QUICKSTART GUIDE

Annex version 1.2

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Running codes with ifort compiler and SSWIDL software on Linux system

- **Download** the package source file annex_version1.2.tgz from MEDOC/TOOLS webpage
- **ifort** compiler and **SSWIDL** software are required. Type the following linux commands:
- **tar -xvzf annex_version1.2.tgz**
- **cd annex_version1.2**
- **The directory contains 2 directories corresponding to 2 different test cases** to be able to check if your results are good : a first test case which corresponds to 29 Nov 2018 HMI observations of 15 min (``TEST_15min" directory), a second test case which corresponds to 29 Nov 2018 HMI observations of 30 min (``TEST_30min" directory)
- **Each of these directories (corresponding to the 2 different test cases above) contains the following files:**

1. **Fortran files (« Fortran » directory):**

   - cst_labv7_FS_2017_deconv.f90 (main program)

   - Makefile.common (used to compile librairies that are in « lib » directory)

   - deriw2d.f90

- detect.f90
- div_curl.f90
- mres2d.f90
- opt_scale.f90
- the_name.f90 (contains thename module)
- segment.f90 (contains segmentation module)
- cg.f90
- interpol2d.f90
- interpol2dth.f90
- interpol2d_routine.f90 (contains interpolationroutine module)
- interpol2d_routine_short.f90
- centre_gravite.f90
- input.f90 (contains input subroutine)
- sub_coef_r.f90
- ftw3.inc, form_num.inc, Makefile.inc
- « lib » directory contains librairies needed for compilation
- **Makefile (file to modify)**: variables CFLAGS and CFLAGS_LIB are to be adapted according to your server (-I/usr/include/x86_64-linux-gnu/c++/8)
- **IAS_cluster-head_29nov2018_script_deconv.sh (file to modify)**: according to your server, you need to add or not the following commands :

« source /opt/intel/compilers_and_libraries_2018.3.222/… » : path to Fortran ifort compiler

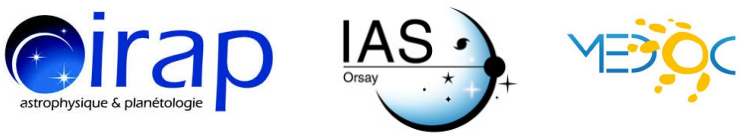
« ulimit -s unlimited »

- **param_seq_29nov2018_EOS_30mn_deconv (file to modify)** :

the following parameters are to be adapted according to the HMI/SDO data: prefix, input_file, arcsec, pixel, bin_sp

2. **IDL files (« IDL »directory):**

- ftm.sav
- deconvol_HMI_29nov2018.pro corresponding to deconvolution from images 4096x4096 pixels to 8192x8192 pixels



- pv_field_SDO_7_pix_15min.pro or pv_field_SDO_3_pix_30min.pro according to the test cases, corresponding to visualization of velocities
- fits and dat files are results prooduced by pv_field_SDO_7_pix_15min.pro or pv_field_SDO_3_pix_30min.pro

- **Take HMI intensity and Doppler data** from **JSOC** (45s-cadence HMI files are not available at MEDOC)

- You must create ``result_idl'' directory which will contain fits files from deconvolution (STEP 1 : IDL part)

- **STEP 1 : IDL PART**

  Adapt the following parameter in IDL ``deconvol_HMI_29nov2018.pro'' file :

  path, path_outTo prepare input data for CST Fortran program, **type the following commands with SSWIDL in « IDL » directory:**

  .r deconvol_HMI_29nov2018.pro

  For 15 min HMI observations, we have (in result_idl directory):
  SDO_20181129_deconv_0001.fits, ..., SDO_20181129_deconv_0020.fits

  For 30 min HMI observations, we have (in result_idl directory):
  SDO_20181129_deconv_0001.fits, ..., SDO_20181129_deconv_0040.fits

- **STEP 2 : FORTRAN PART**
  Choose 18 core for an optimal run. To compile and execute fortran files, here are the commands for SLURM, in « Fortran » directory:

  sbatch IAS_cluster-head_29nov2018_script_deconv.sh

  The output files are (in « JOB_XXXX/results » directory) :

  - output.log : to check if annex code runs well

  - image_cont : last segmented image of the Sun in binary format (visualized by an IDL program « image_cont.pro » (with SSWIDL : .r image_cont.pro))
  - param_seq_29nov2018_EOS_30mn_deconv : parameters used
  - traject_11_0000 : trajectories of all selected granules. The second number of the first line is the total number of treated granules. Column 1 is the granule

number, column 2 is x_cent (gravity center), column 3 is y_cent, column 4 is the number of the image where the granule is born, column 5 is the number of the image where the granule dies, column 6 is the lifetime of the granule in second, column 7 is the velocity ux (in km/s), column 8 is the velocity uy (in km/s)
- nb_gran_0000 : pixel size chosen for the spatial window, 1 arcsec in km, pixel size in arcsec, treatment threshold of CST code
- ux_b_0000, ux_h_0000, ux_l_0000, ux_m_0000, ux_k_0000
- uy_b_0000, uy_h_0000, uy_l_0000, uy_m_0000, uy_k_0000
- div_b_0000, div_h_0000, div_l_0000, div_m_0000, div_k_0000
- rot_b_0000 , rot_h_0000, rot_l_0000, rot_m_0000, rot_k_0000
- err_b_0000, err_h_0000, err_l_0000, err_m_0000, err_k_0000
- ux,uy,div,rot, sampled on a regular grid , traj contains the trajectories of each granule .

- **STEP 3 : IDL PART**

Adapt the following parameters in IDL files (in « IDL » directory):

- pv_field_SDO_7_pix_15min.pro or pv_field_SDO_3_pix_30min.pro according to the test cases: path (path to ``JOB_XXXX/results" directory)

With SSWIDL, type the following commands :
.r pv_field_SDO_7_pix_15min.pro or .r pv_field_SDO_3_pix_30min.pro according to the test cases

For example, for 15 min HMI observations and bin_sp = 7 pixels, ``result_idl" directory size is 5,5 G and ``JOB_XXXX" directory size is 1,4G (in ``Fortran" directory).

For example, for 30 min HMI observations and bin_sp = 3 pixels, ``result_idl" directory size is 11 G and ``JOB_XXXX" directory size is 3,4 G (in ``Fortran" directory).

CONTACTS

If you have any question about the installation or the run of CST codes, please send a mail to :

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CST MEDOC WORKSHOP

A workshop was dedicated to the training and use of the Coherent Structure Tracking (CST) software. It took place on March 3-4, 2020 at IAS in Orsay, France : https://cst2020-medoc.sciencesconf.org/

Part of the workshop was devoted to the explanation of the installation of this CST code on their own servers as well as the various precautions to take.

Presentations are available on :
https://idoc.ias.u-psud.fr/MEDOC/CST%20codes