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Early Warning and Crop Condition Assessment

A Joint Program for Agriculture and Resources Inventory Surveys Through Aerospace Remote Sensing

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COMPUTER PROGRAM DOCUMENTATION FOR THE PASTURE/RANGE CONDITION ASSESSMENT PROCESSOR

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16. Abstract

This report documents the software which has been developed in response to Action Document AD004-72-455-02, "Pasture/Range Condition Assessment Project". The total software system referred to as the Pasture/Range Condition Assessment Processor is described in detail.

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COMPUTER PROGRAM DOCUMENTATION FOR THE PASTURE/RANGE CONDITION ASSESSMENT PROCESSOR

Job Order 72-470

This report describes Spectral Analysis of the Early Warning/Crop Condition Assessment project of the AgRISTARS program.

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SCOPE

This document records the software which has been developed in response to AD004-72-455-02, "Pasture/Range Condition Assessment Project." The total software system referred to as the Pasture/Range Condition Assessment is described in detail.

SYSTEM OVERVIEW

The Range processor allows a user to analyze Landsat segment containing pasture crop cover.
The Range processor allows four options; they are: mapping, generating statistics on range mask, calculating VINS, and plotting VINS.
The Range processor can be read on the SPU or the CCA. Plotting is allowed on the SPU only.

1. RANGE

Purpose

This processor is the driver for the Range software. It will allow the user to analyze Landsat data containing pasture and rangeland. Analysis includes mapping, generating statistics, calculating vegetative indices, and plotting vegetative indices (VINS).

Calling Sequence

Program Range (1.)

Calling Arguments

Not applicable

Files

Not applicable

Common Blocks

The following abbreviations are used in tables throughout this document:

A	=	alpha numeric
I	=	integer
I/O	=	input/output
L	=	logical
R	=	real

Common blocks for Range are /RADVAL/, /FILES/, STATS/, and /VINS/.

/RADVAL/COMMON BLOCK

Name	Relative Word Number	Usage	Type	Definition
IMDATA	I-450	Array	I	Array for IMDACS image data

/VINS/COMMON BLOCK

Name	Relative Word Number	Usage	Type	Definition
AVI	1	Process	I	Ashburn vegetative index.
GRN	2	Process	I	Greeness from Kauth algorithm.
ND3	3	Process	I	ND3 = $(CH3-Ch2)/(Ch3+Ch2)$
ND4	4	Process	I	ND4 = $(CH4-Ch2)/(Ch4+Ch2)$
RAT	5	Process	I	RAT = $2*Ch4/Ch2$
SAVI	6	Process	I	AVI, corrected for sun angle
SGRN	7	Process	I	GRN, corrected for sun angle
SND3	8	Process	I	ND3, corrected for sun angle
SND4	9	Process	I	ND4, corrected for sun angle
SRAT	10	Process	I	RAT, corrected for sun angle
LAVI	11	Process	I	AVI, corrected for sun angle and satellite
LGRN	12	Process	I	GRN, corrected for sun angle and satellite
LND3	13	Process	I	ND3, corrected for sun angle and satellite
LND4	14	Process	I	ND4, corrected for sun angle and satellite
LRAT	15	Process	I	RAT, corrected for sun angle and satellite

/FILES/COMMON BLOCK

Name	Relative Word Number	Usage	Type	Definition
FNAME	1-30	Array	L	Name of fields file
GTNAME	31-60	Array	L	Name of ground truth file
MNAME	61-90	Array	L	Name of mask file
IMGNAM	91-120	Array	L	Name of image data file

/STATS/COMMON BLOCK

Name	Relative Word Number	Usage	Type	Definition
NPRR	1	Process	I	# of pixels labeled range in gt + mask
NPRN	2	Process	I	# of pixels labeled range - gt, nonrange-mask
NPNR	3	Process	I	# of pixels labeled nonrange - gt, range-mask.
NPNN	4	Process	I	# of pixels labeled nonrange ingt + mask
NPR	5	Process	I	# of pixels labeled range-mask
NPN	6	Process	I	# of pixels labeled nonrange-mask
NPMIX	7-16	Array	I	Array dimensioned (2, 5), used in calculating overview statistics report
TOTAL	17	Process	I	Number of pixels in report
NPIXA	18	Process	I	Number of pixels that agree
NPIXD	19	Process	I	Number of pixels that disagree
NPIXPA	20	Process	I	Number of pixels that partially agree

Name	Relative Word Number	Usage	Type	Definition
PROPA	21	Process	R	Proportion of agreement
PROPD	22	Process	R	Proportion of disagreement
PROPPA	23	Process	R	Proportion of partial agreement
PROPC	24	Process	R	Proportion of pixels committed
PROPO	25	Process	R	Proportion of pixels omitted
PROPNC	26	Process	R	Proportion of nonrange pixels committed
PROPRO	27	Process	R	Proportion of range omitted
PROPRC	28	Process	R	Proportion of range committed
PRGTLR	29	Process	R	Proportion of ground truth labeled range
PRMLR	30	Process	R	Proportion of mask labeled range
DIFPGM	31	Process	R	Difference in labeled range proportions

Subroutines Called

Name	Definition	Reference
PRSET	Setup routine, prompts for user input	1.1
LBLGT	Reads digitized ground truth tape and counts subpixels, writes map to disk.	1.2
GTMAP	Generates gray scale map file of ground truth	1.3
MASKMP	Reads an IMDACS formatted mask file and generates gray scale map file.	1.4
CMPGTM	Compares digitized ground truth at subpixel level to mask and generates a gray scale map file.	1.5
WRTMAP	Writes a gray scale map printer.	1.6
MASKST	Compares IMDACS mask file to labeled ground truth and computes statistics.	1.7
WRSTAT	Writes the statistics report to the printer	1.8
PRVIN	Driver for VIN calculations.	1.9
PRPLOT	Driver for VIN plotting.	1.10
PLTVIN	Reads VIN data and plots it on the CalComp plotter.	1.11

Note that PRPLOT and PLTVIN are used on the SPU. On the CCA, the routines are dummy routines.

CALLED BY

RANGE (1.)

Local Variables

Name	Definition
ACQLST	Array of acquisition dates.
AWC	Not used.
CARD	Array for user input.
CMI	Crop moisture index.
CORECT	Data correction .
CRYR	Crop year for ground truth data.
DATYPE	Data type.
DISK	Data disk.
GRASS	Flag for including grass crop codes.
IERR	Error flag.
INBUF	Input array for data.
INOPT	Option.
LSATS	Satellite number associated with data on each acquisition date.
MOPT	Option for map type.
NACQ	Number of acquisitions.
NCOR	Number of data corrections.
NDAT	Number of data types.
OCTALS	Octal equivalent of julian day.
OTHER	Flag for CMI data and CMI plots.
OUTBUF	Output array for data.
PIX	Subpixel counts.
POPT	Option for plot type.
SEGID	Array used in generating file name.
SEGN	Segment number
SLINE	Line number.
SOPT	Option for statistics report.

1.1 PRSET

Purpose

This is the setup routine for the Range processor. It queries the user for input options.

Calling Sequence

Subroutine PRSET (sign, cryr, iopt, thresh, NCC, stype, ccode, NDOT, dotlst, segid, mopt, sopt, nacq, acqlst, popt, card, grass, disk, ierr).

Calling Arguments

Name	Usage	Type	Definition
Sign	Input	I	Segment number
Cryr	Input	I	Year of ground truth data
IOPT	Input	I	Option selector
THRESH	Input	I	Threshold on subpixel count
	If THRESH = N, then N subpixels must be of the crop code for the pixel to be labeled as containing this crop. IFN = 6, the subpixel is pure.		
NCC	I/O	I	Number of crops to map.
STYPE	I/O	I	Option for 1978 segment, wheat or corn.
CCODE	Process	I	Table of crops to map.
NDOT	I/O	I	Number of pixels.
DOTLST	Array		List of pixel coordinates.
SEGID	Array	L	Array used in generating file names.
MOPT	Process	I	Option for map type.
SOPT	Process	I	Option for statistics report type.
NACQ	Process	I	Number of acquisitions.
ACQLST	Array	I	List of acquisition dates.
POPT	Process	I	Option for plot type.
CARD	Array	L	Array for user input.
GRASS	I/O	I	Indicator to use grass crop codes.
DISK	I/O	L	Data disk.
IERR	I/O	I	Error flag.

Files

Not applicable

Common Blocks

PRSET uses common block /FILES/. For a description of /FILES/, refer to Section 1.

Functions Called

Name	Definition	Reference
NUMBR	Decodes a line of input numbers into an integer array	1.1.1
DPNUMB	Same as NUMBR, except for INTEGER *4 input values	1.1.2
NAMEIT	Queries for and inputs disk file name	1.1.3

Called By

Range (1.)

Local Variables

Name	Definition
SEGMT	Segment number
STYPE	Indication for 1978 segment for wheat or corn/soybean.

1.1.1 NUMBR

Purpose

This function decodes an array of character numerals into integer format. Each number must be separated by a comma. NUMBR return the number of integer values in the array.

Calling sequence

Function NUMBR (CARD, COL, NUMVEC, VECSIZ)

Calling Arguments

Name	Usage	Type	Definition
CARD	Input	L	Array for user input.
COL	Input	I	Column the first character is in.
NUMVEC	Output	I	Array of decoded integers.
VECSIZ	Output	I	The number of integers decoded and stored in array NUMVEC.

Files

Not applicable

Common Blocks

Not applicable

Subroutines Called

Not applicable

Called By

PRSET (1.1)

Local Variables

Name	Definition
CHAR	Character being decoded
CRDSIZ	Set to 80, length of input string
NUM	Integer value of CHAR
SUBTOT	Integer value of character string, SUBTOT is stored in NUMVEC.

1.1.2 DPNUMB

This function decodes an array of character numerals into a double precision integer array. DPNUMB is a modification of NUMBR. DPNUMB returns the number of integer values in the array.

Calling Sequence

Function DPNUMB (card, col, numvec, VECSIZ)

Calling Arguments

Name	Usage	Type	Definition
CARD	Input	L	Array for user input
COL	Input	I	Column the first character is in
NUMVEC	Output		Array of decoded integers
VECSIZ	Output	I	The number of integers decoded

Files

Not applicable

Common Blocks

Not applicable

Subroutines Called

Not applicable

Called By

PRSET (1.1), PRPLOT (1.10)

Local Variables

Name	Definition
CHAR	Character being decoded
CRDSIZ	Set to 80 length of input string
NUM	Integer value of CHAR
SUBTOT	Integer value of character stirng, SUBTOT is stored in NUMVEC

1.1.3 NAMEIT

Purpose

This function reads in a disk or tape file name. NAMEIT returns the number of characters in the name.

Calling Sequence

Function NAMEIT (name, iopt, disk)

Calling Arguments

Name	Usage	Type	Definition
NAME	Output	L	File name
IOPT	Input	I	Option used to query user
DISK	Input	L	User UIC

Files

Not applicable

Common Blocks

Not applicable

Subroutines Called

Not applicable

Called By

PRSET (1.1), PRPLOT (1.10)

Local Variables

Name	Definition
BUFF	Buffer for user input
UIC	User UIC, set to [70, 7]

1.2 LBLGT

Purpose

This routine reads the digitized ground truth file and labels pixels according to the map option. For map option 1 or map option 2, subpixel crop codes are compared and a count saved for the code that has the greatest number. This count is compared to a threshold and a file of counts is written. For map option 3, subpixel crop codes are compared to designated crop codes and a count is saved. A file of counts is written.

Calling Sequence

Subroutine LBLGT (iopt, cryr, gtline, iobuf, thresh, grass, pix)

Calling Arguments

Name	Usage	Type	Definition
IOPT	Input	I	Option chosen
CRYR	Input	I	Crop year
GTLINE	Output	I	Array for digitized ground truth values
IOBUF	Output	L	Array of counts
THRESH	Input	I	Threshold for subpixel count
GRASS	Input	I	Indicator for including grass crop codes with range
PIX	Output	L	Array of counts

Files

File	Usage	Record Format
GTNAME	Ground truth data	JSC universal format
Graymap. dat	Pixel counts	unformatted records
SPXCTS. dat	Pixel counts	unformatted records

Common Blocks

LBLGT uses common block/FILES/. For a description of /FILES/, refer to Section 1.

Subroutines Called

Not applicable

Called By

Range (1.), PRVIN (1.9)

Local Variables

Name	Definition
CPIX	Subpixel codes
FLAG	Flag to indicate if a subpixel has been checked
INBUF	Input array for digitized ground truth
INBUF1, INBUF2, INBUF3	Input arrays
NCHK	Number of crop codes to check
OFST	Offset in reading ground truth data
PAS77	1977 pasture and grass crop codes
PAS78	1978 pasture and grass crop codes
PIXCT	Counts in output array
TOTALS	Subpixel counts and codes

1.3 GTMAP

Purpose

This routine creates a gray scale map of ground truth data.

Calling Sequence

Subroutine GTMAP (cryr, ccode, iobuf, ncc, stype)

Calling Arguments

Name	Usage	Type	Definition
CRYR	Input	I	Crop year
CCODE	Input	I	Table of crop codes to map
IOBUF	Output	L	Output array
NCC	Input	I	Number of crop codes to check
STYPE	Input	I	Crop type for year 1978, wheat or corn/soy

Files

File	Usage	Record Format
MAPOUT.DAT	Map file	Unformatted records
CCODE77W.DAT	Crop code symbols	(I3, IX, I3, 2X, A1)
CCODE78W.DAT	Crop code symbols	(I3, 1X, I3, 2X, A1)
CCODE78C.DAT	Crop code symbols	(I3, 1X, I3, 2X, A1)
GTNAME	Digitized ground truth	JSC universal format

Common Blocks

Not applicable

Subroutines Called

Not applicable

Called By

Range (1.)

Local Variables

Name	Definition
CCTAB	Crop codes
CHECK, CODE	Crop code value
SP	Stop pixel number
ST	Start pixel number

1.4 MASKMP

Purpose

This routine generates a gray scale map file of the mask.

Calling Sequence

Subroutine MASKMP (outbuf)

Calling Arguments

Name	Usage	Type	Definition
OUTBUF	Output	L	Output array

Files

File	Usage	Record Format
MNAME	Mask file	8 (126A1) header, (58A1) dummy record, (126A1), (126A1), (126A1), (32A1) data records
MAPOUT.DAT	Map file	Unformatted records

Common Blocks

MASKMP uses common block /FILES/. For a description of /FILES/, refer to Section 1.

Subroutines Called

Not applicable

Called By

Range (1.)

Local Variables

Name	Definition
DUMB1, DUMB2	Arrays used in reading mask file data
INBUF	Array used in reading mask file data

1.5 CMPGTM

Purpose

This routine compares ground truth data to the IMDACS mask file and writes a comparison map file.

Calling Sequence

Subroutine CMPGTM (IOBUF, GTBUF)

Calling Arguments

Name	Usage	Type	Definition
IOBUF	Output	L	Array for output data
GTBUF	Input	L	Array used in reading counts file created by LBLGT

Files

File	Usage	Record Format
MNAME	Mask file	8 (126A1) header, (58A1) dummy record, (126A1), (126A1), (126A1), (56A1) data records
MAPOUT.DAT	Map file	Unformatted records

Common Blocks

CMPGTM used common block /FILES/. For a description of /FILES/, refer to Section 1.

Subroutines Called

Not applicable

Called By

Range (1.)

Local Variables

NAME	Definition
DUMB1,	Arrays used in reading input data
DUMB2	Arrays used in reading input data
INBUF	Array used in reading input data

1.6 WRTMAP

Purpose

This routine writes a gray scale map to the printer.

Calling Sequence

Subroutine WRTMAP (Segn, Cryr, Iopt, Thresh, Iobuf, Cols, Stype, NCC)

Calling Arguments

Name	Usage	Type	Definition
SEGN	Input	I	Segment number
CRYR	Input	I	Crop year
IOPT	Input	I	Indicator of map type
THRESH	Input	I	Threshold on subpixel count
IOBUF	Output	L	Output array for map file.
COLS	Output	I	Column numbers on map
STYPE	Input	I	Indicator for crop type for 1978 data
NCC	Not used		

Files

File	Usage	Record Format
MAPOUT.DAT	Map file	Unformatted records
PRINTER FILE	Map	Map is generated on four pages

Common Blocks

WRTMAP used common block /FILES/. For a description of /FILES/, refer to Section 1.

Subroutines Called

Not applicable

Called By

Range (1.)

Local Variables

Name	Definition
TST	Row numbers on map

1.7 MASKST

Purpose

This routine computes mask pixel statistics.

Calling Sequence

Subroutine MASKST (Iopt, Iobuf, Spixct)

Calling Arguments

Name	Usage	Type	Definition
IOPT	Input	I	Statistics report option
IOBUF	Process	L	Array used in processing mask file data
SPIXCT	Input	L	Array used in reading counts file created in LBLGT

Files

File	Usage	Record Format
MNAME	Mask file	8 (126A1) - header, (56A1) - dummy (126A1), (126A1), (126A1), (56A1) - data records
SPIXCTS.DAT	Counts file	Unformatted records

Common Blocks

MASKST uses common blocks /FILES/ and /STATS/. For a description of these blocks, refer to Section 1.

Subroutines Called

Not applicable

Called By

Range (1.)

Local Variables

Name	Definition
DUMB1, DUMB2	Arrays used in reading input data
FLAG	Indicator that is alternately set to T and F; determines which way pixel is thrown if counts value equals 3
INBUF	Array used in reading input data.

1.8 WRSTAT

Purpose

This routine writes the statistics report.

Calling Sequence

Subroutine WRSTAT (Iopt, Segn, Cryr, Grass)

Calling Arguments

Name	Usage	Type	Definition
IOPT	Input	I	Statistics report option
SEGN	Input	I	Segment number
CRYR	Input	I	Crop year
GRASS	Input	I	Flag to indicate if grass crop codes are included with pasture crop codes

Files

File	Usage	Definition
Printer file	Statistics report	Report prints on one page

Common Blocks

WRSTAT uses common blocks /FILES/ and /STATS/. For a description of these blocks, refer to Section 1.

Subroutines Called

Not applicable

Called By

Range (1.)

Local Variables

Not applicable

1.9 PRVIN

Purpose

This routine is the driver for the option that calculates VINS.

Calling Sequence

Subroutine PRVIN(Iopt, Segid, nacq, Acqlst, ndot, Dotlst, Inbuf, Outbuf, Card, Cryr, Gtline, Thresh, Grass, Octals, Lsats, Disk, IERR)

Calling Arguments

Name	Usage	Type	Definition
IOPT	Input/Output	I	Option for VIN data set
SEGID	Input/Output	I	Segment identification
NACQ	Input/Output	I	Number of acquisitions
ACQLST	Input	I	Acquisition dates
NDOT	Input/Output	I	Number of pixels
DOTLST	Input/Output	I	Pixel coordinates list

Calling Arguments (Cont'd)

Name	Usage	Type	Definition
INBUF	Output	L	Array for pixel counts data.
OUTBUF	Output	L	Array for spectral values.
CARD	Process	L	Array used in reading character strings.
CRYR	Input/Output	I	Crop year of ground truth.
GTLINE	Output	L	Array for digitized ground truth.
THRESH	Input	I	Threshold for subpixel counts.
GRASS	Input	I	Indicator for including grass crop codes with range.
OCTALS	Output	L	Octal equivalent of julian day for each acquisition date.
LSATS	Output	L	Array containing satellite # that acquired data for each acquisition date.
DISK	Input/Output	L	Disk that contains data information.
IERR	Output	I	Error flag.

Files

File	Usage	Record Format
SEGINFO.DAT	Segment information	(80A1)
FIELDATA.IMD;1ØØ	Spectral data for Ch 1	(<PIXCT> I3), value of pixel for each record is stored in array LL.
FIELDATA.IMD;2ØØ	Spectral data for Ch 2	(<PIXCT> I3)
FIELDATA.IMD;3ØØ	Spectral data for Ch 3	(<PIXCT> I3)
FIELDATA.IMD;4ØØ	Spectral data for Ch 4	(< PIXCT>I3)

Common Blocks

PRVIN uses common block /FILES/. For a description of /FILES/, refer to Section 1.

Subroutines Called

Name	Definition	Reference
MASKX	Extracts image data using mask.	1.9.1
LBLGT	Writes a file of subpixel counts	1.9.2
GTX	Extracts image data using ground truth.	1.9.3
FIELDX	Extracts image data using fields file.	1.9.4
DOTX	Extracts image data using dot file.	1.9.5
CALVIN	Calculate VINS.	1.9.6
WRTVIN	Writes VIN file to disk.	1.9.7

Called By

Range (1.)

Local Variables

Name	Definition
ACQDAT	Acquisition date.
ACQUIS	Array for acquisition dates.
ANGL	Sun angle.
DATFIL	File name for image data, set in PRVIN.
IA	Acquisition counter.
LINCT	Number of records in DATFIL.
LL	Number of samples in each record in DATFIL.
LSAT	Laudsat satellite.
OPTI	Option used in LBLGT.
PIX	Count data.
SANGS	Normalized sun angle array.
SUNANG	Sun angle.
UIC	User ID set to [70,7]

1.9.1 MASKX

Purpose

This routine extracts pixels from the IMDACS image file as defined by an IMDACS mask file.

Calling Sequence

Subroutine MASKX (IOBUF, OUTBUF, LINCT, LL, IERR, KCOP)

Calling Arguments

Name	Usage	Type	Definition
IOBUF	Process	L	Array for mask data.
OUTBUF	Output	L	Array for pixel data extracted from IMDACS image file.
LINCT	Output	I	Number of records in FIELDATA.IMD;NØØ.
LL	Output	I	Array containing number of samples in each record in FIELDATA.IMD;NØØ.
IERR	Output	I	Error flag.
KOP	Input	I	Indicator used in selecting mask or non-masked pixels.

Files

File	Usage	Record Format
IMGNAM	IMDACS image file	See IMDACS documentation for format.
MNAME	Mask file	8 (126A1) - header, (56A1) - dummy record, 3 (126A1), (56A1)- data records.
FIELDATA.IMD;NØØ	Data files	N = 1, 2, 3, 4. One file is generated for each of four data channels.

Common Blocks

MASKX uses common blocks /RADVAL/ and /FILES/. For a description of these blocks, refer to Section 1.

Subroutines Called

Name	Definition	Reference
FILEM, Entry AREAD	Reads one line in an IMDACS image file	1.9.1.1

Called By

PRVIN (1.9)

Local Variables

Name	Definition
BBUF	Array used in reading IMDACS image file.
DUMB1, DUMB2	Array used in reading mask data file.
ICHAN	Channel value counter.
ILINE	Line counter.
INBUF	Array used in reading mask data file.
ISTAT	Error flag in reading IMDACS image file.
OFST	Offset in reading IMDACS mask file record.
PIXCT	Counter for samples.

1.9.1.1 FILEM

Purpose

FILEM is an assembler language subroutine that reads one line from an IMDACS formatted image file. FILEM has an entry point named AREAD.

1.9.2 LBLGT

Refer to section (1.2)

1.9.3 GTX

Purpose

This routine extracts pixels from an IMDACS image file as defined by the ground truth.

Calling Sequence

Subroutine GTX (IOPT, GTBUF, IOBUF, LINCT, LL, IERR).

Calling Arguments

Name	Usage	Type	Definition
IOPT	Input	I	Option used in reading data from subpixel counts file.
GTBUF	Process	L	Array used in reading data from subpixel counts file.
IOBUF	Output	L	Array used in writing FIELDATA. IMD;NØØ files.
LINCT	Output	I	Number of records in FIELDATA .IMD file.
LL	Output	I	Array containing number of samples/ record.
IERR	Output	I	Error flag.

Files

File	Usage	Record Format
IMGNAM	Image data file	See IMDACS documentation for format.
GTNAME	Subpixel counts file	Unformatted records.
FIELDATA.IMD;NØØ	Spectral values	[< PIXCT > I3], value of PIXCT for each record is stored in array LL.
SPXCTS.DAT	Not used	

Common Blocks

GTX uses common blocks /RADVAL/ and /FILES/. For a description of these blocks, refer to Section 1.

Subroutines Called

Name	Definition	Reference
FILEM, entry AREAD	Reads one line in an IMDACS image file	1.9.1.1

Called By

PRVIN (1.9)

Local Variables

Name	Definition
BBUF	Array used in reading IMDACS image file.
ILINE	Counter in reading IMDACS image file.
ISTAT	Error flag in reading IMDACS image file.
OFST	Offset in reading IMDACS mask file record.
OPTION	Option used in reading subpixel counts file.
PIXCT	Counter for samples in output data record.

1.9.3.1 FILEM

Refer to Section (1.9.1.1).

1.9.4 FIELDX

Purpose

This routine reads IMDACS fields files and extracts field pixels.

Calling Sequence

Subroutine FIELDX (IOBUF, LINCT, LL, IERR).

Calling Arguments

Name	Usage	Type	Definition
IOBUF	Output	L	Array used in writing FIELDATA.IMD;NØØ files.
LINCT	Output	I	Number of records in FIELDATA.IMD file.
LL	Output		Array containing number of samples/ record
IERR	Output	I	Error flag.

Files

File	Usage	Record Format
IMGNAM	Image data file	See IMDACS documentation for format.
FNAME	Fields data	Direct access, unformatted records.
FIELDATA.IMD;NØØ	Spectral data	(< PIXCT > I3), value of PIXCT for each record is stored in array LL.

Common Blocks

FIELDX uses common blocks /RADVAL/ and /FILES/. For a description of /RADVAL/ and /FILES/, refer to Section 1.

Subroutines Called

Name	Definition	Reference
FLDINT	Extracts pixels for field from scanline	1.9.4.1
FILEM, entry AREAD	Reads one line in an IMDACS image file	1.9.4.2

Called By

PRVIN (1.9)

Local Variables

Name	Definition
BBUF	Array used in reading IMDACS image data.
END	Highest sample number in scanline.
FLDATA	Field data array.
FLDHED	Field data heading.
FLDVTX	Field data vertices.
FPIX, LPIX	Pixel intercepts for given field.
ICHAN	Counter for data files.
ICNT	Vertice counter.
IFLD	Field counter.
ILINE	Line counter.
INV	Number of vertices for a given field.
IREC	Associate variable in reading field file.
ISTAT	Error flag in reading IMDACS image file.
IMAX	Maximum line number for a given field.
IMIN	Minimum line number for a given field.
LININT	Pixel coordinates for field vertices.
MAXLIN	Number of lines for each field.
NINT	Number of vertices in given field.
NPIX	Number of pixels on scanline in given field.
NVER	Number of vertices for each field.
OFST	Offset in storing field vertices.
PIXCT	Counter in writing samples in output array.
VERTXS	Array containing vertices for one field.

1.9.4.1 FLDINT

Purpose

This routine will return the pixel numbers of those pixels on a given line that are contained within the boundaries of a nonrectangular field.

Calling Sequence

Subroutine FLDINT (FIELD, NPTS, FL, YLINE, NSAMP, JJ).

Calling Arguments

Name	Usage	Type	Definition
FIELD	Input	I	Nonrectangular field table.
NPTS	Input	L	Number of vertices.
FL	Output	I	Array containing pixel intercepts.
YLINE	Input	L	Scanline number.
NSAMP	Output	L	Number of pixels in field on scanline.
JJ	Output	L	Number of pixel pairs in array FL.

Files

Not applicable.

Common Blocks

Not applicable.

Subroutines Called

Not applicable.

Called By

FIELDX (1.9.4).

Local Variables

Name	Definition
NPTSE	Number of vertices in field minus one.
NPTS1	Number of vertices
RXX	X intercept.
RX1, RY1, RX2, RY2	Field vertices.
XNM1, YNM1	Vertice pair before current pair.
XNP2, YNP2	Vertice pair following current pair.
XX	X integer.
X1, Y1, X2, Y2	Field vertices.

1.9.4.2 FILEM

Refer to Section 1.9.1.1

1.9.5 DOTX

Purpose

This routine reads an IMDACS formatted image file and extracts up to ten user defined pixels.

Calling Sequence

Subroutine DOTX (NDOT, DOTLST, IERR).

Calling Arguments

Name	Usage	Type	Definition
NDOT	Input	I	Number of pixels to extract.
DOTLST	Input	I	Pixel coordinates.
IERR	Output	I	Error flag.

Files

File	Usage	Record Format
IMGNAM	IMDACS image file	See IMDACS documentation for format.
FIELDATA.IMD;NØØ	Spectral values	(< NDOT > I3)

Common Blocks

DOTX uses common blocks /RADVAL/ and /FILES/. For a description of these blocks, refer to Section 1.

Subroutines Called

Name	Definition	Reference
FILEM, entry AREAD	Reads one line in an IMDACS image	1.9.1.1

Called By

PRVIN (1.9)

Local Variables

Name	Definition
BBUF	Image data.
DOTS	Ordered pixel pairs.
ILINE	Line counts.
ISTAT	Error flag in reading IMDACS file.
PIXEL	Extracted spectral values.
TEMP1, TEMP2	Used in ordering pixel coordinates in DOTLST.

1.9.5.1 FILEM

Refer to Section 1.9.1.1

1.9.6 CALVIN

Purpose

This routine calculates VINS for each pixel. Then the average VIN for all pixels is calculated.

Calling Sequence

Subroutine CALVIN (IACQ, IOPT, NLINE, SUNCOR, LSAT, LL).

Calling Arguments

Name	Usage	Type	Definition
IACQ	Input	I	Acquisition.
IOPT	Input	I	Data set option.
NCLINE	Input	I	Number of scanlines of data.
SUNCOR	Input	I	Sun angle correction.
LSAT	Input	L	Lauc[illegible]t number.
LL	Input	I	Array containing number of pixels in each scanline.

File

File	Usage	Record Format
FIELDATA.IMD;NØØ	Spectral values	(< NPIX > I3), where NPIX for each record is stored in array LL.

Common Blocks

CALVIN uses common blocks /VINS/. For a description of /VINS/, refer to Section 1.

Subroutines Called

Not applicable

Called By

PRVIN (1.9)

Local Variables

Name	Definition
CHAN	Spectral data.
CHAN1,	Arrays used in reading spectral data values.
CHAN2,	Arrays used in reading spectral data values.
CHAN3,	Arrays used in reading spectral data values.
CHAN4	Arrays used in reading spectral data values.
LIA	Landsat 1A to Landsat 2 correction.
LIB	Landsat 1B to Landsat 2 correction.
L2C	Landsat 2C to Landsat 2 correction.
L3A	Landsat 3A to Landsat 2 correction.
IAVI	AVI, no corrections.
IGRN	Kauth greeness, no corrections.
IND3	Normalized difference for Ch 2 and Ch 3.
IND4	Normalized difference for Ch 2 and Ch 4.
IRAT	Ratio of the Ch 4/Ch 2.
ILAVI	IAVI corrected for Landsat 2.
ILGRN	IGRN corrected for Landsat 2.
ILND3	IND3 corrected for Landsat 2.
ILND4	IND4 corrected for Landsat 2.
ILRAT	IRAT corrected for Landsat 2.
ISAVI	IAVI corrected for sun angle.
ISGRN	IGRN corrected for sun angle.

Local Variables

Name	Definition
ISND3	IND3 corrected for sun angle.
ISND4	InD4 corrected for sun angle.
ISRAT	IRAT corrected for sun angle.
PIXCT	Number of pixels used in VIN calculation.
RPIX	PIXCT stored as real value.
SAC	Sun angle corrected data.
TAVI	Total AVI.
TGRN	Total Kauth greeness.
TND3	Total normalized difference for Ch 2 and Ch 3.
TND4	Total normalized difference for Ch 2 and Ch 4.
TRAT	Total ratio for Ch 4/Ch 2.
TLAVI	Total AVI corrected for sun angle and Landsat.
TLGRN	Total IGRN corrected for sun angle and Landsat.
TLND3	Total IND3 corrected for sun angle and Landsat.
TLND4	Total IND4 corrected for sun angle and Landsat.
TLRAT	Total IRAT corrected for sun angle and Landsat.
TSAVI	Total ISAVI corrected for sun angle.
TSGRN	Total ISGRN corrected for sun angle.
TSND3	Total ISND3 corrected for sun angle.
TSND4	Total ISND4 corrected for sun angle.
TSRAT	Total ISRAT corrected for sun angle.

1.9.7 WRTVIN

Purpose

This routine writes VIN values as a disk file on EWØ31.

Calling Sequence

Subroutine WRTVIN (SEGID, CRYR, IOPT, OCTALS, NACQ, DISK, UIC).

Calling Arguments

Name	Usage	Type	Definition
SEGID	Input	L	Segment identification.
CRYR	Input	I	Crop year of ground truth data
IOPT	Input	L	Data type
OCTALS	Input	L	Array containing octal equivalent of julian day for each acquisition.
NACQ	Input	I	Number of acquisitions.
DISK	Input	L	Data disk label.
UIC	Input	L	User ID, set as [70,7].

Files

File	Usage	Record Format
VINAME	VIN data	(5F8.3)

Common Blocks

WRTVIN uses common block /VINS/. For a description of /VINS/, refer to Section 1.

Subroutines Called

Not applicable.

Called By

PRVIN (1.9)

Local Variables

Name	Definition
DATYPE	Data type.
EXTN	Extension, set as '.VIN;'
IACQ	Counter for acquisitions.
VINAME	Name of VIN disk file.
YR	Crop year.

1.10 PRPLOT

Purpose

This routine queries user for plotting parameters.

Calling Sequence

Subroutine PRPLOT (SEGN, SEGID, CRYR, ACQLST, NACQ, OCTALS, LSATS, CMI, AWC, DATAYPE, NDAT, CORECT, NCOR, CARD, OTHER, IERR).

Calling Arguments

Name	Usage	Type	Definition
SEGN	Input	I	Segment number.
SEGID	Input	L	Segment identification.
CRYR	Input	I	Crop year of ground truth data.
ACQLST	Output	I	Acquisition list.
NACQ	Output	I	Number of acquisitions.
OCTALS	Output	L	Array containing octal equivalent of julian day for each acquisition.
LSATS	Output	L	Array containing satellite number corresponding to each acquisition date.
CMI	Output	R	Crop moisture index data.
AWC	Not used		
DATYPE	Output	L	Data type.
NDAT	Output	I	Number of data types.
CORECT	Output	I	Correction.
NCOR	Output	I	Number of corrections.
CARD	Process	L	Array used in reading character data.
OTHER	Output	L	Flag that is set if CMI data is read.
IERR	Output	I	Error flag.

Files

File	Usage	Record Format
SEGINFO.DAT;1	Segment information	(80A1)
PALMER.DAT;1	Crop moisture index data	(5X, I4, 8X, I2, 6X, I2, 37X, F6.2).

Common Blocks

Not applicable

Subroutines Called

Name	Definition	Reference
DPNUMB	Decodes a string of input numbers into a double precision integer array.	1.10.1
NAMEIT	Queries for and inputs data file names.	1.10.2

Called By

Range (1.)

Local Variables

Name	
ACQDAT	Acquisition date.
ACQUIS	Array containing acquisition dates.
BDUM	Character data.
BEGDAY	Day 1 for CMI data for years 1974 - 1979.
CRD	Crop reporting district for each acquisition.
DIST	Crop reporting district.
FLAG	Flag used in checking plot options.
IACQ	Counter in acquisition list.
IAWC	Not used.
ICMI	Crop moisture index data.
INPUT	Character data.
SEGMT	Segment number as character string.
VINAME	VIN data file name.
WEEK	Week equivalents of julian dates.

1.10.1 DPNUMB

Refer to Section 1.1.2.

1.10.2 NAMEIT

Refer to Section 1.1.3.

1.11 PLTVIN

Purpose

This routine plots VIN data on the CALCOMP plotter.

Calling Sequence

Subroutine PLTVIN (SEGN, SEGID, CRYR, ACQLST, NACQ, OCTALS, ISATS, CMI, AWC, DATYPE, NDAT, CORECT, NCOR, DISK, OTHER, IERR).

Calling Arguments

Name	Usage	Type	Definition
SEGN	Input	I	Segment number.
SEGID	Input	L	Segment identification.
CRYR	Input	I	Crop year of ground truth data.
ACQLST	Input	I	Acquisition list.
NACQ	Input	I	Number of acquisitions.
OCTALS	Input	L	Array containing octal equivalent of julian day for each acquisition.
LSATS	Input	L	Array containing satellite number corresponding to each acquisition date.
CMI	Input	R	Crop moisture index data.
AWC	Not used		
DATYPE	Input	L	Data type(s)
NDAT	Input	I	Number of data types.
CORECT	Input	I	Correction(s).
NCOR	Input	I	Number of corrections.
DISK	Input	L	Data disk.
OTHER	Input	L	Flag indicating if CMI data will be plotted.
IERR	Output	I	Error flag.

Files

File	Usage	Record Format
VINAME	VIN data file	(5F8.3).

Common Blocks

Not applicable.

Subroutines Called

All subroutines called are CalComp plotting routines. See Programming CalComp Electromechanical Plotters for more information on these routines.

Name	Definition
PLOTS	Initialization routine.
FACTOR	Scaling factor for graphs, axes and headings.
NEWPEN	Routine for changing pen color
PLOT	Positioning routine.
LINE	Writes points or draws lines.
SYMBOL	Writes points or writes heading.
AXIS	Draws axis and writes axis scale and label

Called By

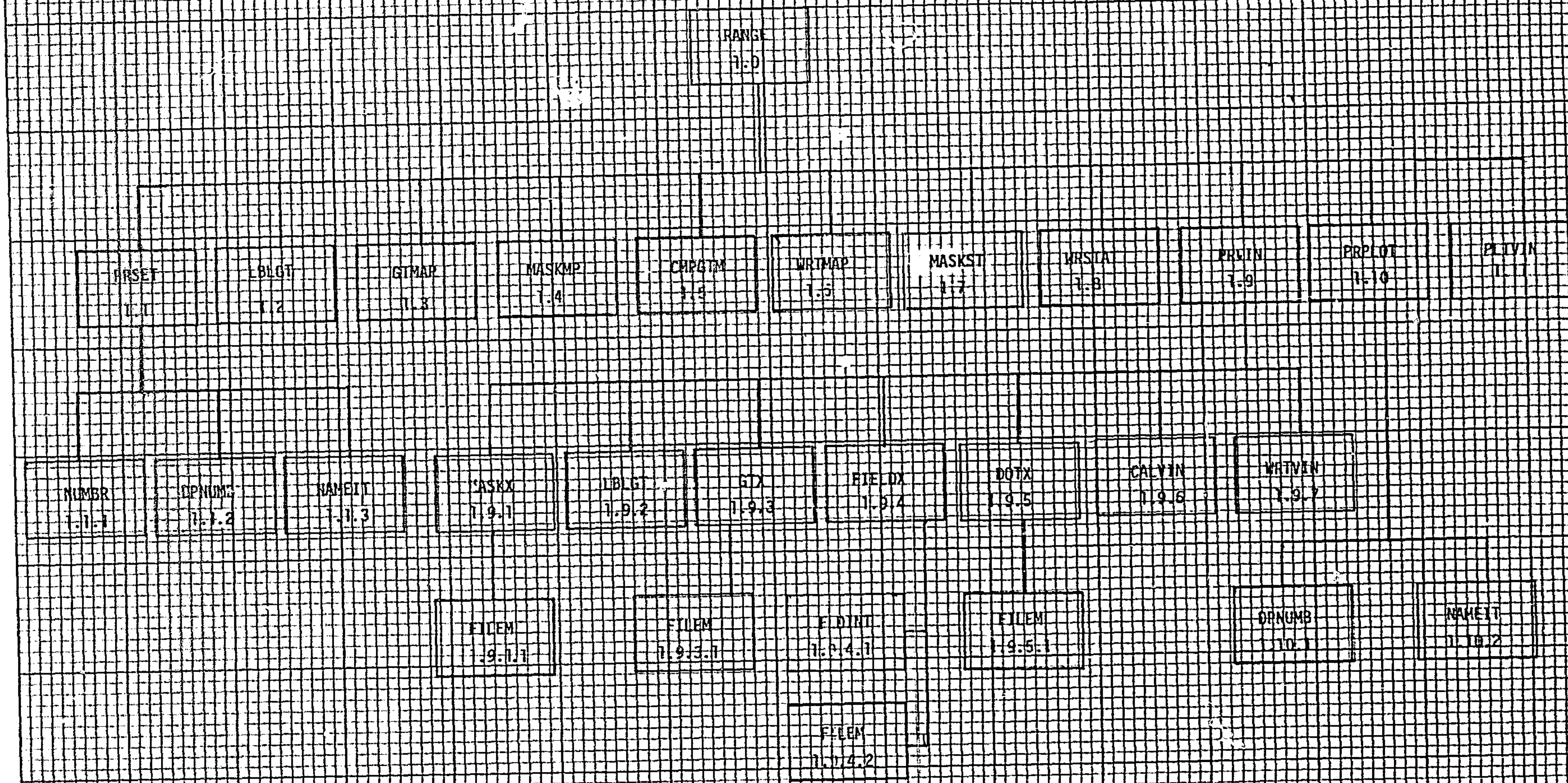
Range (1.).

Local Variables

Name	Definition
ATYPE	Index in choosing data type heading.
BDUM	Byte variable.
DATHED	Heading for AWC (not used) or CMI data axis.
DDUM	Date
DV	NACQ + 2
EXTEN	Extension, set as '.VIN;'
FV	NACQ + 1
HGT	Parameter used in placement of plot headings.
IA,IACQ	Counter for acquisitions.
ISYM	Plotting symbol for points on graph.
ITYPE	Counter for data type.
IVIN	Counter for plots.
LDATA	Vin data, sun angle and Landsat corrected.
LHED	Landsat and sun angle heading.
LSYM	Graph symbol.
NOTRAW, NOTSUN,	Flags for data types.

Local Variables (Cont'd)

Name	Definition
NOTSAT	
RDATA	VIN Data, no corrections.
RHED	Raw data heading.
SDATA	VIN data, sun angle corrected.
SEGMT	Segment number as character string.
SHED	Sun angle heading.
THEAD	Data type heading.
TYPHED	Data correction
UIC	User identification, set as '[70,7]'
VINAME	VIN data file name.
VINHED	Headings for independent axis.
XDATE	Julian dates for acquisitions, initial axis value, and axis increment.
XDV	X axis increment.
XFV	X axis initial value.
XHED	Contains 'DATE' as character string.
XPOINT	X axis data point, initial axis value and axis increment.
YDV	Y axis increment for each graph.
YFV	Y axis initial value for each graph.
YHED	Y heading on CMI plot.
YPOINT	Y axis data point, initial axis value and axis increment.
YR	Ground truth year.
YRHED	Ground truth year heading.
YVIN	Independent axis data.
ZDV	CMI axis increment.
ZFV	CMI axis initial value.
ZHED	CMI axis heading.
ZPOINT	CMI data value, initial axis value and axis increment.
ZVALUE	CMI data.



2.0 FLOW DIAGRAM OF RANGE