MEDSLIK-II Version 1.01
User Manual
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1 A Brief Overview of MEDSLIK

The oil-spill model code MEDSLIK-II (De Dominicis et al. 2012a-b), based on its precursor the oil-spill model MEDSLIK (Lardner and Zodiatis 1998; Lardner et al. 2006; Zodiatis et al. 2005, 2008) is freely available and can be downloaded from the website http://gnoo.bo.ingv.it/MEDSLIKII/. MEDSLIK-II is available under the GNU General Public License (see APPENDIX B for license terms and conditions).
MEDSLIK-II is designed to predict the transport and weathering of an oil spill using a Lagrangian representation of the oil slick. MEDSLIK-II simulates the transport of the surface slick governed by the water currents and by the wind. Oil particles are also dispersed by turbulent fluctuation components that are parameterized with a random-walk scheme. In addition to advective and diffusive displacements, the oil-spill particles change due to various physical and chemical processes that transform the oil (evaporation, emulsification, dispersion in water column, adhesion to coast). MEDSLIK-II includes a proper representation of high-frequency currents and wind fields in the advective components of the Lagrangian trajectory model, introduction of the Stokes drift velocity and coupling with remote-sensing data.
Input and Output
MEDSLIK-II requires as input oil-spill data, wind field, sea-surface temperature and three-dimensional sea currents. MEDSLIK-II can make use of atmospheric wind and oceanographic fields (i.e., currents, temperature) from several different sources. The oil-spill data required to define a numerical oil-spill initial condition are: location, time and area of the spill, as well as the age of the oil spill from initial arrival in the sea. This information can be easily provided to MEDSLIK-II by satellite monitoring systems MEDSLIK-II produces as output the evolution of oil properties and the position, every hour and for the next days, of the surface, dispersed oil and oil arrived on the coasts.

2 Program Installation

2.1 System Requirements

The architecture currently supported is Linux (tested on Ubuntu 10.04 LTS).
The software requirements are:
- FORTRAN 90/95 compiler (gfortran is fully compatible):

to Install gfortran compiler:
sudo apt-get install gfortran
- NetCDF library.

sudo apt-get install netcdf-bin
sudo apt-get install libnetcdf-dev
- NCL (provided within the model for visualization).

2.2 Installation

1) Download the model and put the tarball in your home directory.
   The file downloaded will have a different name according to the version.

2) Uncompress and extract the contents of the tarball.
   tar –xvzf MEDSLIK_II_1.01.tar.gz MEDSLIK_II_1.01

This operation will create and populate the directories MEDSLIK_II_1.0/EXE containing the source files and script files and executables for running and visualizing the test case.
The MEDSLIK_II_1.01 system is composed of six main parts:

- source code (directory source);
- input data files (directory data);
- output data files (directory output);
- script files to compile and execute in a Linux operative system;
- visualization software (directory medslik_plots);
- Test Case set-up (directory test_cases).

3) Enter MEDSLIK_II_1.01 and compile the code. For example:
   cd $HOME/MEDSLIK_II_1.01/EXE
   sh source/compile.sh

4) At this stage, you need the sample current and wind files.
   Pick up the sample current file Currents
   Pick up the sample wind file Wind

5) Unzip and place currents in $HOME/MEDSLIK_II_1.01/DATA/fcst_data/O1h and winds in $HOME/MEDSLIK_II_1.01/DATA/fcst_data/ECM.

6) Copy the Algeria test case input file
   cd $HOME/MEDSLIK_II_1.01/EXE
   cp test_cases/TEST_ALGERIA/medslik_inputfile.txt .
   cp test_cases/TEST_ALGERIA/observation_0808071050.txt .

7) Now you are ready to run the code. Just type
   ./RUN.sh

The simulation will start, and after a few minutes in the directory
$HOME/MEDSLIK_II_1.01/EXE/output/MFS_2008_08_06_0951_TEST_ALGERIA/plots
you will find pictures of the initial position of the slick and its predicted position every 6 hours.
You can also visualize the pictures by opening the file index.html (in the directory plots) with a web browser.

3 Medslik-II Reference Code Description

The MEDSLIK-II.V1.01 system is composed of seven main parts:

1) source code;
2) meteo-oceanographic data files
3) input data files;
4) script files to execute the model in a Linux operative system;
5) visualization software;
6) output data files;
7) a Test Case set-up.

3.1 Source Code

The MEDSLIK-II.V1.01 Fortran source codes are located in the folder *source.*
The main codes are (all the codes are listed in Figure 1):
medslik_II.for: simulation of a single oil spill.
Extract_II.for: extraction of the required forecast data from the text files derived from netCDF forecast output.

3.2 Meteo-oceanographic Data Files

The meteo-oceanographic data archive part of MEDSLIK-II consists of 2 folders:

- $HOME/MEDSLIK_II_1.01/EXE/data contains the bathymetry files for the different region in the Mediterranean Sea and other associated data files.
- $HOME/MEDSLIK_II_1.01/DATA/fcst_data contains the oceanographic and wind data organized into subdirectories.

When forecasts/analysis are used for any of the oceanographic or atmospheric parameters, the relevant data files must be placed in the appropriate sub-directory of *$HOME/MEDSLIK_II_1.01/DATA/fcst_data*. MEDSLIK-II extracts from these files the needed data for a sufficiently large sub-region around the spill site using the Extract_II.for routine. The data extracted are saved in the directory *$HOME/MEDSLIK_II_1.01/EXE/fcst_data*.
This is a list of the meteo-oceanographic model output that can be used by MEDSLIK-II_1.01:

Mediterranean Forecasting System (MFS) daily output. These daily average analyses are produced in NetCDF format for the whole Mediterranean Sea. Three files are produced for each date: MEDaaEyymmdd_24_grid_U.nc, MEDaaEyymmdd_24_grid_*V.nc* and MEDaaEyymmdd_24_grid_*T.nc* for date *yymmdd*. These should be placed in the directory *$HOME/MEDSLIK_II_1.01/DATA/fcst_data/OPA*.

Mediterranean Forecasting System (MFS) hourly output. These hourly average forecasts are produced in NetCDF format for the whole Mediterranean Sea. Three files are produced for each date: MEDffEyymmdd_01_grid_U.nc, MEDffEyymmdd_01_grid_*V.nc* and MEDffEyymmdd_01_grid_*T.nc* for date *yymmdd*. These should be placed in the directory *$HOME/MEDSLIK_II_1.01/DATA/fcst_data/O1h*.

Adriatic Forecasting System (AFS) daily output. These daily average simulations are produced in NetCDF format for the Adriatic Sea. Three files are produced for each date: ADRIssEyymmdd_24_grid_U.nc, ADRIssEyymmdd_24_grid_*V.nc* and ADRIssEyymmdd_24_grid_*T.nc* for date *yymmdd*. These should be placed in the directory *$HOME/MEDSLIK_II_1.01/DATA/fcst_data/A24*.

Adriatic Forecasting System (AFS) hourly output. These hourly average forecasts are produced in NetCDF format for the whole Mediterranean Sea. Three files are produced for each date: ADRIffEyymmdd_01_grid_U.nc, ADRIffEyymmdd_01_grid_*V.nc* and ADRIffEyymmdd_01_grid_*T.nc* for date *yymmdd* These should be placed in the directory *$HOME/MEDSLIK_II_1.01/DATA/fcst_data/A1h*.

Sicily Channel Regional Model (SCRM) daily output. These daily average analyses are produced in NetCDF format for the Sicily Channel Region. Three files are produced for each date: SCRMaaEyymmdd_24_grid_U.nc, SCRMaaEyymmdd_24_grid_*V.nc* and SCRMaaEyymmdd_24_grid_*T.nc* for date *yymmdd*. These should be placed in the directory *$HOME/MEDSLIK_II_1.01/DATA/fcst_data/S24*.

Sicily Channel Regional Model (SCRM) hourly output. These hourly average forecasts are produced in NetCDF format for the Sicily Channel Region. Three files are produced for each date: SCRMffEyymmdd_01_grid_U.nc, SCRMffEyymmdd_01_grid_*V.nc* and SCRMffEyymmdd_01_grid_*T.nc* for date *yymmdd*. These should be placed in the directory *$HOME/MEDSLIK_II_1.01/DATA/fcst_data/S1h*.

Tyrrhenian Regional Model (TYRR) daily output. These daily average analyses are produced in NetCDF format for the Tyrrhenian Sea. Three files are produced for each date: TIRRaaEyymmdd_24_grid_U.nc, TIRRaaEyymmdd_24_grid_*V.nc* and TIRRaaEyymmdd_24_grid_*T.nc* for date *yymmdd*. These should be placed in the directory *$HOME/MEDSLIK_II_1.01/DATA/fcst_data/T24*.

Thyrennian Regional Model (TYRR) hourly output. These hourly average forecasts are produced in NetCDF format for the whole Mediterranean Sea. Three files are produced for each date: TIRRffEyymmdd_01_grid_U.nc, TIRRffEyymmdd_01_grid_*V.nc* and TIRRffEyymmdd_01_grid_*T.nc* for date *yymmdd*. These should be placed in the directory *$HOME/MEDSLIK_II_1.01/DATA/fcst_data/T1h*.

Western Mediterranean Regional Model (WMED) hourly output. These hourly average forecasts are produced in NetCDF format for the western Mediterranean Sea region. Three files are produced for each date: WMEDfsEyymmdd_01_grid_U.nc, WMEDfsEyymmdd_01_grid_*V.nc* and WMEDfsEyymmdd_01_grid_*T.nc* for date *yymmdd*. These should be placed in the directory *$HOME/MEDSLIK_II_1.01/DATA/fcst_data/WME*.

Relocable Model (REL) hourly output. These hourly average forecasts are produced in NetCDF format for any region of the Mediterranean Sea. **This version of MEDSLIK-II reads the output produced by the IRENOM model, which is based on the HOPS model code.** Three files are produced for each date: HOPS3km_H_yymmdd_U.nc, HOPS3km_H_yymmdd_V.nc, HOPS3km_H_yymmdd_T.nc for date *yymmdd*. These should be placed in the directory *$HOME/MEDSLIK_II_1.01/DATA/fcst_data/H3k*.

ECMWF Wind Forecasts. The ECMWF wind forecasts and analyses are available for the whole Mediterranean Sea with a horizontal resolution of 0.25. They are snapshots every 6 hours (at hours 00, 06, 12, 18) and files named *yyyymmdd.nc* for date *yymmdd*. These files should be placed in the sub-directories *fcst_data/E25*. Before the 11th of January 2009 the ECWMF analysis were produced at a resolution of 0.5, with the same temporal resolution and naming convention as the forecasts and analysis currently provided. They should be placed in the directory *$HOME/MEDSLIK_II_1.01/DATA/fcst_data/ECM.*

3.3 Input Data Files

The main input file files are:

- *medslik_inputfile.txt*: contains the input spill data needed to perform the simulation: spill date and time, position, spill duration, spill volume, type of oil, etc. The *medslik_inputfile.txt* is processed by *medslik_II.sh* and the input data are saved in the *medslik5.inp* file and in the file *medslik.tmp*
- *medslik5.par*: contains the parameters needed for the simulation, such as the drift angle, the drift angle, the current depth and horizontal and vertical diffusivity

These are ASCII format files and may be read and edited using any text editor.

Input file: medslik_inputfile.txt

The following are the input data entered manually. A typical example of the file *medslik_inputfile.txt* is in $HOME/MEDSLIK_II_1.01/EXE/test_cases/TEST_ALGERIA.

Simulation name (SIM_NAME). Name of the simulation (any name without blank spaces and symbols), e.g. *SIM_NAME=TEST*

Model data (MODEL). A string representing each of the different current model outputs for which MEDSLIK-II can read the data. For example, *MFS* represents the MFS hourly output, *MFS24* the MFS daily output, *AFS* the AFS hourly output and so on (for the complete list see Table 1), e.g. *MODEL=MFS.*
Wind data (WIND). A string representing each of the different wind fields for which MEDSLIK-II can read the data. *ECMF025* represents ECMWF data with a resolution of 0.25, while *ECMF05* represents ECMWF data with a resolution of 0.5 (for the complete list see Table 1), e.g. *WIND=ECMF025.*
Length of the Simulation (sim_length). The number of hours from the start of the spill or trajectory for which the prediction of position and state of the oil are required. This written using 4 characters, e.g. *sim_length=0072*.
Day of Spill/Start (day). The day on which the spill or the trajectory starts. This item must be written using 2 characters, e.g. *day=03*.
Month of Spill/Start (month). The month on which the spill or the trajectory starts. This item must be written using 2 characters, e.g. *month=02*.
Year of Spill/Start (year). The year on which the spill or the trajectory starts. This item must be written using 2 characters, e.g. *year=09*.
Hour of Spill/Start (hour). The hour of day between 0 and 23. This item must be written using 2 characters, e.g. *hour=08*.
Minutes of Spill/Start (minutes). The minutes after the hour of start, between 0 and 59, at which the spill or trajectory is started. This item must be written using 2 characters, e.g. *minutes=05*.
Location of the Spill/Start (lat_degree). The latitude at which the spill occurred is entered in degrees and decimal minutes. This item has 2 characters, e.g. *lat_degree=42*.
Location of the Spill/Start (lat_minutes). The latitude at which the spill occurred or the trajectory started is entered in degrees and decimal minutes. This item has 4 characters, e.g. *lat_minutes=22.20*.
Location of the Spill/Start (lon_degree). The longitude at which the spill occurred or the trajectory started is entered in degrees and decimal minutes. This item has 2 characters, e.g. *lon_degree=10*.
Location of the Spill/Start (lon_minutes). The longitude at which the spill occurred or the trajectory started is entered in degrees and decimal minutes. This item has 4 characters, e.g. *lon_minutes=55.50*.
Duration of the Spill/Releases (duration). The number of hours during which oil or pollutant was spilling. For an instantaneous spill enter 0. It is written using 4 characters, e.g. *duration=0072 or duration=0000*.
Rate of Spillage (spillrate). The rate (in tons per hour) at which oil was spilt. For an instantaneous spill, the total volume has to be written, e.g. *spillrate=10.50*.
Slick age (age). The slick age, which can be 0, 24 or 48 hrs, e.g. *age=0*.
Oil tracer grid size (**grid_size**): Each time the results are printed in one of the output files, the particles are aggregated inside 'pixels', the size of which is specified by the grid_size parameter, e.g. *grid_size=150*.
Oil (OIL). If the precise name of the oil is known, write *OIL=NAME*, if it is unknown write *OIL=API*.

Type of Oil. The name of the oil type that has been spilt can be chosen from a list of over 200 oils (*oil_list.txt*) e.g. *OIL_TYPE=Arabian Heavy*. If the precise name of the oil is unknown, you must enter the API number of the oil, e.g. *OIL_TYPE=17.*

Point or areal source of spill (ContourSlick and SAT_DATA): MEDSLIK-II allows the simulation of (1) a point source of spill or (2) an areal source of spill with manual insertion of contour coordinates or (3) an areal source of spill using satellite data.

1) Use *SAT_DATA=NO* and *ContourSlick=NO* to perform a simulation of a point source of spill (no need to fill the Number of Slicks - Nslick and list of latitude and longitude of slick points contour - S1lon[1], S1lat[1], S1lon[2], S1lat[2]..)

2) Use *SAT_DATA=NO* and *ContourSlick=YES* to perform a simulation of an areal source of spill. If *ContourSlick=YES* is chosen, then the following parameters have to be specified (otherwise leave them blank):

> **Number of Slicks (Nslick):** number of oil slick to be simulated, written using 1 character, e.g. NSlick*=2*.
>
> **List of latitude and longitude of slick points contour (S1lon[1], S1lat[1], S1lon[2], S1lat[2]…):** latitude and longitude (in decimal degrees) of the oil slick polygon vertices.

3) Use *SAT_DATA=YES* and *ContourSlick=NO* to perform a simulation of an areal source of spill using satellite data (no need to fill the Number of Slicks - Nslick and list of latitude and longitude of slick points contour - S1lon[1], S1lat[1], S1lon[2], S1lat[2]…).

When MEDSLIK-II is used for forecast of a slick observed by satellite or by other means, the data for the observation is read from a file named initial*.tx*t in the main model directory (*$HOME/MEDSLIK_II_1.01/EXE)*. This file has been converted by the ReadSatData.py from a '*.gml*' or '*.xml*' file derived from the satellite image.

Satellite data is received from EMSA in a file of type '**.gml*' which can be visualized on Google Earth. Such files may contain data for several oil slicks, with the boundary of each digitized to a fine resolution, especially in the case of a *gml* file.

If SAT_DATA=YES is chosen the following parameters have to be filled (otherwise leave them blank):

> **namefileGML** has to be filled with the name of the GML file (e.g. *namefileGML=ASA_WSM_1PNACS20080806_095116_000000612071_00022_33643_0001.N1.00000_Oil.gml*). The file has to be saved in $HOME/MEDSLIK_1.01/EXE.
>
> **N_OS** has to be filled with the number of the oil slick in the file to be simulated (e.g. *N_OS=1*)

Parameter file: medslik5.par

The following will provide a brief description of the significance of the parameters in the medslik5.par. These are the parameters that a user is most likely to want to change from their default values.

Stokes drift correction. Choosing 01 allows the model to use the wave-induced velocity (Stokes drift) calculated using an empirical formulation. Choosing 00 Stokes drift velocity will not be applied. The default value is 01.

Wind correction (Drift Factor). The drift speed of the slick is equal to this factor multiplied by the wind speed. The default value is 0.

Wind correction (Drift Angle). The wind-driven drift of the slick occurs at this angle to the right of the wind direction. The default value is 0.0 degrees, which causes the slick to move directly downwind.

Variable Drift Angle. Choosing 01 allows the model to use a drift angle that decreases as the wind speed increases; a wind speed at which the drift angle is reduced by 50% must then be entered in the line below. The default is that such a reduction is not made.

Reduction of Forecast Wind Speed. When using forecast water circulation in a simulation, the forecast water velocities already include the effect of the wind forces on the water surface. It may thus be considered appropriate in some cases to reduce the wind speed used in the drift formula by a fraction of the winds used in the forecast. This can be done writing 01 in effective wind speed and entering in the line below the reduction fraction (between 0 and 1). The default is that such a reduction is not made.

Smagorinsky Scheme. Choosing 01 allows the horizontal diffusivity to be computed from the water currents using the Smagorinsky scheme. The default value is 0.

Horizontal Diffusivity. Enter the diffusivity that determines the horizontal diffusive spreading of the slick. The default value is 2.0 m^2/s. A larger value will cause the slick to spread faster.

Vertical Diffusivities. The model allows the use of two values of vertical diffusivity: a larger value in the top well-mixed layer and a smaller value below the mixed layer. The defaults are 0.01 and 0.0001 m^2/s respectively.

Depth of Mixed Layer. The default for this depth is 30 m.

Number of parcels. Diffusion and dispersion are modelled using a Monte Carlo algorithm, representing the oil by a large number of particles which are then given appropriate random displacements, and the resulting cloud of parcels used to estimate the concentration of the oil in the slick. MEDSLIK-II uses 10,000 parcels as the default, but the user can increase this up to 300,000.

Depths of Forecast Currents. The current fields are extracted from the Nectdf and are given in the text files in *$HOME/MEDSLIK_II_1.01/EXE/fcst_data* at fixed depths. Whatever depths are used in the text files (they can only be changed by modifying the Extract_II.for code), the same depths must be entered in the parameters form.

In the MEDSLIK-II_1.01 version the current fields are given at 3 depths (10 m, 30 m and 120 m) plus the surface.

Selection of currents for convection of slick. In the MEDSLIK-II_1.01 version it is possible to choose between 4 options: 00 for surface currents, 01 for 10 m deep currents, 02 for 30 m deep currents and 03 for 120 m deep currents. The default strategy is to use the surface velocities for advection of the slick and to ignore the wind drift altogether (by setting the drift factor equal to zero).

Number of Time Steps per Hour. The default value is 2. The default time step for computation of the convection and diffusion is 30 minutes. (A shorter step is used for the fate processes.) In general this is adequate, but for a continuous spill with strong winds and/or currents, the 30-minute step may cause the computed slick to appear as a number of discrete slicks that do not merge for several hours. This lack of reality can be reduced by using a shorter time step.

Dimension of the Array used for representing the slick. Each time the results are printed in one of the output files, the particles are aggregated inside 'pixels', the size of which was entered in the **medslik_inputfile.txt (grid_size)**. These pixels form an array the dimension of which is set by this parameter. The default array dimension is 2000×2000 and the maximum is 4000×4000. Choosing this maximum causes the run program to slow very significantly. On the other hand, too small a dimension causes the displayed slick to have straight, barrier-like, edges. If this occurs, you must either choose a larger array dimension or a larger pixel size.

3.4 Script Files and Executables

The script *RUN.sh* first launches the model run (*medslik_II.sh*) and then the visualization execution (*medslik_plots/medslik_plots.sh*).

The operations performed by the Linux shell script (*medslik_II.sh*) are listed below.

1. Read input data: *medslik_inputfile.txt* is processed.
2. Read the oil characteristics (using the routine read_oil_data.py) from the oil-type database (*oilbase.txt* and *oil_list.txt*).
3. Read slick contour: if the corresponding options has been selected, the oil-slick contour is read from the medslik_inputfile.txt or from the satellite data file.
4. Save Input data in the *medslik5.inp* file (which is read by *medslik_II.exe*).
5. Area selection: This section is for the selection of the area affected by the spill (using the routine *lat_lon*). The limits of the area and the list of the current forecast files needed for the simulation are saved in the *medslik.tmp* file (which is read by *medslik_II.exe*).
6. Check the currents and wind files needed for the simulation
7. Extract currents, wind and SST data: this section calls the routine *Extract_II.exe*, which extract the currents, wind and SST of the area interested by the spill.
8. Run: this section calls *medslik_II.exe* in order to perform the simulation of the transport and weathering of the oil.
9. Archive of the MEDSLIK-II output files, currents and winds used in the simulation in one unique folder contained in *$HOME/MEDSLIK_II_1.01/EXE/output*.

A brief description of the executables, launched by the script shell, is given below:

- *lat_lon*

lat_lon calculates the geographical limits of the area affected by the spill (the area is calculated assuming the slick travels at less than 1.5 nauticalmiles/h from spill site)

- *jday*

jday converts the calendar dates to astronomical Julian dates and the elapsed time between instances over periods of time.

- *read_oil_data.py*

read_oil_data.py reads the oil characteristics from the oil-type database file *oilbase.txt* and *oil_list.txt* (located in the *data* folder).

- *ReadSatData.py*

ReadSaDatat_EMSA.py reads the satellite data file (if the corresponding option has been selected) and writes two text files (*Initial.txt and medslik_sat.inp*) containing the slick contour and oil-spill data. This routine has to be adapted for the specific satellite date file format (usually XML or GML file).

- *Extract_II.exe*

Extraction of the required wind/currents data from the netCDF files. *Extract_II.for* reads from the *medslik.tmp* the limits of the region that has to be extracted from the wind/currents data files.

- *medslik_II.exe*

medslik_II.exe is the executable of the *medsliku_II.for* code.

3.5 Visualization Software

The visualization software is located in the folder *medslik_plots*, which contain the NCL codes and the shell script (*medslik_plots.sh*) to run the visualization procedure.

The MEDSLIK-II.V1.01 visualization software reads the oil-on-surface output (.srf) and plots the oil-slick concentration in space and time, as well as the wind and currents.

The maps are saved in the subfolder *plots* located in the simulation output directory (MMM_YYYY_MM_DD_HH_MM_NAME).

The MEDSLIK-II.V1.01 visualization software allows available satellite observations to be plotted together with the oil-slick prediction. The software automatically reads the observation files that have to be saved in the simulation output directory (examples of observation file format are provided in the *test_cases* folder).

The parameter files are contained in *medslik_plots.ncl*, which is located in the simulation output directory. This can be edited by the user to set the lat/lon image limits and choose the time step between two subsequent images.

3.6 Output Data Files

The output files are contained in *$HOME/MEDSLIK_II_1.01/EXE/output*. The output data files are ASCII format files and images. After each simulation the output files are automatically saved in a subfolder the name of which has the structure MMM_YYYY_MM_DD_HHMM_NAME
where
(MMM is the name of the oceanographic model used for simulation; YYYY the year; MM the month; DD the day; HH the hour; MM the minutes; NAME the simulation name chosen by the user).
The folder contains:
- the input files in text format (medslik_inputfile.txt, medslik5.inp and medslik.tmp);
- the satellite data file (if used) containing the slick contour (initial.txt) and converted from the original .gml file.
- the parameter file in text format (medslik5.par);

- the medslik_plots.ncl visualization parameter file;
- the medslik.fte file, which contains the trend over time of: the oil volume spilled, the percentage of oil evaporated, the percentage of oil on the surface, the percentage of oil dispersed, the percentage of oil on the coast, the oil-water emulsion viscosity, the oil viscosity, the oil density, the fraction of water contained in the oil-water emulsion, etc.
- outhhhh.srf files: contain the values of the oil concentration on the surface;
- outhhhh.dsp files: contain the values of the dispersed oil concentration;
- outhhhh.cst files: contain the values of the oil concentration on the coast;

In the file name hhhh indicates the number of hours after the start of the spill.
In addition, the folder *output* contains one subfolder (*plot)* containing the two sub-folders containing the data of the wind and currents in the area affected by the spill.

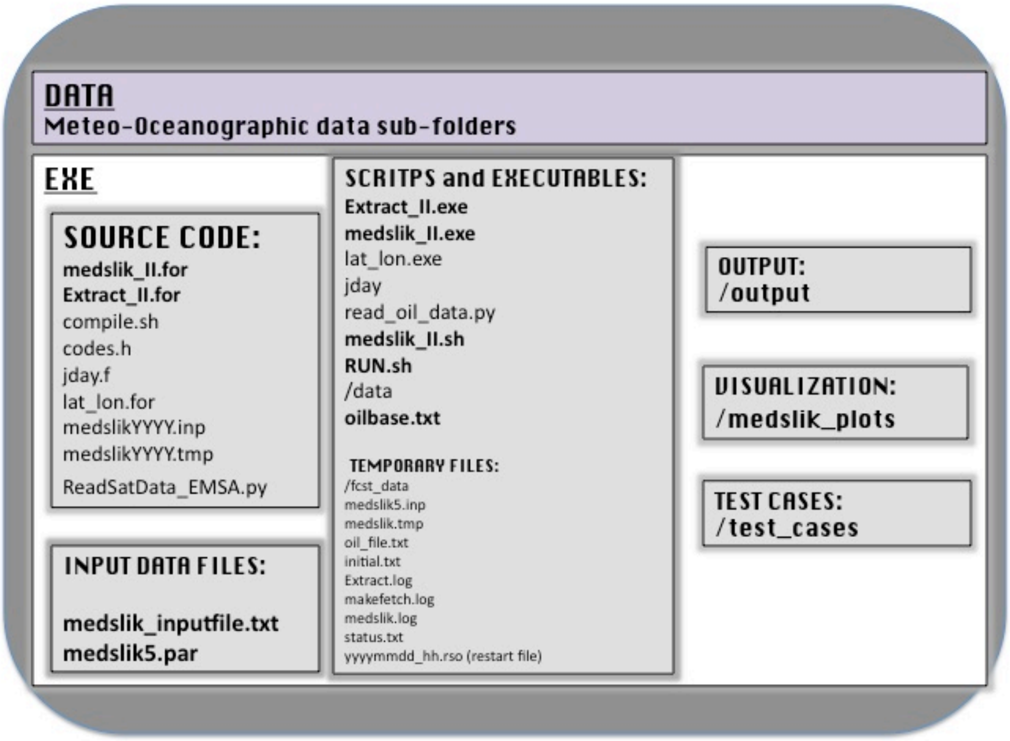

Figure 1. MEDSLIK-II Reference Code Architecture.

3.7 Test Case Set-up

In order to the test the correct operation of the system, the meteo-oceanographic data and input file needed to run 1 test case are located in the folder *test_cases*/TEST_ALGERIA.
This folder contains the input file, the observation file, the Mediterranean Forecasting System hourly data archived in the folder O1h and the ECMWF wind data archived in the folder ECM.

To execute the test cases:

- manually copy the files contained in O1h and ECM in the corresponding subfolders located in the *fcst_data* folder;
- manually copy the input file and observation file in the main MEDSLIK-II directory
- run the script shell *RUN.sh* (on the virtual machine provided: source *RUN.sh*)

The folder *output/MFS_2008_08_05_0951_ALGERIA* will contain the output files (*srf, *dsp, *cst and *tot for each hour of simulation and the *medslik.fte* file), the input and parameter text files (*medslik_inputfile.txt, medslik.tmp, medslik5.inp, initial.txt*), the observation file (*observation_0808071050.txt*) and the visualization parameter file (*medslik_plots.ncl*). The subfolders O1h and ECM will contain the meteo-oceanographic data for the area affected by the spill in text format. The subfolder plot will contain the oil concentration maps.
In Figure 2 three example maps are shown.

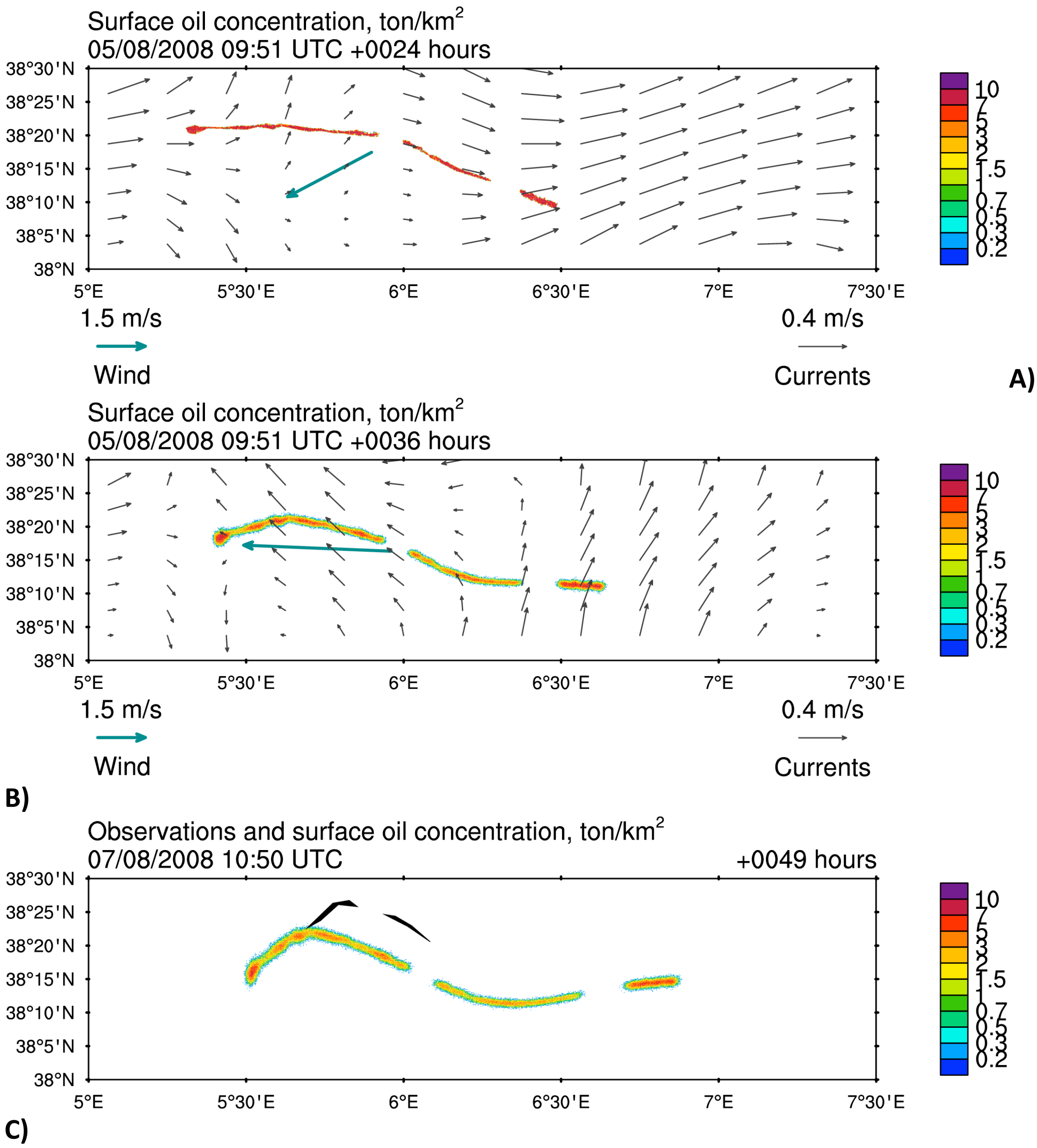

Figure 2. Test case 'TEST_ALGERIA' output map. In panel A and B are plotted, after 24 (A) and 36 (B) hours of simulation: oil-slick concentration; current fields (black arrows); wind in the centre of the slick (blue arrow) In panel C the superimposition of the observation and the oil slick after 49 hours of simulation is shown.

MODEL OUTPUT	DIRECTORY	INPUT FILE STRING	FLAG USED IN THE CODES
Mediterranean Forecasting System (MFS) – hourly output	**O1h**	MFS	**70**
Adriatic Forecasting System (AFS) – hourly output	**A1h**	AFS	**72**
Mediterranean Forecasting System (MFS) – daily output	**OPA**	MFS24	**10**
Adriatic Forecasting System (AFS) – daily output	**A24**	AFS24	**11**
Sicily Channel Regional Model (SCRM) - hourly output	**S1h**	SCRM	**71**
Sicily Channel Regional Model (SCRM) - daily output	**S24**	SCRM24	**12**
Western Mediterranean Model (WME) - hourly output	**WME**	WME	**75**
Relocatable model	**H3k**		**74**
Tyrrhenian Forecasting System (TFS) - hourly output	**T1h**	TYRR	**73**
Tyrrhenian Forecasting System (TFS) - daily output	**T24**	TYRR24	**13**
ECMWF 0.5 ° winds	**ECM**	ECMWF025	**25**
ECMWF 0.25°	**E25**	ECMWF05	**6**

Table 1. Models output and corresponding folders.

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Version 3, 29 June 2007
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