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Meteorology

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Met: Introduction

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- The EMEP/MSC-W model uses meteorology off-line and meteorological fields are read from files at 3-h intervals
- NWP models: Parlam-PS, Hirlam, Hirham, WRF, Aladin, MM5 and IFS-ECMWF(currently used)
- Grid properties are read from the meteorological input files:
  - Preprocessing is necessary (interpolation vert. and hor., mass balance)
  - Large range of domains from local scale (7 km) to global scale (100km) (projection,resolution,area,..)
  - NetCDF CF 1.0 convention

Met: Input file example

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NetCDF Climate and Forecast (CF) Metadata convention or
NetCDF CF 1.0 convention (http://cf-pcmdi.llnl.gov/)

mifaab@stallo-2:/global/work/mifapw/emep/Data/EECCA/metdata_EC/2010

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```
netcdf meteo20110101 {
dimensions:
        i = 132 ;
        j = 159 ;
        k = 20 ;
        time = UNLIMITED ; // (8 currently)
variables:
        double i(i) ;
                i:coord_axis = "x" ;
                i:long_name = "EMEP grid x coordinate" ;
                i:units = "km" ;
        double j(j) ;
                j:coord_axis = "y" ;
                j:long_name = "EMEP grid y coordinate" ;
                j:units = "km" ;
        double k(k) ;
                k:coord_alias = "level" ;
                k:long_name = "vertical sigma coordinates" ;
                k:units = "sigma_level" ;
                k:positive = "down" ;
        int time(time) ;
                time:long_name = "time at middle of period" ;
                time:units = "seconds since 1970-1-1 00:00:00.0 +00:00" ;
        double map_factor(j, i) ;
                map_factor:long_name = "mapping factor" ;
                map_factor:units = "" ;
        double lat(j, i) ;
                lat:long_name = "latitude coordinate" ;
                lat:standard_name = "latitude" ;
                lat:units = "degrees_north" ;
        double lon(j, i) ;
                lon:long_name = "longitude coordinate" ;
                lon:standard_name = "longitude" ;
                lon:units = "degrees_east" ;
:
```

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```
                SMI1:units = "" ;
                SMI1:_FillValue = -32767s ;
                SMI1:scale_factor = 4.05014828359991e-05 ;
                SMI1:add_offset = 0.552709182743798 ;
                SMI1:meteo_date_first = 2011, 1, 1, 3 ;
                SMI1:meteo_date_last = 2011, 1, 1, 24 ;
                SMI1:validity = "instantaneous" ;
        short SMI3(time, j, i) ;
                SMI3:long_name = "SMI3" ;
                SMI3:numberofrecords = 8 ;
                SMI3:units = "" ;
                SMI3:_FillValue = -32767s ;
                SMI3:scale_factor = 4.05014828359991e-05 ;
                SMI3:add_offset = 0.552709182743798 ;
                SMI3:meteo_date_first = 2011, 1, 1, 3 ;
                SMI3:meteo_date_last = 2011, 1, 1, 24 ;
                SMI3:validity = "instantaneous" ;

// global attributes:
                :Conventions = "CF-1.0" ;
                :projection = "Stereographic" ;
                :projection_params = "90.0 -32.0 0.933013" ;
                :vert_coord = "vertical coordinates = (p-p(top))/(p(surf)-p(top))
" ;
                :Grid_resolution = 50000. ;
                :xcoordinate_NorthPole = 8. ;
                :ycoordinate_NorthPole = 110. ;
                :fi = -32. ;
                :ref_latitude = 60. ;
                :created_date = "20110928" ;
                :created_hour = "154531.091" ;
                :lastmodified_date = "20120510" ;
                :lastmodified_hour = "121121.097" ;
}
(END)
```

Met: 3-D fields

Component	unit	Type	main purpose
Horizontal wind vel. comp.	m/s	Inst.	Advection
Specific humidity	kg/kg	Inst.	Chem. reactions, dry deposition
Pot. temperature	K	Inst.	Chem. reactions, eddy diffusion
Precipitation(or 2D+sh/clw)	mm	Acc.	Wet and dry deposition
Cloud cover	%	Avg.	Wet removal, photolysis
Cloud liquid water content	kg/kg	Inst.	Wet removal
Optional (USE_CONV = «T/F» in *config_EMEPSTD.nml*):			
Vert. wind in σ/eta coor.	1/s or Pa/s	Inst.	Vertical advection
Convective updraft flux	kg/m2s	Avg.	Vertical transport, wet removal
Convective downdraft flux	kg/m2s	Avg.	Vertical transport, wet removal

Simpson et al. *The EMEP MSC-W chemical transport model – technical description* acp-12-7825-2012

Met: 2-D fields

Component	unit	Type	main purpose
Surface pressure	hPa	Inst.	Air density, def. of vert. levels
Temperature at 2m	K	Inst.	Dry deposition, stability
Surf. flux of sens. heat	W/m2	Inst.	Dry deposition, stability
Surf. flux of lat. heat	W/m2	Inst.	Dry deposition
Surf. stress or frict. vel.	N/m2 or m/s	Avg./Inst.	Dry deposition, stability
Snow depth	m	Inst.	Dry deposition
Fraction of ice cover	%	Inst.	Dry deposition
Relative humidity	%	Inst.	

Optional (USE_SEASALT/USE_SOILWATER = «T/F» in *config_EMEPSTD.nml*):

Sea surface temp.	K	Inst.	Sea salt
10-m wind-speed	m/s	Inst	Sea-salt
Soil water content	m^3/m^3	Inst.	Dry deposition
Soil moisture content level 1 and 3		Inst.	Dry deposition
Convective/large-scale prec.	m	Inst.	Wet/dry deposition

Met: Available data

Meteorological fields with the Open Source code:
ftp://ftp.met.no/projects/emep/OpenSource/YYYYMM/input/meteo*

- Horizontally interpolated to 50x50km^2 polar-stereographic grid projection
- Vertically interpolated to 37 EMEP levels (new 2013)
- Open source code released with 20 sigma levels (need Vertical_levels.txt)
- Meteorological years with previous Open source releases and 20 sigma levels (as reported to EMEP):
    - 2012 EECCA
    - 2011 EECCA
    - 2010 EECCA
    - 2008 EECCA
    - 2005 EMEP – basic meteorological fields

Config_emep.nml : startdate, enddate, meteo (link to meteo files)

(modrun.sh : startdate, enddate)

Met: IFS-ECMWF background

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- In 2010 IFS had a major resolution upgrade - available to run on T799 and 60 vertical eta levels on a global domain
- Forecast initialised by ERA-Interim data (better use of observations)
- IFS is run at ECMWF as experiment in hindcast mode by EMEP/MSC-W - a special branch for extra 3D output
  - good description of 3D fields: precipitation and convective parameters
  - same meteorological driver cover global to local domains
  - same model version (trend analysis)

Met: IFS-ECMWF process

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- 2 weeks and 1 200 000 SBUs to run 1 year (incl. download)
- Preprocessing meteorological input files into model domain and projection ~ 1 week
- Experiment IFS modelversion change every 2 year with new HPC - all years used for trend studies need to be rerun
- Archiving 1 year of IFS data ~ 10 Tb

- Experiment IFS data available on ECMWF MARS archive