



Remote sensing: Data formats and software packages

Rüdiger Gens



What is this presentation is about

- broad overview about
 - most common data formats used in remote sensing
 - software packages dealing with those formats
- starting point for further studies

Data formats and software packages



What this presentation is NOT about

- the conclusive answer to all the questions about data formats you ever had
- an attempt to cover every remote sensing data format under the sun
- a sales pitch for any of the software packages
- a tutorial on the different image products

Data formats and software packages



Common remote sensing data

- Optical
 - Landsat, Aster, AVHRR, MODIS, SPOT
- SAR
 - Radarsat, ERS, JERS-1
- DEMs
 - GTOPO30, SDTS, NED, SRTM
- Vector data
 - ESRI shape files
- Models
 - netCDF

Data formats and software packages



HDF-EOS format

- standard data format for all NASA Earth Observing System (EOS) data products
 - multi-object file format developed at the National Center for Supercomputing Applications (NCSA)
- standard HDF objects: images, tables, text, and data arrays
- three additional data types based on HDF objects: grid, point, and swath
- self-describing format

Data formats and software packages



GeoTIFF format

- extension of the regular TIFF format
- uses a small set of reserved TIFF tags to store a broad range of georeferencing information
- only commonly used generic image format that can handle geolocation information
- available in all standard remote sensing and GIS packages



ERDAS Imagine

- .lan format
 - old ERDAS Imagine 7.5 format
 - around for long time: most packages can read it
- .img format
 - one of the standard remote sensing format
 - plays well with ArcGIS (Arc/Info)

Data formats and software packages



CEOS format

- standard data format for radar data
 - Radarsat, ERS, JERS-1
- comes in a large variety of flavors
- contents depends on processing facility
- usually requires software tools to read and convert into different format
- interface for ASF data available in next version of ERDAS Imagine

Data formats and software packages



MrSID format

- stands for Multi-resolution Seamless Image Database
- wavelet based image encoder, viewer and file format: compression efficient
- main format of USGS scanning products
 - topo maps
 - aerial photographs
- regularly used in GIS applications



Landsat data

- available formats
 - HDF-EOS
 - GeoTIFF
 - Fast L7
 - each band is self-contained in its own file
 - header file containing three ASCII metadata records (administrative, radiometric, and geometric)

Data formats and software packages



Terra / Aqua data

- large variety of products
- Terra instruments
 - ASTER, CERES, MISR, MODIS, MOPITT
- Aqua instruments
 - AIRS, AMSR-E, CERES, HSB, MODIS
- number of software packages with interfaces
- available formats
 - HDF-EOS

Data formats and software packages



AVHRR data

- number of software package interfaces available
- available formats
 - Level 1b 8-bit/10-bit/16-bit HRPT/LAC
 - Level 1b 8-bit/10-bit/16-bit GAC
 - Dartcom 16-bit HRPT
 - Satlantic 16-bit HRPT
 - Quorum Qtrack 16-bit HRPT
 - 16-bit HRPT Minor Frame
 - Dundee 16-bit HRPT
 - AVHRR CEOS (Raw AVHRR CCT Image Format)

Data formats and software packages



SPOT data

- SPOT 1-4: CAP format
- SPOT 5 and later: DIMAP format
- usually requires software package with SPOT data interface

Data formats and software packages



Digital Orthophoto Quadrangle (DOQ)

- computer-generated image of an aerial photograph
 - image displacement caused by terrain relief and camera tilt has been removed
 - combines the image characteristics of the original photograph with the georeferenced qualities of a map
- available formats
 - native (viewer and conversion tools available)
 - GeoTIFF

Data formats and software packages



GTOPO30

- global topographic data (30 arc seconds)
- format
 - DEM – digital elevation model data (flat binary)
 - HDR – header file for DEM (ASCII)
 - DMW – world file (ASCII)
 - STX – statistics file (ASCII)
 - PRJ – projection information file (ASCII)
 - GIF – shaded relief image (GIF format)
 - SRC – source map (8-bit binary)
 - SCH – header file for source map (ASCII)



SDTS format

- stands for Spatial Data Transfer Standard
- used by USGS for providing DEMs
 - SDTS was ratified by the National Institute of Standards and Technology (NIST) as a Federal Information Processing Standard (FIPS 173).
 - Compliance with FIPS 173 by federal agencies became mandatory in 1994



National Elevation Dataset (NED)

- provided by USGS using the Seamless Data Distribution System
- available formats
 - ArcGrid (integer data)
 - GeoTIFF
 - GridFloat (Arc floating point data)
 - BIL (flat binary – band interleaved by line)

Data formats and software packages



SRTM data

- distributed by the USGS EROS Data Center
- available formats
 - ArcGrid (integer data)
 - BIL (flat binary – band interleaved by line)
 - GeoTIFF

Data formats and software packages



ESRI shape files

- standard for vector data
- basis of what GIS is all about
- support point, line and area features
- attributes stored in dBase format

Data formats and software packages



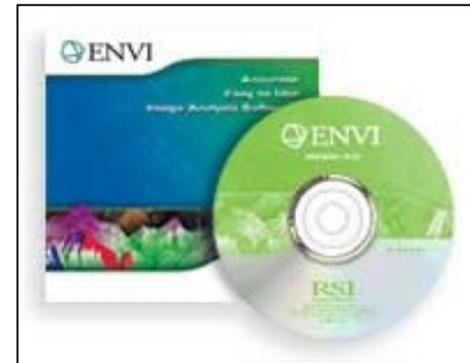
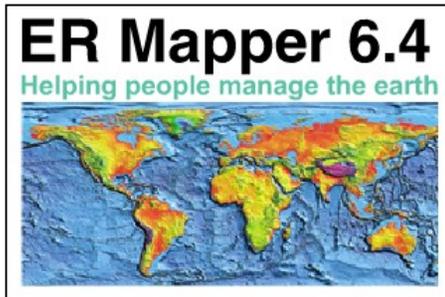
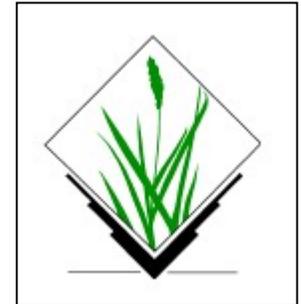
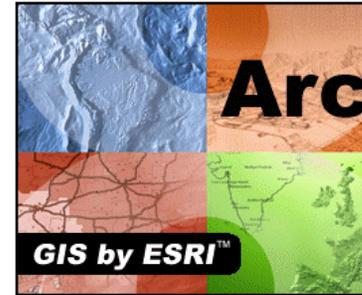
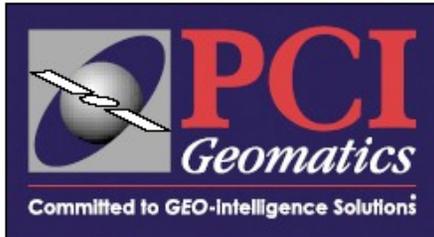
netCDF format

- stands for network Common Data Form
- an interface for array-oriented data access
- a library that provides an implementation of the interface
- main format for atmospheric models
- marine Geophysics data (gravity, magnetics and bathymetry)



Software packages

Data formats and software packages





ArcGIS

- comprehensive GIS package
- graphical user interface to Arc/Info
- developed by ESRI
- runs on Windows
- handles raster formats
 - GRID
 - GeoTIFF
 - JPEG
 - MrSID
 - ERDAS Imagine

Data formats and software packages

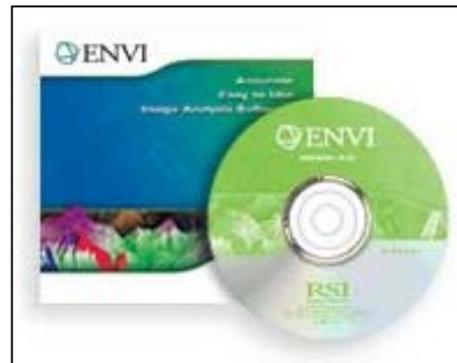




ENVI 4.1

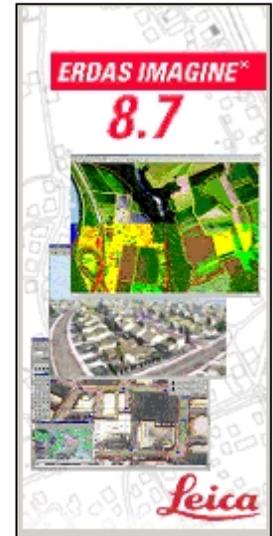
- originally developed for hyperspectral data
- developed by Research Systems Inc.
- image processing package
- runs on all major platforms (Windows, Linux, Mac, various Unix flavors)
- handles all major raster and vector formats
- interfaces to all common remote sensing data

Data formats and software packages





ERDAS Imagine 8.7



- full-blown remote sensing package
- developed by Leica Geosystems
- runs on Windows and Solaris
- handles all major raster and vector formats
- interfaces to all common remote sensing data
- next version supports ASF CEOS format

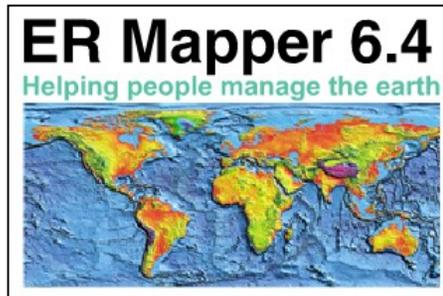
Data formats and software packages



ER Mapper 6.4

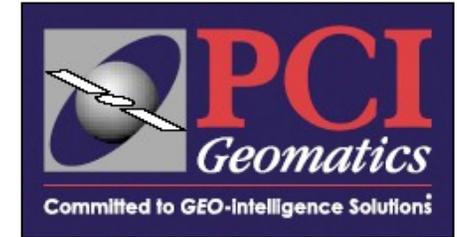
- mapping and image processing package
- developed by Earth Resource Mapping
- runs on Windows
- handles most common raster and vector formats
- interfaces for some remote sensing data

Data formats and software packages





Geomatica 9.1



- remote sensing package
- developed by PCI
- runs on Windows, Linux, Solaris and Irix
- handles all major raster and vector formats
- interfaces to common remote sensing data

Data formats and software packages



GeoMedia 5.2

- focus on mapping and geospatial solutions
- strong link to Open GIS Consortium (OGC)
- developed by Intergraph
- runs on Windows

Data formats and software packages





GRASS 5.3



Data formats and software packages

- Geographic Resources Analysis Support System
- GIS package with image processing functionality
- handles common GIS formats and a few remote sensing formats
- runs on Linux, Mac, various flavors of Unix
- freeware



ILWIS 3.2

- stands for Integrated Land and Water Information System
- developed at ITC, the Netherlands
- remote sensing and GIS package
- runs on Windows
- shareware

Data formats and software packages





IDRISI Kilimanjaro

- focus on environmental decision making with GIS
- developed by Clark Labs in Worcester, Massachusetts
- GIS and image processing package
- handles common data formats
- interfaces to selected remote sensing data
- runs on Windows

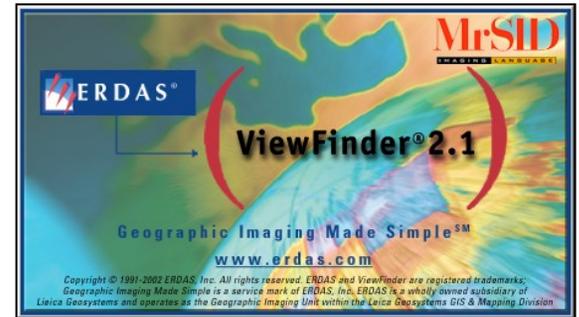
Data formats and software packages





Nifty little helpers

- free viewing tool (ERDAS) providing basic image viewing and manipulation capabilities
- supports a variety of raster formats
 - Arc/Info BIL, BIP, BSQ
 - ER Mapper
 - ERDAS Imagine
 - JPEG
 - MrSID



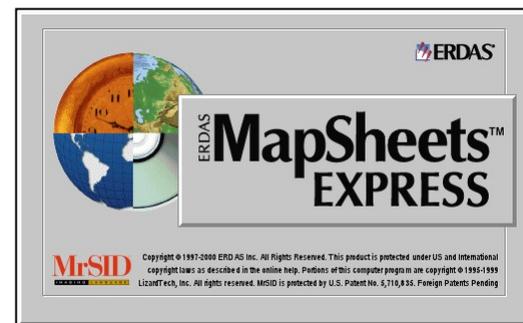
Data formats and software packages



Nifty little helpers

Data formats and software packages

- free viewing and mapping tool (ERDAS)
- supports raster and vector formats
 - ERDAS Imagine Files
 - ESRI Shape Files
 - Tagged Image File Format (TIFF)
 - MrSID
 - JPEG





Nifty little helpers



Data formats and software packages

- ExpressView Browser Plug-in (MrSID)
 - for Internet Explorer and Netscape
 - ability to natively display MrSid and JPEG2000



Nifty little helpers



HDF-EOS Tools and Information Center

- HDF-EOS tools
 - HDF-EOS to GeoTIFF converter
 - General Coordinate Transformation Package (GCTP)
 - HDF Explorer – viewer for HDF-EOS and netCDF

Data formats and software packages



Nifty little helpers

- free image viewing tool (PCI)



- Geomatica FreeView

- handles all common remote sensing data formats
- basic image viewing and analysis functions

Data formats and software packages



Nifty little helpers

- free image viewing tool (ER Mapper)
- basic image viewing functions
- supports raster formats
 - ER Mapper (incl. compressed)
 - GeoTIFF
 - ESRI BIL
 - USGS Digital Ortho Quad
 - JPEG





Take home message

- there is a lot of stuff out there
 - no silver bullet that does it all
 - look at your needs
 - look around – solutions don't have to be expensive
- trend towards data integration
 - image processing and enhanced analysis
 - GIS is the keyword
- data format of the moment: GeoTIFF
 - generic data format
 - meets most user's needs

Data formats and software packages



List of useful URLs

Data formats and software packages

http://www.asf.alaska.edu/~rgens/teaching/data_sw.html