**Processing of U and V-WIND maps from the ECMWF Integrated Forecast System**

**Introduction.**

As output from various numerical weather prediction models, like those from ECMWF (in the Meteorological Data Dissemination Service) and from the Arpege model (Meteo France) a U and V wind map, at different pressure levels, is provided. The U-component represents the east-west component of the wind, while the V-component represents the north-south wind component.

The script transforms the various U and V-wind components from the IFS model into wind direction and wind speed. Here 0.5 degree maps are assumed and global coverage.

The file name conventions applicable are:

*A\_HVXA85ECMF040000\_C\_ECMF\_20140204000000\_an\_v\_850hPa\_global\_0p5deg\_grib2.bin*

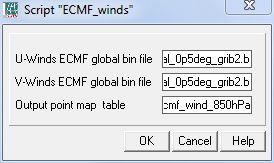
and

*A\_HUXA85ECMF040000\_C\_ECMF\_20140204000000\_an\_u\_850hPa\_global\_0p5deg\_grib2.bin*

These files are the v and u winds of the Analysis at 20140204 at 00:00 UTC at 850 hPA. Note that also forecasts are available and different pressure levels. The generic routine processes all files, substitute the file name accordingly, use of the extension is expected.

**Running the script.**

Download the ZIP file and copy the “ECMF\_winds.Zip” file into the ILWIS subdirectory \Scripts and then Unzip the file. Copy the files ECMF\_winds.grf, ECMF\_winds.dom, ECMF\_winds\_east.grf and ECMF\_winds\_west.grf into the ILWIS sub-directory \System. Check if the file mpp2table.exe is available in the Start ILWIS sub-directory \Scripts. If all relevant service objects are copied into the respective sub-directories, select from the main menu the option “*Operations*” >> “*Script*” and select the script “*ECMF\_winds*”. From the pop-up script input window specify the input U and V wind maps and the output name for the point map and table, see figure 1. Note that the WFS-Ethiopia toolbox needs to be installed!

**Figure 1: input layers needed to calculate wind direction – speed point map and table**

**Script listing.**

// SCRIPT in conjunction with WFS-ETHIOPIA TOOLBOX

// Calculation of wind vectors (direction and speed)

// Input is processed layers from ECMF NWP model

// The U and V Wind maps are required in their original format

// Provide the full name of the U and V winds, including extension (bin)

// File name convention expected is for U-winds: A\_HUXA85ECMF040000\_C\_ECMF\_20140204000000\_an\_u\_850hPa\_global\_0p5deg\_grib2.bin

// File name convention expected is for V-winds: A\_HVXA85ECMF040000\_C\_ECMF\_20140204000000\_an\_v\_850hPa\_global\_0p5deg\_grib2.bin

// Method implemented according to http://www.ndbc.noaa.gov/wndav.shtml

rem import the U and V wind layers

!'%ILWIS\_LOCATION%\Extensions\WFS\_E-Toolbox\GDAL\bin\'gdal\_translate.exe -of ilwis %1 ECMF\_uwind.mpr

!'%ILWIS\_LOCATION%\Extensions\WFS\_E-Toolbox\GDAL\bin\'gdal\_translate.exe -of ilwis %2 ECMF\_vwind.mpr

rem create subset maps

ECMF\_uwind\_east.mpr:=MapSubMap(ECMF\_uwind,2,1,360,360)

ECMF\_uwind\_west.mpr:=MapSubMap(ECMF\_uwind,2,361,360,360)

ECMF\_vwind\_east.mpr:=MapSubMap(ECMF\_vwind,2,1,360,360)

ECMF\_vwind\_west.mpr:=MapSubMap(ECMF\_vwind,2,361,360,360)

rem add submap georef

setgrf ECMF\_uwind\_east.mpr ECMF\_winds\_east

setgrf ECMF\_uwind\_west.mpr ECMF\_winds\_west

setgrf ECMF\_vwind\_east.mpr ECMF\_winds\_east

setgrf ECMF\_vwind\_west.mpr ECMF\_winds\_west

rem glue maps using georef global

ECMF\_uwind\_remap.mpr:=MapGlue(ECMF\_winds.grf,ECMF\_uwind\_west,ECMF\_uwind\_east,replace)

ECMF\_vwind\_remap.mpr:=MapGlue(ECMF\_winds.grf,ECMF\_vwind\_west,ECMF\_vwind\_east,replace)

//Calculation wind speed and direction

direction\_rad:=atan2(ECMF\_uwind\_remap,ECMF\_vwind\_remap)

direction\_degree:=raddeg(direction\_rad)

wind\_speed:=sqrt((POW(ECMF\_uwind\_remap,2))+(POW(ECMF\_vwind\_remap,2)))

wind\_speed.mpp:=PointMapFromRas(wind\_speed)

direction\_degree.mpp:=PointMapFromRas(direction\_degree)

!cmd /c copy "%ILWIS\_LOCATION%\scripts\mpp2table.exe"

!mpp2table.exe wind\_speed.mpp wind\_speed.tbt

!mpp2table.exe direction\_degree.mpp direction\_degree.tbt

windspeed.tbt:=TableChangeDomain(wind\_speed.tbt,ECMF\_wind.dom)

%3.tbt:=TableChangeDomain(direction\_degree.tbt,ECMF\_wind.dom)

tabcalc %3.tbt WindDirection:=name;

tabcalc %3.tbt WindSpeed:=ColumnJoin(windspeed.tbt,name);

calc %3.tbt;

tabcalc %3.tbt Scale\_Speed:=WindSpeed\*0.5;

delcol %3.tbt.name;

%3.mpp:=PointMapFromTable(%3,Coordinate)

!cmd /c del mpp2table.exe

!cmd /c del ECMF\_uwind\_remap.mp\*

!cmd /c del ECMF\_vwind\_remap.mp\*

!cmd /c del ECMF\_vwind\_east.mp\*

!cmd /c del ECMF\_uwind\_east.mp\*

!cmd /c del ECMF\_vwind\_west.mp\*

!cmd /c del ECMF\_uwind\_west.mp\*

!cmd /c del ECMF\_uwind.\*

!cmd /c del ECMF\_vwind.\*

!cmd /c del direction\_rad.mp\*

!cmd /c del direction\_degree.mp\*

!cmd /c del direction\_degree.mp\*

!cmd /c del direction\_degree.pt\*

!cmd /c del direction\_degree.tb\*

!cmd /c del wind\_speed.mp\*

!cmd /c del wind\_speed.pt\*

!cmd /c del wind\_speed.tb\*

!cmd /c del windspeed.tb\*

!cmd /c del ECMF\_uwind\_\*.grf

!cmd /c del ECMF\_vwind\_\*.grf

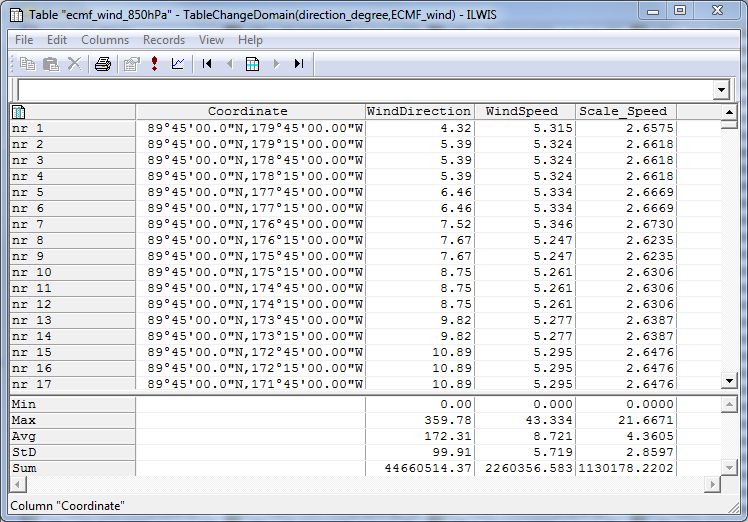
!cmd /c del ECMF\_winds\_west.grf

!cmd /c del ECMF\_winds\_east.grf

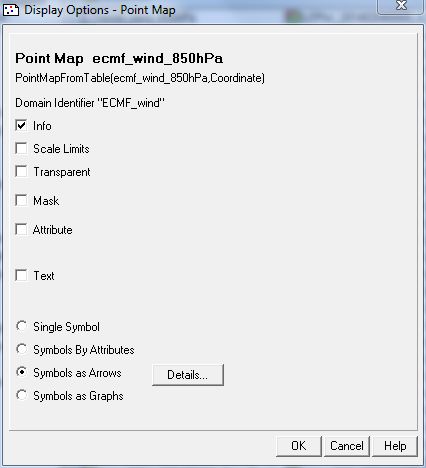
Note: the file “mpp2tables.exe” should be available in the ILWIS sub-directory \scripts! Furthermore note that here an “ID” domain has been created for the ECMF maps, assuming a map dimension of 360 lines by 720 columns (259186 ID’s are currently defined). It therefore expects a global map as input (at half degree spatial resolution)

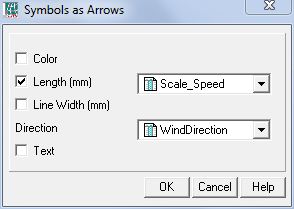
**Output.**

When calculation has completed, two files have been created, a table and point map, according to the naming specifications as provided (see figure 1). Display the table, your result should resemble the one in figure 2. A column “Scale\_speed” has been computed which can be used for visualization, in case of high wind speed at lower pressure levels.

**Figure 2: Final output table**

To display the point map, double click the point map created and enter the settings as specified in figure 3, note that with the ID-domain used you can visualize the points using an arrow symbol and these can be scaled (for this purpose the column ‘WindSpeed’ or ‘Scale\_Speed’ is used). The resulting map is given in figure 4 showing winds at 850 hPA – Analysis, using a vector file with the country boundaries for geographical reference.

**Figure 3: Point map options using table attributes**



**Figure 4: Resulting point map visualization**

