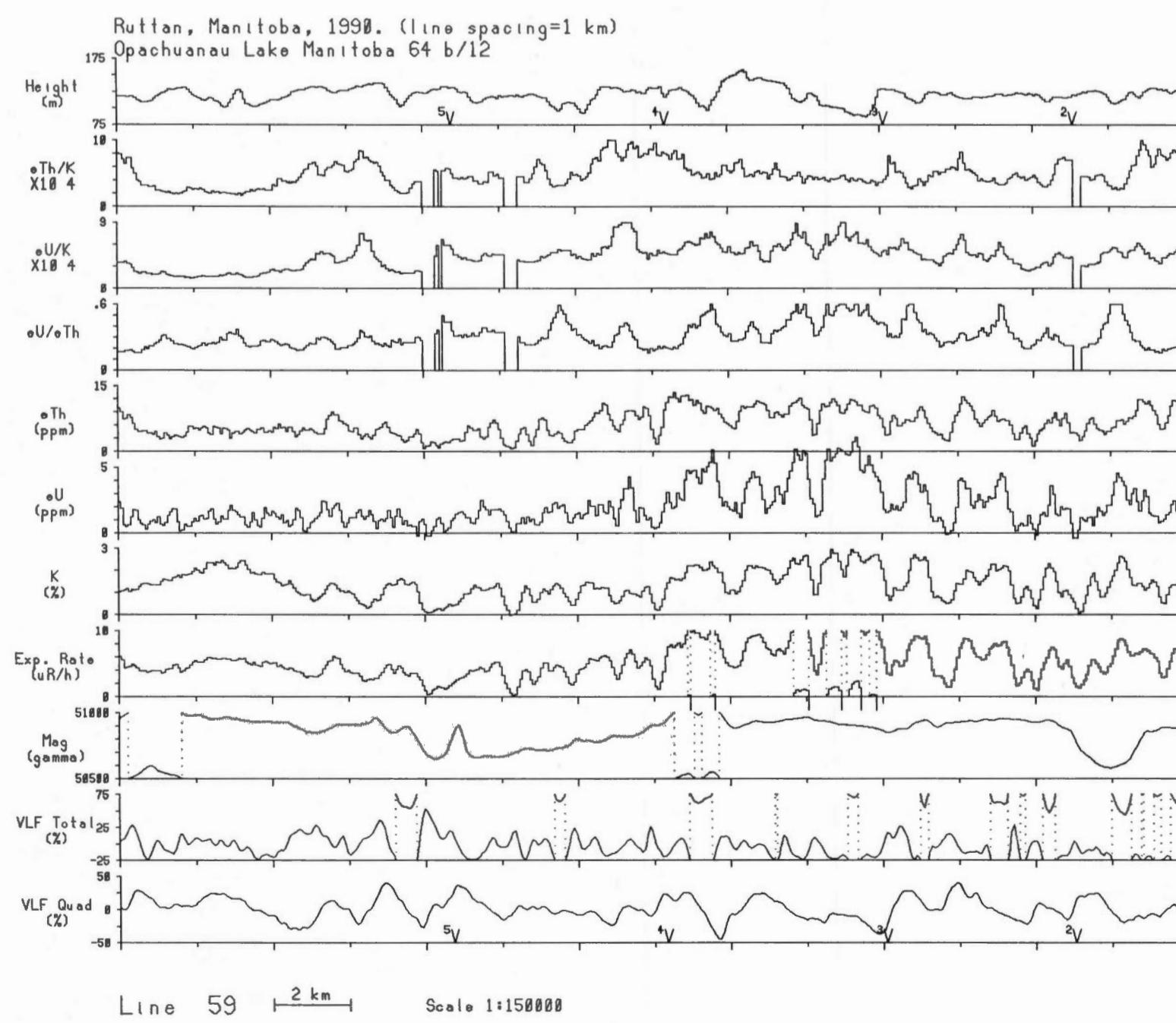
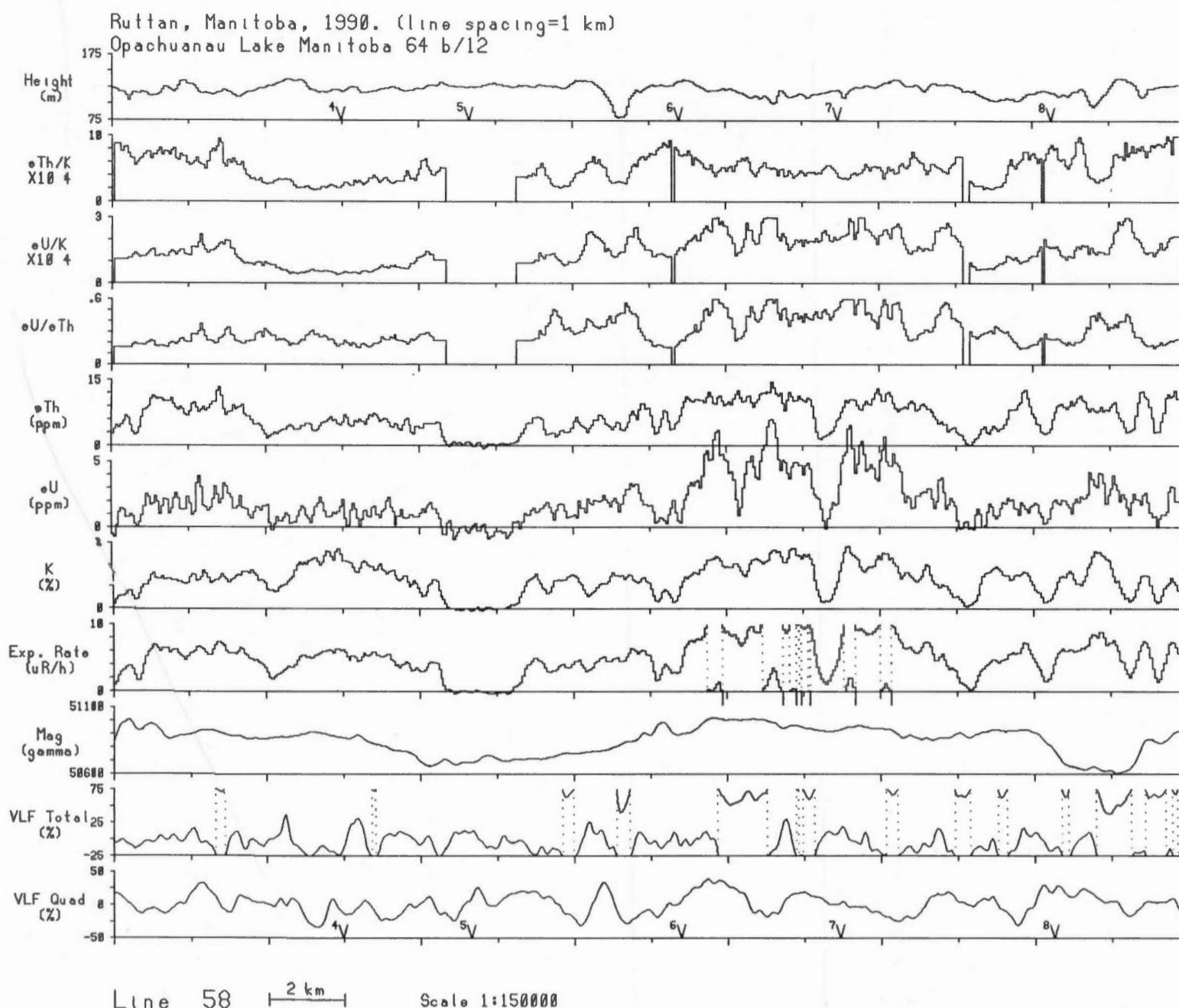


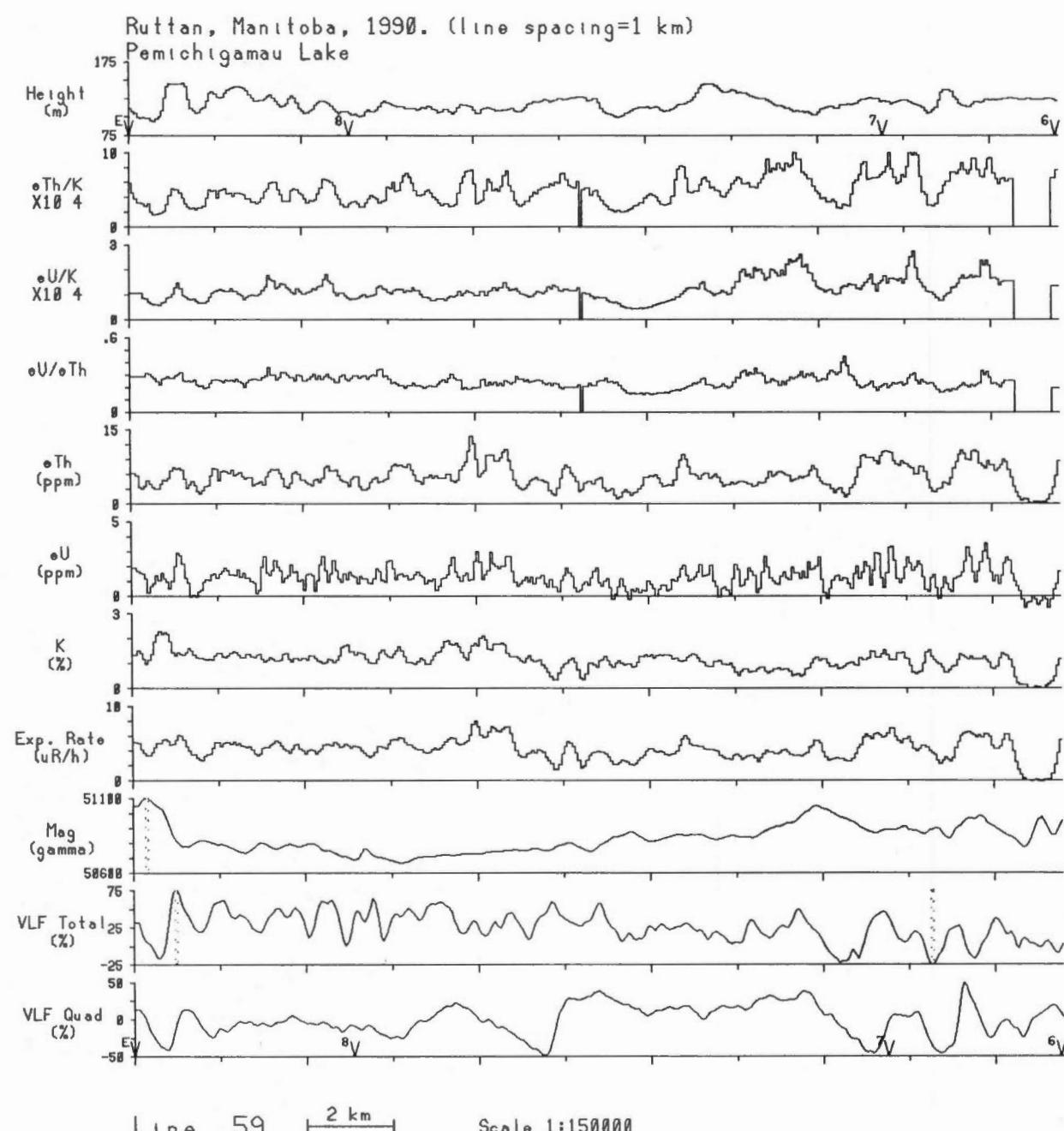
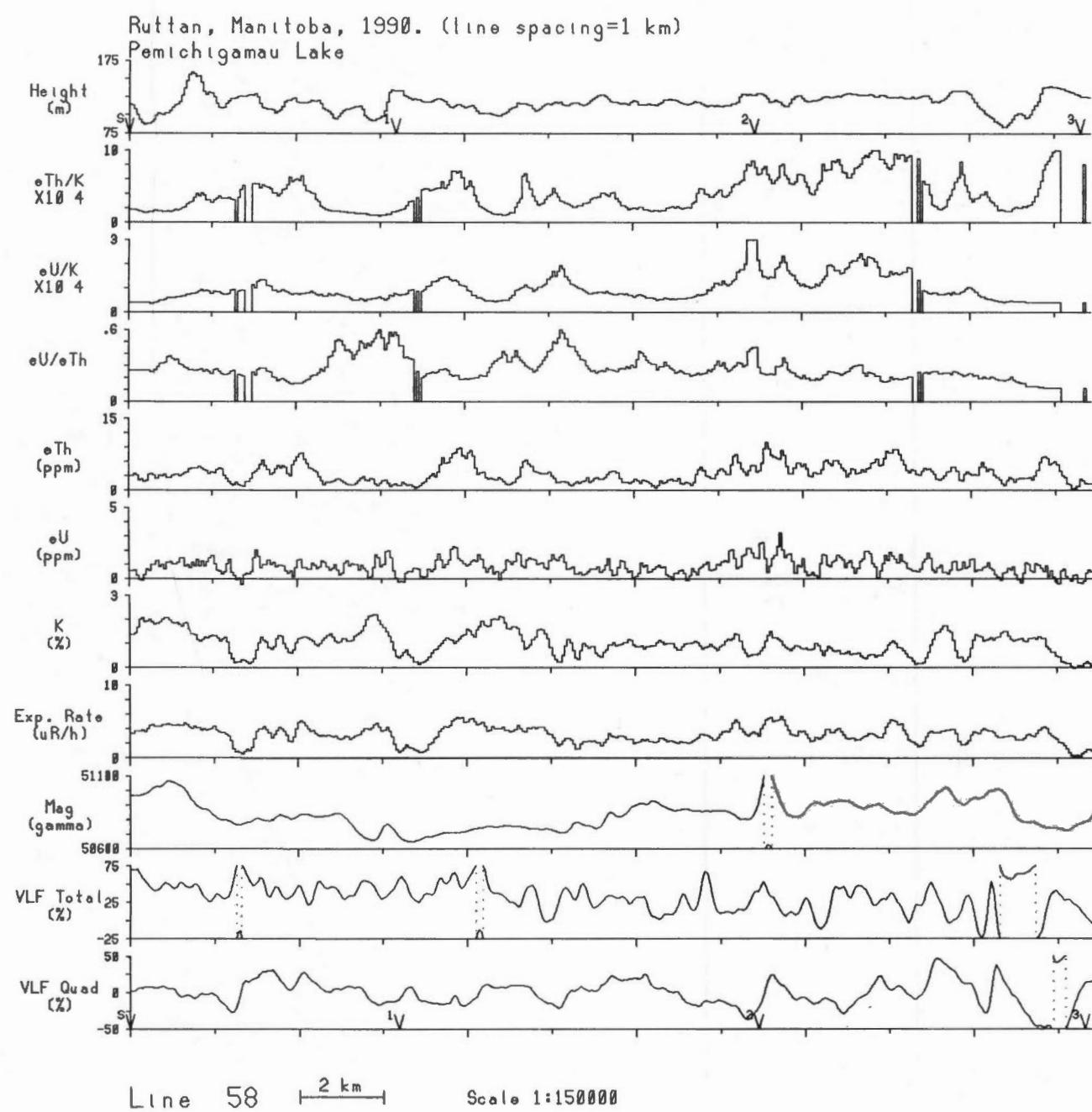


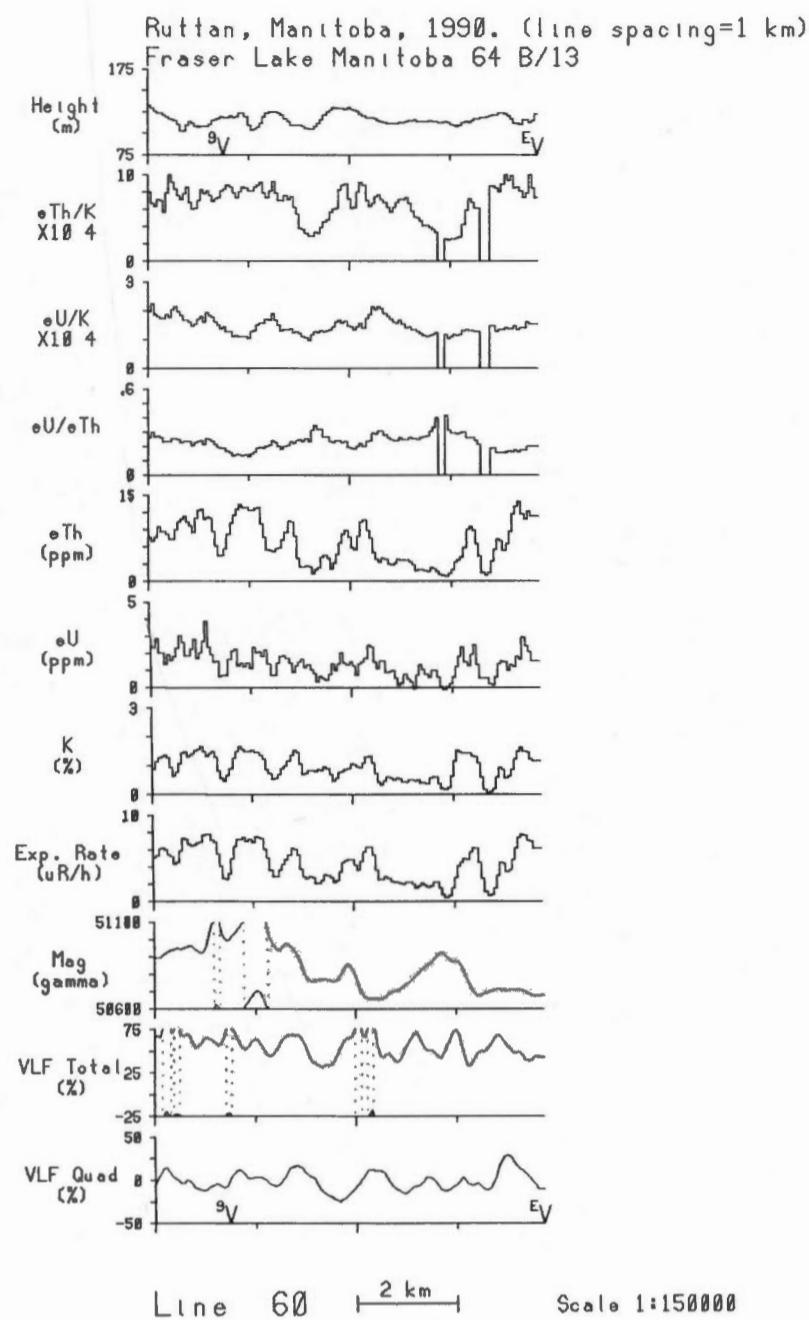




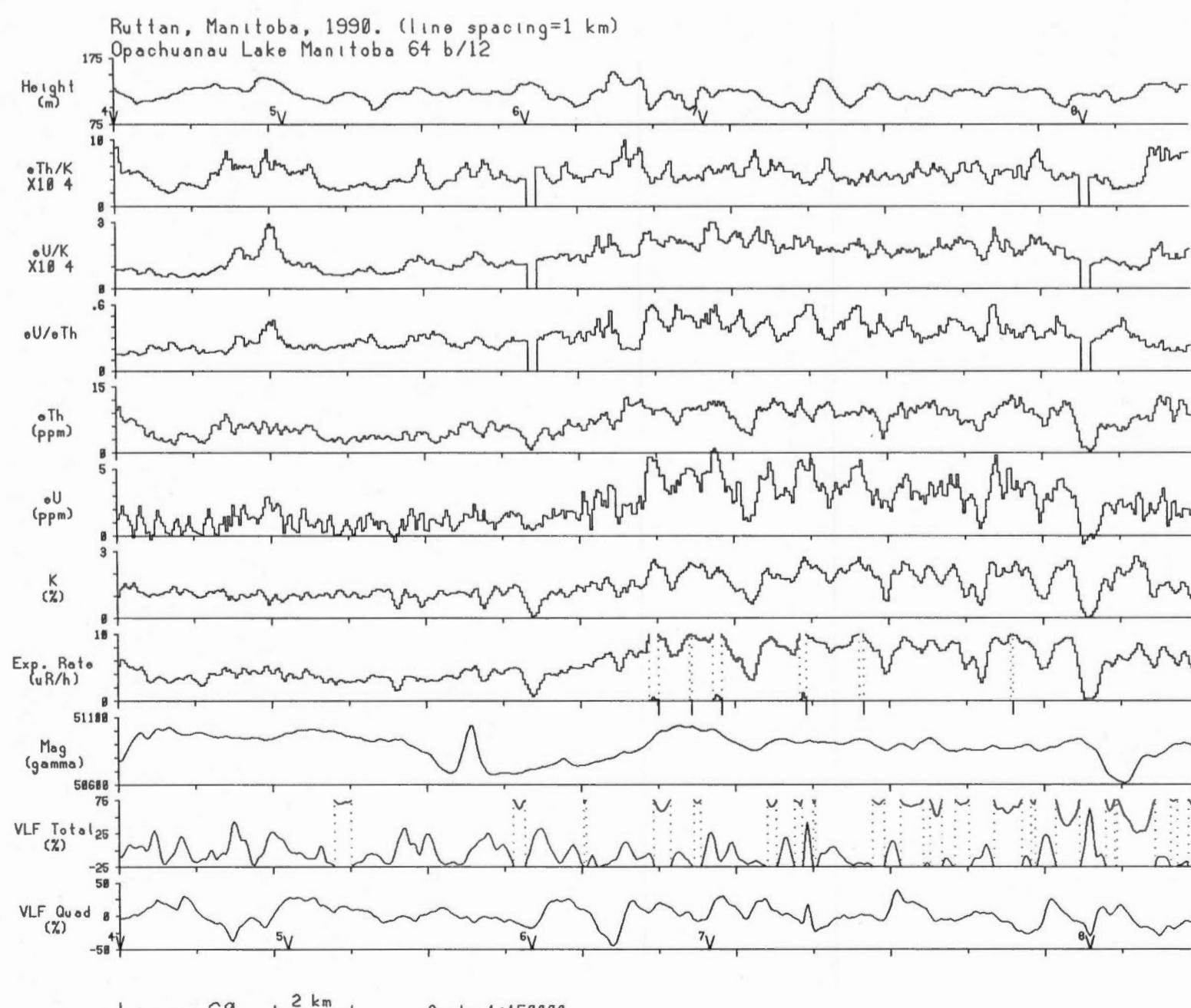




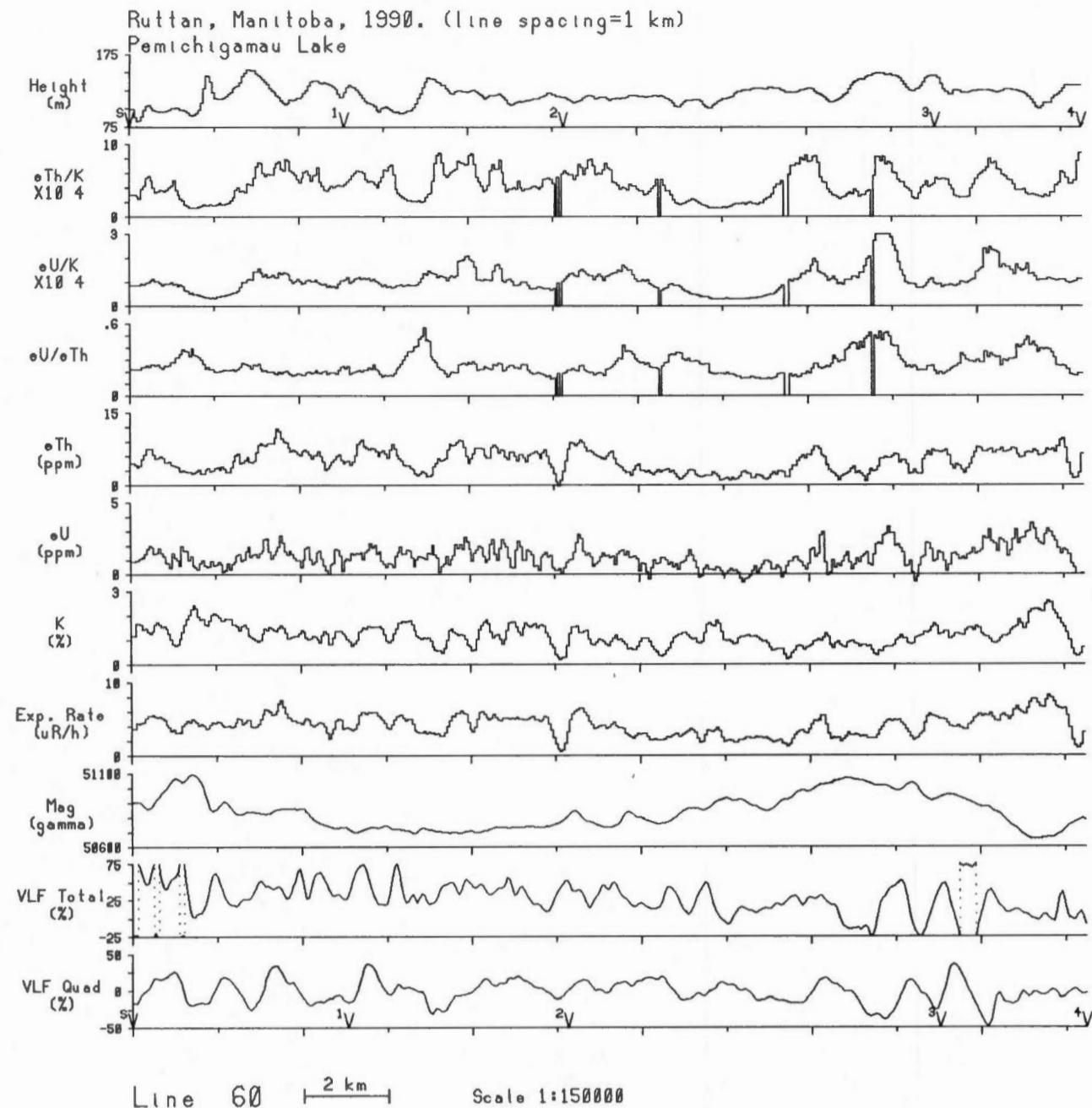




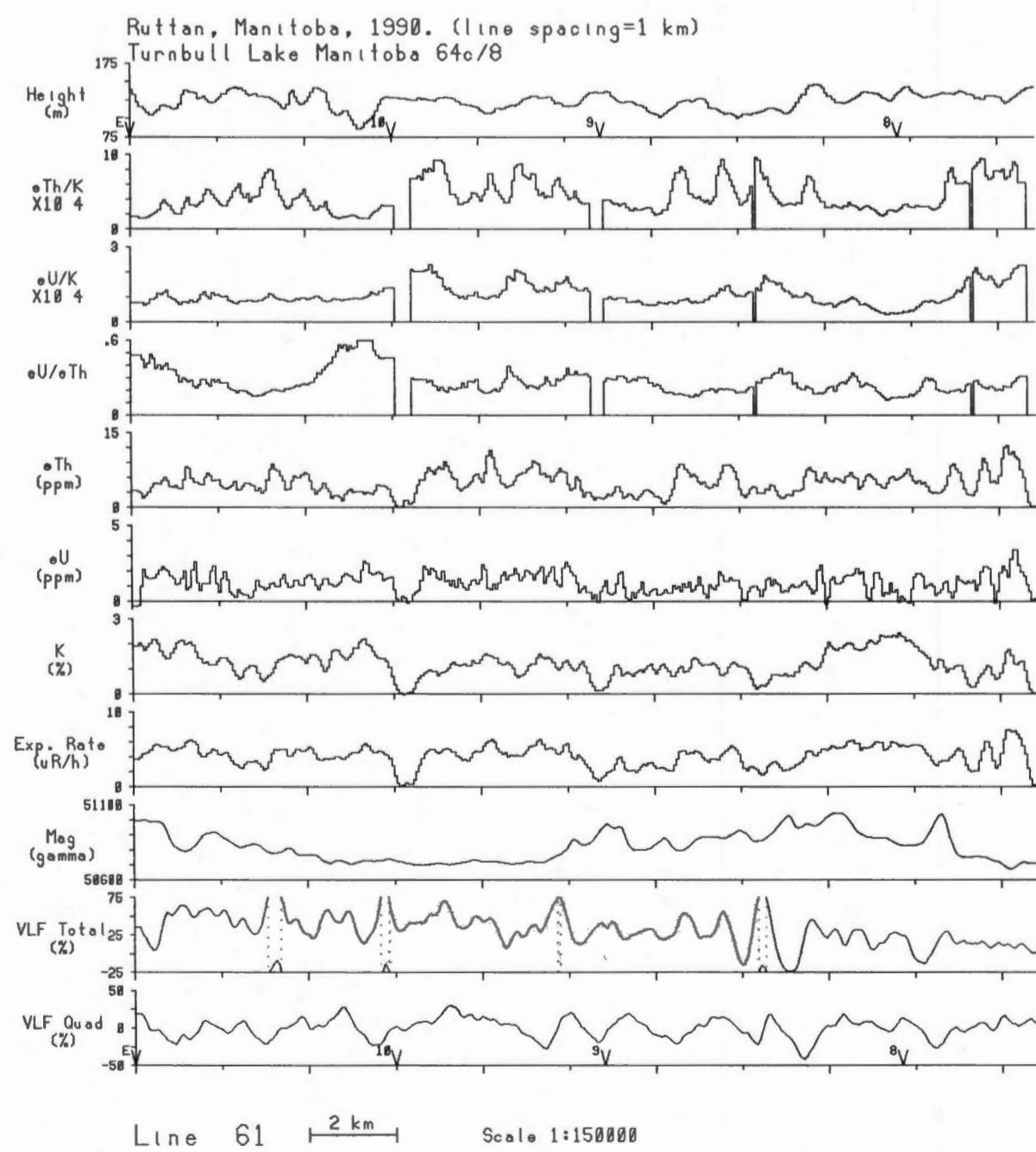
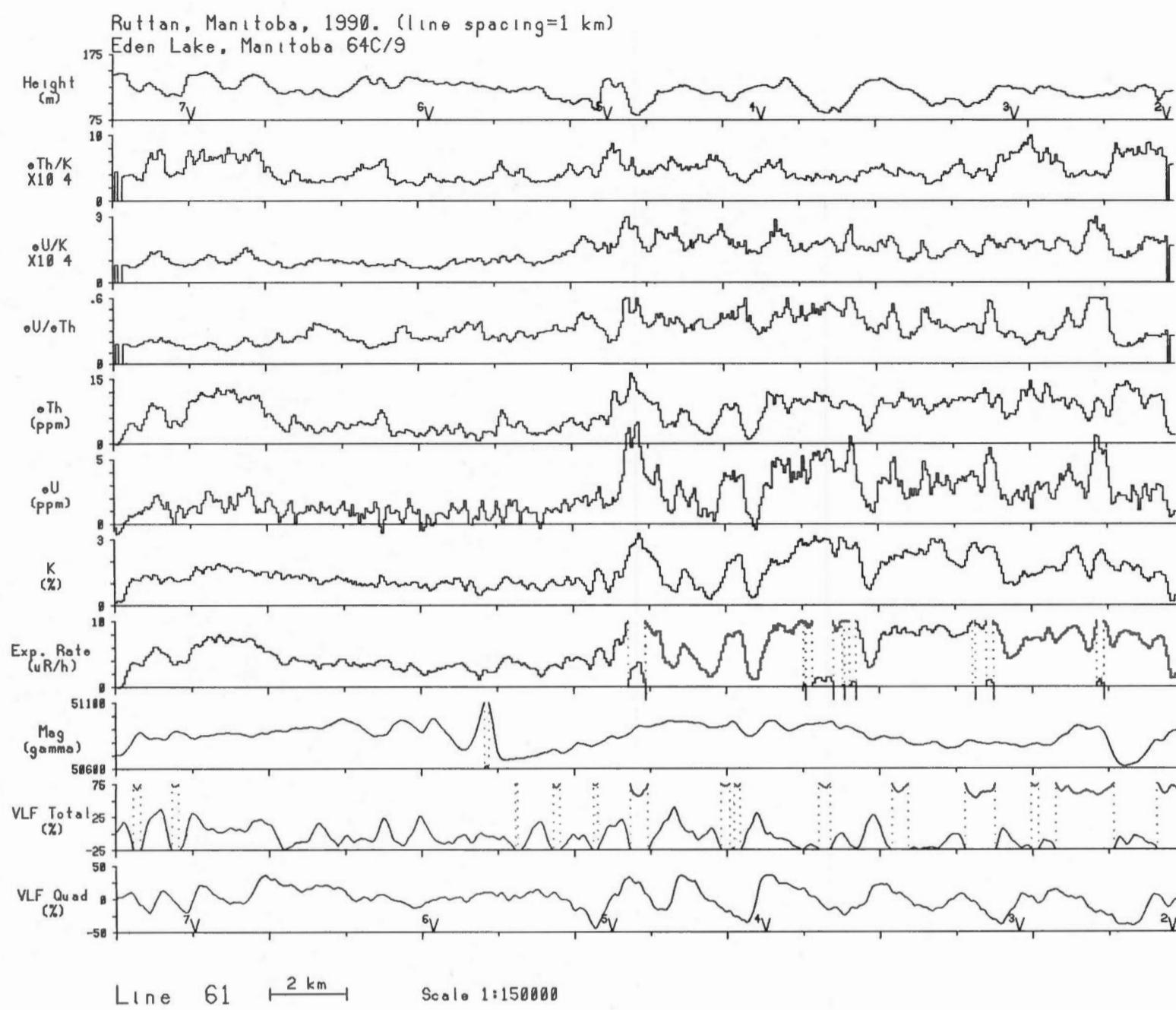
Line 60 2 km Scale 1:150000

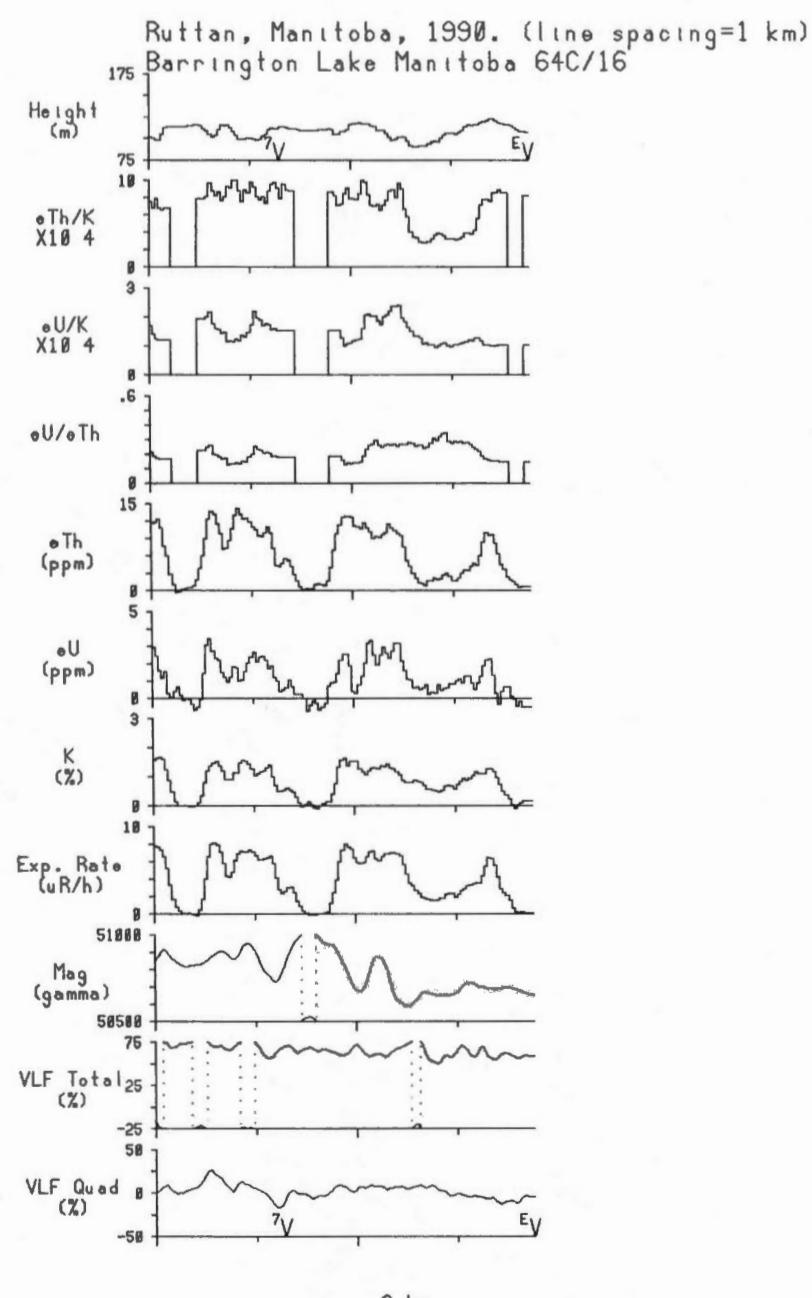
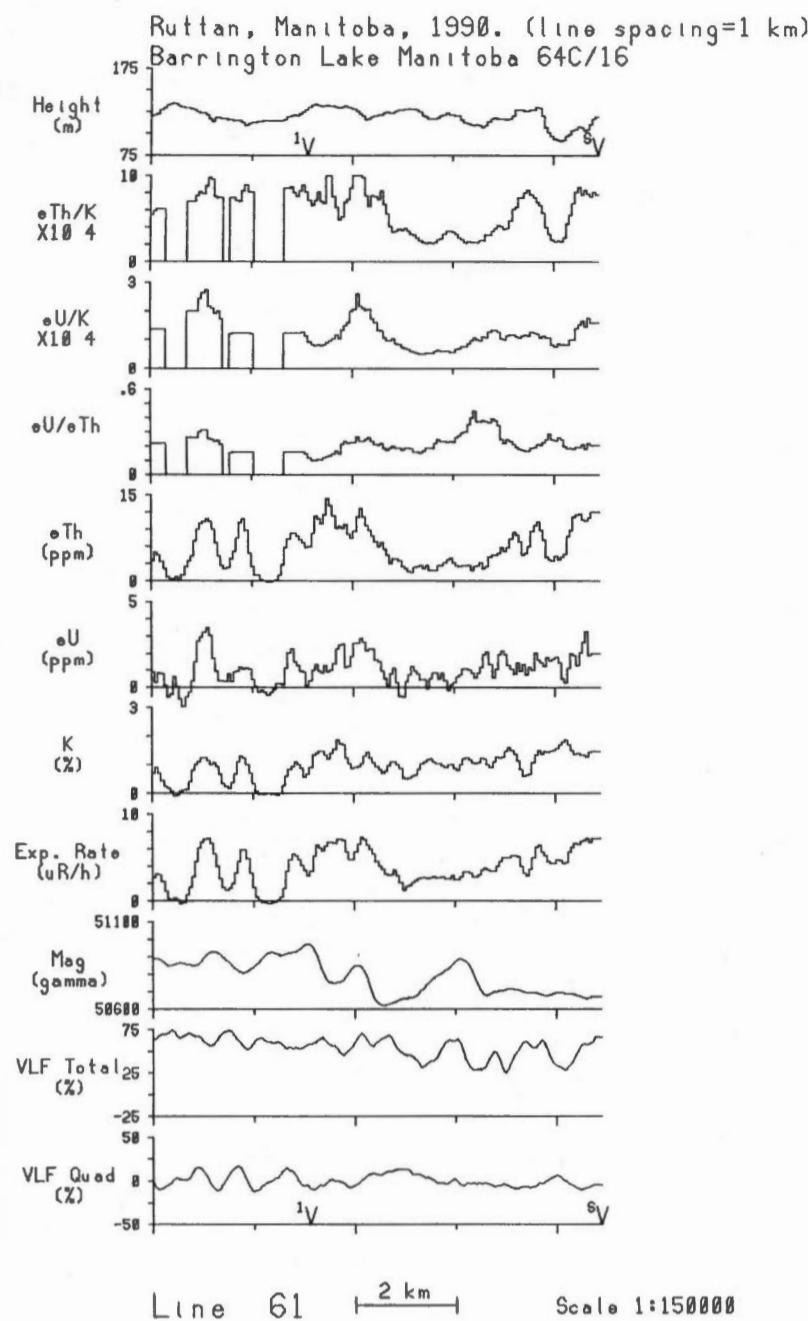


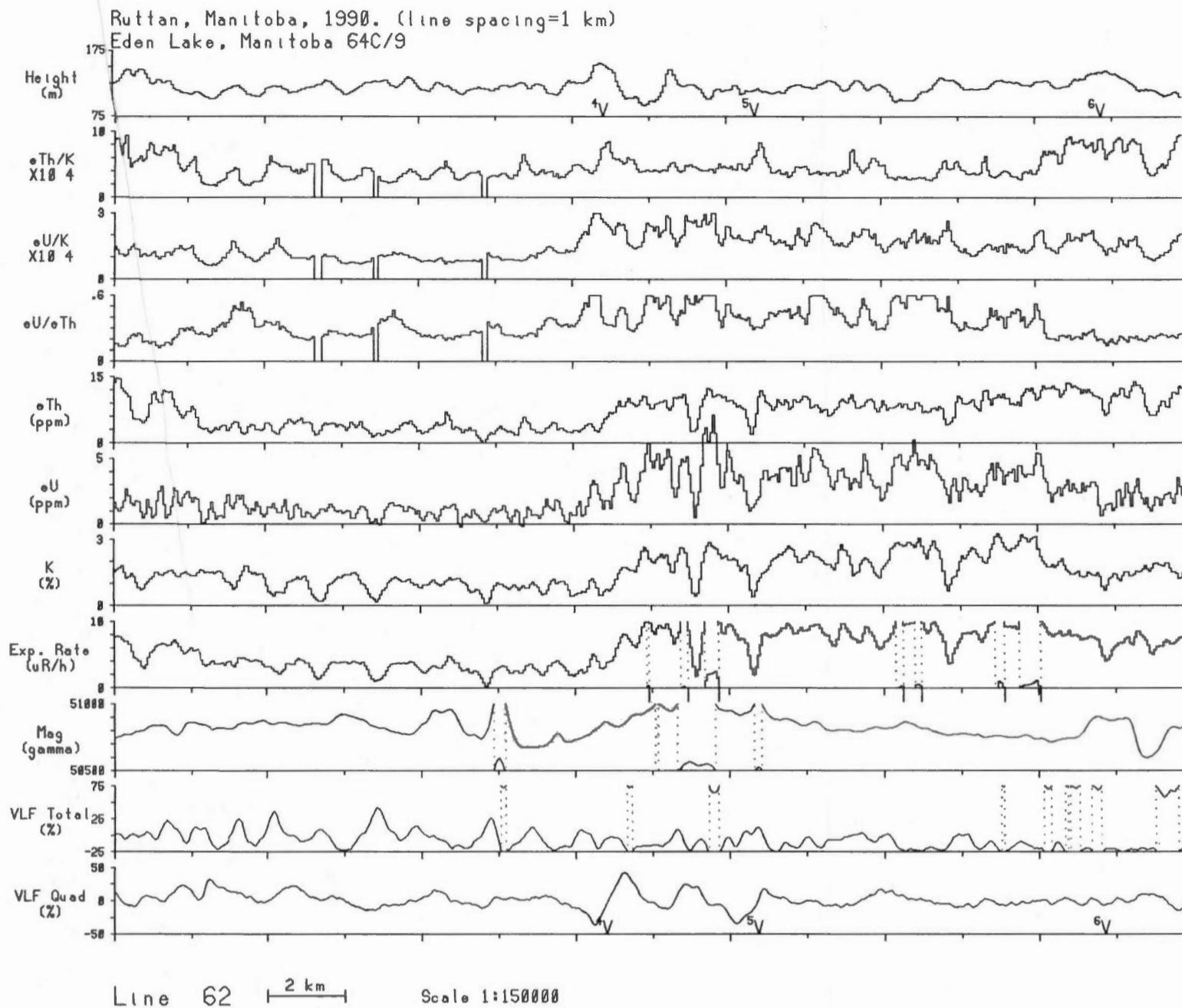
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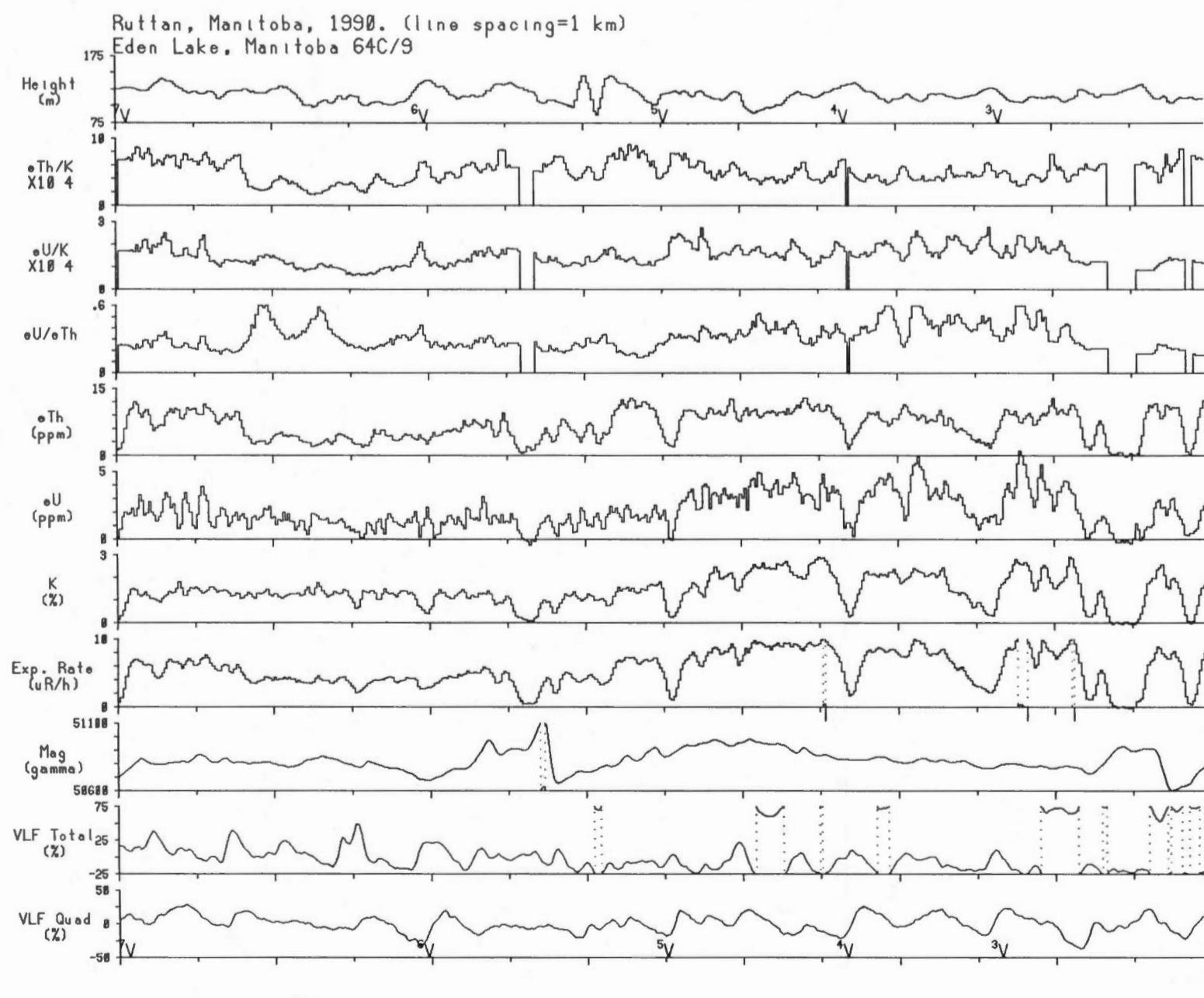
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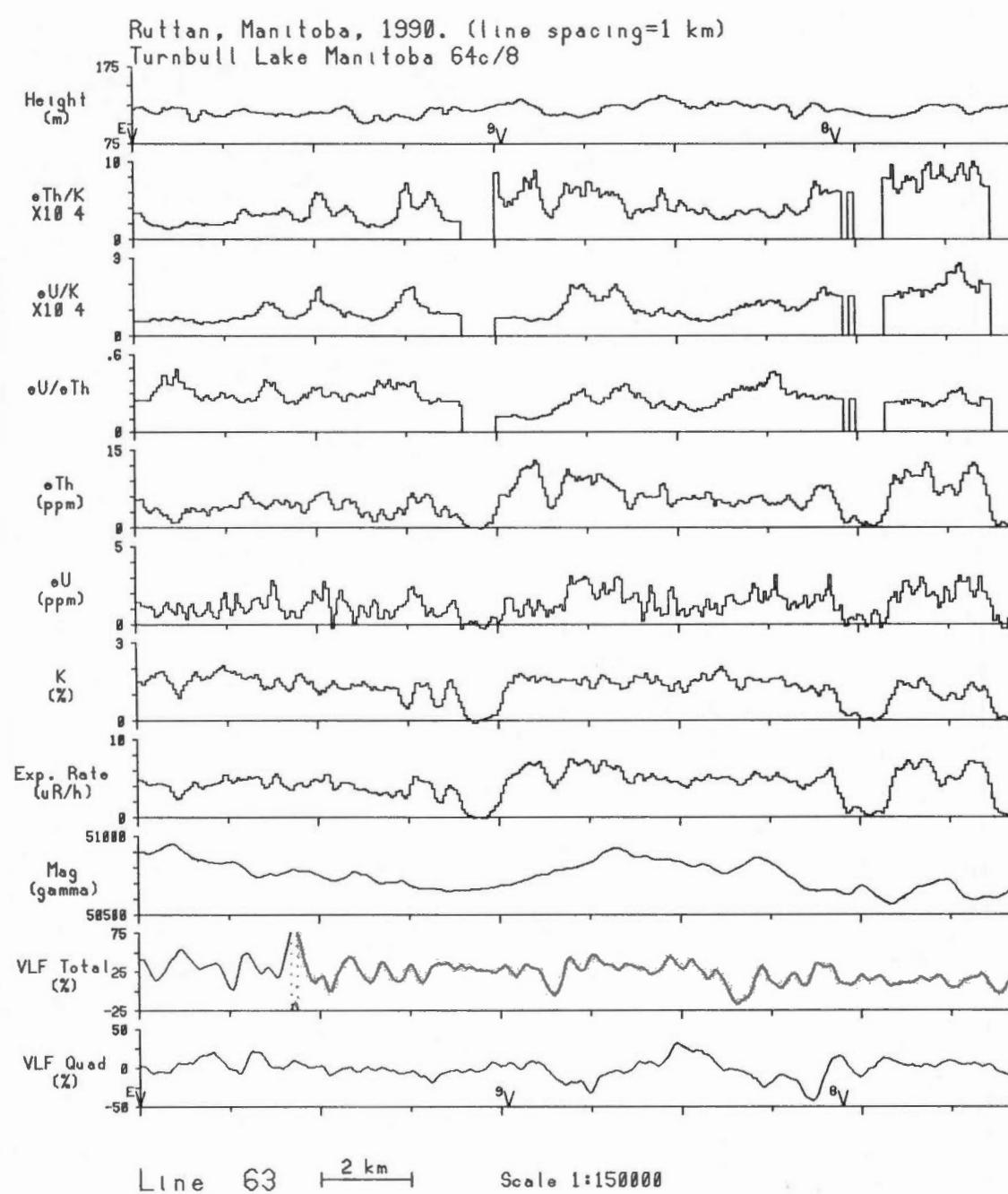
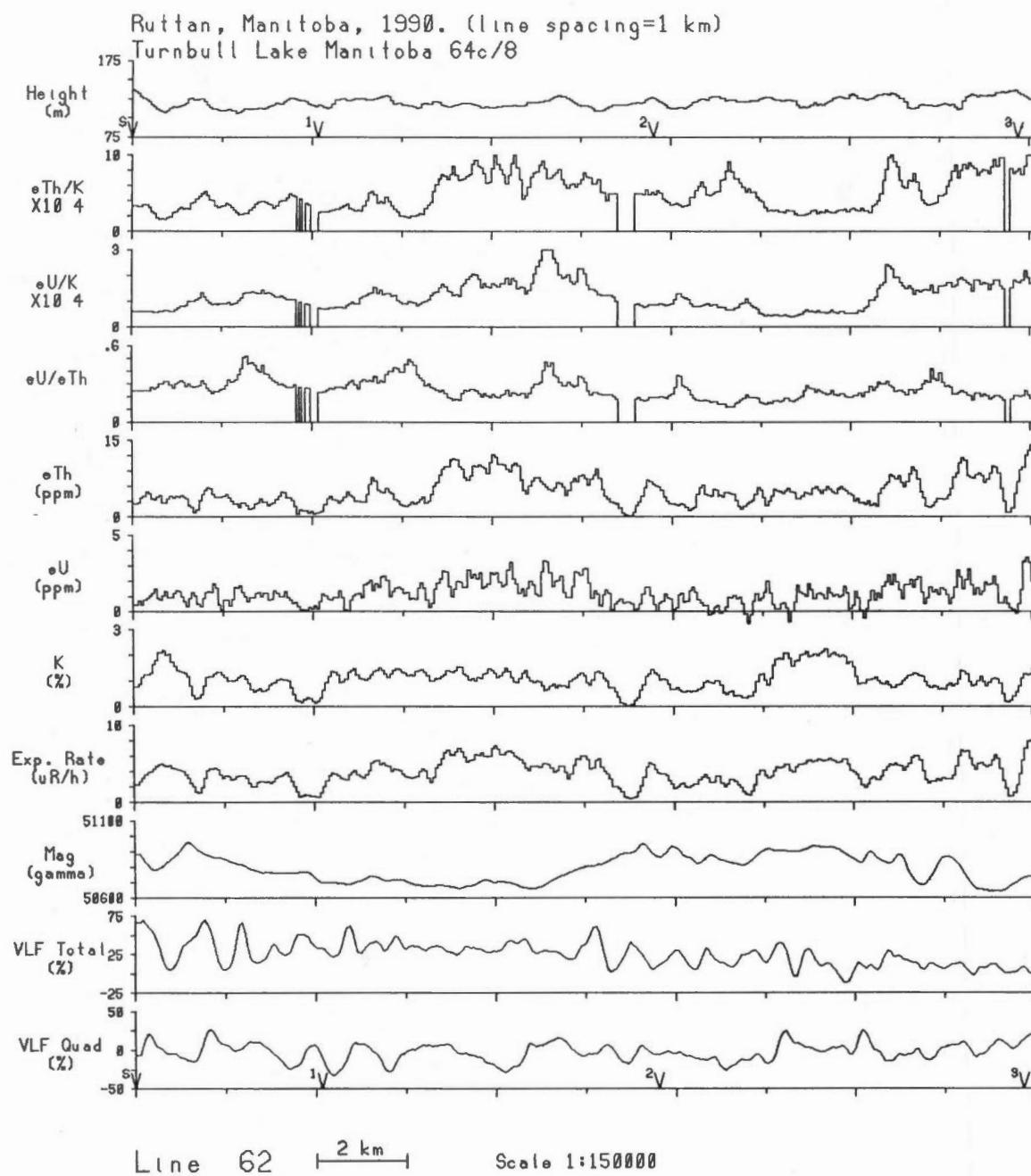


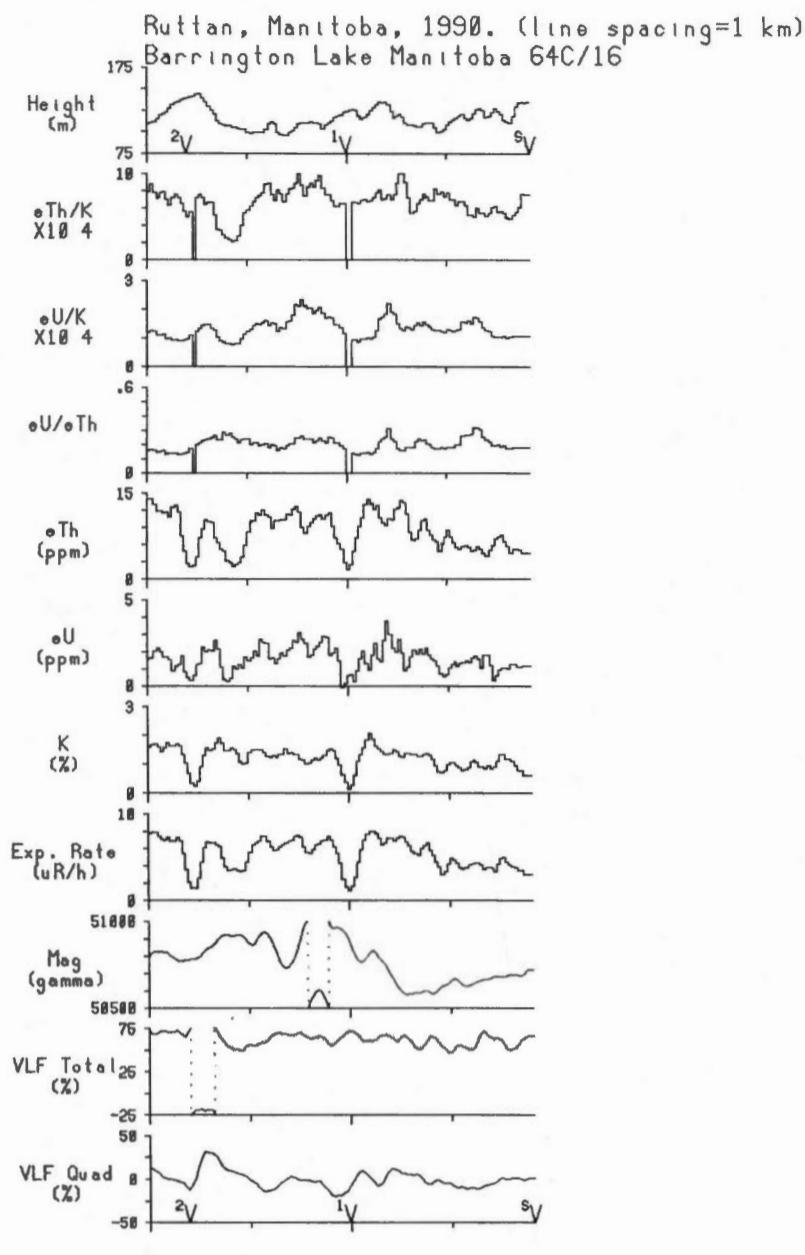


Line 62 2 km Scale 1:150000

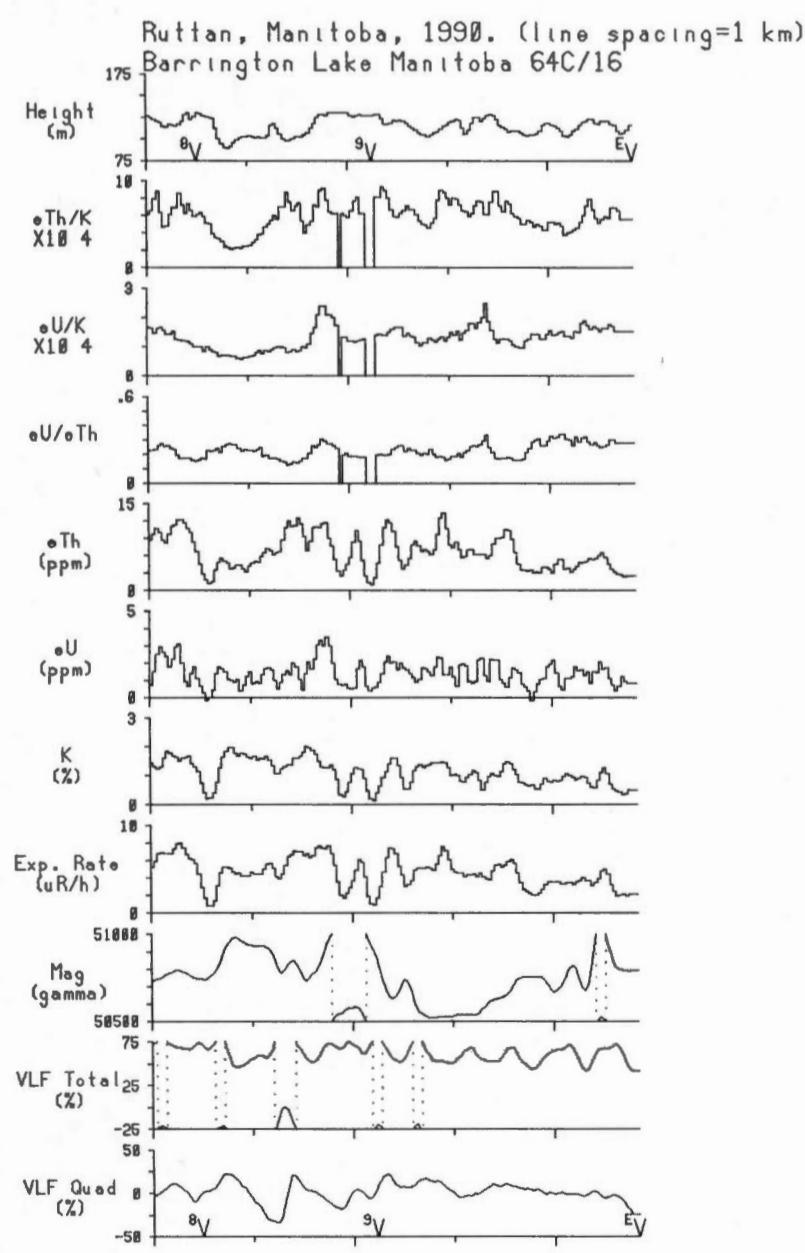


Line 63 2 km Scale 1:150000

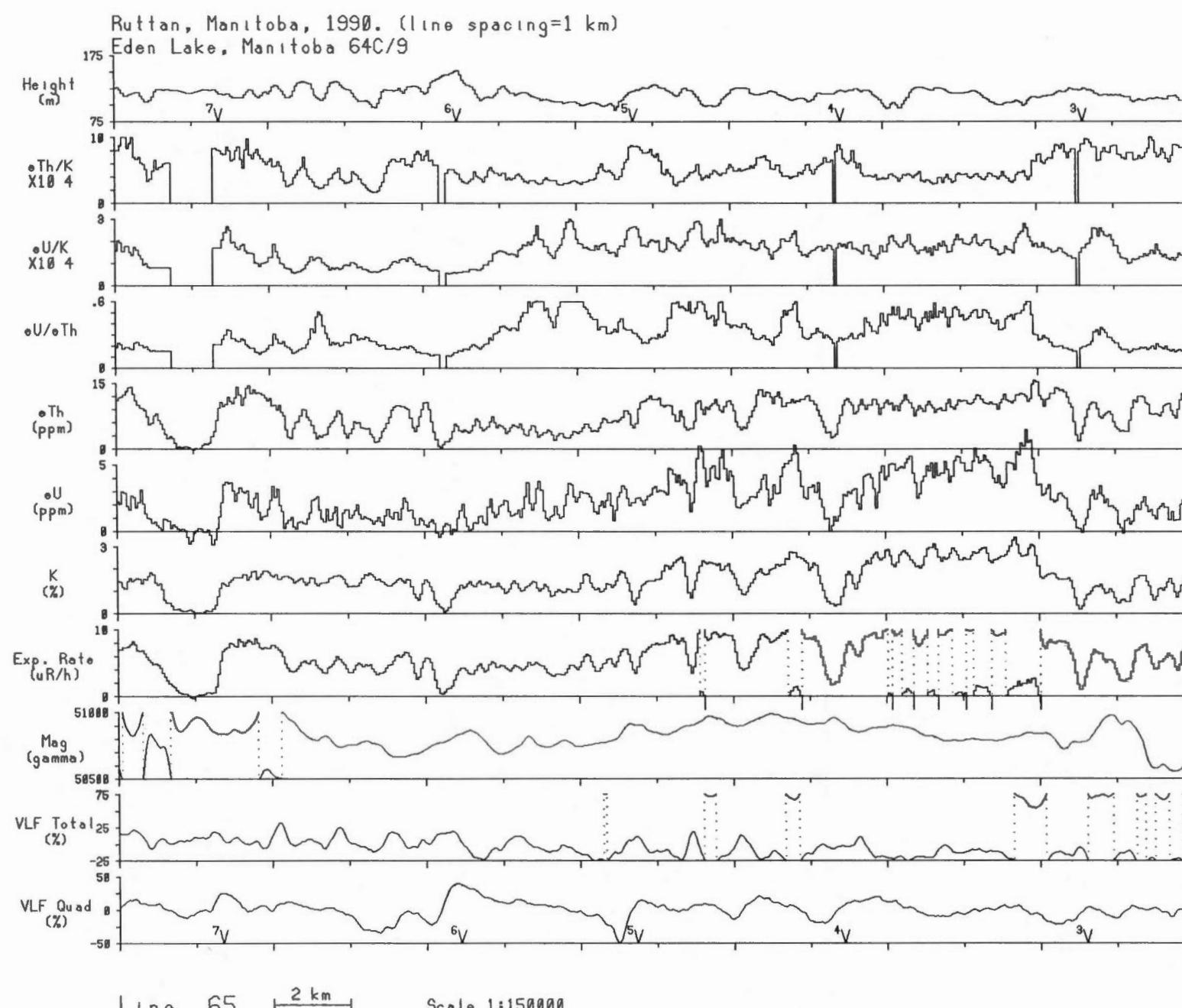
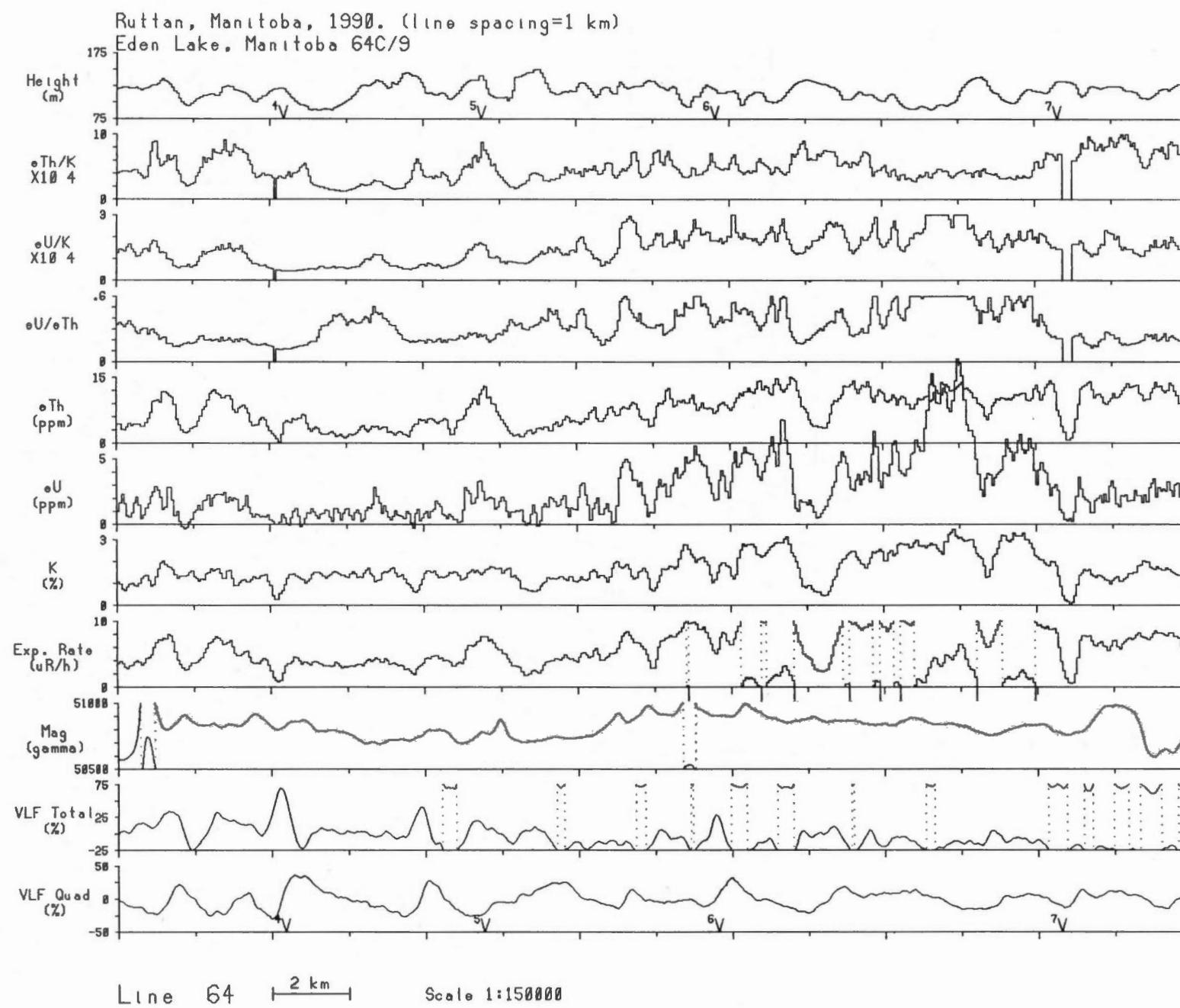


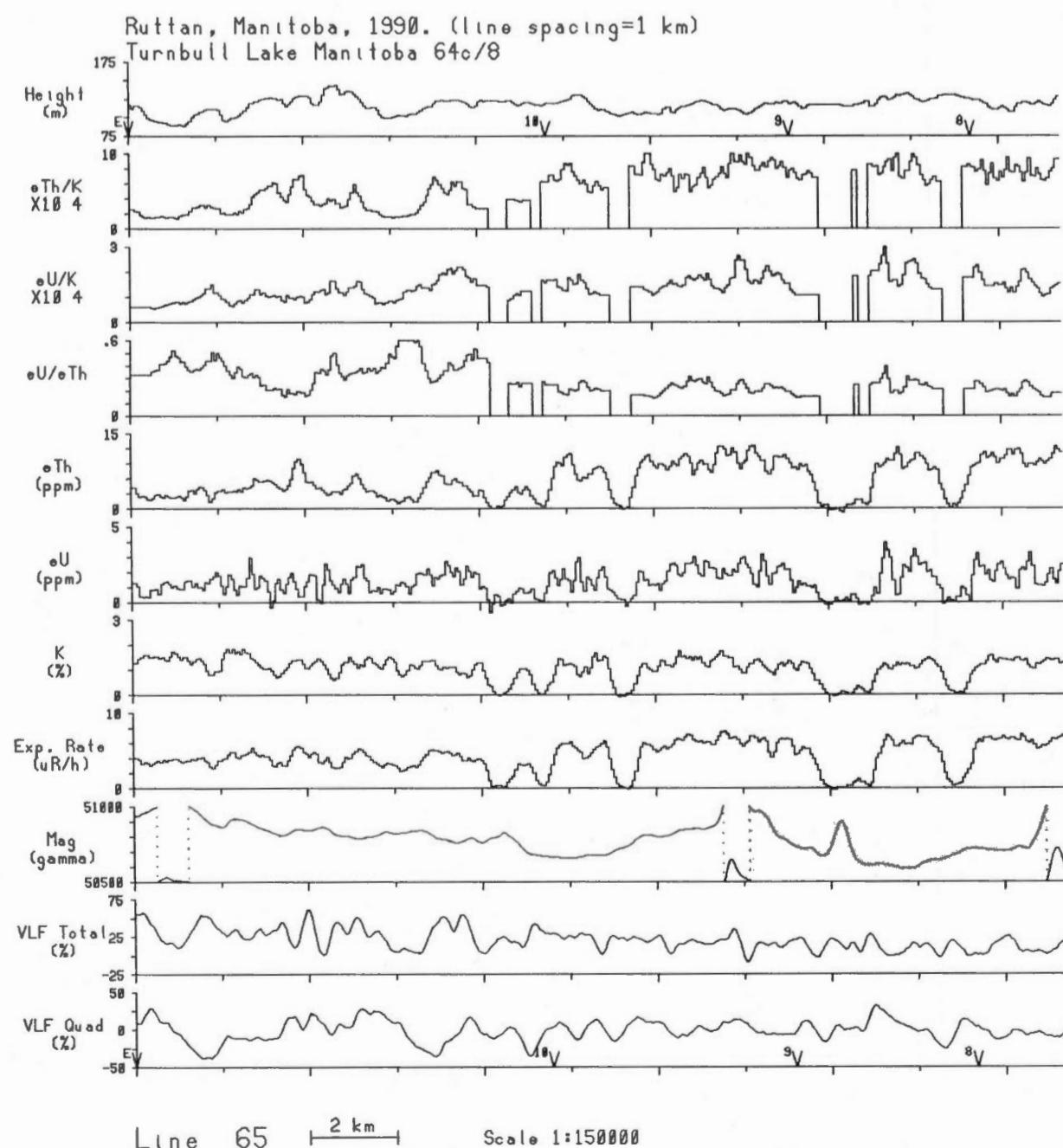
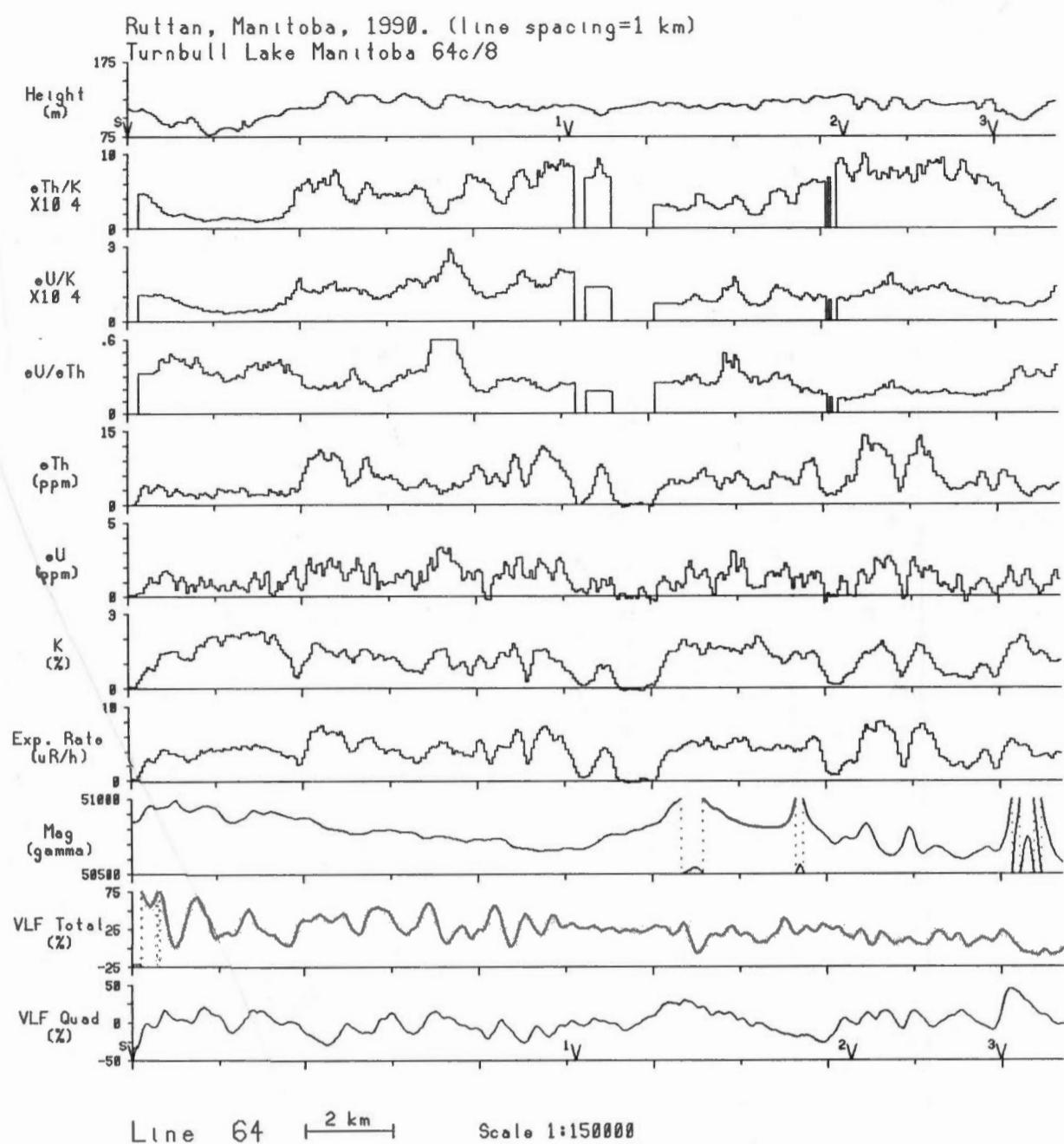


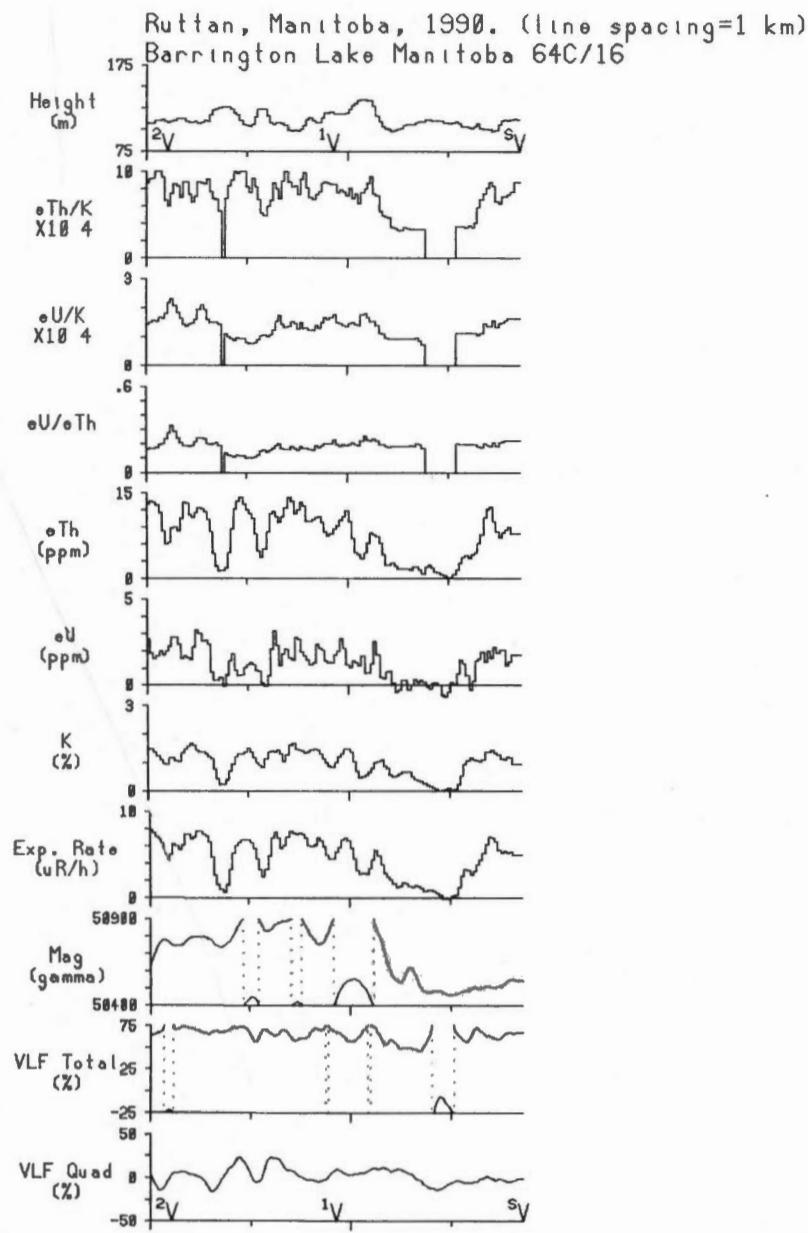
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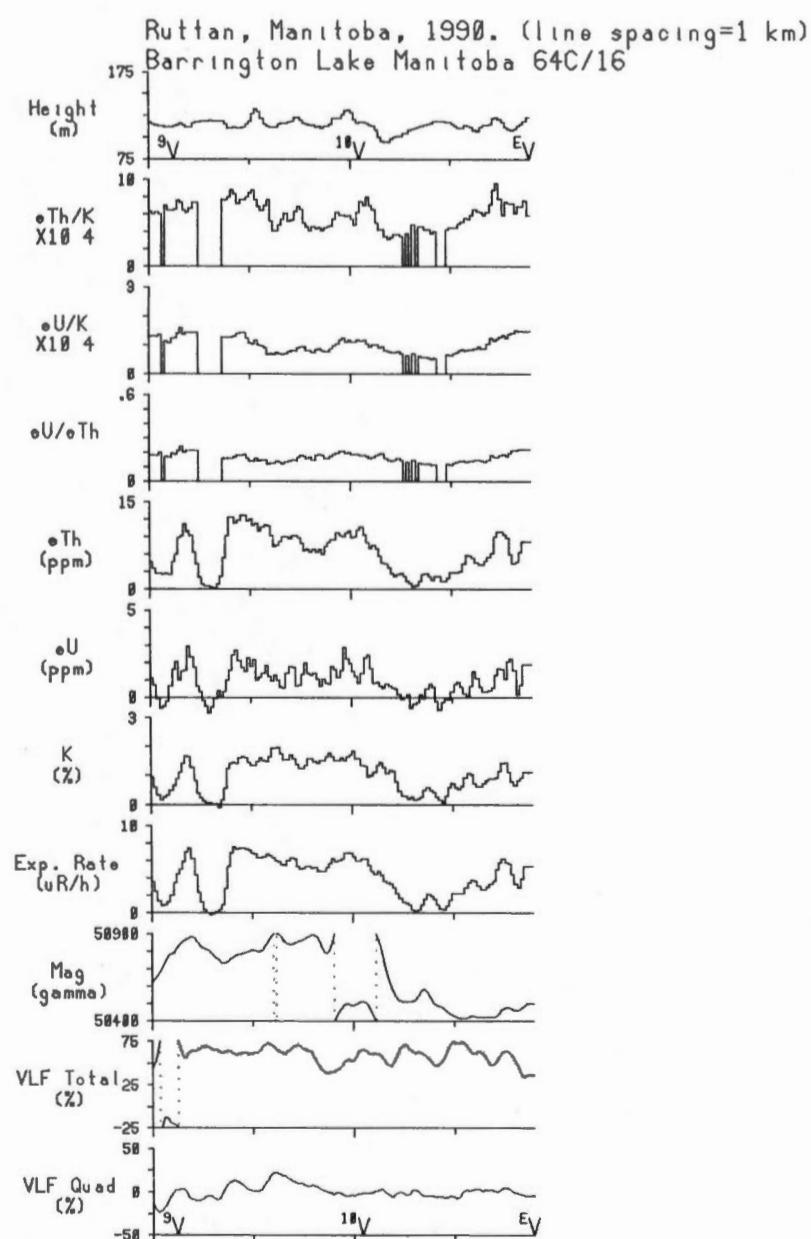
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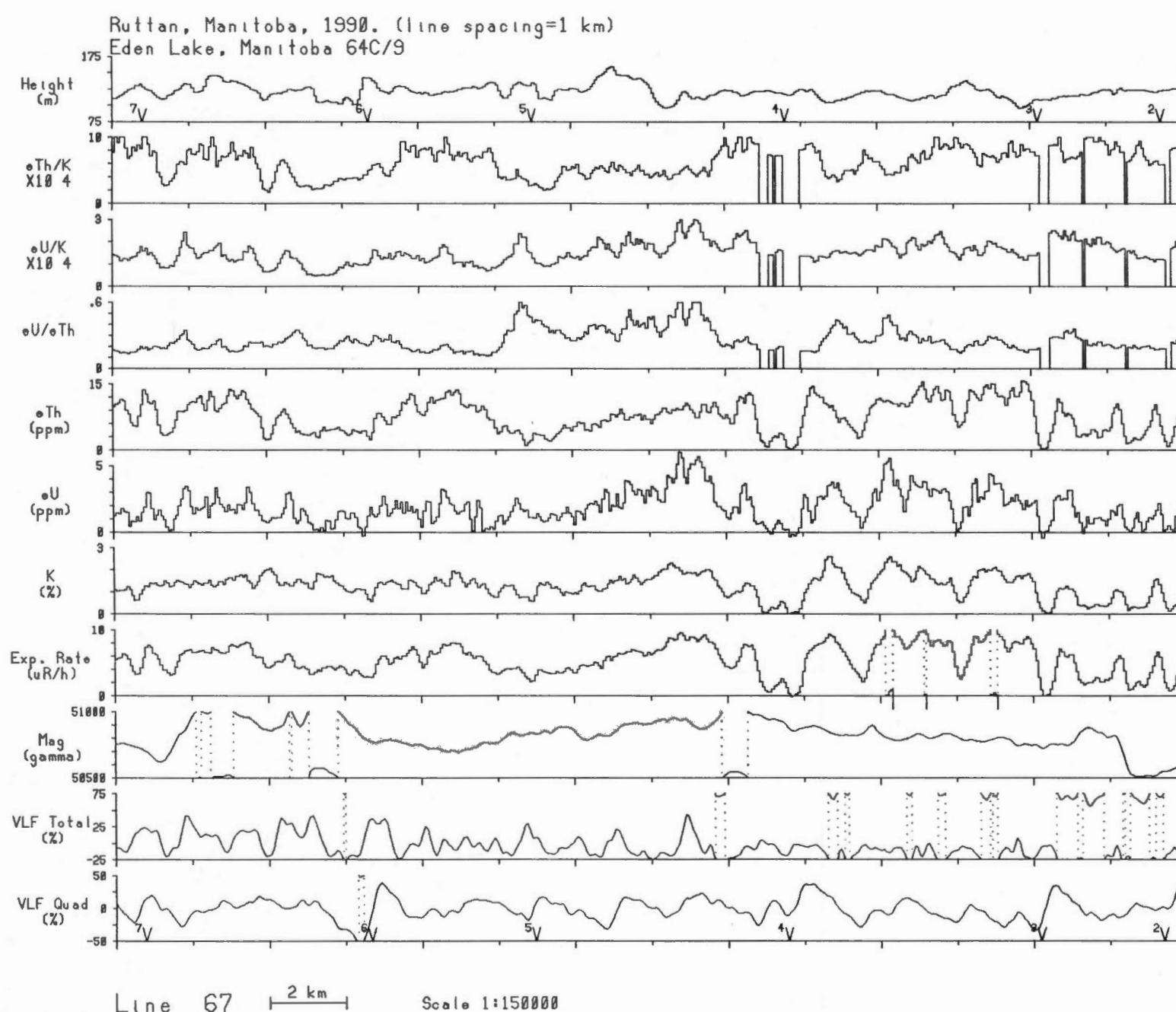
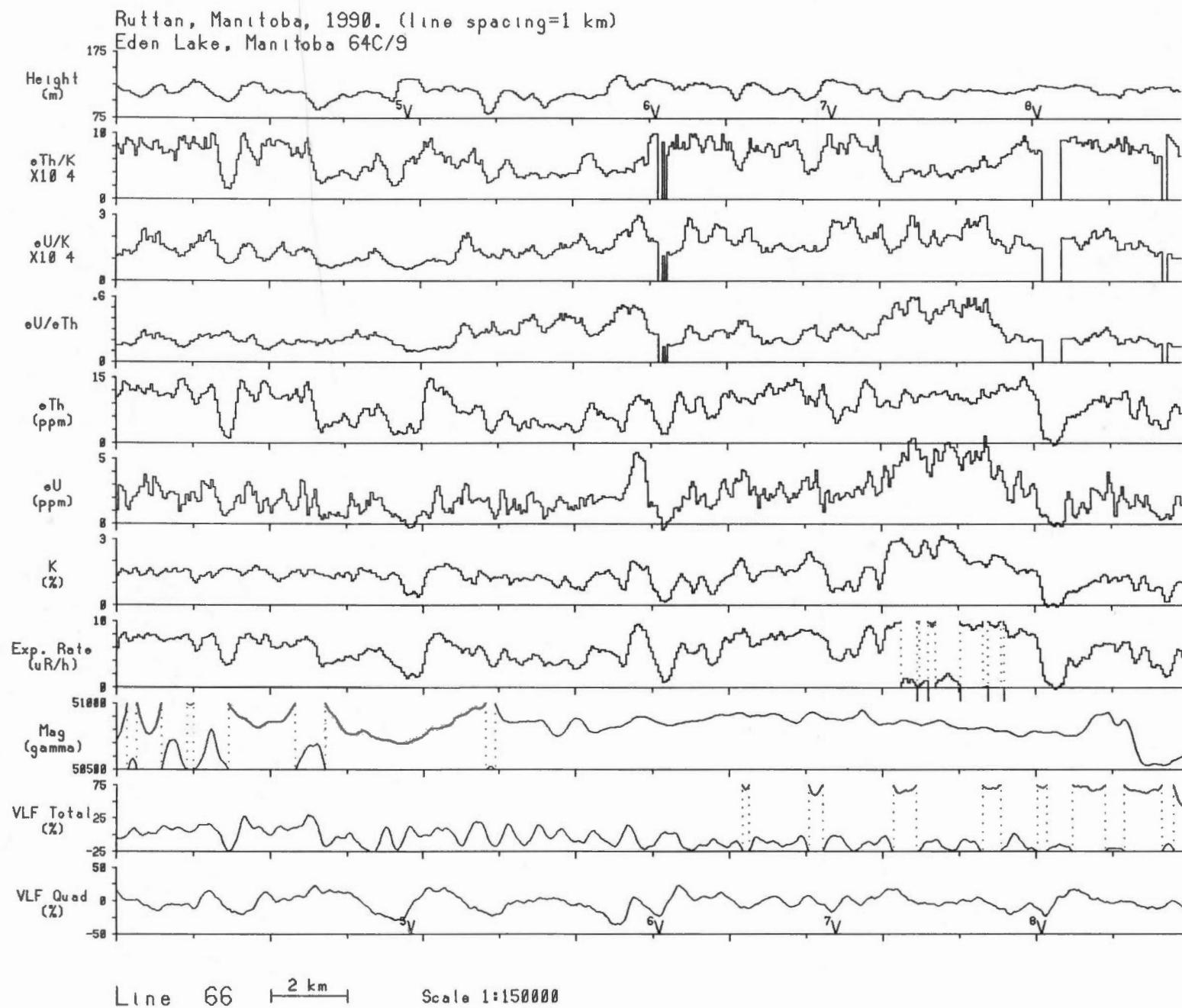


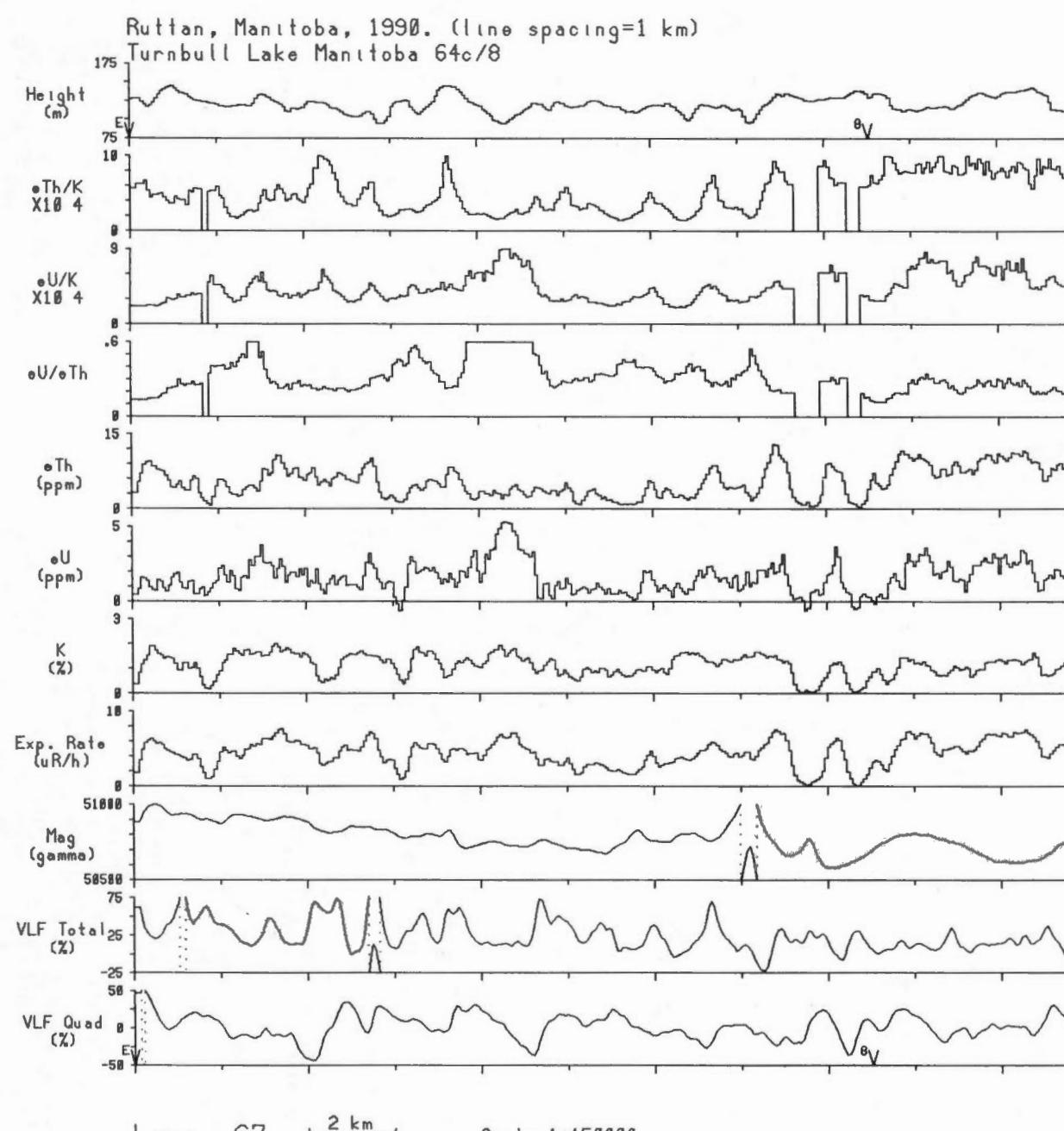
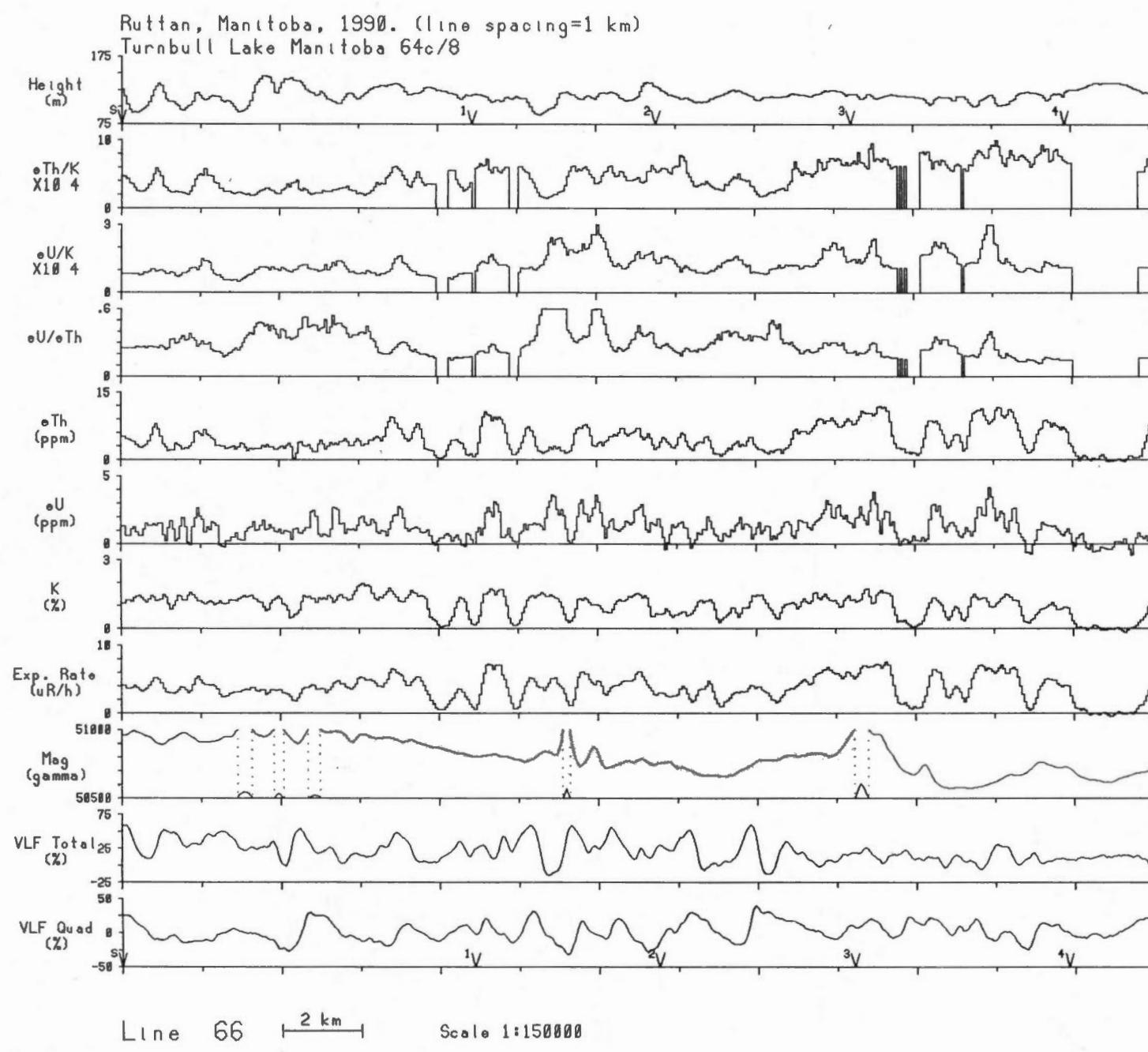


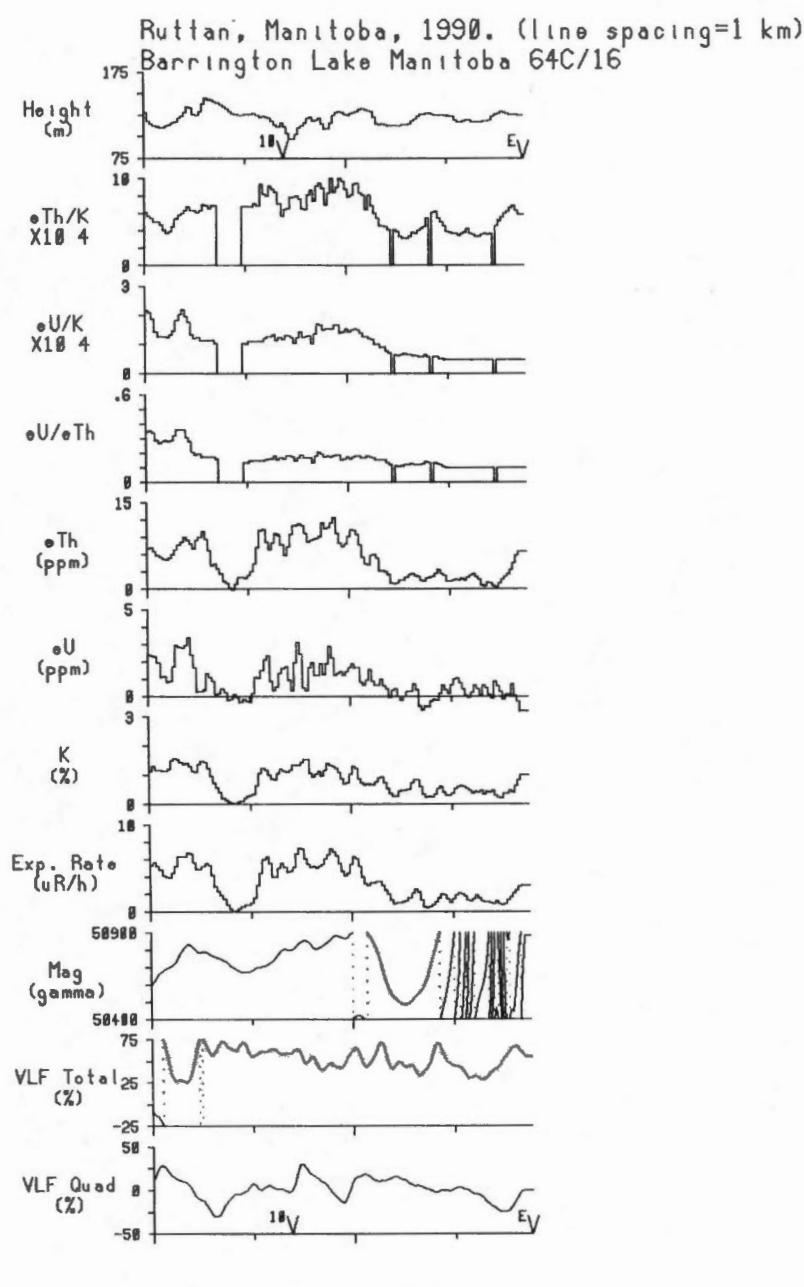
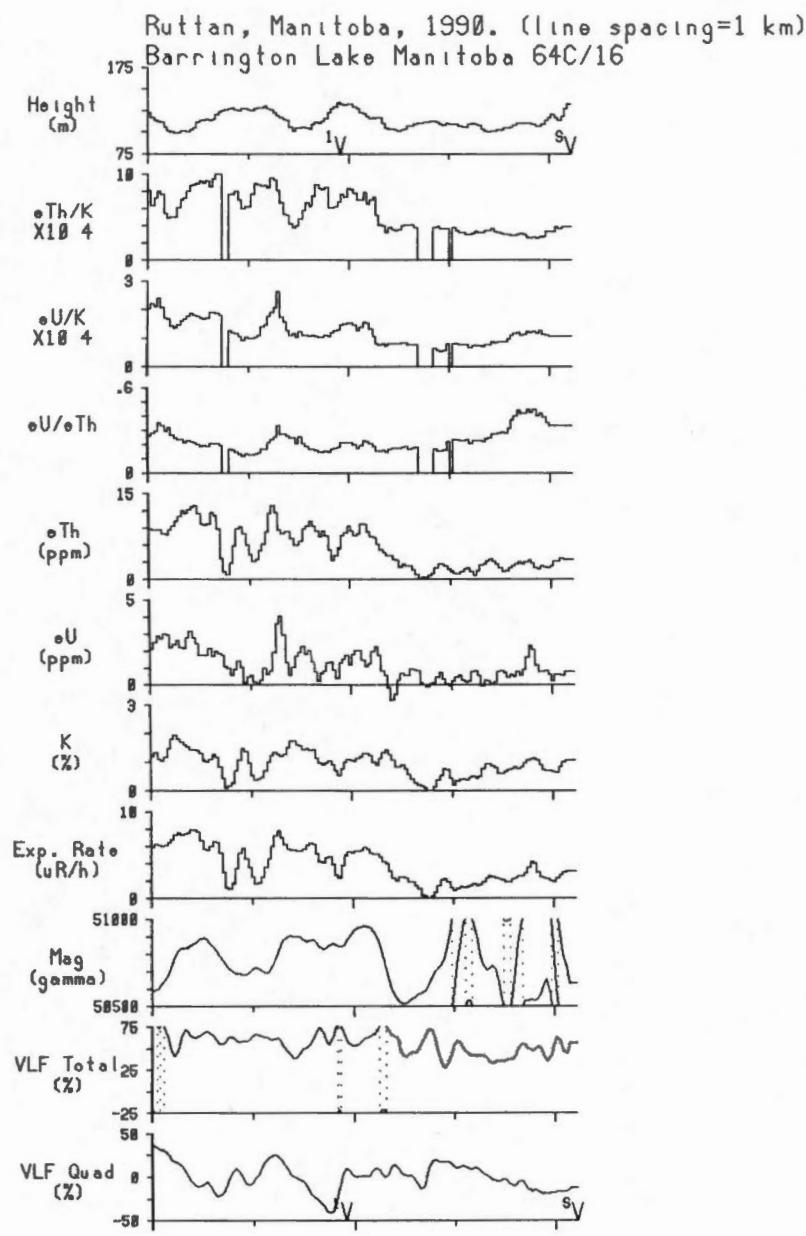
Line 65 2 km Scale 1:150000

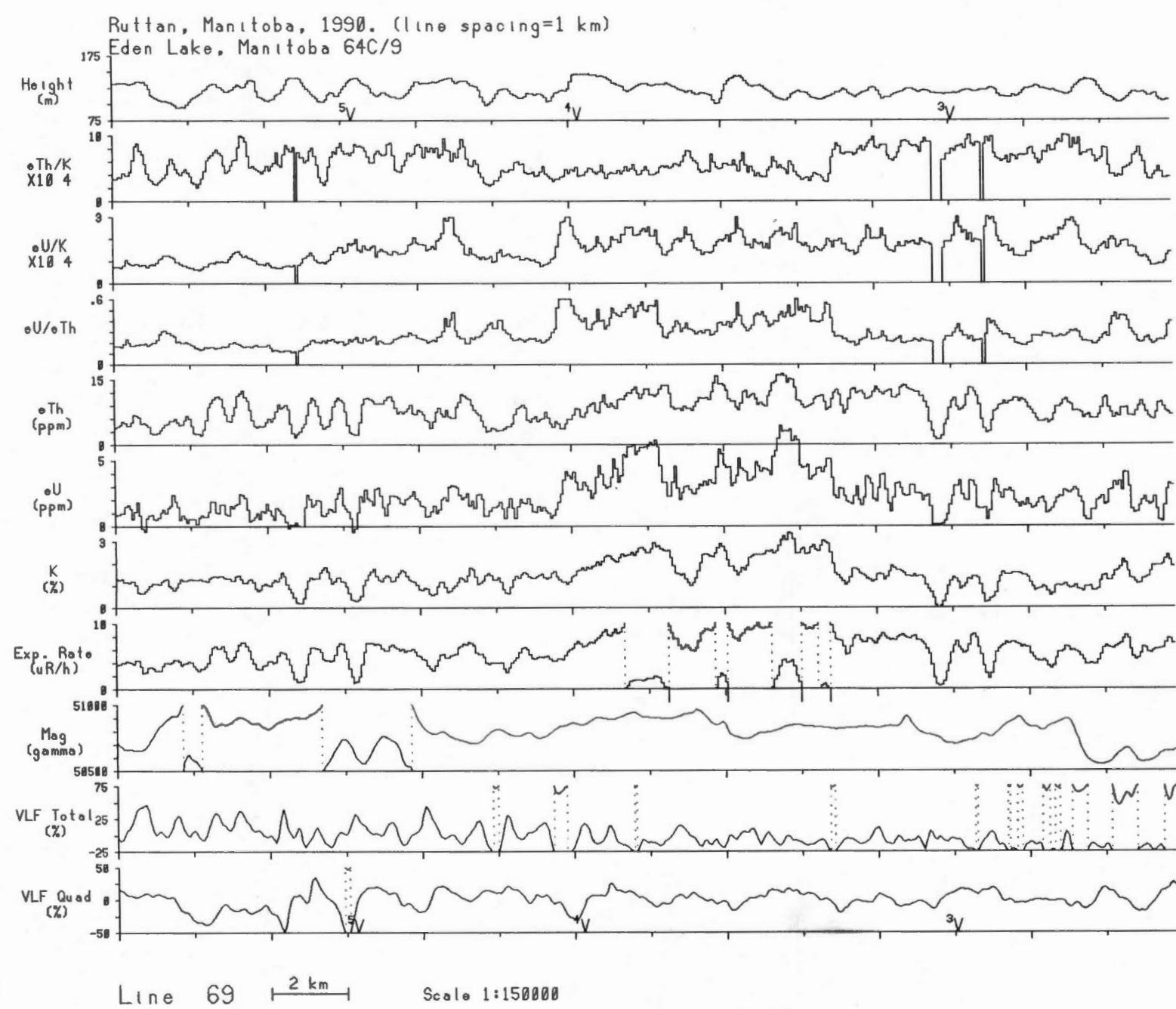
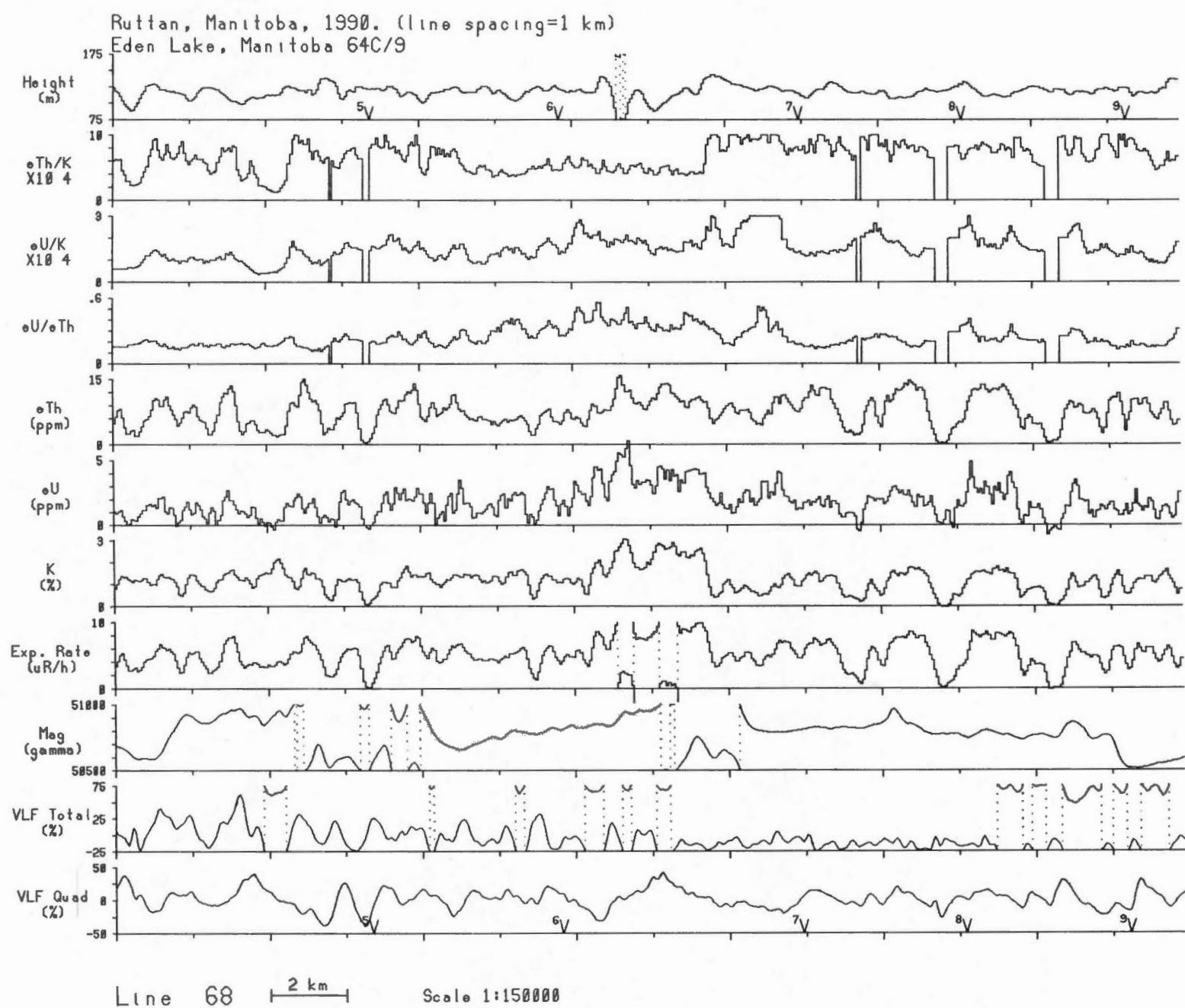


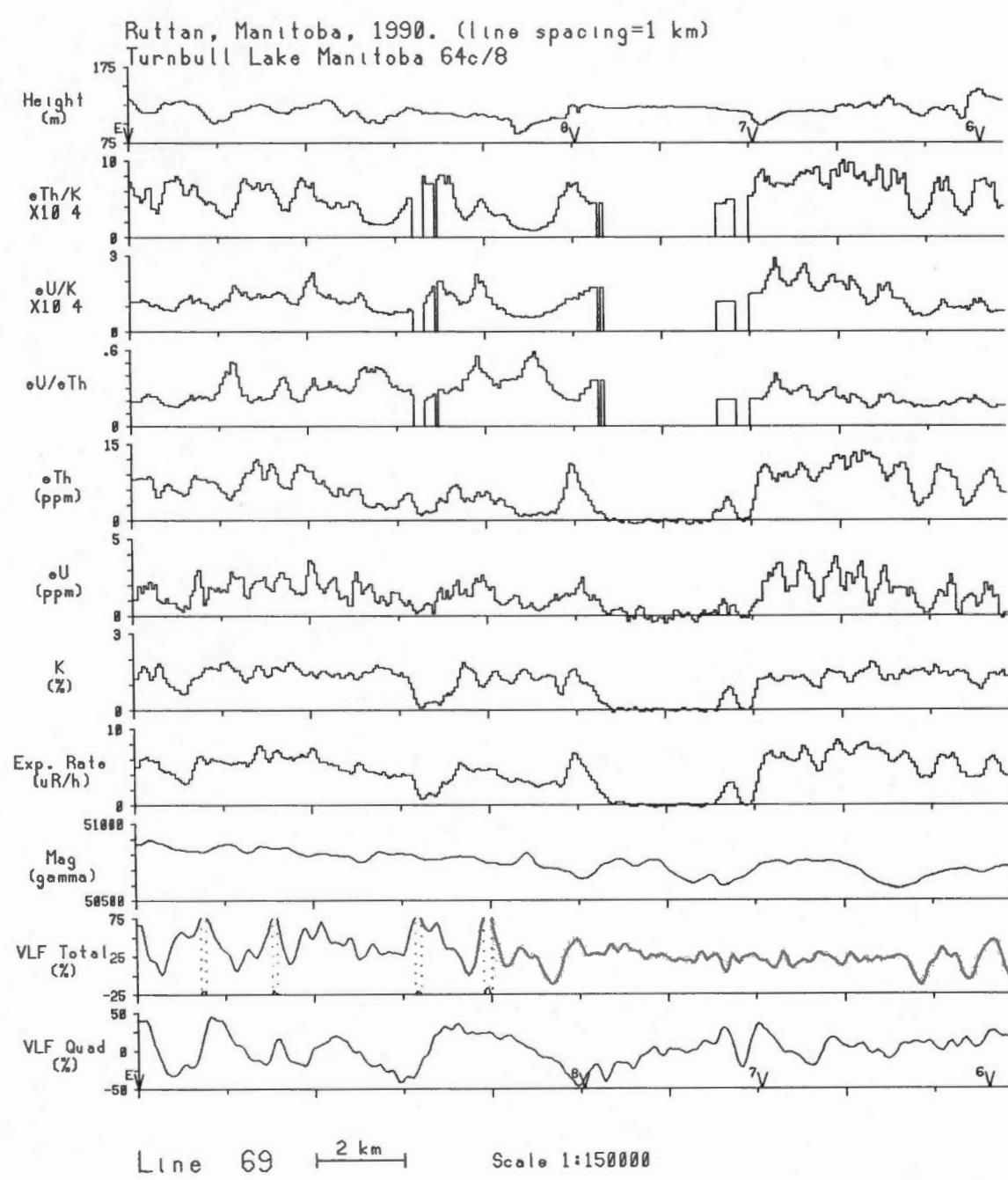
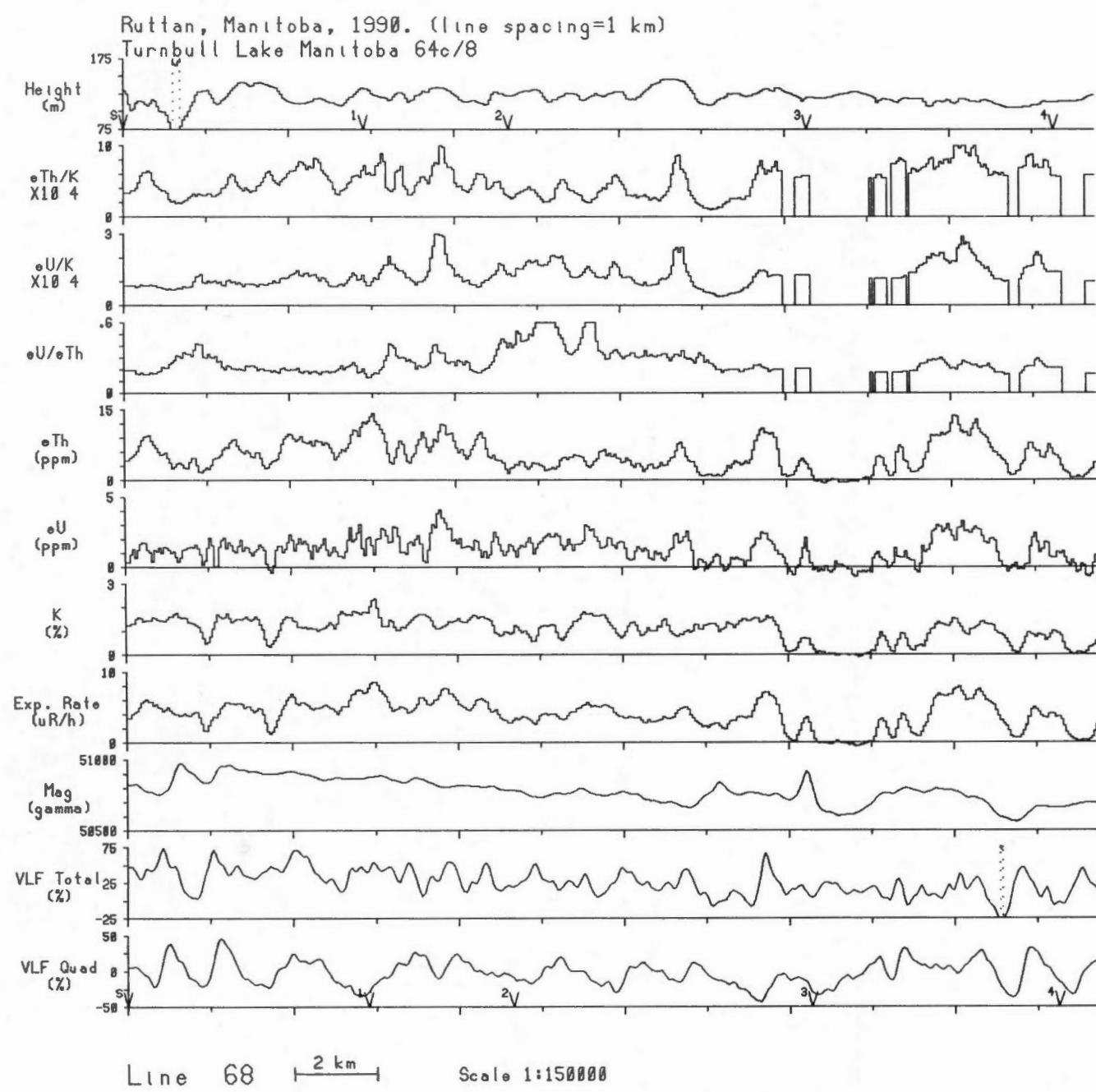
Line 66 2 km Scale 1:150000

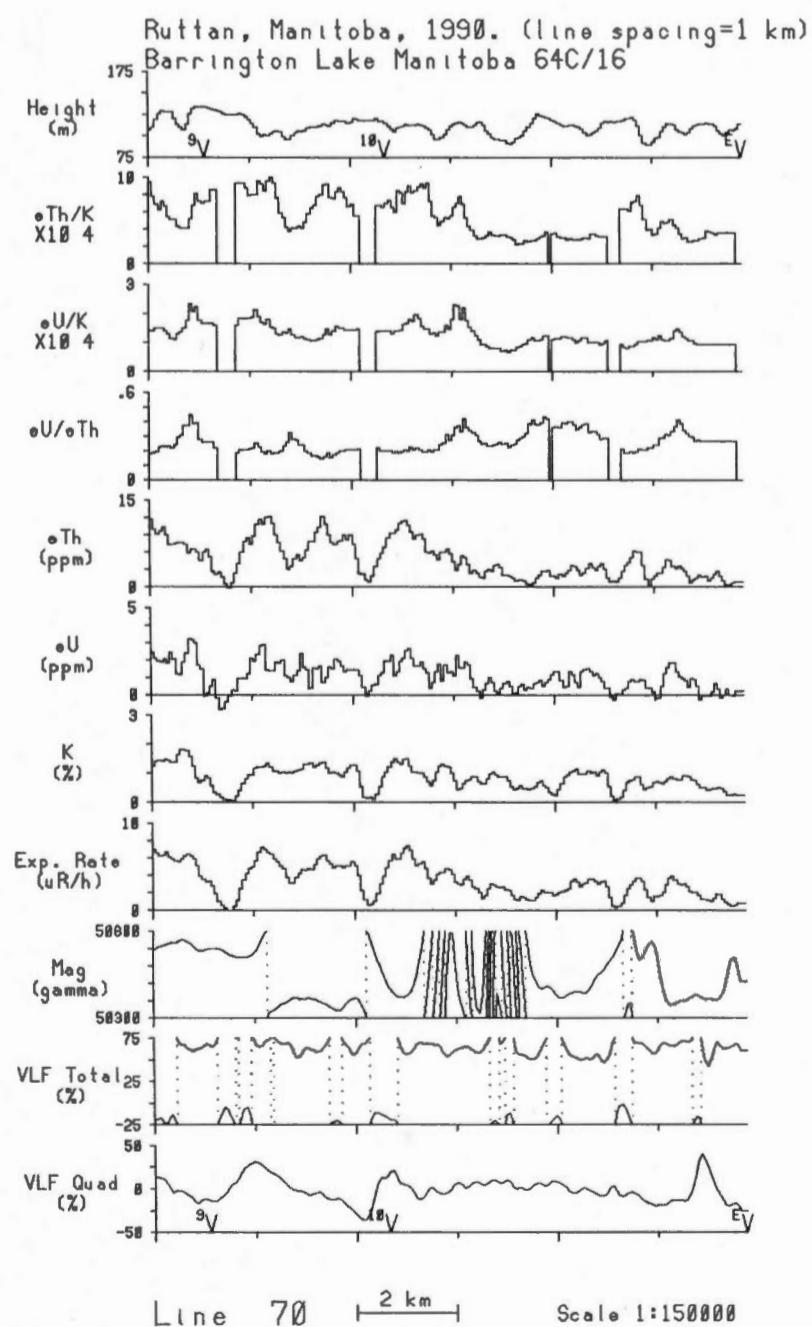
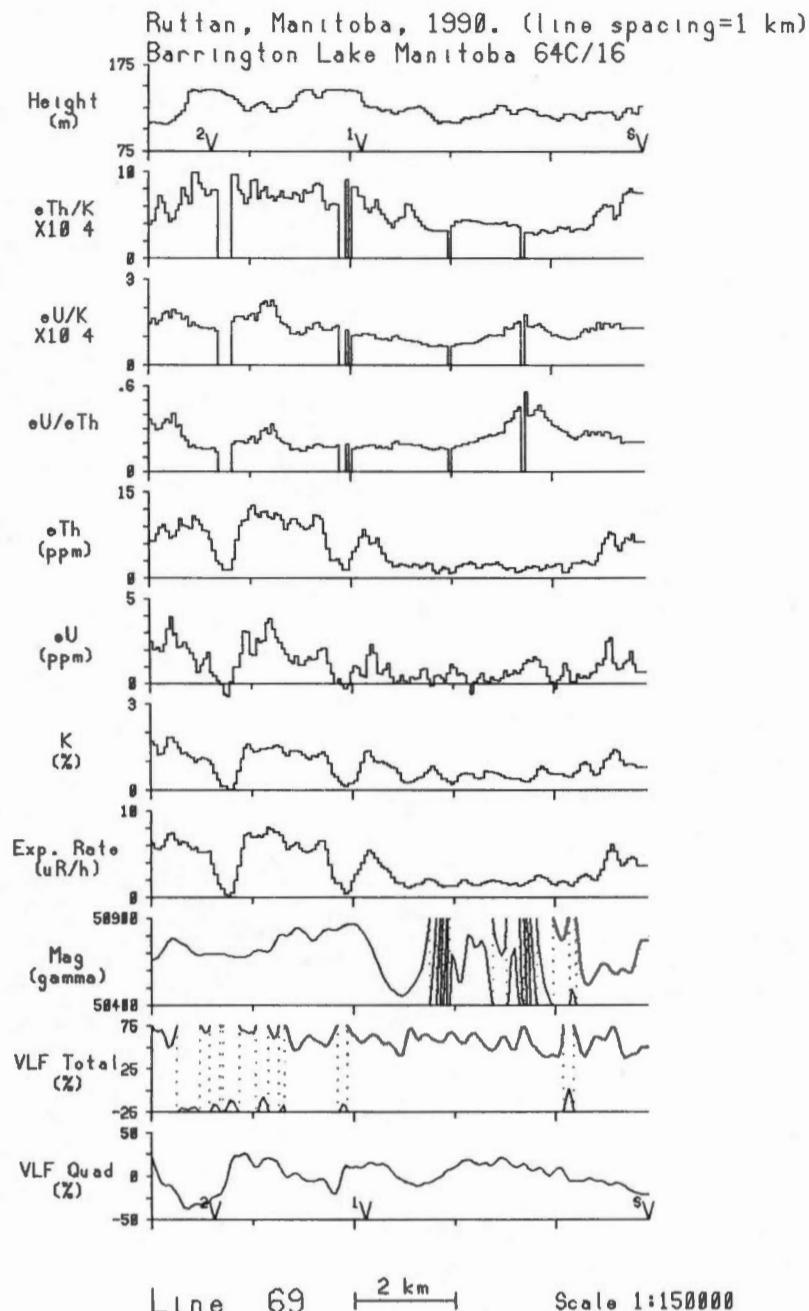


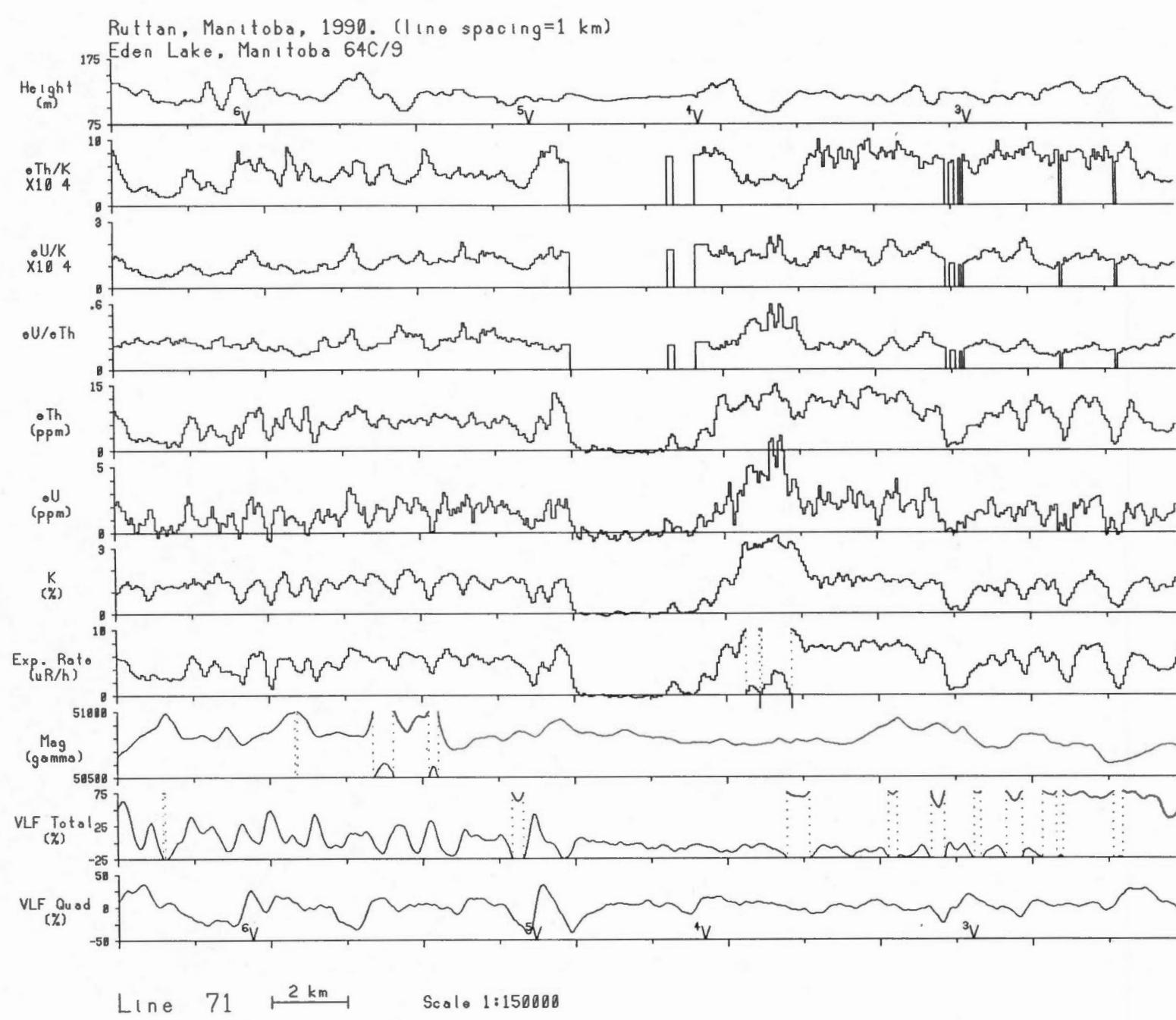
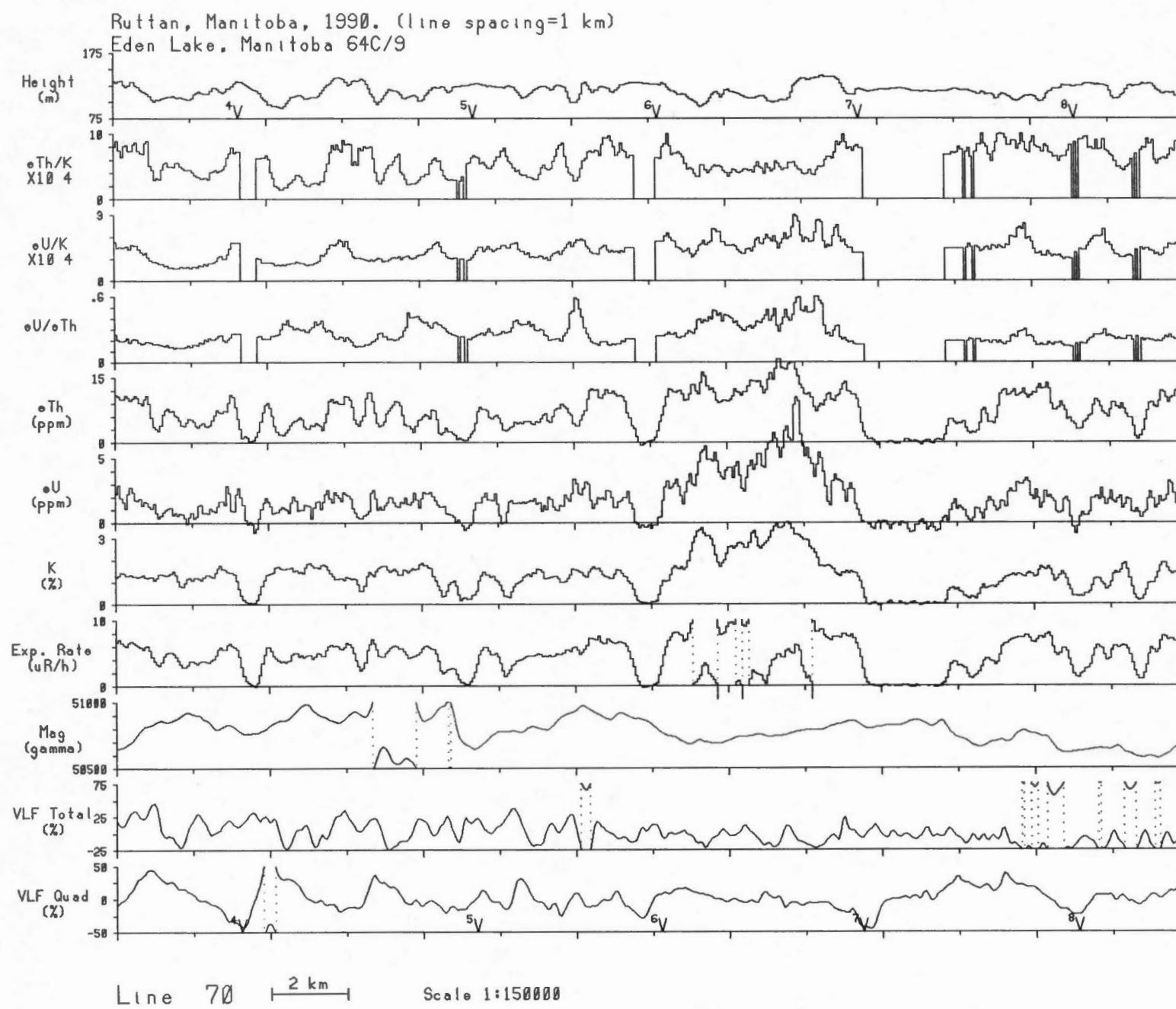


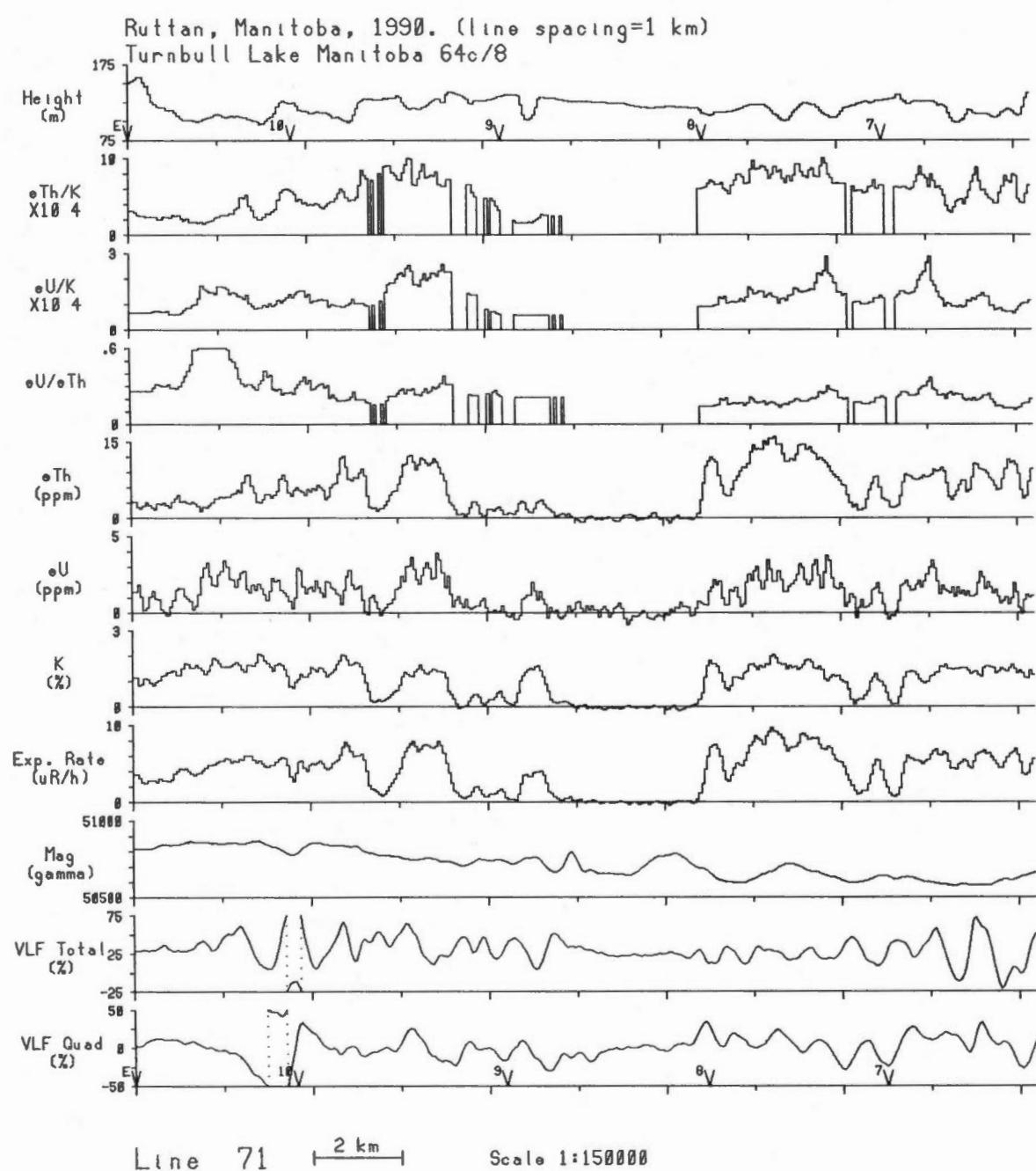
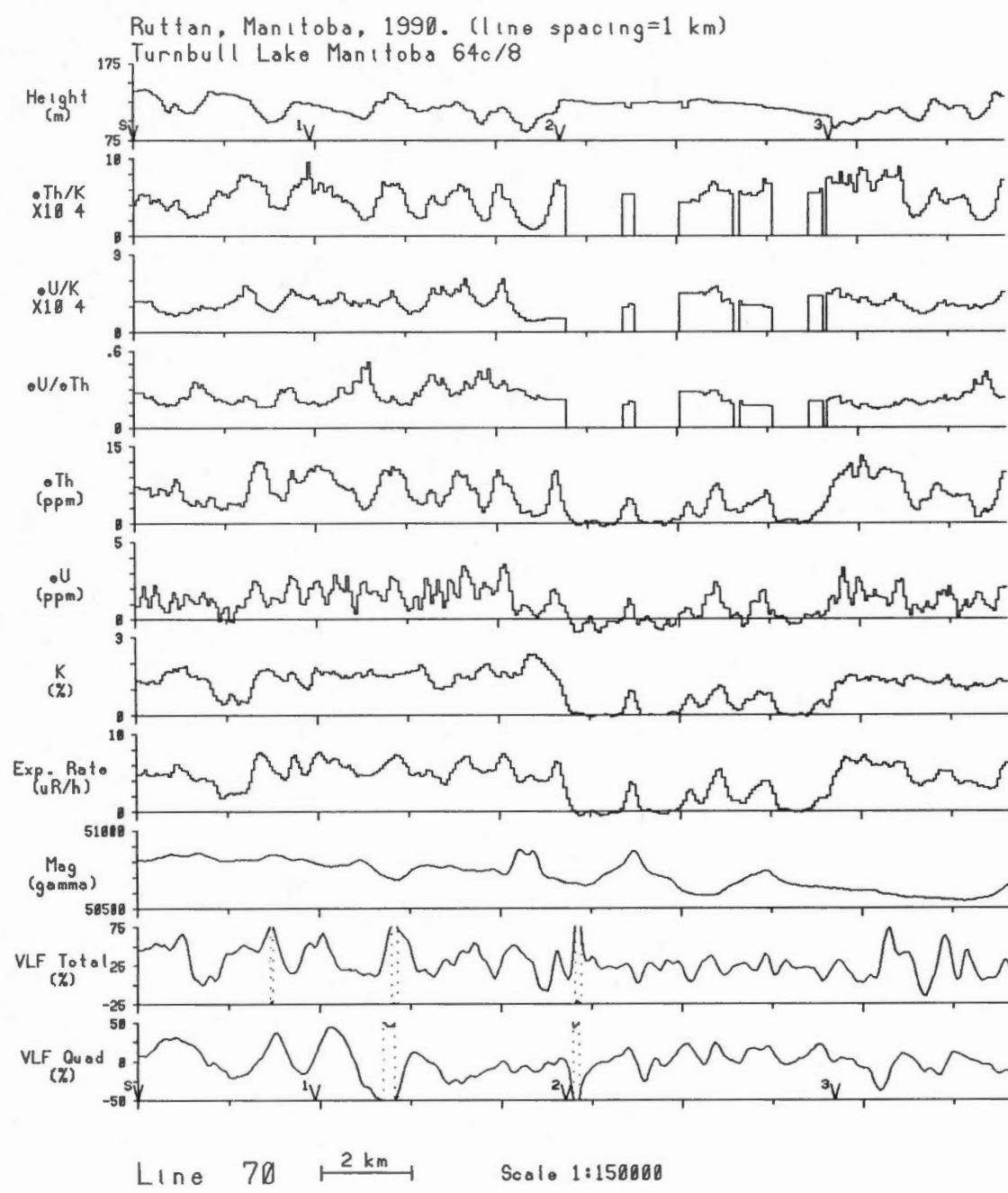


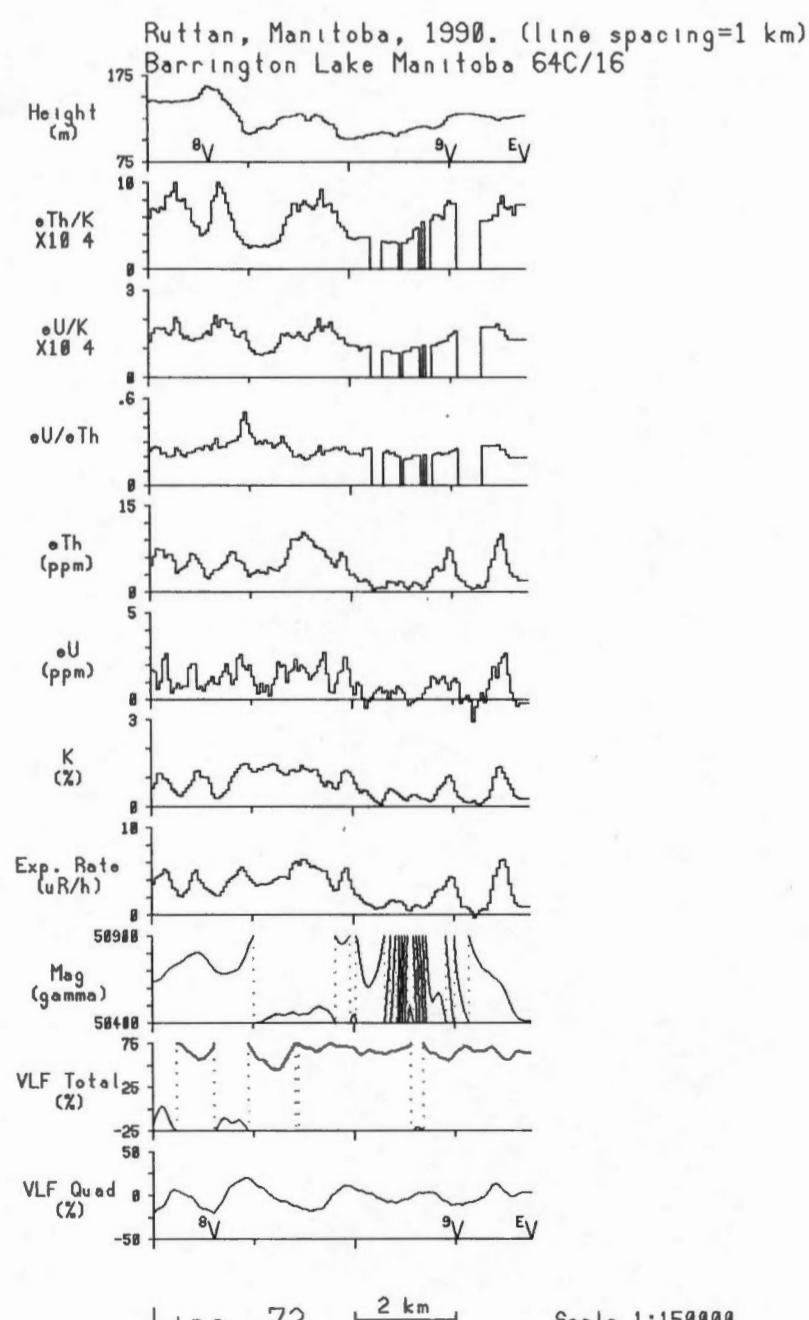
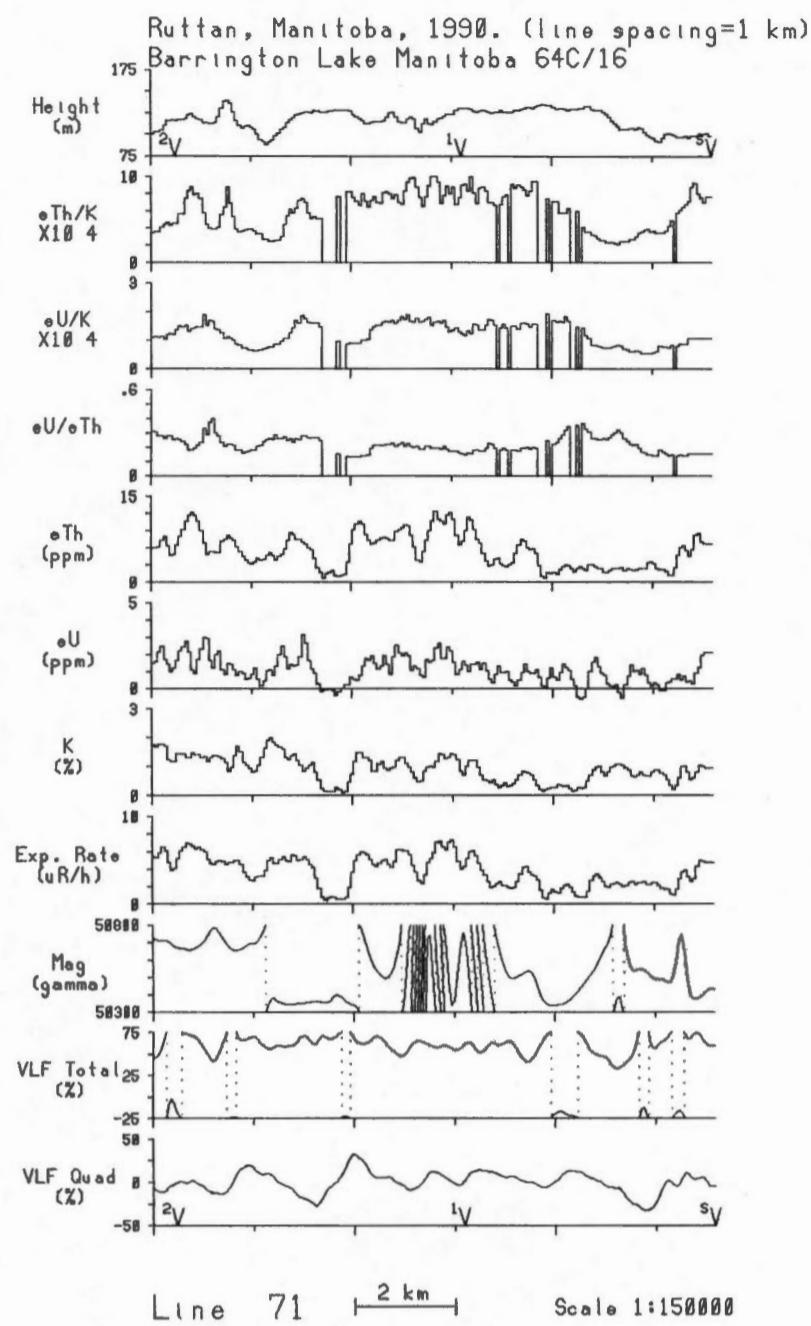


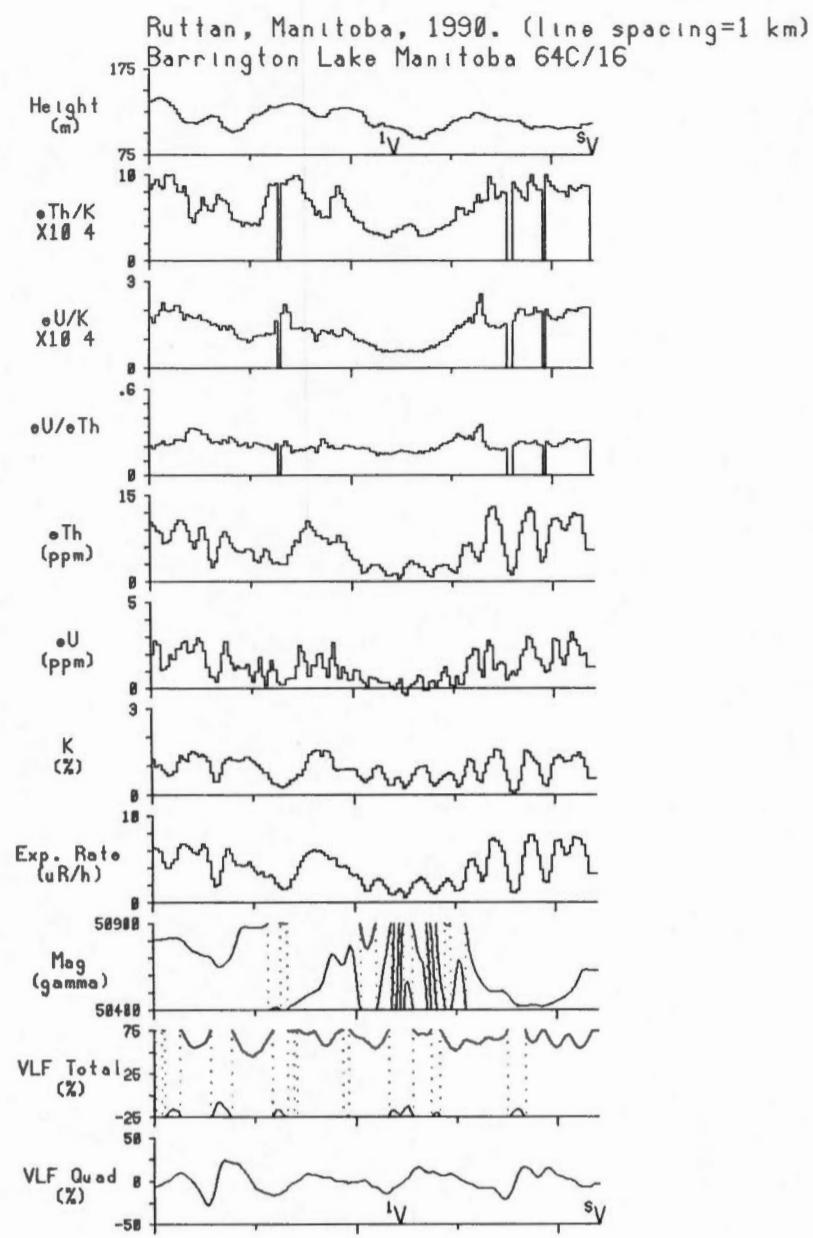




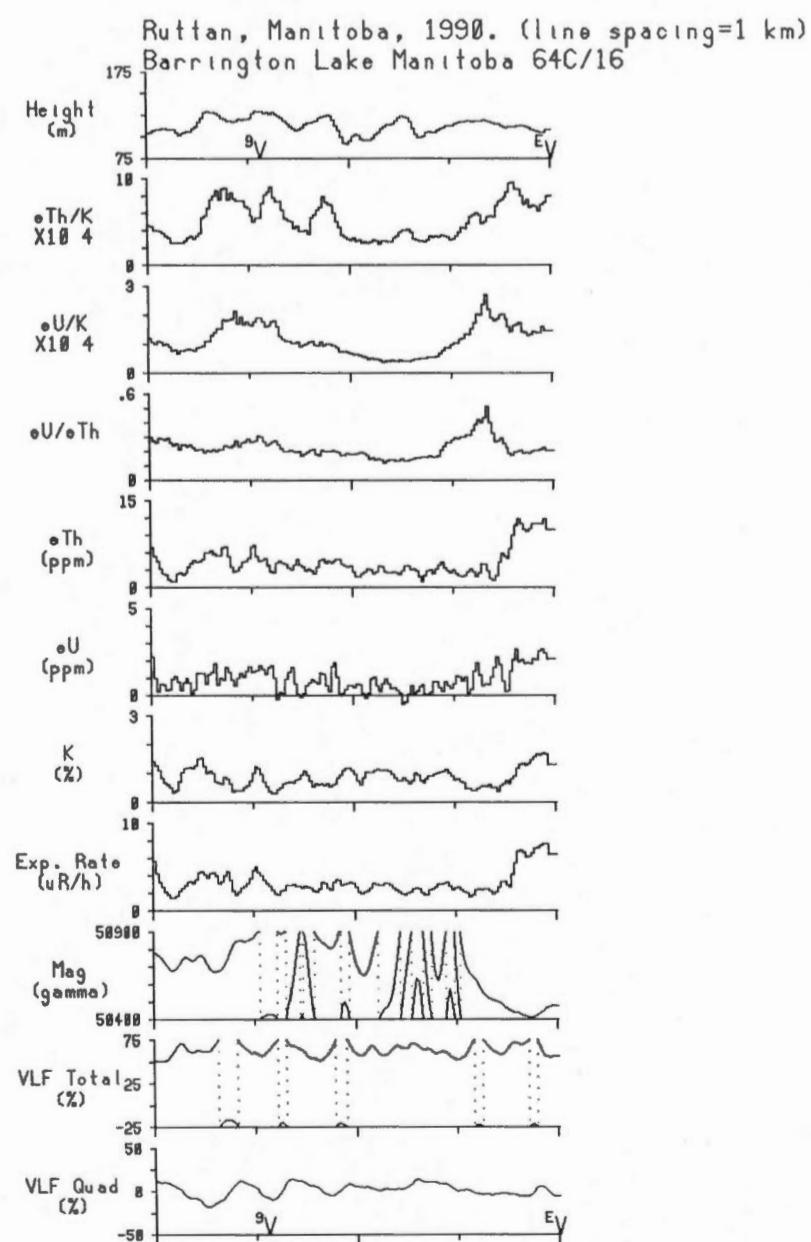




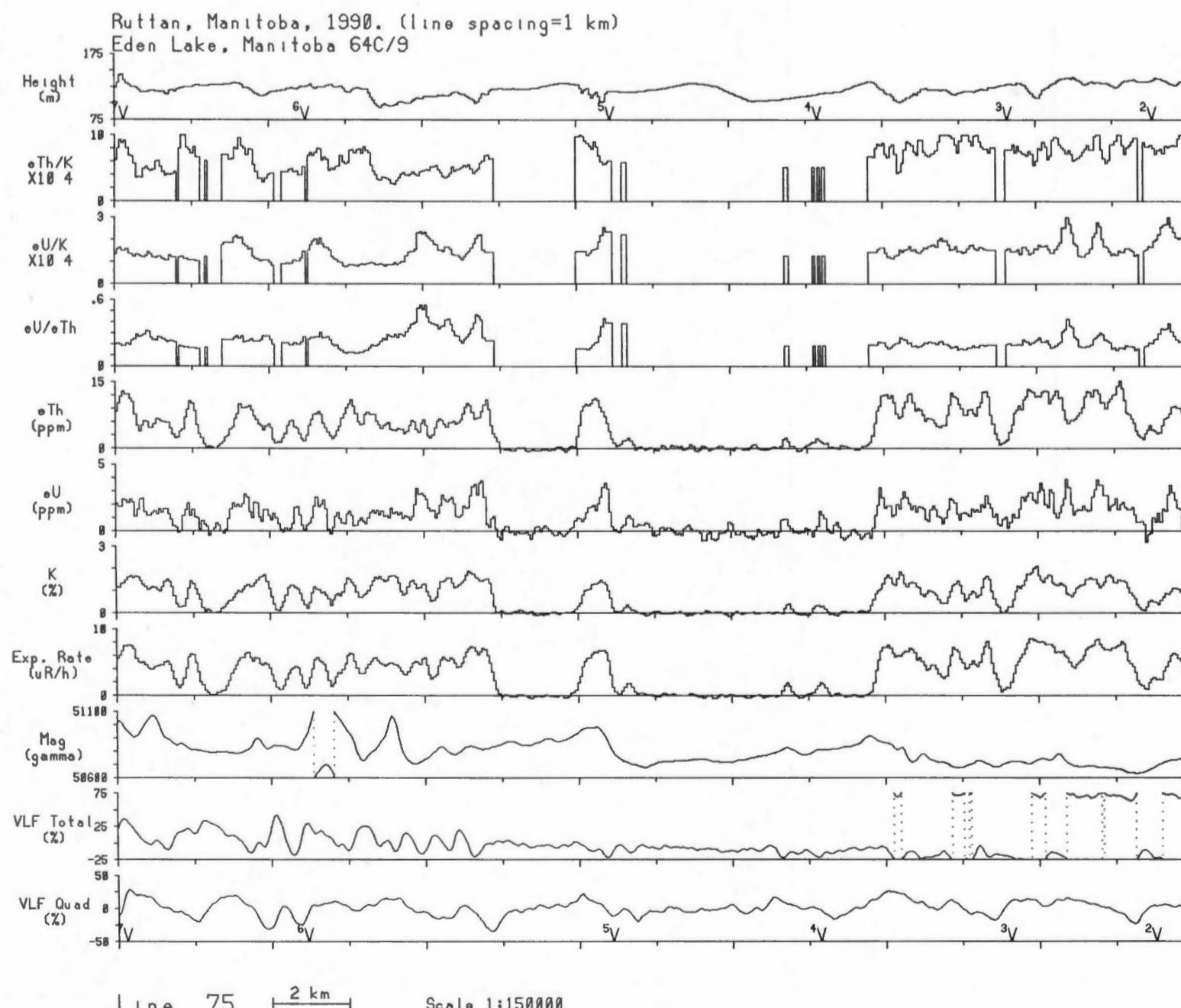
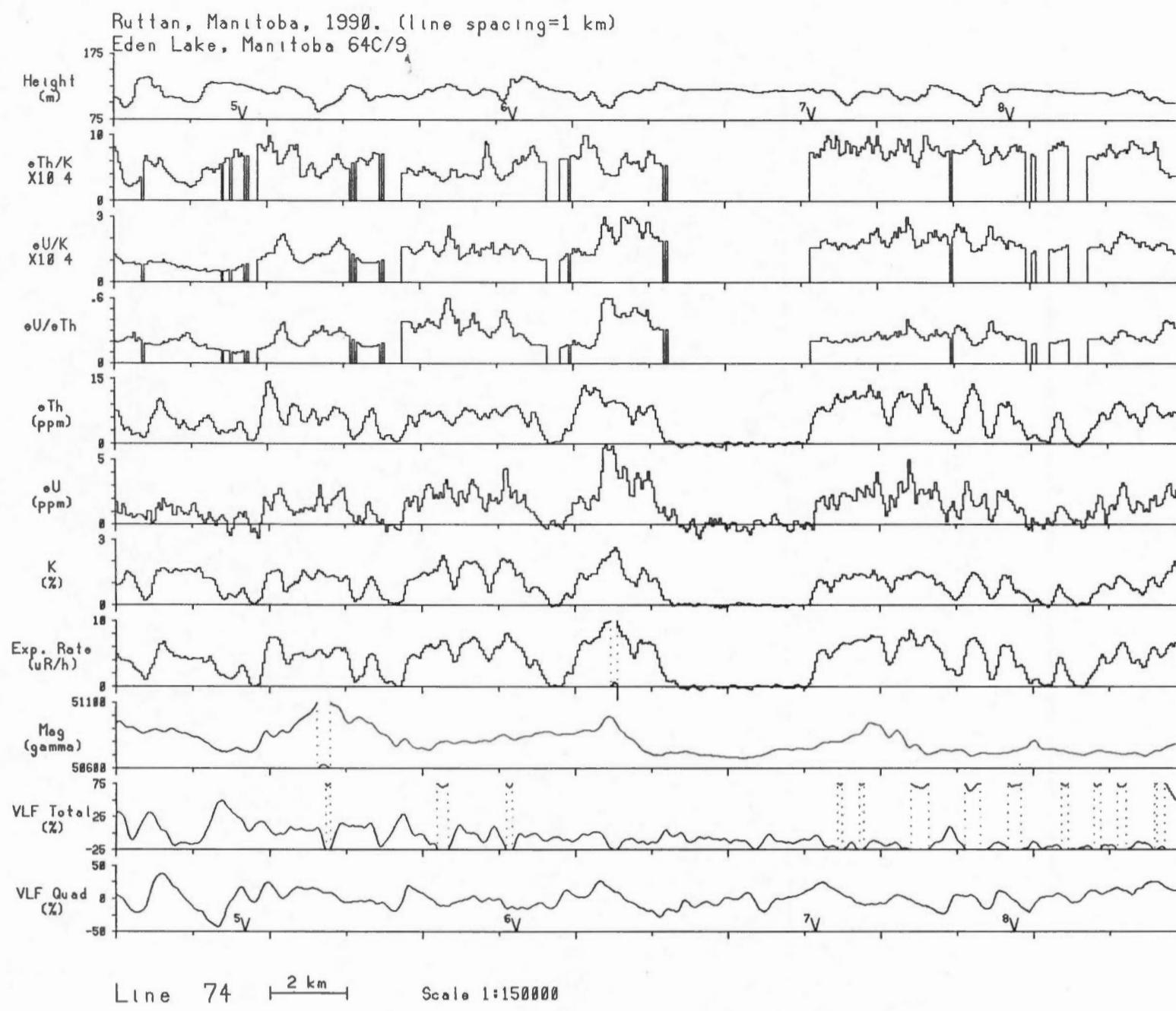


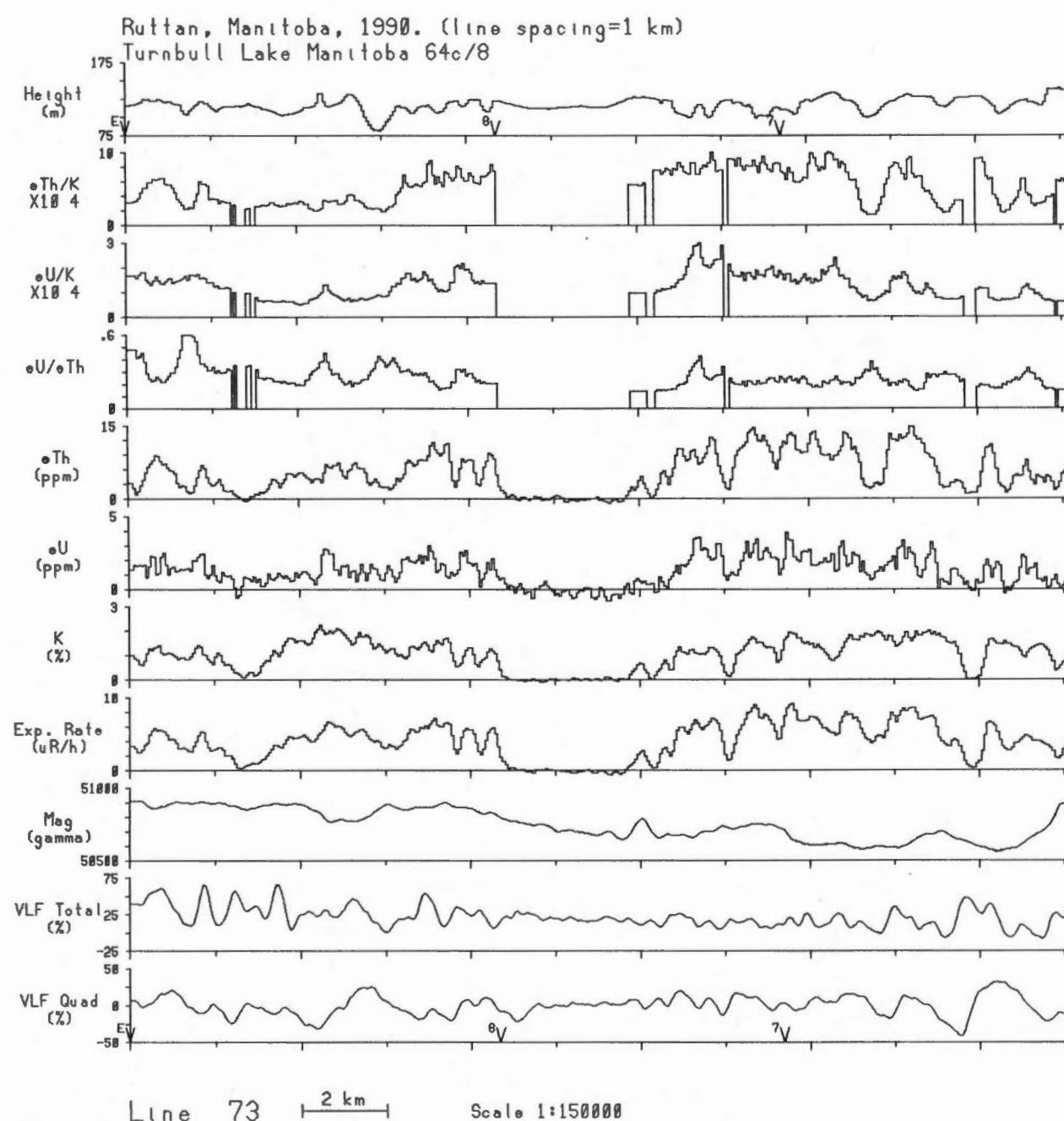
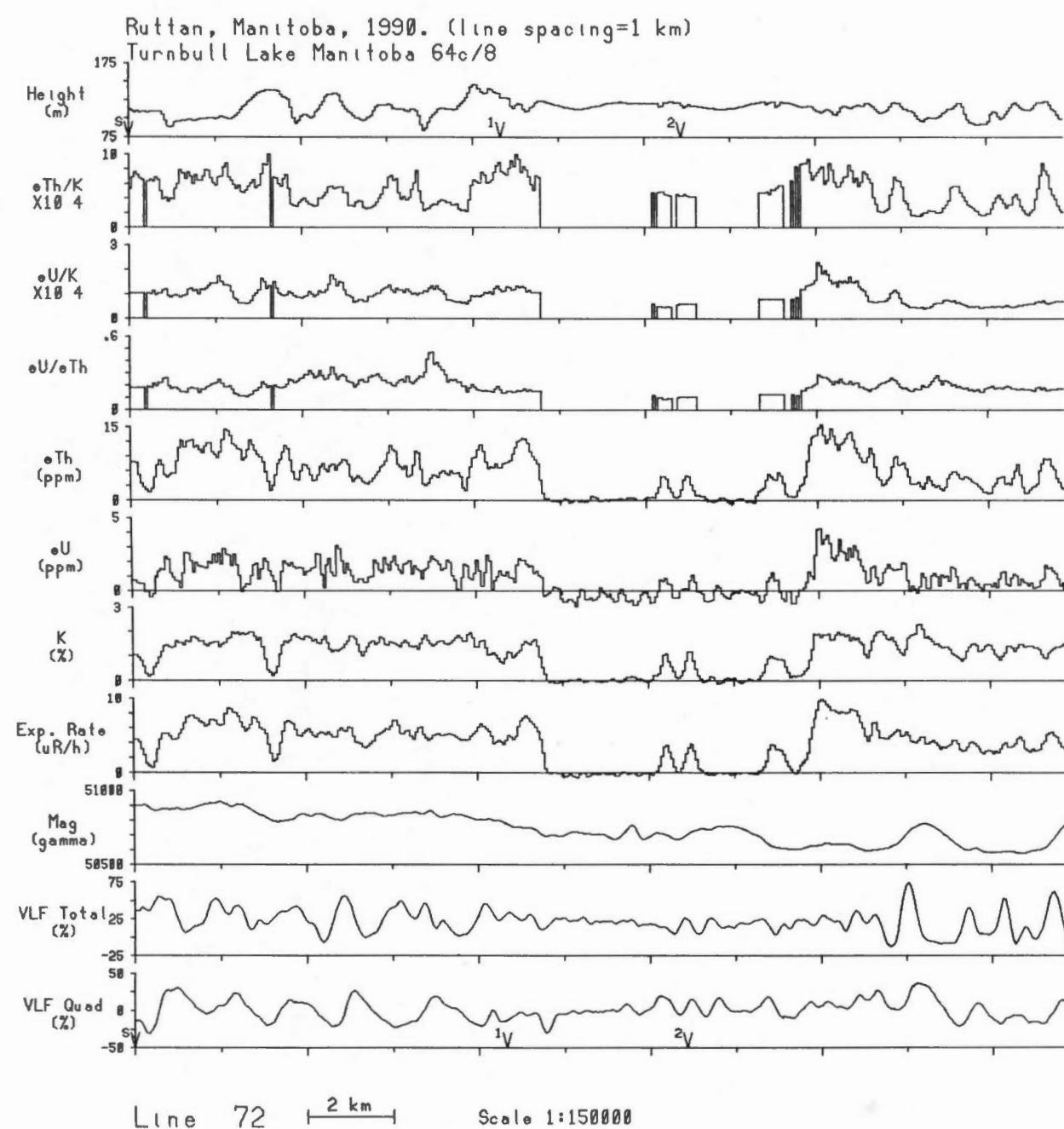


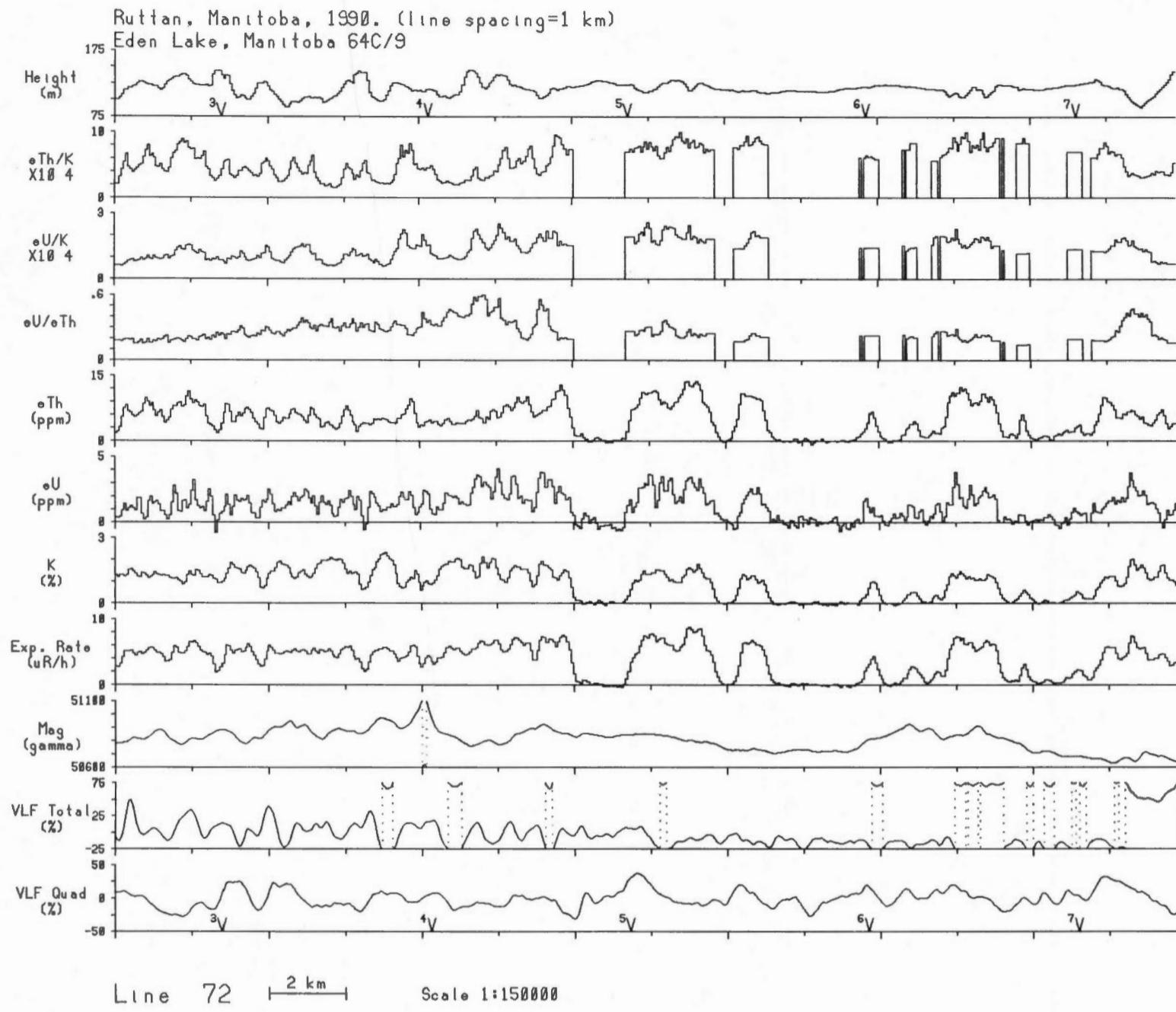
Line 73 2 km Scale 1:150000



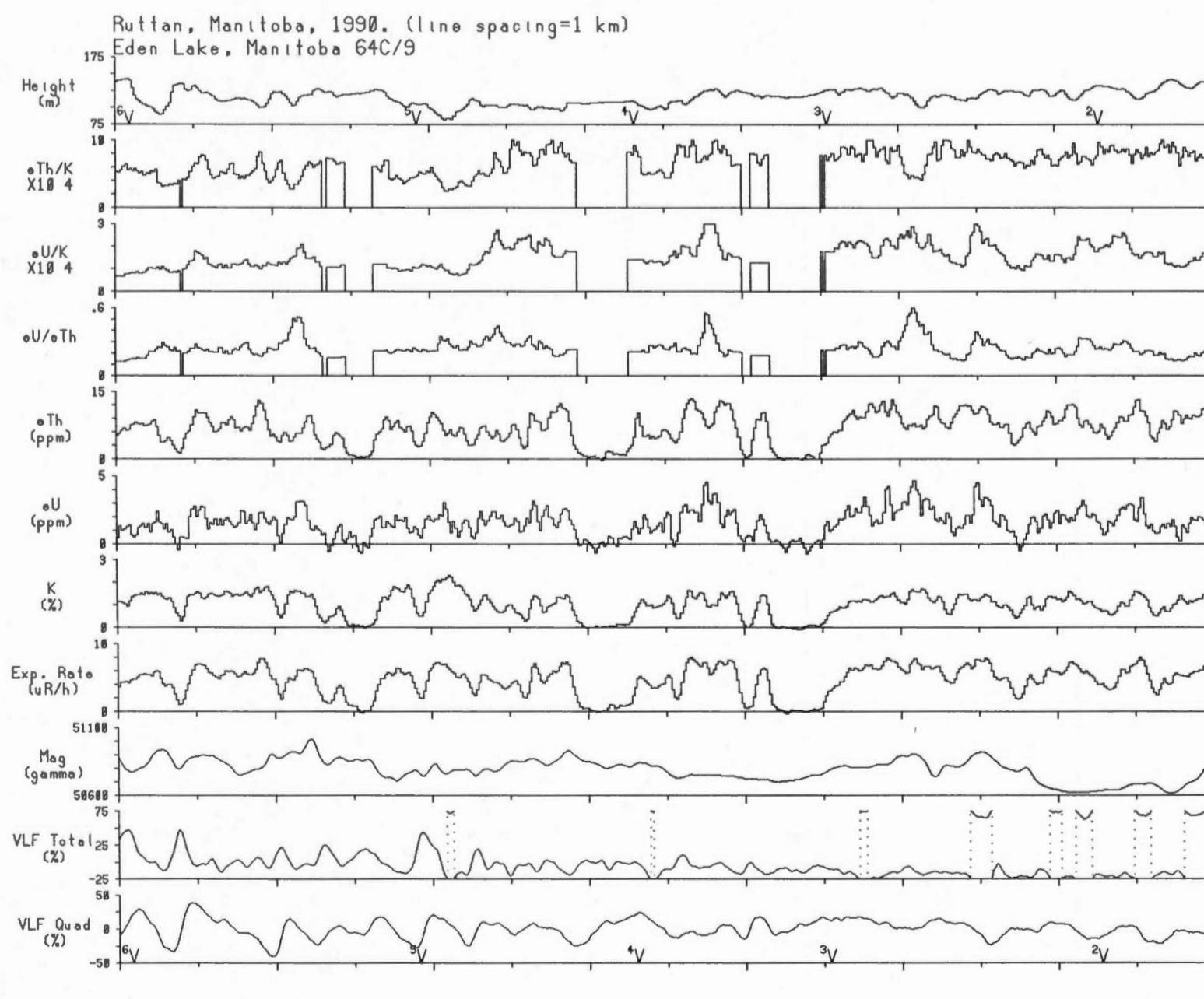
Line 74 2 km Scale 1:150000



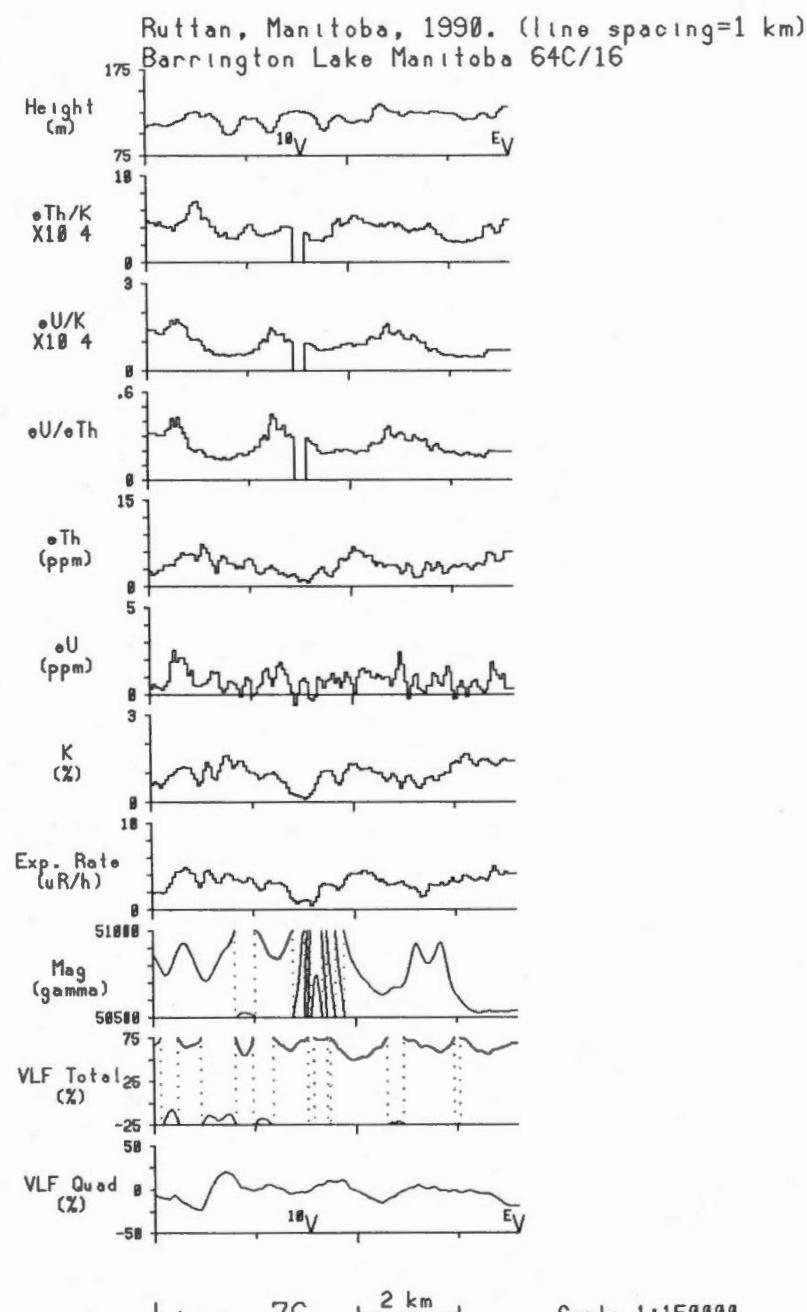
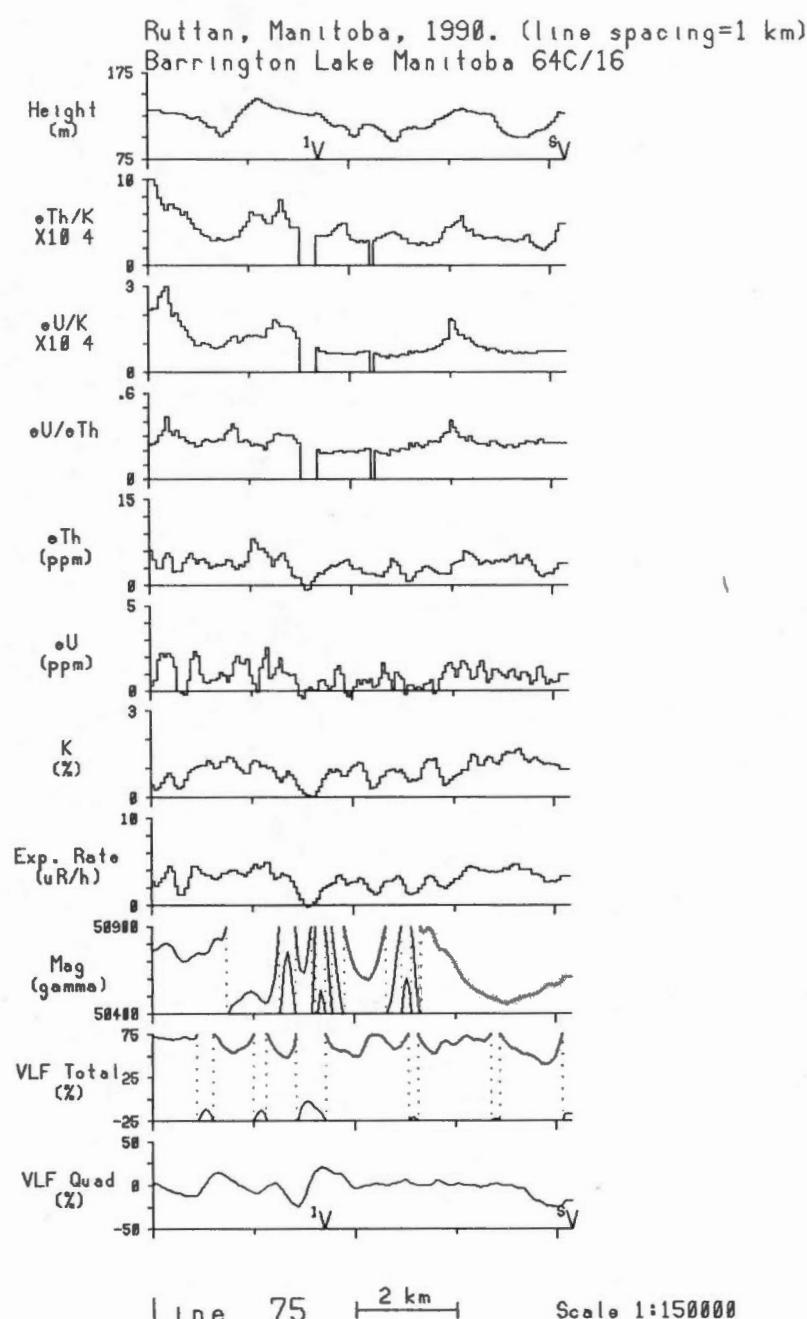


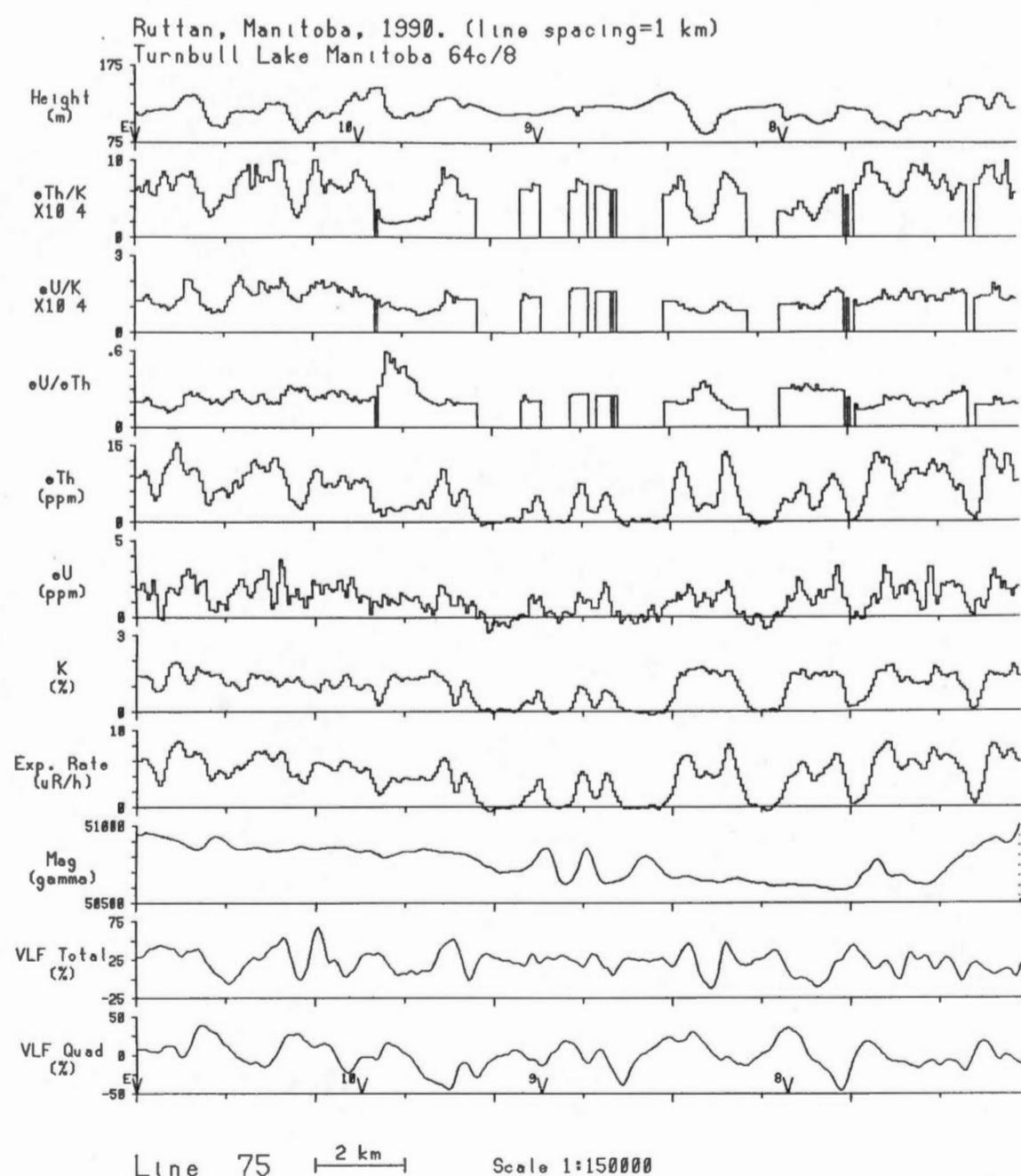
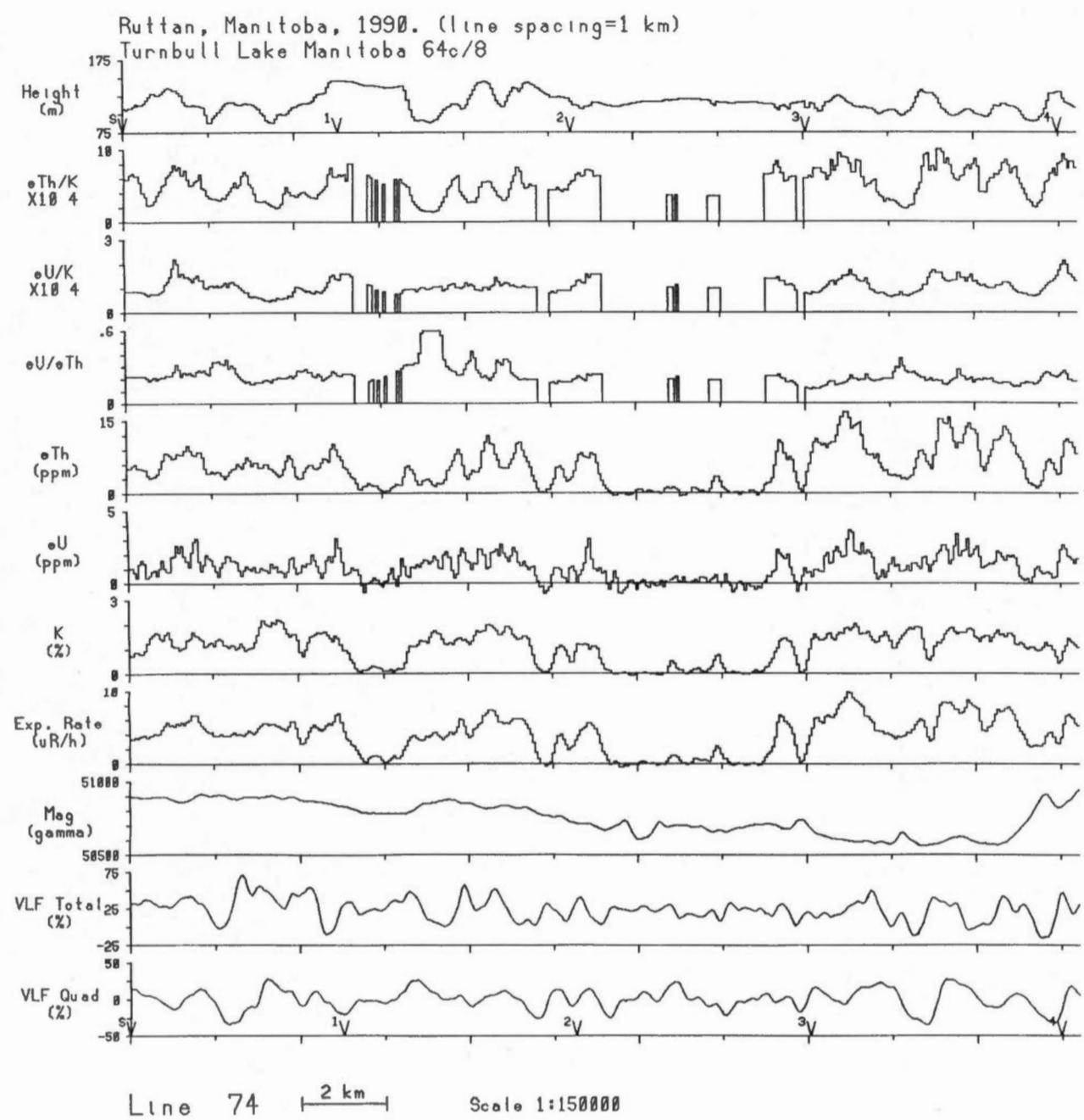


Line 72 2 km Scale 1:150000

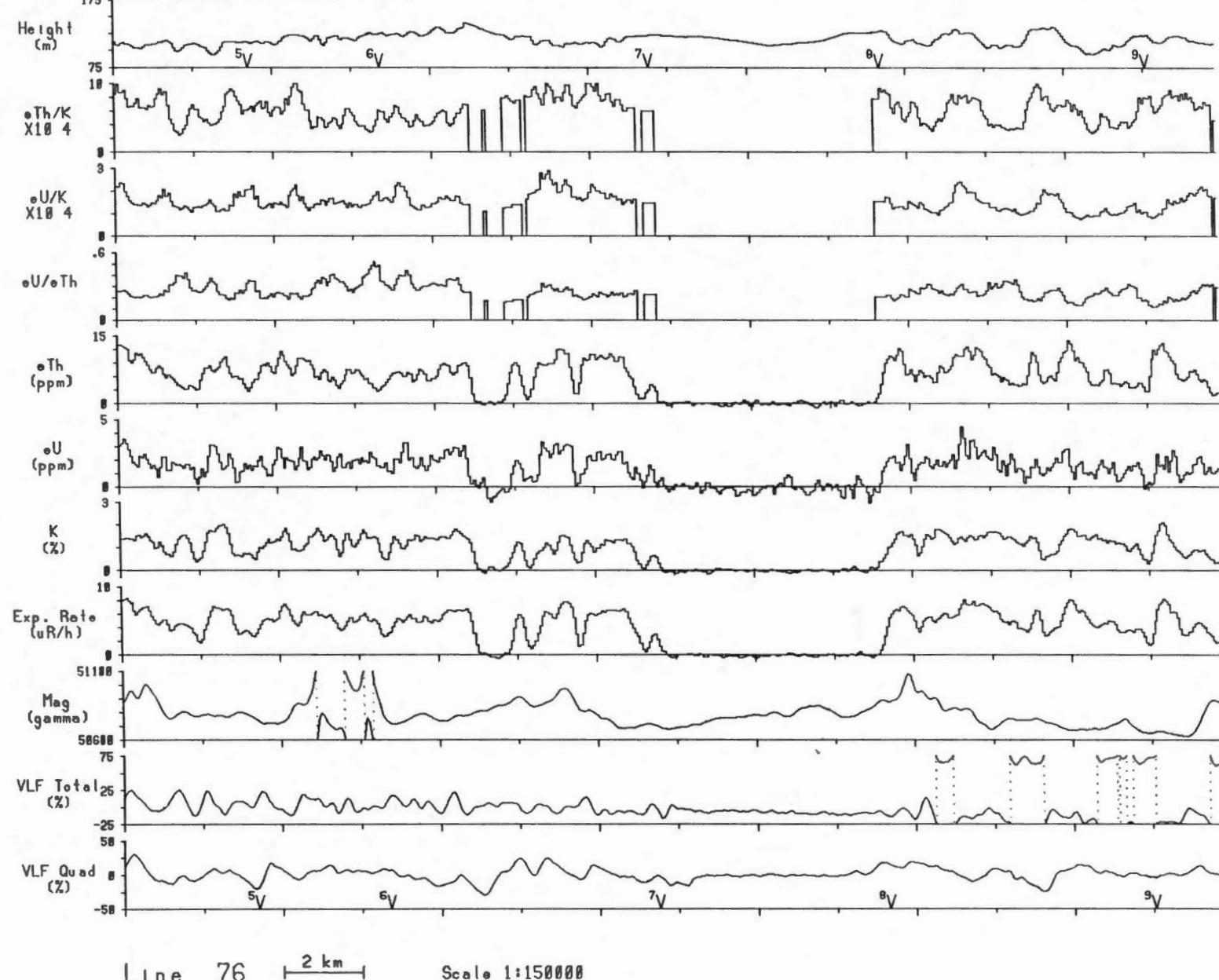


Line 73 2 km Scale 1:150000





Rutian, Manitoba, 1990. (line spacing=1 km)
Eden Lake, Manitoba 64C/9



Rutian, Manitoba, 1990. (line spacing=1 km)
Turnbull Lake Manitoba 64c/8

