

A Geostationary Weather Satellite Station

Part 2

Geostationary Image Processing

by Douglas Deans

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Those who read part 1 of this article will have appreciated that there is a large volume and diversity of WEFAX imagery sent from Meteosat on a daily basis. The availability of identical images in differing wavelengths, regularly repeated, clearly offers marvellous image processing opportunities, but transferring images in that quantity to other programs for manual processing is just too cumbersome and time consuming.

Whilst software provided with integral systems is normally of a very high standard its strengths have tended to lie in the area of reception and automation and less in subsequent image processing, albeit masks, colour options and animation are all provided as standard.

There is now software available which not only offers every conceivable image processing capability but, more importantly, provides it with a high degree of automation.

I am, of course, referring to GeoSatSignal the latest offering from the keyboard of David Taylor. David already well known in weather satellite circles for his WXtrack and SatSignal programs has turned his skills to images from geostationary satellites to produce a wealth of goodies, in my opinion long overdue.

Many aspects of this software, including automated retrieval of images from the Internet, particularly suitable for those with no station, have already been well covered by Les Hamilton in Journal 68. I will restrict my review to those features I have found most useful and which augment the capabilities of existing station software. For those already using such software, do not be under the misapprehension that this program has nothing new to offer; quite the opposite, as almost all of its facilities are new and unavailable, to my knowledge, anywhere else.

So what does this software have to offer?

Before processing images you must first load them and GeoSatSignal is designed to accept a wide range of image types, from a variety of sources. Those include the better known JPEG, GIF, BMP and PNG image formats as well as Timestep .dat files and digital files from a variety of HRI systems. Input can be from the conventional *File>Open* commands, but there is also a drag and drop facility (registered users) and a very useful browse tool. Setup is straightforward, and is divided into a *Common Setup* and a *Job Setup*. The common setup covers a wide selection of options likely to be

applicable to all processes and includes station location, cartography, and a range of thermal and sensor calibrations. The job setup allows you to choose a suite of particular processing parameters and save them as a job number. Simply selecting that job number will then ensure that all processing is done in accordance with your chosen settings. The beauty of this arrangement is that you can set up a number of 'packages' each with its own particular parameters and separately selectable. This greatly speeds up the automation process and allows a suite of options at the press of a key – very neat. The job setup covers processing requirements such as false colour, brightness, re-mapping options, animation settings to mention but a few.

Let us now look at the many processing facilities and start with the most basic and fundamental. For those familiar with Meteosat WEFAX, a 9-sectored format, it must seem incredible that until now it had not been possible to automatically join adjacent sectors. This is all the more surprising when you consider that some of the sector splits can be very compromising both geographically and meteorologically. Examples include the C02/C03 split through London and the D1/D4 split which can often bisect tropical storms and hurricanes in the Atlantic. Although there are whole-disc WEFAX images they are of a much reduced resolution.

A wide range of sector joining is now available. When *Open>Join* is selected and a relevant image loaded the programme looks for the corresponding sector(s) in the same wavelength and with a similar timestamp then joins them. Initially the joined image is loaded in a new window called Image Joiner which provides nudge facilities as shown in *fig.1*.

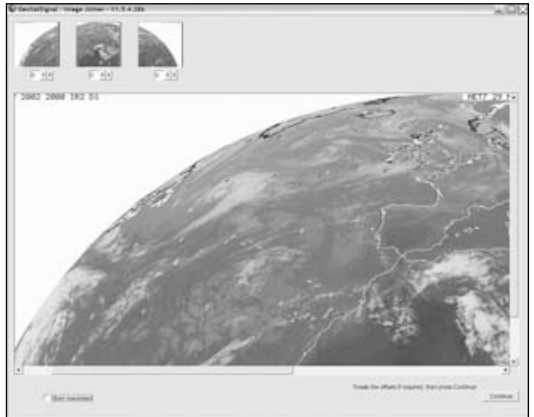


Fig.1 - The Joiner window

Sometimes received images can be a pixel or two out of registration, and this useful facility allows either image to be nudged, if necessary, to perfect the join, enabling high quality images for presentations. For animations the nudge facility is not used as it would seriously slow down processing of large quantities of images and a pixel or two is hardly noticeable in these circumstances. Details as to which sectors can be joined have already been published in Journal 68, p.67 and can also be viewed at David's web site. An example of a simple C02/C03 join is shown in *fig.2*.

I have dwelt a little on sector joining but it's automation that has been, in my opinion, the most missed facility in Meteosat WEFAX image processing. The

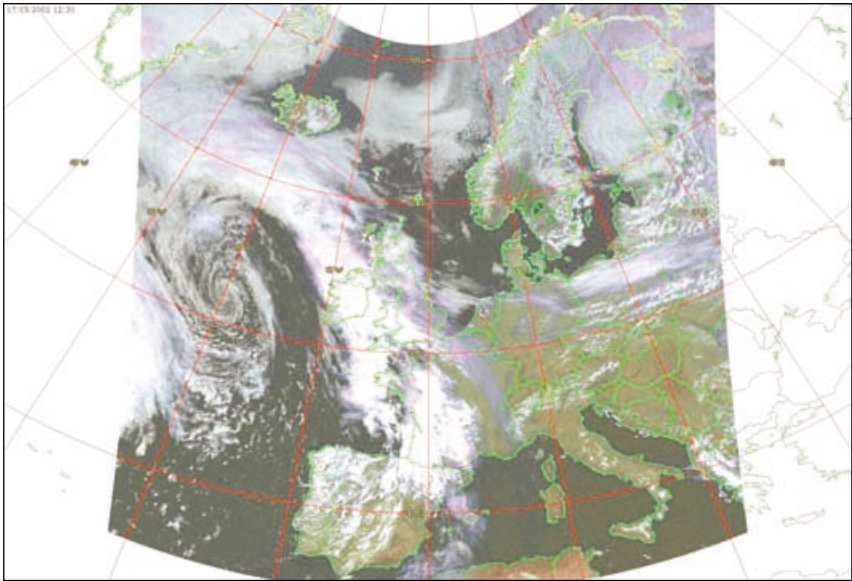


Fig.3 - A composite coloured stereographic image

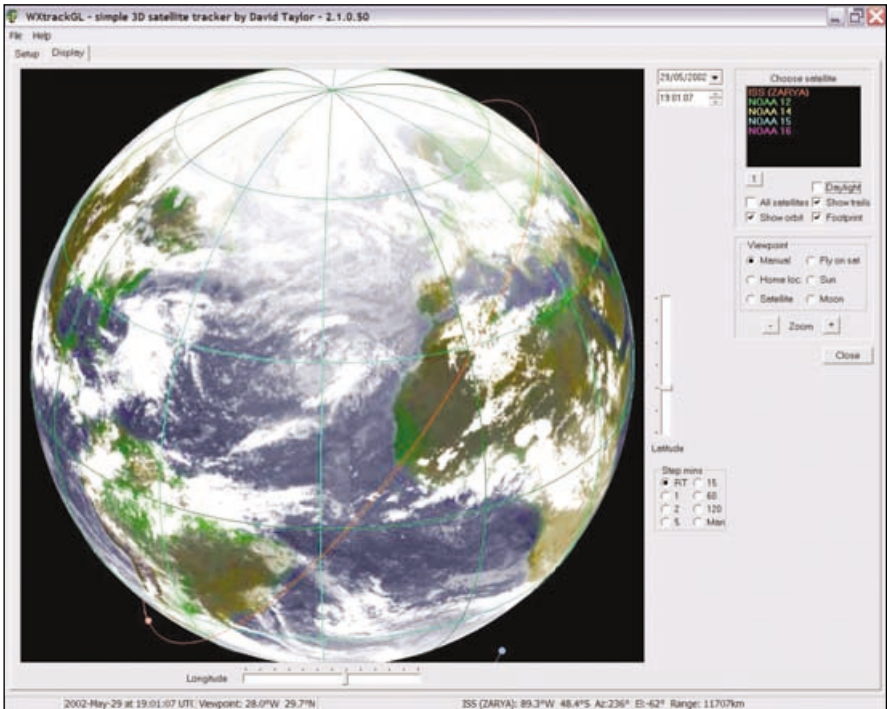


Fig.5 - 3D global weather

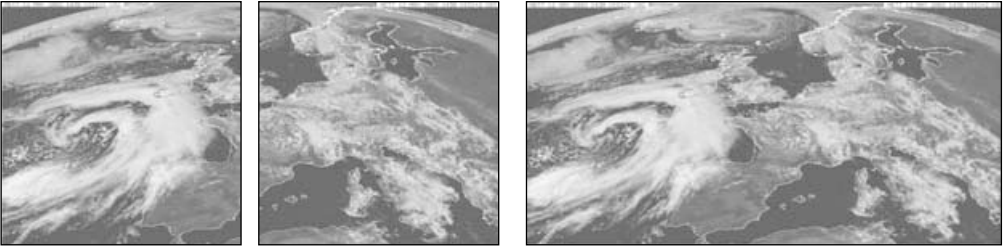


Fig.2 - Automatic seamless join of Meteosat CO2 and CO3 images

icing on the cake is that every processing option available for individual images is now equally applicable to composite images.

Figure 3 demonstrates this and includes a wide range of other processes I would now like to review. The image was achieved by loading a single visible greyscale C02 frame (such as the leftmost image in *fig.2*) using the 'Open Join' option. Subsequent processing followed automatically in accordance with a pre-defined set-up (Job Option) which:

- Identified the corresponding C03 visible image with the same timestamp and joined it to C02
- Identified the corresponding D2 thermal image (D2 covers the same geographic area as a combined C02/C03) and adjusted its size
- Combined the visible and thermal images to produce false colour
- Crispended and adjusted brightness according to settings
- Re-mapped the image to polar stereographic (orthographic and mercator also available) to a size stipulated in the setup
- Added geographic and country boundaries in chosen colours
- Added gridding in a chosen colour
- Added the date and timestamp to the image

And you can actually animate a sequence of such processed composite images!

Overlays Using MSLP Charts

The MSLP (Mean Sea Level Pressure) option is available for registered users of Geosatsignal, and allows images (and composites) to be overlain with the latest MSLP chart from Bracknell. The program cleverly adjusts size and location to match the overlays perfectly. *Fig.4* shows D1, D2 and D3 (IR) images combined and overlaid with MSLP data. This feature is a useful educational tool, allowing study, amongst other things, of the relationships between fronts and cloud patterns. In my opinion the program is worth registering for this option alone.

In *fig.4* I have provided a full screen-shot to show the window lay-out, which

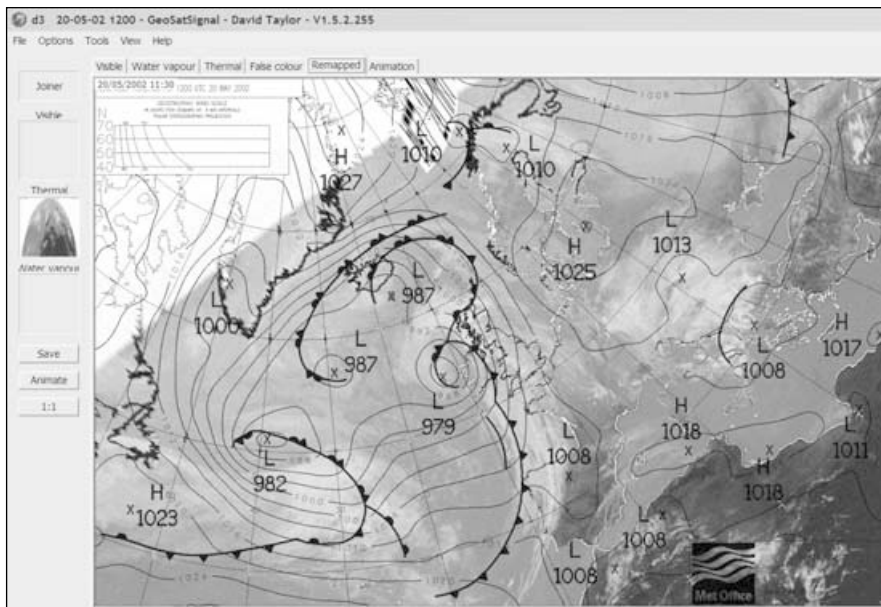


Fig.4 - MSLP Chart Superimposed on a thermal composite image

includes tabs for visible, water vapour, thermal, false colour, re-mapped and animation. Although both *fig.3* and *fig.4* show only the final image, the constituent frames and all intermediate composites formed during the processing stages remain available for viewing under their respective tabs.

Geostationary satellite WEFAX offers marvellous opportunities for animating sequences of images and again GeoSatSignal rises to the challenge, and can animate any sequence of saved images, provided they conform to one of the many naming standards accepted by the program.

The registered version allows you to create, and continually update, a 3-day D2 animation of around 150 frames, and includes an option for inserting an additional interpolated frame between each of the saved ones to make the animation even smoother. This is particularly useful where the image gap may be more than half an hour. The job setup allows a number of animation parameters to be chosen including the speed of the animation in frames per second.

As previously mentioned composite images can be animated. Once a single composite has been processed and on the screen, select animate and the program will automatically complete the sequence according to the predefined settings. During the summer months an eight hour animation of the composite shown in *fig.3*. is possible.

This article has taken a glance at some of my favourite processing tools in GeoSatSignal. It is impossible in such a brief review to do the program justice, either in content or quality, but I'd like to conclude by briefly mentioning some other options to whet your appetite further.

GeoSatsignal can import a wide range of high-resolution data either from your own station or taken from the many Internet sites, and colour composites of these high resolution images can be breathtaking.

There is a wide choice for re-mapping, including polar stereographic, orthographic and Mercator projections plus a further option which allows you to relocate the centre and scaling of the mapping.

GeoSatSignal offers much for those using data from other geostationary satellites. Examples of this include joining of the four GMS-5 quadrants into a full disc and joining of the NE and NW sectors from GOES.

Currently David is working on a number of updates and new features to further extend the program's capabilities. As the program can use data received from your own station or collected from Internet sources (automatically using AutoGet) it is difficult to see how any serious hobbyist could be without it.

GeoSatSignal's strength lies in concentrating on processing and automation, which should render it readily adaptable to deal with images from the new digital satellites that will soon be with us.

WXtrackGL

Another of David Taylor's programs, WXtrackGL, contains an experimental world view which can combine images from five different geostationary satellites around the Earth and overlay a composite image on to the 3D world image. This is a stunning feature and is shown in *fig.5*.

What Does the Future Hold?

Finally to complete the story of these two articles, a look at what the future promises from geostationary weather satellites? Meteosat-7, the current primary satellite, is the last with analogue WEFAX capabilities. In addition, Meteosat-5, positioned at 63°E and Meteosat-6, the primary backup at approximately 9°W remain operational.

The next generation of European geostationary satellites known as MSG (Meteosat Second Generation) will be all-digital, and disseminate High Rate Information Transmission (HRIT) and Low Rate Information Transmission (LRIT). Both these transmissions will be compressed and encrypted.

The first of those satellites, MSG-1 is currently due for launch in mid-August and may be in geostationary orbit by the time you read this. As the first of

a new series of satellites, extensive testing of both satellite and ground segment will be required before the satellite becomes fully operational. EUMETSAT hope for the first image by October, followed by a prolonged period of testing and evaluation and the possibility of full service by September 2003. Whatever happens, it has been agreed that Meteosat-7 will continue operating in parallel with MSG-1 (but probably not at 0°) until at least the end of 2003. Meteosat-7 has sufficient station-keeping fuel to last several years beyond that if necessary.

Digital telemetry is going to offer new challenges, but in return give better quality, more frequent images in a wider range of spectral bands. Unfortunately all data will be encrypted, and for amateur and educational use, a one-off payment will be required for the purchase of a key unit. There will be no charge for the licence application.

Recognising the difficulties and costs of changing from SDUS to LRIT stations, EUMETSAT have announced their intention to provide a near real-time Internet service for LRIT data. Not quite as challenging, fulfilling or educational as running your own station, and begging the question 'why encrypt the lower resolution data in the first place!.' Still, let us be grateful for small mercies.

It is early days as regards the availability of equipment, although companies such as Timestep are already making very promising noises. Most existing equipment, soundcard options etc. will become redundant and certainly for a while reception is going to cost us more. When we consider what ingenuity, innovation and dedication have brought to the hobby in the last 20 years, I feel confident that there is still an exciting and affordable future for amateurs and enthusiasts once the new techniques are mastered.