

Manual WSAT program (2004.08).

Introduction.

This is the manual of `wsat`, the program to receive high resolution weather satellite pictures of NOAA and Meteosat. Currently only the so-called "Rob Alblas decoder" is supported. The HTML-version of this manual is interactive: click on a menu item to jump to the description of that item.

Starting the program.

`wsat` may be started by clicking an icon, by means of a command shell or by means of a script (e.g. `autoexec.bat`). In the last case automatic recording is possible.

Usage:

```
wsat {options} [file]
     {options}:

-i <file>          read <file>
-sn               south-north (flip hor and ver)
-w <width>        Window width (default: 400)
-h <height>       Window height (default: 300)
-record <sat:chan> Auto-record; exit program if done
  <sat:chan>      specify satellite and channels
  <sat>           hrpt | chrpt | hri
  <chan>          1-5, a, g (hrpt)
                  1-0, a, g (chrpt) (0=channel 10)
                  g (hri)
                  a=all channels
                  g=generator mode (only usefull for test)
-crecord <sat:chan> Same as -record, but record 'forever'
-batch <sat:chan>  Batch-record; exit program if done.
                  Same as -record, except no graphical mode.

-cbatch <sat:chan> Same as -batch, but record 'forever'

-log             batch messages in wsat.log in
                  home dir. instead of in shell
```

Examples:

```
wsat                start wsat
wsat ned.gif         start and read in file 'ned.gif'
wsat -record hrpt:124 record HRPT channels 1/2/4
wsat -record chrpt:1290 record CHRPT channels 1/2/9/10
wsat -record hrpt:a  record HRPT, all channels
wsat -record hri     record HRI
wsat -record hrpt:ag record HRPT generator mode
```

Note: See Interface preferences: Select hardware for automatic switching of the decoder to the right type.

More about commandline options.

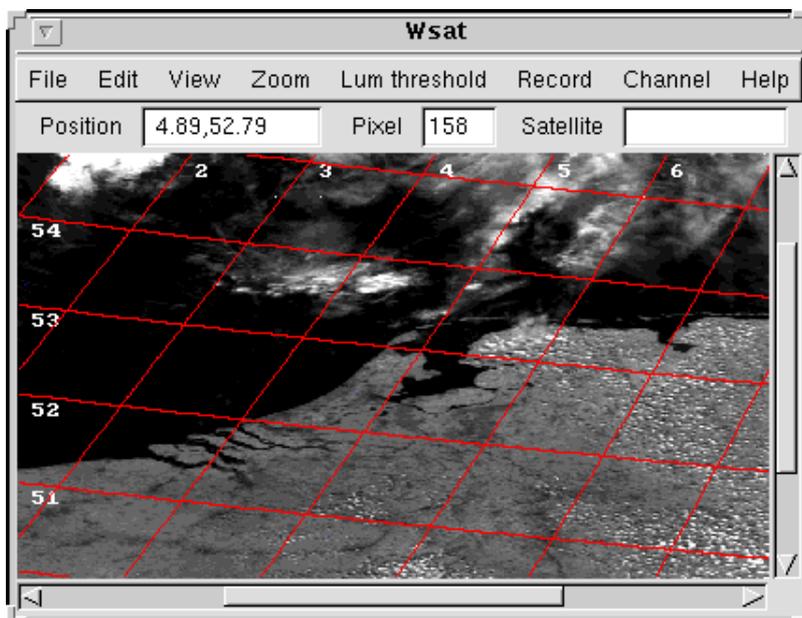
- -record: **wsat** gui starts in record mode. As soon as the decoder gets in-sync recording starts. If the decoder gets out-of-sync recording stops and the program exits.
- -crecord: Same as -record; after decoder gets out-of-sync recording stops, but program doesn't exit. It waits for next time decoder gets in-sync and starts recording again. So, in this mode **wsat** records forever.

Stop this endless loop by clicking on the 'Stop' button in the Record HRPT or Record HRI window.

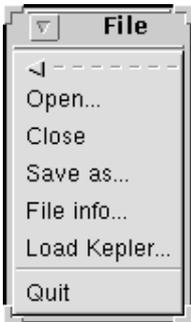
- -batch: Same as Record, but without a gui. Messages are printed in the command shell from which **wsat** was started, or in a log file.
- -cbatch: Same as batch, but program doesn't exit; it goes on 'forever' (as with crecord). Stop by using e.g. the kill command (Linux) or kill.exe (windows) (or reboot ;-))
- -log: Batch messages are logged into a file (appending). This file is 'wsat.log' in \$HOME (Linux) or in the top-disk (Windows, e.g. C:)

Note that for Windows you need the -log option always if you want to see any messages!

Overview program; main menu.



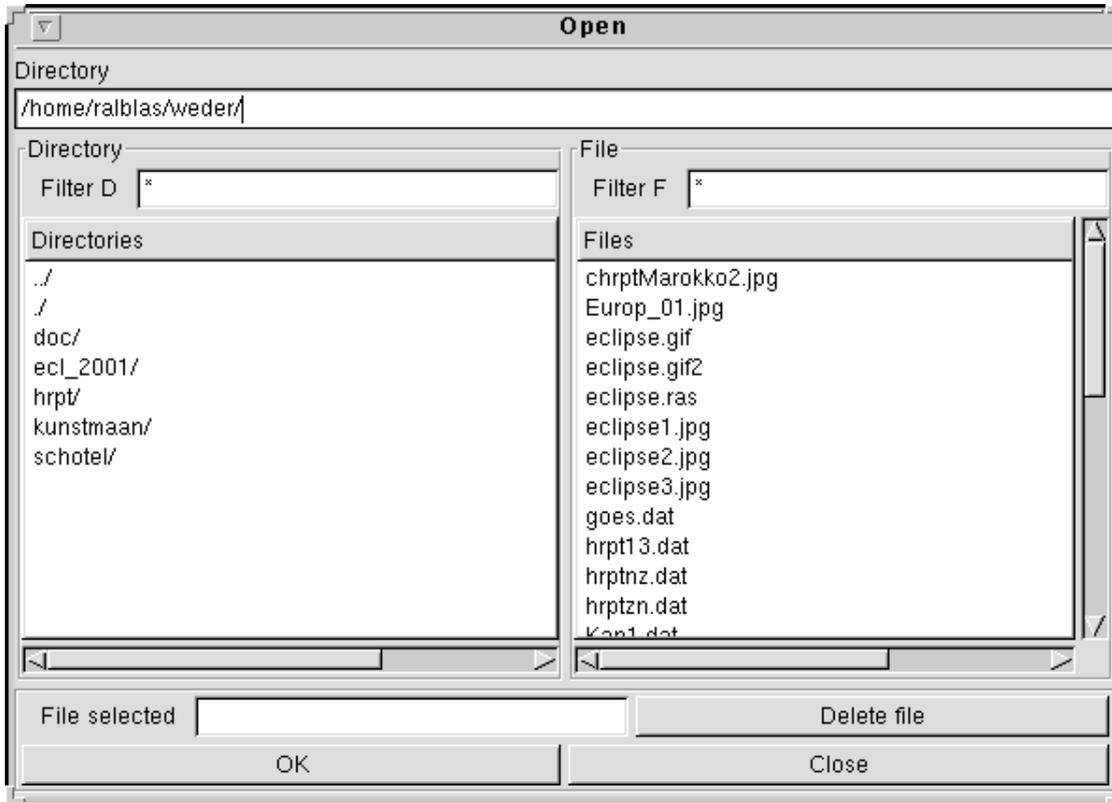
Menu: File.



Open.

Open an existing picture file:

- Select a directory:
 - Double click on a directory name in the left list
 - Or change the directory name in the 'Directory' entry part. Every time you type a dir. separator ('/' or '\') the directory list will be evaluated and the file list in the right list is updated
- Select a file:
 - Double click on a file name in the right list
 - Or select a file (1 click) and then click 'OK'
- To restrict the amount of listed items:
 - Change 'Filter D' to restrict the amount of listed directories
 - Change 'Filter F' to restrict the amount of listed files



Delete a file: Select a file, then press 'Delete file'.

Close.

Close current file. Normally 'wsat' only closes a file if a new file is selected for viewing. If a file is first viewed and then has to be renamed or deleted outside 'wsat' (e.g. with a file manager) the file has first to be closed.

Save as.

Save current picture.

File types supported:

- HRPT (dedicated format)
- HRI (dedicated format)
- PGM (standard monochrome format)
- PPM (standard 3-color format)
- GIF (compressed lossless format)

Note that for translating HRPT into another format (GIF, PGM, PPM) information is lost (10 bits --> 8 bits per pixel).

The luminance settings are used to determine which bits are selected:

Lmax	bits saved
> 511	9 ... 2
<= 511 and > 256	8 ... 1
< 256	7 ... 0

- Zoom in if a part of the picture has to be saved.
- Make sure that Lmax in luminance settings is OK, if translating from hrpt to other format
- Select file format.
- Select channel(s) to save (only if in and output file are both HRPT format).
- Determine file name to generate:
 - Click on 'New name' to generate a unique filename (normally not needed)
 - Change the filename in the 'Save to' entry box if needed
- Click on 'Save'. (You will be warned if the file already exists.)



If filetype *PPM* is chosen and, at the same time, the *View->Channel_map* is active a color picture will be saved, as specified in the *View->Channel_map* window. Also, alignment is done, if desired.

Example:

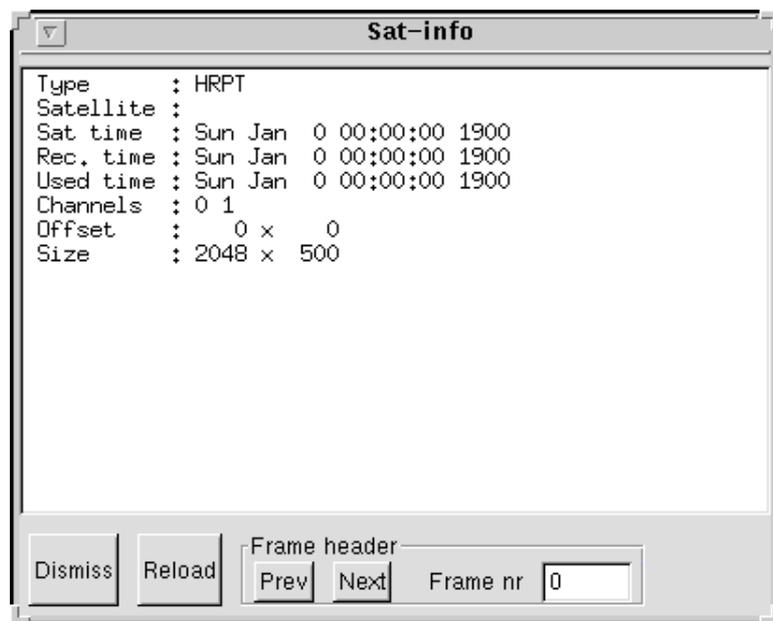
To save a CHRPT picture in color:

- Select *View->Channel_map*
 - Click on Auto color to load mapping of 3 channels onto RGB
 - Click on Auto align to align the channels
- Click on Lum threshold to get a better luminance range
- Select *File->Save as*
 - Click on PPM
 - Click on Save

Note: Don't exit the *View->Channel_map* window before saving the picture. (Iconizing is, however, no problem.)

Sat info.

Information about the current file is shown. For HRPT and HRI files the frame header info is also shown; by clicking on 'Prev' or 'Next' info in a header of a certain frame can be examined.



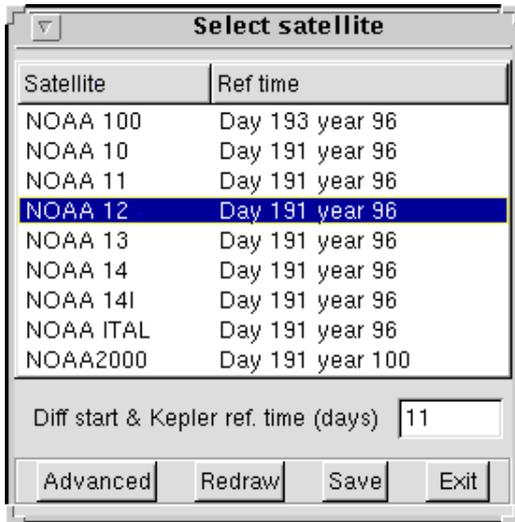
Load Kepler.

First a Open file window will be shown.

- Select the desired NORAD 2-lines Kepler-file.

Now the 'Select satellite' window pops up.

- Select the desired satellite.
- Check the "Diff start & Kepler ref. time" to see that the Kepler data is not too old.
The shown number is the difference between record time and reference time of the selected satellite, in days.
- *Advanced*: show/change the Kepler-elements.
- *Redraw* show the new grid ("grid" should be activated).
- *Save*: save the new settings (times and Kepler elements) into the HRPT-file.



Quit.

Exit the program.

Menu: Edit.



Menu: File header.

Change some items in the file header.

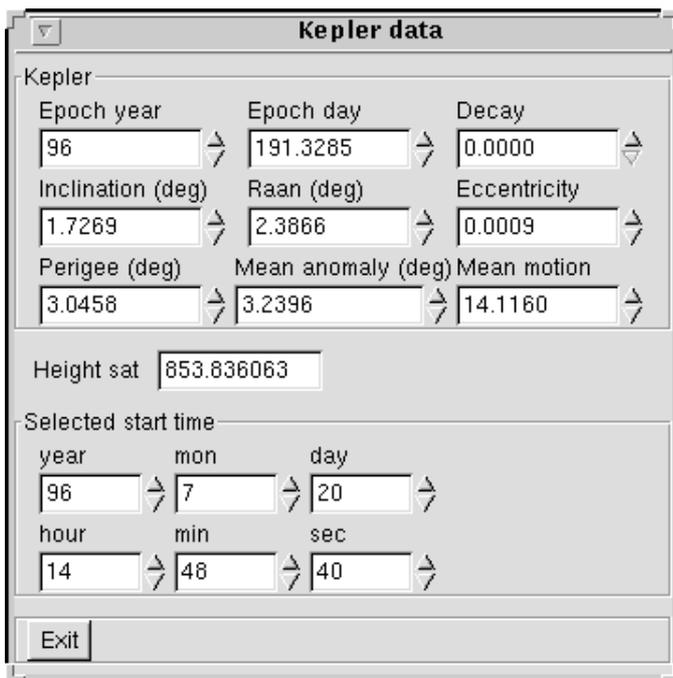
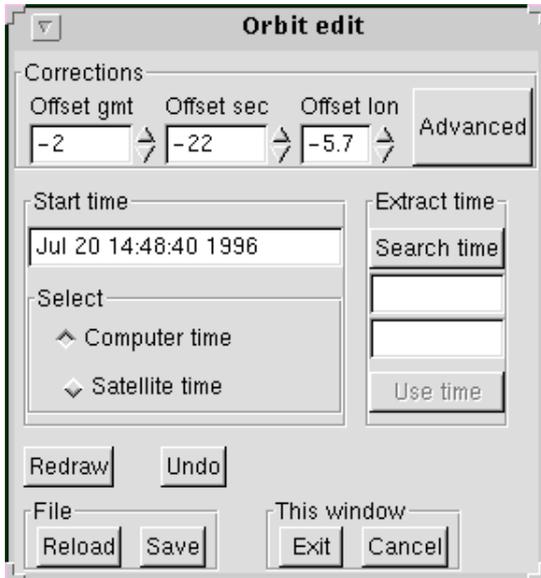
- Satellite name:
 - *Search frame info* Search reliable frame header
 - *Use it* copy the found satellite name
 - *Edit name* Change satellite name if needed
- Scan direction:
 - Select satellite pass direction: nort->south or south->north
- *Save*: Save the changed items into the file.



Kepler.

Change orbit/kepler data manually.

- *Extract*: Extract start-time from satellite data.
 - Click on *Search time*. The fields below show which line is used and the satellite name. Click again on *Search time* if derived time seems unreliable.
 - Click on *Use time* to load/use the extracted time.
- *Select*: Choose which time to use: the computer-time or the time transmitted by the satellite. (Note: In the last case the year is derived from the computer time!)
- *Redraw*: Show the new grid ("grid" should be activated).
- *Undo*: get previous settings.
- *Reload*: reload orbit/kepler settings from the HRPT file.
- *Save*: save the new settings (times and Kepler elements) into the HRPT-file.
- *Exit*: exit the window; settings will be kept.
- *Cancel*: exit the window; settings will be lost (except if saved into the file).



Preferences.

All preferences are saved in a file called *.wsatrc*. This file is read at program-start. By means of the Preferences window the preference items can easily be changed. (The *.wsatrc* file is ASCII, so may also be changed using a text editor.)

The *.wsatrc* file is searched for in the following directories, in this order:

- multi-user O.S. (Linux/Unix):
 1. Start-up directory (for special settings)
 2. Home directory (for user specific settings)
 3. Program location directory (for default settings)

- single-user O.S. (Windows):
 1. Start-up directory (for special settings)
 2. Top-directory of current disk (e.g. C:\, D:\ etc.) (for more common settings)
 3. Program location directory (for default settings)

The first .wsatrc-file found is taken.

If no .wsatrc file is found the built-in defaults are taken.

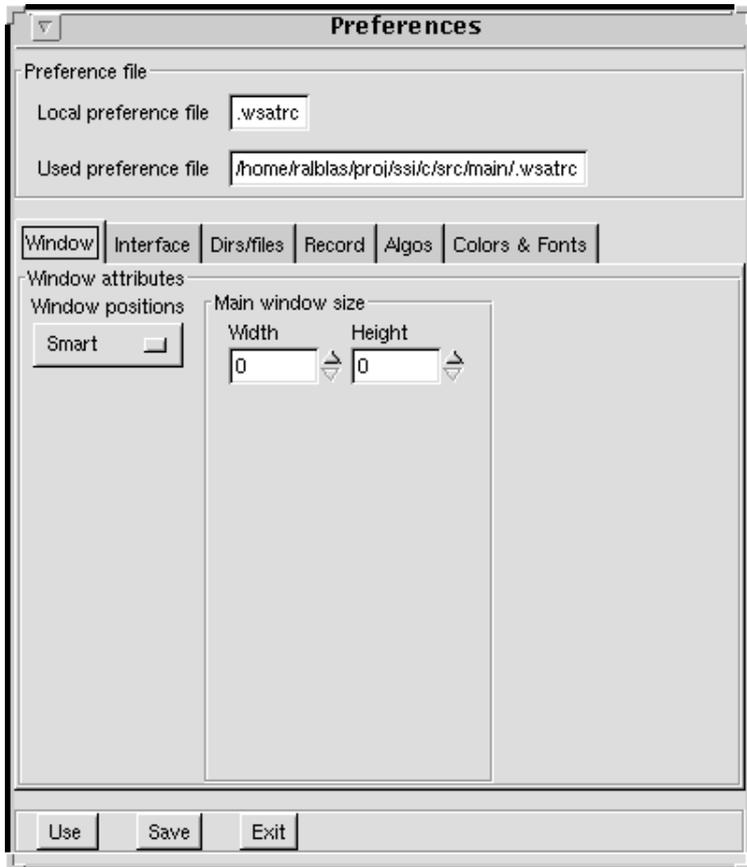
After changing items:

- Press Use to make changes effective
- Press Save to save changes in the .wsatrc file

Changes will always be saved in a .wsatrc file in the current directory. Move it to one of the mentioned locations, if desired.

Main window position and size

- Window position:
 - Default: Position of each window is determined by Window manager
 - Smart: Position of each window is such that windows don't overlap, or overlap is minimal. Main window is placed in upper left corner.
- Main window size:
 - Width and height of window at start-up. Note that by pressing 'm' on keyboard the window size can easily be toggled between full screen and original size.



Decoder interface

- Parallel port selection:
 - Choose port 1 or port 2.
 - Select 'Fast parport access' if all 10 CHRPT channels need to be recorded.
NOTE: "Fast parport access" needs a change in hardware: the 'Readyn' signal has to be delayed. This mode will not always work properly. The delay of readyn needs to be more than the delay of the slowest data pin; if this delay is too big the par. port will be too slow to record all 10 CHRPT channels.
If just HRPT, HRI or max. 8 channels of CHRPT need to be recorded then don't select this mode.
- Select hardware:
 - decoder/generator: Selecting decoder/generator will automatically also switch the hardware between decoder and generator mode.
 - Switch SM is not needed (remove or leave open).
 - The decoder type (HRPT/CHRPT/HRI) has to be selected by means of switches on the hardware (SD and SX).
 - decoder type: Selecting HRPT/CHRPT/HRI will automatically also switch the hardware between HRPT and CHRPT or HRPT and HRI.
 - Choosing between decoder and generator has to be done using a switch on the

hardware (SM).

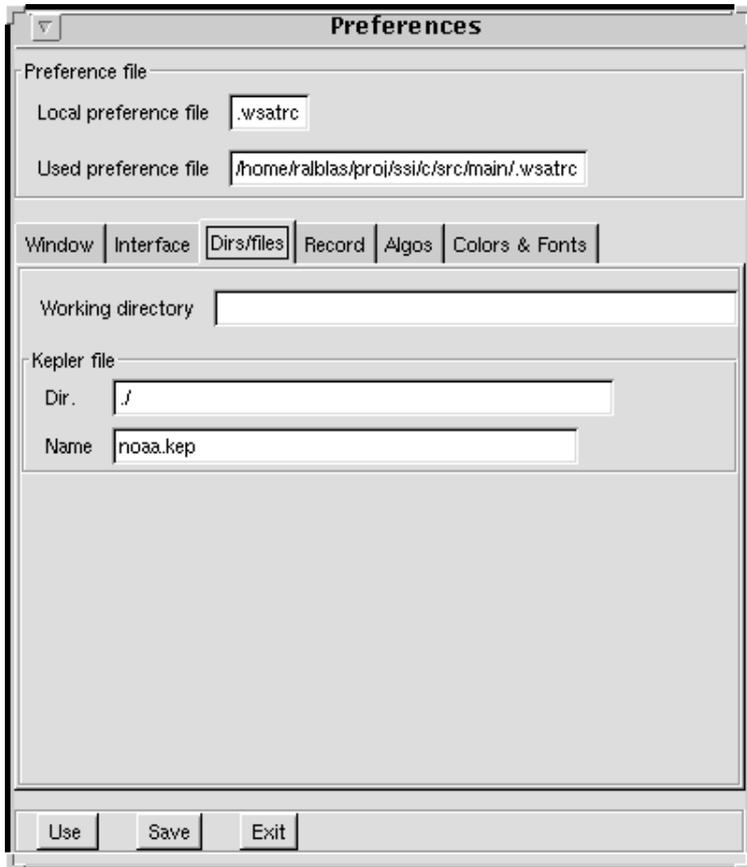
- Also, the HRPT/HRI pair or HRPT/CHRPT pair has to be selected by means of a hardware switch (SX).
- Switch SD is not needed (remove or leave open).

NOTE: This mode needs a small change in the hardware: D9 needs to be connected to R12 instead of to R11.



Working directory and Kepler files

- Working directory:
 - Directory to which recorded files are written.
This is also the directory activated after selecting 'File Open'.
- Kepler file: File and place of this file used to load Kepler data after recording.
 - Directory in which to search for NORAD2 Kepler files.
 - Name of Kepler file to open.



Record related settings

- HRPT Record times:
 - Start after: #frames while decoder is in-sync after which recording is started. (6 frames = 1 second.)
 - Stop after: #frames while decoder is out-sync after which recording is aborted. (90 frames = 15 seconds.)
 - HRPT filenames:
 - base name: Base name of the file.
 - Extension: File name extension.
- These names are used to generate unique filenames:
- {basename}{number}{extension}
- In this example the generated filenames would be:
- hrpt01.dat
 - hrpt02.dat
 - etc.
- HRI Record times: See HRPT Record times. Except: #frames per second is 57.
 - HRI filenames: See HRI filenames.

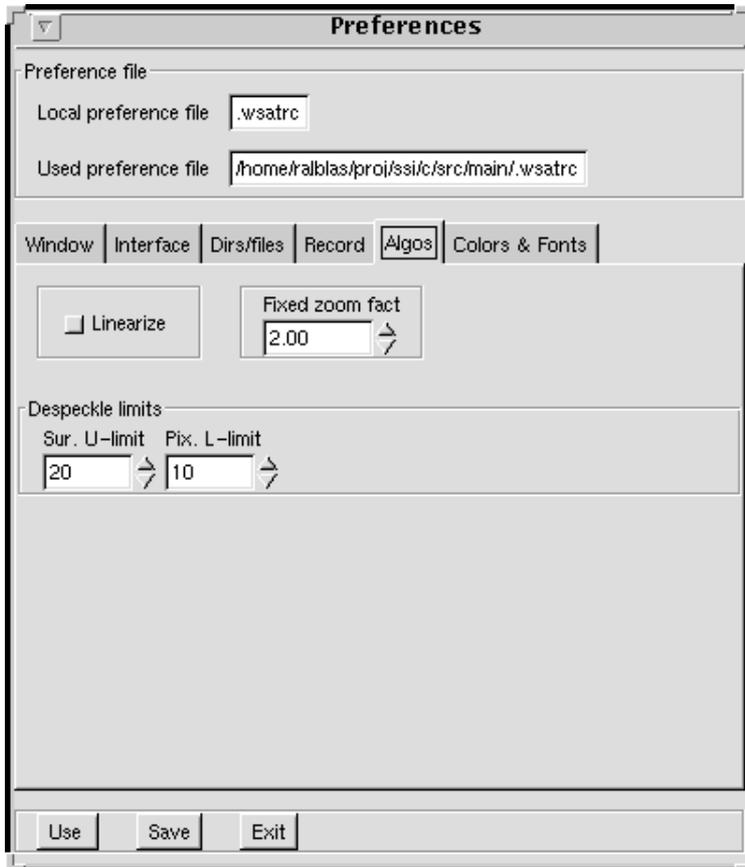


Algorithmic

- Define linearize on or off at start-up
- Define fixed-zooming factor for:
 - short-key 'i' and 'o'
 - ctrl-key in combination with mouse
- Define speckle-limits for despeckling: A speckle is detected if (in shown example):
 - Sur. U-limit: value difference between surrounding pixels < 20
 - Pix. L-limit: value difference between surrounding pixel and examined pixel > 10

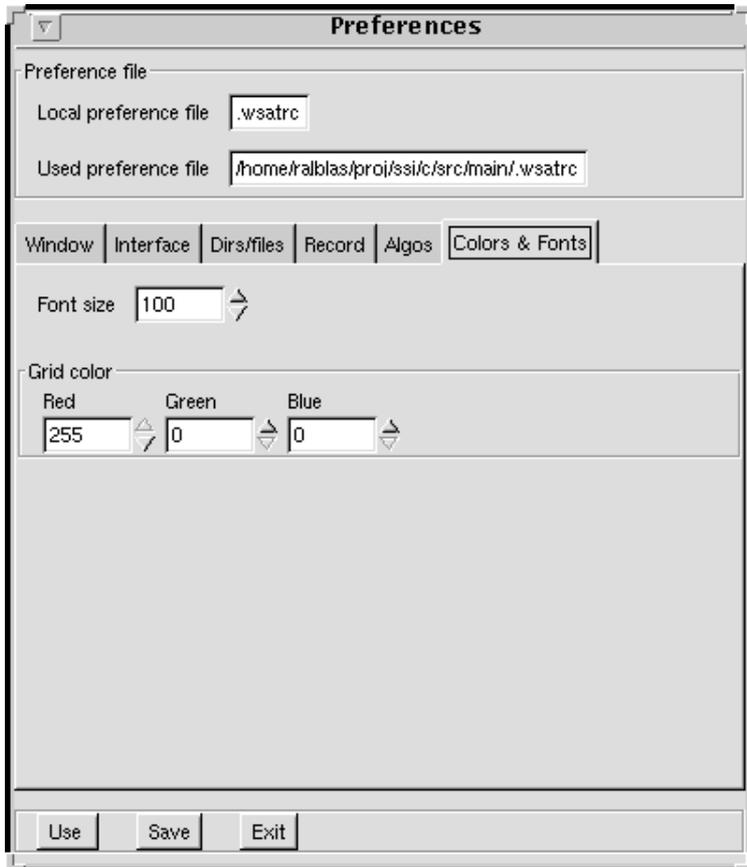
U
L P R
B

In other words: If the pixels U, L, R and B have luminance differences of less than 20, and at the same time pixel P has a difference of more than 10 with the surrounding pixels then pixel P is detected as a 'Speckle'. Its value will be changed to the value of pixel D.



Colors and fonts.

- Font size: Size of fonts of all windows/menus/buttons etc. Default: 120.
- Grid color: Define the color of:
 - HRPT grid (longitudes/lattitudes)
 - HRI grid (land markings as transmitted by Meteosat)



Menu: View.



-
- **Sat direction** Choose satellite direction: from south to north or from north to south.
 - **Grid** Activate lon/lat lines for HRPT or grid for HRI.

-
- **Invert** Invert picture

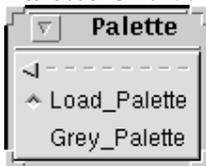
 - **Temperature** Make temperature mapping (IR-channels only).

 - **Linearize** Linearize HRPT picture.

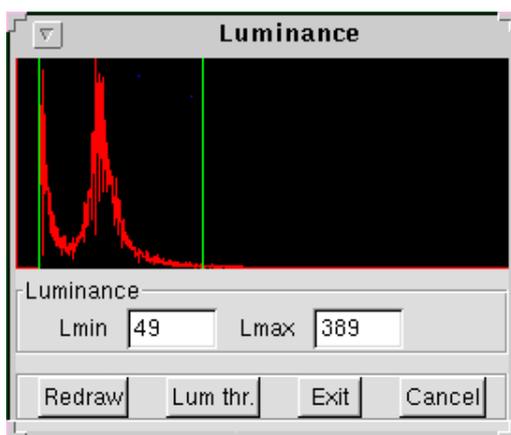
 - **Despeckle** Despeckle picture. See Preferences for some important settings.

 - **Skip faulty lines** Skip faulty lines in HRPT or HRI pictures. The faulty lines are replaced by the nearest line which is OK. This is done by a flag present in HRPT and HRI files for each line, indicating if the decoder was in-sync.

 - **Palette** Choice between palette present in file and grey-palette.

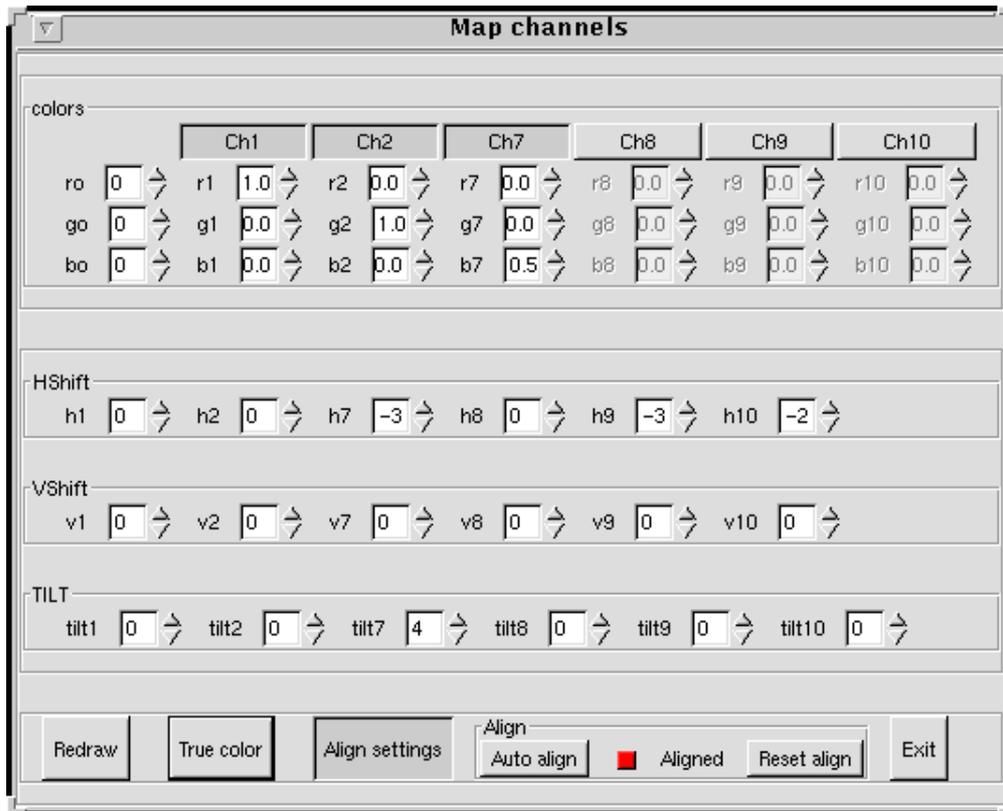


-
- **Luminance** Change luminance mapping.
Press left mouse button near a green line and drag it.
 - *Lmin*: Enter lower threshold.
 - *Lmax*: Enter upper threshold.
 - *Redraw*: Show the new luminance mapping.
 - *Lum thr.*: Automatic luminance setting.

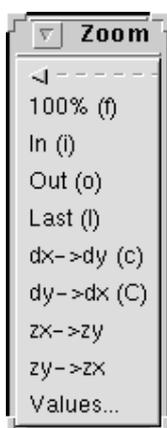


-
- **Channel mapping** Combine several channels. (Only works for (C)HRPT and Seawifs.)
 - ro/go/bo = red/green/blue offset
 - r/g/b 1/2/3/.... = contribution of channel to red/green/blue
 - *Redraw*: Show new mapping results.
 - *Auto color*: Automatic settings for CHRPT/Seawifs true color pictures.
 - HRPT NOAA <=14: red=channel 1, green=channel 2, blue=channel 4
 - HRPT NOAA >=15: red=channel 3, green=channel 2, blue=channel 1
 - CHRPT: red=channel 1, green=channel 2, blue=channel 7

- Seawifs: red=channel 6, green=channel 5, blue=channel 2
- *Align settings*: Show/hide align buttons
- *Auto align*: Align CHRPT channels.
- *Reset align*: Reset all align-numbers to 0.
- *Exit*: Exit this window.

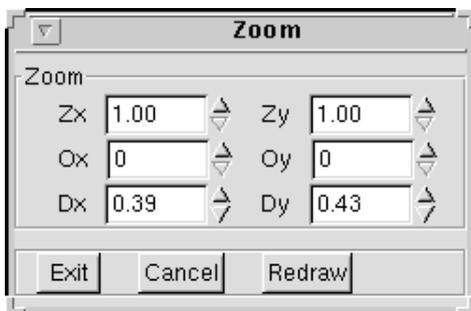


Menu: Zoom



shortcut	function
z	Zoom; click on 2 opposite corners of virtual rectangle (right-mouse button: cancel)
Z	Zoom fixed; move rectangle to part of picture in which to zoom and click (right-mouse button: cancel) (See preferences to change fixed-zoom factor.)
{Ctrl}	Zoom fixed; see 'Z'
f	full picture (zx=zy=1)
i	zoom in fixed (default: 2x; see preferences)
o	zoom out fixed (default: 2x; see preferences)
l	last (previous) zoom
c	dx->dy: Make pixel-size dx equal to dy
C	dy->dx: Make pixel-size dy equal to dx
	zx->zy: Make zoom-factor zx equal to zy
	zy->zx: Make zoom-factor zy equal to zx

Change zoom vars manual.



Menu: Luminance threshold.

Calculate "ideal" picture mapping on grey palette.

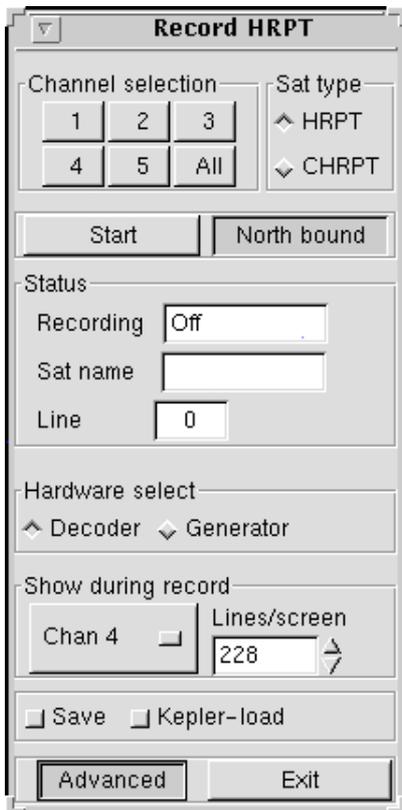
Menu: Record.

See preferences to define parallel port and fast par. port access.



HRPT

- *Channel selection*: Choose 1 or more channels to record.
- *Sat type*: Choose the satellite to record. (NOTE: You have to make sure that the selected sat-type on software and hardware is the same!)
- *Record mode*: Choose decoder or generator. (Not present if deocder type is switched instead of decoder/generator; see preferences.)
- *Show during record*:
 - Select the channel to show on screen during record.
 - Select the scan direction This selection will also be saved in the recorded file.
 - Select amount of lines per screen. This is the amount of lines needed to fill one screen; next lines overwrite the previous lines. (This setting has no influence on what is saved in file!)
If the number is set to '0' then lines/screen equals the height of the screen.
- *Save*: Enable if the picture to record has to be saved.
- *Kepler load*: Enable if Kepler data has to be loaded automatically after recording. See preferences for Kepler file name and location.
- *Start*: Start record. Make sure that the Save button is in the right state!
- *Stop*: Abort record. Results up to now are kept.
- *Exit*: Exit this window.



HRI

- *Record mode*: Choose decoder or generator. (Not present if deocder type is switched instead of decoder/generator; see preferences.)
- *Record all*: If set, all pictures are recorded (including encrypted pictures)
- *Save*: Click if the picture to record has to be saved.
- *Start*: Start record. Make sure that the Save button is in the right state!
- *Stop*: Abort record. Results up to now are kept.
- *Exit*: Exit this window.

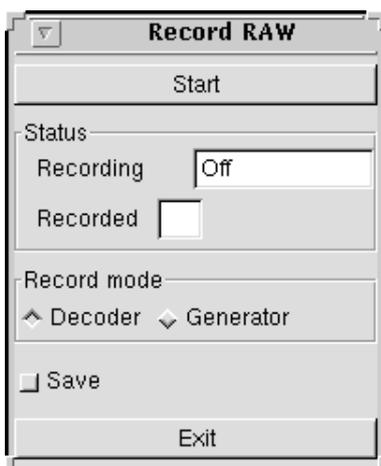


Raw

Records raw data from parallel port. Not for a specific format.
Bytes from parallel port are dumped in a file, without headers, frame separations etc.

This option is ment for MSG, but can also be used to put raw HRI or HRPT data on disk. With HRPT just the 8 MSB's are recorded (2 LSB's are lost), and channel selection has to be done using the HRPT recording window or with switches on the hardware. (If there is a need to record all 10 bits in raw format let me know.)

The picture on screen during record shows 2048 pixels per line. HRPT and HRI are not shown correctly; MSG recording will (should) show a vertical structure in 8 of the 2048 pixels per line.



Menu: Channel.

Choose a channel to view.



Menu: Help.

Program info and test.



Program info



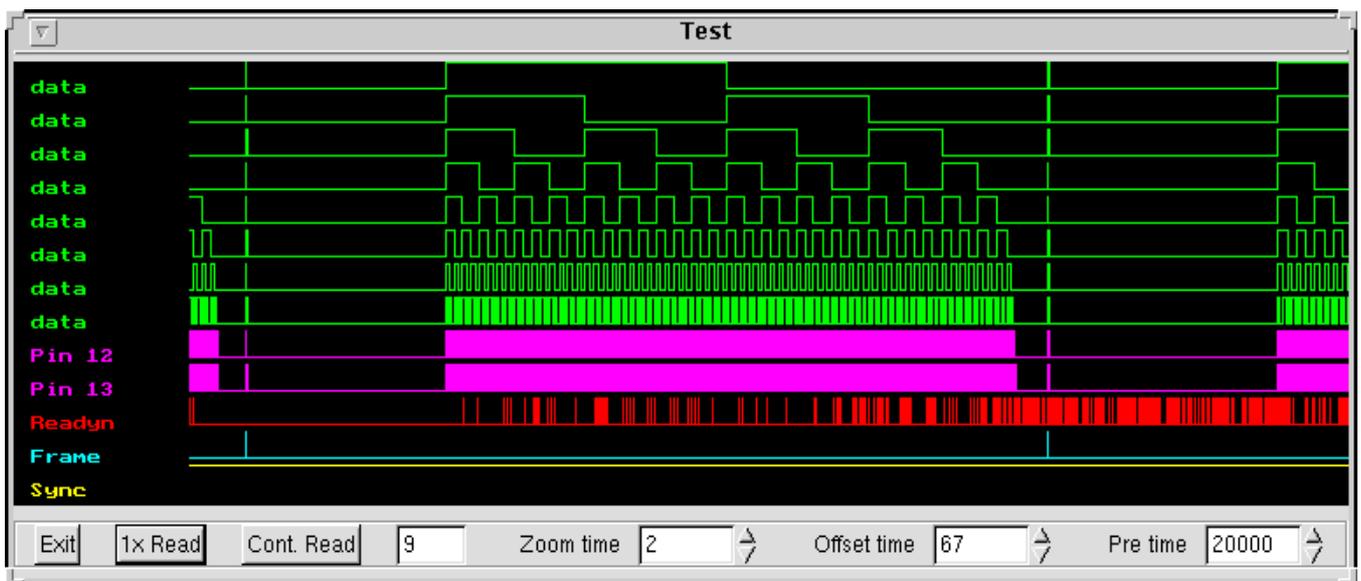
Test parallel port

- If (C)HRPT is chosen: Select channel(s) using the HRPT Record window.
- Pre time: Determines how many pre-read cycles are done before data is actually caught.
 - A small number will catch data nearly immediately; because decoder-buffer is full, data transfer will go fast (waves look like 'HF').
 - A big number (1000000) will first empty the decoder-buffer and then catch data. Data looks

mostly 'LF'; data speed is limited by actual 'satellite' data speed.

- Click on '1x Read' to catch data from par. port.
- Zoom time: Zoom in/out
- Offset time: Shift waves.
- Cont. Read: Continuous data read, waves are refreshed all the time.

To stop: Click 1again on 'Cont. Read', or click on '1x Read'. (Note: If 'pre-time' has a very high number, and if data is read a long time, then it can take some time before reading is stopped. Click on '1x Read' and wait.



This image shows the result of waveforms with HRPT generator, channel 1 selected. This channel is a black-to-white image; data is:

```
0000000000
0000000001
0000000010
0000000011
0000000100
0000000101
0000000110
0000000111
0000001000
...
1111111110
1111111111
```

So, the LSB has a high frequency (pin 13), the MSB has the lowest frequency (upper 'data' wave) which is clearly shown in the picture.

- The Frame pulses mark the start of a new frame.
- 'Sync' is high (generator is always "in-sync")
- Readyn: This wave is not very reliably shown; it should be a pulse at every new word coming in. A bigger value for 'Pre time' and zooming in 100x or so will give a more realistic waveform for this signal.
