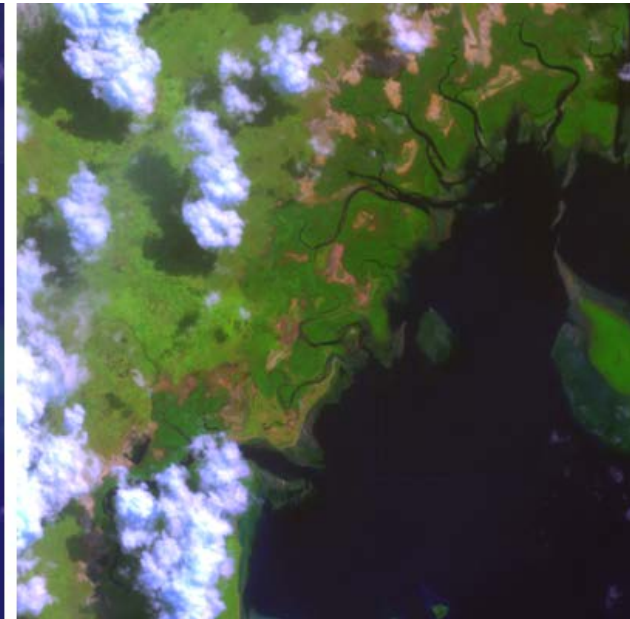
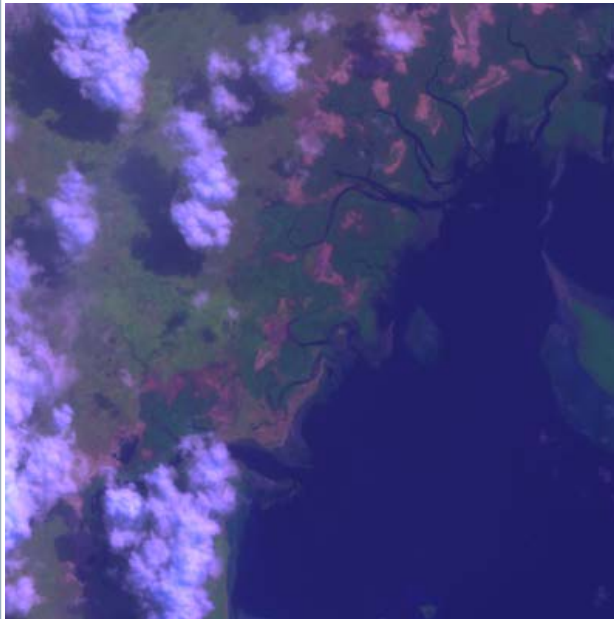


# LEDAPS atmospheric correction production line

User guide



Note no

**SAMBA/39/11**

Authors

**Øivind Due Trier**

Date

**20 December 2011**

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**Abstract**

This note describes how to install and run the LEDAPS atmospheric correction production line.

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# 1 Deliverables

The deliverables are:

1. The shell scripts
  - a. jobprocess.sh,
  - b. newfiles.sh,
  - c. process\_landsat.bash, and
  - d. do\_ledaps.bash
2. This user guide
3. A separate report "Evaluation of the Landsat surface reflectance estimated by LEDAPS" (Zortea *et al.*, 2011).

The LEDAPS pre-processing software (Masek *et al.*, 2006) is required, and must be downloaded. The latest version currently available is from 25 February 2011.

## 2 Installation

### 2.1 Overview

In short, the following must be done to install and run the LEDAPS atmospheric correction production line:

1. Obtain the LEDAPS preprocessing tools from NASA.
2. Edit the files jobprocess.sh and newfiles.sh (developed by NR) to make all paths agree with the actual file structure of the run time environment.
3. Run newfiles.sh and jobprocess.sh as cron jobs

### 2.2 Obtaining LEDAPS

The LEDAPS preprocessing is listed as one of several free software tools at <http://ledaps.nascom.nasa.gov/tools/tools.html>. As stated there, to obtain it, you must send an email to Jeff Masek at [Jeffrey.G.Masek@nasa.gov](mailto:Jeffrey.G.Masek@nasa.gov).

### 2.3 Installing LEDAPS

This is the installation guide as stated in readme.txt:

```
Installation Guide  
(tested in Linux bash, Feb. 2011)
```

### 1. Install ancillary files

```
tar -xvzf ledapsAnc.20110224.tar.gz
```

### 2. Install source files

```
tar -xvzf ledapsSrc.20110224.tar.gz
cd ledapsSrc/src
source env.sh
make
make install
make clean
```

This will create a list of executable files under bin/  
lndapp lndcal lndcsm lndpm lndsr lndsrbm.ksh sixsv1.0B  
cmrbv1.0 compadjn comptemp geo2xy SDSreader3.0 xy2geo  
(tested in gcc and g95 compiler)

\* Note that new cloud mask program (lndsrbm) calls command "ncdump" which is a standard HDF command. This release includes a linux version ncdump command in bin directory. You need replace ncdump program if it runs from different OS systems. If you don't want to run optional lndsr-based cloud mask (lndsrbm), you will not need a ncdump program)

### 3. Setup environment

```
export ANC_PATH="directory_saved_ancillary_files"
(or in c shell use
setenv ANC_PATH "directory_saved_ancillary_files")
```

(note to replace "directory\_saved\_ancillary\_files" with the actual path that stores the ancillary files)

### 4. Test

download Landsat files and then run following commands separately

```
lndpm <Landsat_meta_file>
lndcal <lndcal_input_text>
lndcsm <lndcsm_input_text>
lndsr <lndsr_input_text>
lndsrbm.ksh <lndsr_input_text> (optional)
```

OR simply run the combined commands to generate all (includes lndsrbm)

```
do_ledaps.csh <Landsat_meta_file>
```

(verify result with the provided example)

```
mkdir test
cp example.tar.gz test/
cd test
tar -xvzf example.tar.gz
```



```
do_ledaps.csh L5014033_03320060801_MTL.txt
```

(then compare result `lndsr.L5014033_03320060801.hdf` with `L5TSR.a2006213.w2p014r033.020.2011045152828.hdf` from LEDAPS operational system)

## 2.4 Editing of files delivered by NR

### 2.4.1 Newfiles.sh – new version

`Newfiles.sh` takes as an argument the full path to the location where files will be downloaded. This eliminates the editing that was needed with the initial version of `newfiles.sh`, see Section 2.4.2 below.

You may still need to edit one specific thing in `newfiles.sh`, that is, the maximum depth to look for new `tar.gz`-files. This must in fact exactly reflect the subdirectory level under which new `tar.gz`-files will appear. If a too deep level is specified, then the already converted files will be ‘discovered’ again, but if a too shallow level is specified, then no new files will be discovered.

Here is the line you may want to edit:

```
find -L $DATADIR -mmin +$MODTIME -maxdepth 2 | grep '.tar.gz' >> $TMP1
```

The `-L` option is to allow `find` to follow symbolic links. With `-maxdepth 2`, all files to be converted are in subdirectories directly under the directory that was specified as the argument to `newfiles.sh`.

#### 2.4.1.1 Example

The use of `-L` and `-maxdepth 2` makes it possible to use, e.g., the following directory structure:

```
/nr/samba/jodata3/pro/TropSkogTanz/data
/nr/samba/jodata3/pro/TropSkogTanz/data/newfiles – argument to newfiles.sh
/nr/samba/jodata3/pro/TropSkogTanz/data/165-068
/nr/samba/jodata3/pro/TropSkogTanz/data/166-063
/nr/samba/jodata3/pro/TropSkogTanz/data/166-064
/nr/samba/jodata3/pro/TropSkogTanz/data/166-067
/nr/samba/jodata3/pro/TropSkogTanz/data/167-063
/nr/samba/jodata3/pro/TropSkogTanz/data/167-064
/nr/samba/jodata3/pro/TropSkogTanz/data/167-065
/nr/samba/jodata3/pro/TropSkogTanz/data/167-066
/nr/samba/jodata3/pro/TropSkogTanz/data/167-067
/nr/samba/jodata3/pro/TropSkogTanz/data/168-062
/nr/samba/jodata3/pro/TropSkogTanz/data/168-067
/nr/samba/jodata3/pro/TropSkogTanz/data/171-063
/nr/samba/jodata3/pro/TropSkogTanz/data/172-063
```

Then, under `newfiles`, I specify symbolic links to the directories that I want to monitor, e.g.:

```
trier@samba5:/nr/samba/jodata3/pro/TropSkogTanz/data/new_files$ ls -l
total 4
lrwxrwxrwx 1 trier samba 11 2011-12-19 13:20 166-063 -> ../166-063/
lrwxrwxrwx 1 trier samba 10 2011-12-19 13:05 167-065 -> ../167-065
lrwxrwxrwx 1 trier samba 10 2011-12-19 13:05 167-066 -> ../167-066
lrwxrwxrwx 1 trier samba 11 2011-12-19 13:05 167-067 -> ../167-067/
```

```
lrwxrwxrwx 1 trier samba 11 2011-12-19 13:05 168-062 -> ../168-062/
lrwxrwxrwx 1 trier samba 11 2011-12-19 13:05 168-067 -> ../168-067/
lrwxrwxrwx 1 trier samba 11 2011-12-19 13:06 171-063 -> ../171-063/
lrwxrwxrwx 1 trier samba 11 2011-12-19 13:06 172-063 -> ../172-063/
```

Under these directories, I currently have files in only one:

```
trier@samba5:/nr/samba/jodata3/pro/TropSkogTanz/data/new_files$ ls *
166-063:
LE71660632000198EDC00.tar.gz LE71660632008268ASN00.tar.gz LE71660632010097ASN00.tar.gz
LE71660632000342SGS00.tar.gz LE71660632008284ASN02.tar.gz LE71660632010113ASN00.tar.gz
LE71660632001312SGS00.tar.gz LE71660632008300ASN00.tar.gz LE71660632010145ASN00.tar.gz
LE71660632001328SGS00.tar.gz LE71660632008316ASN00.tar.gz LT41660631992176AAA02.tar.gz
LE71660632002203SGS00.tar.gz LE71660632008332ASN00.tar.gz LT51660631984130XXX03.tar.gz
LE71660632002315SGS00.tar.gz LE71660632008348ASN00.tar.gz LT51660631984338XXX03.tar.gz
LE71660632006022ASN00.tar.gz LE71660632008364ASN00.tar.gz LT51660631985068XXX04.tar.gz
LE71660632006054ASN00.tar.gz LE71660632009014ASN00.tar.gz LT51660631985100XXX05.tar.gz
LE71660632006070ASN00.tar.gz LE71660632009030ASN00.tar.gz LT51660631986231XXX04.tar.gz
LE71660632006102ASN00.tar.gz LE71660632009046ASN00.tar.gz LT51660631986279XXX03.tar.gz
LE71660632006278ASN00.tar.gz LE71660632009062ASN00.tar.gz LT51660631987218XXX01.tar.gz
LE71660632006326EDC00.tar.gz LE71660632009078ASN00.tar.gz LT51660631995032XXX01.tar.gz
LE71660632006342ASN00.tar.gz LE71660632009094ASN00.tar.gz LT51660631995048XXX01.tar.gz
LE71660632007009ASN00.tar.gz LE71660632009126ASN00.tar.gz LT51660632008164MLK00.tar.gz
LE71660632007025ASN00.tar.gz LE71660632009174ASN00.tar.gz LT51660632008260MLK00.tar.gz
LE71660632007121ASN00.tar.gz LE71660632009190ASN00.tar.gz LT51660632009182MLK00.tar.gz
LE71660632007217ASN00.tar.gz LE71660632009222ASN00.tar.gz LT51660632009310MLK01.tar.gz
LE71660632007265ASN00.tar.gz LE71660632009254ASN00.tar.gz LT51660632009326MLK01.tar.gz
LE71660632007281ASN00.tar.gz LE71660632009270ASN01.tar.gz LT51660632009342MLK01.tar.gz
LE71660632007297ASN00.tar.gz LE71660632009334ASN00.tar.gz LT51660632010041MLK01.tar.gz
LE71660632007329ASN00.tar.gz LE71660632009350ASN00.tar.gz
LE71660632008076ASN00.tar.gz LE71660632010001ASN00.tar.gz
LE71660632008092ASN01.tar.gz LE71660632010033ASN00.tar.gz
167-065:
167-066:
167-067:
168-062:
168-067:
171-063:
172-063:
```

I can now call

```
./newfiles.sh /nr/samba/jodata3/pro/TropSkogTanz/data/new_files
```

Then, a new folder metadata will be created under  
/nr/samba/jodata3/pro/TropSkogTanz/data/new\_files

containing two files:

\_dlcomp.txt

\_newfiles\_tmp1

#### 2.4.2 newfiles.sh – old version

The delivered shell script appears below. The absolute paths refer to NR's file system, and must be replaced. Specifically:

1. DATADIR must refer to the location where new Landsat images, in tar gz-compressed form, will be downloaded. No other files must be located under this directory, and no subdirectories must exist.
2. METADIR must refer to the location where metadata may be stored.

```
#!/bin/sh -
#
# newfiles.sh - create list of fully downloaded files
#
# Location where new Landsat images will appear, as .tar.gz
# files:
DATADIR=/nr/samba/jodata3/pro/GEO-FCT-Hub/landsat
# Directory for the metadata of the script, i.e., list of files
# that have been completely downloaded:
METADIR=/nr/samba/jodata3/pro/GEO-FCT-Hub/metadata
# We use a very simple criterion to determine if a file has been
# successfully downloaded: Has it been changed during the last
# 10 minutes?
# Files not modified in MODTIME minutes are assumed to be
# complete
MODTIME=10
# All files assumed to be fully downloaded
DLCOMP=$METADIR/_dlcomp.txt
TMP1=$METADIR/_newfiles_tmp1
test -e $DLCOMP || touch $DLCOMP
# Generate list of files not modified in MODTIME minutes
cp $DLCOMP $TMP1
find $DATADIR -type f -mmin +$MODTIME >> $TMP1
sort -u $TMP1 > $DLCOMP
```

#### 2.4.3 Jobprocess.sh – new version

Jobprocess.sh takes as an argument the full path to the location where files will be downloaded. This eliminates some of the editing that was needed with the initial version of jobprocess.sh, see Section 2.4.4 below.

Still, one absolute path in line 109 needs to be edited:

```
/nr/samba/jo/pro/GEO-FCT-Hub/usr/trier/src/process_landsat.bash $JOBFILE
```

One may want to change the number of files that may be processed simultaneously, by editing the following line in jobprocess.sh:

```
MAXJOBS=10
```

Here is the full listing of jobprocess.sh:

```
#!/bin/sh -
#
# jobprocess.sh - process completely downloaded files
#

if ["$#" -lt "2"]; then
    echo "Usage:"
    echo "$0 directory"
    exit 1
fi

DATADIR = $1

# This is where we look for information about new files:
#METADIR=/nr/samba/jodata3/pro/GEO-FCT-Hub/metadata
#METADIR=/nr/samba/jodata3/pro/TropSkogTanz/data/metadata
METADIR=$1/metadata
# Maximum number of files that may be processed in parallel:
# MAXJOBS=10
MAXJOBS=10

# all files assumed to be fully downloaded:
DLCOMP=$METADIR/_dlcomp.txt
# fully downloaded files, processing started:
JOBSTART=$METADIR/_procstart.txt
# fully downloaded files, processed completed:
JOBCOMP=$METADIR/_processed.txt
JOBDIR=$METADIR/_jobs
DONEJOBDIR=$METADIR/_donejobs
LOCK=$METADIR/_processlock

TMP1=$METADIR/_process_tmp1
TMP2=$METADIR/_process_tmp2
TMP3=$METADIR/_process_tmp3

# acquire lock for _processed.txt file/job startup

echo "Acquire lock"
if test -e $LOCK; then
    echo "jobprocess.sh: already locked, exiting"
    exit 1
fi
if ! touch $LOCK; then
    echo "jobprocess.sh: unable to acquire lock, exiting"
```

```

        exit 1
    fi
    trap 'rm -rf $LOCK; exit 0' 0 1 2 3 13 15

    echo "Create directories if they don't exist already:"
    echo "    $JOBDIR"
    test -e $JOBDIR || mkdir $JOBDIR
    echo "    $DONEJOBDIR"
    test -e $DONEJOBDIR || mkdir $DONEJOBDIR
    echo "    $JOBCOMP"
    test -e $JOBCOMP || touch $JOBCOMP
    test -e $JOBSTART || touch $JOBSTART

    # update list of processed jobs:
    donejobs=`find $DONEJOBDIR -type f`
    if test x"$donejobs" != x; then
        cp /dev/null $TMP2
        for file in $donejobs; do
            cat $file >> $TMP2
            rm -f $file
        done
        cat $JOBCOMP $TMP2 | sort > $TMP3
        mv $TMP3 $JOBCOMP
    fi

    echo "Create file if it does not exist already:"
    echo "    $DLCOMP"
    test -e $DLCOMP || touch $DLCOMP
    # generate list of jobs where processing has not started:
    echo "Generate list of jobs where processing has not yet started:"
    echo "comm -23 $DLCOMP $JOBSTART > $TMP1"
    comm -23 $DLCOMP $JOBSTART > $TMP1
    echo "$TMP1:"
    echo "-----"
    cat $TMP1
    echo "-----"
    # exit if file is empty:
    test -s $TMP1 || echo "    List is empty, exiting."
    test -s $TMP1 || exit 0

    # process up to MAXJOBS parallel jobs:
    echo "Process up to $MAXJOBS in parallel"
    cp $JOBSTART $TMP2
    if test $? -ne 0; then
        echo "jobprocess.sh: error: cp failed for $JOBSTART"
        exit 1
    fi
    cat $TMP1 | while read JOBFILE; do
        # still room for more jobs?
        test `ls $JOBDIR | wc -l` -lt $MAXJOBS || break
        # XXX filename collision theoretically possible if same file in
        # JOBDIR and DONEJOBDIR. not likely but would lead to JOBCOMP
        # not being fully updated.
        JOBID=`mktemp $JOBDIR/_job$$XXXXXXXX`
        if test x"$JOBID" = x; then
            echo "jobprocess.sh: error: unable to create job file"
            continue
        fi
    done

```

```

fi
echo $JOBFILE >$JOBID
# echo "running command on $JOBFILE"
(
    #####
    # place command to run here:
    # (No error handling)
    /nr/samba/jo/pro/GEO-FCT-Hub/usr/trier/src/process_landsat.bash $JOBFILE
    #####
    mv $JOBID $DONEJOBDIR
) &
echo "$JOBFILE" >> $TMP2
done
#update list of started jobs
sort $TMP2 > $JOBSTART

```

### 2.4.3.1 Example

To continue the example from Section 2.4.1 above, I could call `jobprocess.sh` with the same path as for `newfiles.sh`. However, before actually attempting to call `jobprocess.sh`, the two scripts

```

process_landsat.bash and
do_ledaps.bash

```

need to be edited, see Sections 2.4.5 and 2.4.7 below.

Since `jobprocess.sh` takes some time to complete, it might be a good idea to nice it:

```

nice ./jobprocess.sh /nr/samba/jodata3/pro/TropSkogTanz/data/new_files/

```

### 2.4.4 jobprocess.sh – old version

The delivered shell script appears below. There is one absolute path which refers to NR's file system, and must be replaced. It must have the same path as in `newfiles.sh`:

1. METADIR must refer to the location where metadata is stored.

Also, the command to be run is given by an absolute path, near the end of the file, and must be changed:

```

/nr/samba/jo/pro/GEO-FCT-Hub/usr/trier/src/process_landsat.bash

#!/bin/sh -
#
# jobprocess.sh - process completely downloaded files
#
# This is where we look for information about new files:
METADIR=/nr/samba/jodata3/pro/GEO-FCT-Hub/metadata
# Maximum number of files that may be processed in parallel:
MAXJOBS=10
# all files assumed to be fully downloaded:
DLCOMP=$METADIR/_dlcomp.txt
# fully downloaded files, processing started:

```

```

JOBSTART=$METADIR/_procstart.txt
# fully downloaded files, processed completed:
JOBCOMP=$METADIR/_processed.txt
JOBDIR=$METADIR/_jobs
DONEJOBDIR=$METADIR/_donejobs
LOCK=$METADIR/_processlock

TMP1=$METADIR/_process_tmp1
TMP2=$METADIR/_process_tmp2
TMP3=$METADIR/_process_tmp3

#acquire lock for _processed.txt file/job startup

echo "Acquire lock"
if test -e $LOCK; then
    echo "jobprocess.sh: already locked, exiting"
    exit 1
fi
if ! touch $LOCK; then
    echo "jobprocess.sh: unable to acquire lock, exiting"
    exit 1
fi
trap 'rm -rf $LOCK; exit 0' 0 1 2 3 13 15

echo "Create directories if they don't exist already:"
echo "    $JOBDIR"
test -e $JOBDIR || mkdir $JOBDIR
echo "    $DONEJOBDIR"
test -e $DONEJOBDIR || mkdir $DONEJOBDIR
echo "    $JOBCOMP"
test -e $JOBCOMP || touch $JOBCOMP
test -e $JOBSTART || touch $JOBSTART

#update list of processed jobs
donejobs=`find $DONEJOBDIR -type f`
if test x"$donejobs" != x; then
    cp /dev/null $TMP2
    for file in $donejobs; do
        cat $file >> $TMP2
        rm -f $file
    done
    cat $JOBCOMP $TMP2 | sort > $TMP3
    mv $TMP3 $JOBCOMP
fi

echo "Create file if it does not exist already:"
echo "    $DLCOMP"
test -e $DLCOMP || touch $DLCOMP
# generate list of jobs where processing has not started
echo "Generate list of jobs where processing has not yet
started:"
echo "comm -23 $DLCOMP $JOBSTART > $TMP1"
comm -23 $DLCOMP $JOBSTART > $TMP1
echo "$TMP1:"
echo "-----"

```

```

cat $TMP1
echo "-----"
#exit if file is empty
test -s $TMP1 || echo "    List is empty, exiting."
test -s $TMP1 || exit 0

# process up to MAXJOBS parallel jobs
echo "Process up to $MAXJOBS in parallel"
cp $JOBSTART $TMP2
if test $? -ne 0; then
    echo "jobprocess.sh: error: cp failed for $JOBSTART"
    exit 1
fi
cat $TMP1 | while read JOBFILE; do
    #still room for more jobs?
    test `ls $JOBDIR | wc -l` -lt $MAXJOBS || break
    #XXX filename collision theoretically possible if same file
in
    #JOBDIR and DONEJOBDIR. not likely but would lead to JOBCOMP
    #not being fully updated.
    JOBID=`mktmp $JOBDIR/_job$XXXXXXXX`
    if test x"$JOBID" = x; then
        echo "jobprocess.sh: error: unable to create job file"
        continue
    fi
    echo $JOBFILE >$JOBID
#    echo "running command on $JOBFILE"
    (
        #####
        # place command to run here:
        # (No error handling)
        /nr/samba/jo/pro/GEO-FCT-
Hub/usr/trier/src/process_landsat.bash $JOBFILE
        #####
        mv $JOBID $DONEJOBDIR
    ) &
    echo "$JOBFILE" >> $TMP2
done
#update list of started jobs
sort $TMP2 > $JOBSTART

```

#### 2.4.5 process\_landsat.bash – new version

The script process\_landsat.bash takes as input one gzip-compressed tar file, which is assumed to contain one Landsat image. The tar.gz-file is uncompressed and unpacked, and then LEDAPS pre-processing is run on the Landsat image by calling do\_ledaps.bash.

This file contains one absolute path in line 13, which needs to be replaced:

```
exe_dir="/nr/samba/jo/pro/GEO-FCT-Hub/usr/trier/src"
```

Here is the complete file:



```

#!/bin/bash

if [ $# != 1 ]
then
    echo "Usage: process Landsat.tar.gz_file"
    exit 1
else
    fullpath=$1
    directory=`echo $fullpath | sed -e 's/.gz//' -e 's/.tar//'`
    echo "directory=$directory"
fi

exe_dir="/nr/samba/jo/pro/GEO-FCT-Hub/usr/trier/src"
echo "exe_dir=$exe_dir"
echo "mkdir $directory"
mkdir $directory
echo "mv $fullpath $directory"
mv $fullpath $directory

echo "tar -C $directory/ -xvzf $directory/*.tar.gz"
tar -C $directory/ -xvzf $directory/*.tar.gz

current_dir=`pwd`
echo "current_dir=$current_dir"

echo "cd $directory"
cd $directory

echo "$exe_dir/do_ledaps.bash *_MTL.txt:"
$exe_dir/do_ledaps.bash *_MTL.txt

cd $current_dir

```

#### 2.4.6 process Landsat.bash – old version

This file does not need to be changed, but is given here in verbatim for completeness.

```

#!/bin/bash

if [ $# != 1 ]
then
    echo "Usage: process Landsat.tar.gz_file"
    exit 1
else
    fullpath=$1
    directory=`echo $fullpath | sed -e 's/.gz//' -e 's/.tar//'`
    echo $directory
fi

echo "mkdir $directory"
mkdir $directory
echo "mv $fullpath $directory"
mv $fullpath $directory

echo "tar -C $directory/ -xvzf $directory/*.tar.gz"

```

```

tar -C $directory/ -xvzf $directory/*.tar.gz

current_dir=`pwd`
echo "current_dir=$current_dir"

echo "cd $directory"
cd $directory

echo "$current_dir/do_ledaps.bash *_MTL.txt:"
$current_dir/do_ledaps.bash *_MTL.txt

cd $current_dir

```

## 2.4.7 do\_ledaps.bash – new version

This file is a modification of the file do\_ledaps.csh, which comes with the LEDAPS source code. do\_ledaps.bash contains one absolute path in line 15, which needs to be replaced:

```
bin_dir="/nr/samba/jo/pro/GEO-FCT-Hub/usr/trier/src/LEDAPS/ledapsSrc/bin"
```

The file is listed using a small 8pt font to avoid line breaks.

```

#!/bin/bash

export ANC_PATH="/nr/samba/jo/pro/GEO-FCT-Hub/usr/trier/src/LEDAPS/ANC"

if [ $# != 1 ]
then
    echo "Usage: do_ledaps.bash <Landsat_MTL_file>"
    exit 1
else
    meta_file=$1
    meta=`echo $meta_file | sed -e 's/.txt//' -e 's/_MTL//' -e 's/.met//`
    echo "[do_ledaps.bash] meta=$meta"
fi

bin_dir="/nr/samba/jo/pro/GEO-FCT-Hub/usr/trier/src/LEDAPS/ledapsSrc/bin"
echo "[do_ledaps.bash] bin_dir=$bin_dir"

# run LEDAPS modules

echo "[do_ledaps.bash] $bin_dir/lndpm $meta_file"
$bin_dir/lndpm $meta_file

echo "[do_ledaps.bash] $bin_dir/lndcal lndcal.$meta.txt"
$bin_dir/lndcal lndcal.$meta.txt

echo "[do_ledaps.bash] $bin_dir/lndcsm lndcsm.$meta.txt"
$bin_dir/lndcsm lndcsm.$meta.txt

echo "[do_ledaps.bash] $bin_dir/lndsr lndsr.$meta.txt"
$bin_dir/lndsr lndsr.$meta.txt

```

## 2.4.8 do\_ledaps.bash – old version

This file is a modification of the file do\_ledaps.csh, which comes with the LEDAPS source code. do\_ledaps.bash contains several absolute paths, which all need to be replaced. The file is listed using a small 8pt font to avoid line breaks.

```
#!/bin/bash

export ANC_PATH="/nr/samba/jo/pro/GEO-FCT-Hub/usr/trier/src/LEDAPS/ANC"

if [ $# != 1 ]
then
    echo "Usage: do_ledaps.bash <Landsat_MTL_file>"
    exit 1
else
    meta_file=$1
    meta=`echo $meta_file | sed -e 's/.txt//' -e 's/_MTL//' -e 's/.met//'`
    echo $meta
fi

# run LEDAPS modules

echo "/nr/samba/jo/pro/GEO-FCT-Hub/usr/trier/src/LEDAPS/ledapsSrc/bin/lndpm $meta_file"
/nr/samba/jo/pro/GEO-FCT-Hub/usr/trier/src/LEDAPS/ledapsSrc/bin/lndpm $meta_file

echo "/nr/samba/jo/pro/GEO-FCT-Hub/usr/trier/src/LEDAPS/ledapsSrc/bin/lndcal
lndcal.$meta.txt"
/nr/samba/jo/pro/GEO-FCT-Hub/usr/trier/src/LEDAPS/ledapsSrc/bin/lndcal lndcal.$meta.txt

echo "/nr/samba/jo/pro/GEO-FCT-Hub/usr/trier/src/LEDAPS/ledapsSrc/bin/lndcsm
lndcsm.$meta.txt"
/nr/samba/jo/pro/GEO-FCT-Hub/usr/trier/src/LEDAPS/ledapsSrc/bin/lndcsm lndcsm.$meta.txt

echo "/nr/samba/jo/pro/GEO-FCT-Hub/usr/trier/src/LEDAPS/ledapsSrc/bin/lndsr
lndsr.$meta.txt"
/nr/samba/jo/pro/GEO-FCT-Hub/usr/trier/src/LEDAPS/ledapsSrc/bin/lndsr lndsr.$meta.txt
```

## 2.5 Running commands as cron jobs

To run newfiles.sh and jobprocess.sh as cron jobs, you need to create entries for them in the crontab file. There is a special command to edit the crontab file. The default behaviour is to open the crontab file in the VI editor. Unless you really like VI, you should specify an alternative editor, e.g., emacs, with this command:

```
export VISUAL='emacs'
```

To edit the crontab file, use the command:

```
crontab -e
```

This opens the crontab file in an editor. If it is empty, it looks like this:

```
# m h dom mon dow    command
```

You should add one entry for newfiles.sh and one for jobprocess.sh, e.g.:

```
# m h dom mon dow    command
1 * * * * /nr/samba/jo/pro/GEO-FCT-Hub/usr/trier/src/newfiles.sh
/nr/samba/jodata3/pro/TropSkogTanz/data/new_files
5 * * * * nice /nr/samba/jo/pro/GEO-FCT-Hub/usr/trier/src /jobprocess.sh
/nr/samba/jodata3/pro/TropSkogTanz/data/new_files
```

The above crontab file has three lines; unfortunately the second and third lines have been split across two lines in this document.

The comment in the first line indicates the fields, which are separated by space characters.

Column 1: The minute past the hour to start the command. This may be several during one hour, e.g., one could use '0,15,30,45' to have the process execute every 15 minutes. An asterisk means 'every', so in column 1 it would mean every minute.

Column 2: The hour to start the command. '\*' means every hour, '\*/2' means every second hour, '15' means 3PM. Usually, every hour would be fine.

Column 3: The day of the month. For our purpose, use '\*'.

Column 4: The month. Again, use '\*'.

Column 5: Weekday, with 0=Sunday, 1=Monday, etc.

Column 6: The command to issue.

When testing this, it is a good idea to edit the following line in jobprocess.sh:

```
MAXJOBS=10
```

and set it very low, e.g.,

```
MAXJOBS=1
```

Then, when everything works fine, you can increase it. Note that the value of MAXJOBS should be balanced with how long it takes to run LEDAPS pre-processing on one file, and how often the cron jobs are started. Still, there will not be more than MAXJOBS instances of jobprocess.sh running in parallel, so there is no harm in having the cron jobs starting too frequently.

The cron jobs will be executed simply by appearing in the crontab file. Note that you must exit the editor for any changes to take effect. To stop the jobs, precede each line in the crontab file with a hash (#), then save the file and exit the editor.

### 3 References

Masek, Jeffrey G.; Eric F. Vermote, Nazmi E. Saleous, Robert Wolfe, Forrest G. Hall, Karl F. Huemmrich, Feng Gao, Jonathan Kutler, and Teng-Kui Lim, 2006. A Landsat Surface Reflectance Dataset for North America, 1990-2000, *IEEE Geoscience and Remote Sensing Letters*, Vol. 3, No. 1, pp. 68-72.

Zortea, M., Trier, Ø. D., and Solberg, R., 2011. Evaluation of the Landsat surface reflectance estimated by LEDAPS, NR-note No. SAMBA/37/11.