

Appendix 5

Compression, Geocoding and Mosaic of Historical Maps Images

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1 Compression, Geocoding, and Mosaic of Historical Maps

This paper present results and tests of compression, geocoding and mosaic of images.

The aim is to find out compression rate, geocoding and mosaic times.

2 Results

2.1 MrSID Compress Publisher

Earlier tests of the program MrSID Compress Publisher gave the conclusion that it is possible to compress the historical map files to a size 20 times smaller than the uncompressed file. Still you can't see any difference between the compressed map and the original map. The map's geometry is also maintained. The program allows batch compressing and there's no limit for how much data (megabyte) you can compress at one time. Other advantages with MrSID are that you can choose the number of zoom levels in the compressed Sid-file and that you can do the level 2 geocoding.

Some new tests of the program were done and the results are shown in table 1.

| Compression of TIFF-files saved on harddisk | | | | | Harddisk: 4 GB | Harddisk: 12,5 GB |
|---|------------------------|----------------|-----------------|----------------|--------------------|----------------------|
| | | | | | RAM: 64 MB | RAM: 288 MB |
| File | Compression (about) | Zoom levels | TIFF (in MB) | SID (in MB) | Time (min :sec) | Time (min :sec) |
| Askersund | 20:1 | 4 | 29,7 | 1,3 | 04:19 | 04:16 |
| Askersund | 20:1 | 3 | 29,7 | 1,3 | 04:18 | ---- |
| Linköping | 10:1 | 4 | 3,8 | 0,33 | 00:10 | 00:08 |
| Linköping | 10:1 | 3 | 3,8 | 0,34 | 00:09 | ---- |
| 07702a | 20:1 | 5 | 237,6 | 9,1 | 15:25 | 09:06 |
| 07702b | 20:1 | 5 | 192,1 | 7,9 | 09:47 | 07:53 |
| 05505a | 20:1 | 5 | 199,9 | 8,6 | 09:58 | 07:26 |
| 05505b | 20:1 | 5 | 237,4 | 11,3 | 13:11 | 10:02 |
| Compression of TIFF-files directly from CD-ROM. | | | | | | |
| 05505a | 20:1 | 5 | 199,9 | 8,6 | 14:36 | ---- |

Table 1. Account of some compression tests in MrSID Compress Publisher.

MrSID Viewer can be used to look at the compressed maps (Sid-files). In the Viewer you can amongst other things pan, measure, zoom in- and out and export to TIFF-file.

2.2 Geocoding, mosaic, compression

The results of tests made for different kinds of historical maps are shown in table 2. "Original size" in column 3 means the together total size of the original TIFF-files that have been used to create the result-file. In the table you can also see the size of the TIFF-file you get after the work in ERDAS IMAGINE (column 4). Column 5 shows the size of the compressed file. The choice of compression level (about 20 times smaller) is based on earlier tests of the program MrSID Compress Publisher. The conclusion was that it is possible to compress the historical map files to a size of about 20 times smaller than the uncompressed file and still you can't see any difference between the compressed map and the original map. Column 6 shows the effective compression time and column 7 the total work time (approximately) from original files to result file. Column 8 shows which worksteps the map went through except the compression.

The total work time can be reduced in different ways. A faster computer (more RAM) would for example reduce the time.

The total work time for the square-divided map series can be much reduced if you use the level 2 geocoding method and have a list of the map-squares upper left co-ordinates. The tfw-files will be easier to make and you don't have to do all the work in ERDAS IMAGINE. An older economic map (e.g. Laholm in table 2) would take only about 10 minutes or probably less if you use this method.

Digital Historical Maps

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| SID-file (result) | TIFF-files (original) | Size (tiff) (original, in MB) | Size (tiff) (from ERDAS, in MB) | Size (Sid) (MB, 20 times smaller) | Compression (time in min.) | Total time (in hours and min.) | Steps (except compression) | Type of map |
|------------------------------|----------------------------------|--|--|--|---------------------------------------|---|--|---|
| Grebbestad | 133_9A3h78_t | 71,5 | 71,9 | 3,4 | 3 | 0.55 | Level 3 geocoding | Economic map, 1977 |
| Laholm | 114_M67-1_t | 75 | 75,6 | 3,1 | 3 | 0.55 | Level 3 geocoding | Older economic map (Härad map), 1923 |
| Hörda | 05505a 05505b | 437 | 193,6 | 8,4 | 7 | 2.20 | Rectification, mosaic, level 3 geocoding | Statutory redistribution, 1906 |
| Hördau | 05505a | | 59,7 | 1,8 | 2 | 0.40 | Cutting (new img-file), level 3 geocoding | Statutory redistribution, 1906 |
| Målen | 07702a 07702b | 429 | 275,2 | 8,5 | 11 | 2.45 | Rectification, mosaic, level 3 geocoding | Statutory redistribution, 1851 |
| Målen2 | 07702a 07702b | 429 | 285 | 10,5 | 11 | 2.15 | Rectification, mosaic, level 2 geocoding | Statutory redistribution, 1851 |
| Barkhyttan | 0030102 | 138 | 165,1 | 7,5 | 7 | 1.20 | Level 3 geocoding | Geometric map, 1758 |
| Barkhyttan2 | 0030102 | 138 | 138,9 | 7,1 | 5 | 0.35 | Level 2 geocoding | Geometric map, 1758 |
| Rölunda | A11002c A11002d A11002e | 294 | 89,4 | 3,4 | 3 | 1.40 | Rectification, mosaic, level 2 geocoding | Geometric Land Books, 17 th century |

Table 2. Results from tests with different types of maps and also account for original files and worksteps.

2.3 Level 3 geocoding of square-divided economic maps

Level 3 geocoding of square-divided economic maps can be done with the method of level 2 geocoding (it is about the same accuracy). A test was made for 10 scanned economic maps, see table 3. These 10 maps covered a continuous area of 2*5 maps. The total time of work include time to get the TIFF-files from the server (13 min), time to calculate the upper left co-ordinates for each map (4 min) and time to create a tfw-file for each TIFF-file (5 min). These steps can probably be optimised to reduce the total work time. Also these maps were compressed 20 times smaller.

| Type of map | Size (tiff) in MB, (10 maps) | Size (sid) in MB, (10 maps) | Compression Time in min. (10 maps) | Total work- time (min) (10 maps) | Steps (except compr.) |
|---------------------------|---------------------------------|--------------------------------|--|--|--------------------------|
| Economic map (10 maps) | 715 | 36,3 | 25 | 47 | Level 2 geocoding |

Table 3. Batch compressing and geocoding for 10 scanned earlier economic maps. RAM: 288 MB.

These old economic maps have the co-ordinate system RT 38 2,5 gon V and not the RT 90 2,5 gon V. A position on a map may differ with up to about 5 meters between the two co-ordinate systems, but the position is generally the same in both co-ordinate systems.

3 Methods for testing

The functions in MrSID Compress Publisher were more limited than we had expected when it came to geocoding and mosaic of historical maps. You couldn't for example make a good seamless mosaic of overlapping scanned map parts. Therefore we instead started to look at ERDAS IMAGINE to see if this program could satisfy our wishes. The result comes to following proposal of a workflow including seamless mosaic, two levels of geocoding and also the compression in MrSID Compress Publisher. The work is however very time consuming, especially if you want to make a mosaic and the level 3 geocoding, which may limit a fully use of this method.

3.1 Workflow 1 – with geocoding

1. **Import** the TIFF-file to ERDAS IMAGINE and open the map in a Viewer.
2. **Find** the same area of the historical map in a reference map that has the co-ordinate system you want.
3. Do the **geocoding** of the historical map. Choose between level 2 or 3 method.
4. Make a visually check of the result.
5. **Export** the IMAGINE-file back to TIFF-format.
6. Create a **TIFF World file (.tfw)**.
7. **Compress** the map in MrSID Compress Publisher.

3.2 Workflow 2 – with seamless mosaic and geocoding

1. **Import** the TIFF-files to ERDAS IMAGINE and open the map-parts in a Viewer each.
2. **Rectify** the map-parts so they have the same pixel system.
3. Make a seamless **mosaic** of the overlapping map-parts.
4. Then follow steps 2-7 in the **workflow 1**.

3.3 Geocoding – level 2

This sort of geocoding is done in MrSID Compress Publisher simultaneously with the compression. First you have to create a text file, called Tiff World File (.tfw), with the information about the map's upper left co-ordinates and the pixel-extension in X- and Y-direction.

This method could be useful for the old maps in the Geometric Land Books (17 Th. century) but the accuracy in co-ordinates will only become about some hundreds of meters up to a couple of kilometres. The method works very well (a higher accuracy in the co-ordinates) for square-divided historical map series such as older economic maps (20 th century).

3.4 Geocoding – level 3

This method means that you try to find identical points (crossroads, houses etc) in the historical map and a modern digital map with a co-ordinate system. The result can be very good if the geometry in the historical and modern maps is fairly similar. Using this method, some of the oldest hand-drew maps may though become too distorted to be useful.

4 Programs and hardware

Computer capacity for:

- The work in ERDAS IMAGINE: 4 GB HD, 128 MB RAM.
- Compressing in MrSID: 12,5 GB HD, 288 MB RAM

Following program versions are used:

- ERDAS IMAGINE v8.3.1
- MrSID Compress Publisher v1.2.1
- MrSID Viewer v2.0.0.48