Lagranto 2.0

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„It‘s the trajectory, stupid!“

Philospohy: There is a object called trajectory and Lagranto offers tools to create, modify, select, extend, visualise, .. these objects

New header line

```
> more wcb.1
Reference date 19891020_0000 / Time range    4320 min

  time      lon      lat      p        PS          RH         PV
-------------------------------------------------------------------

  0.00   -19.56    46.94    905  1005.242      83.514      0.291
  6.00   -14.72    48.17    892   999.182      88.325      0.242
 12.00   -10.58    50.53    862   993.145      97.718      0.293
 18.00    -7.22    53.02    792   972.076      99.216      0.738
 24.00    -3.71    55.89    724   956.135      93.218      1.076
 30.00    -0.19    58.87    629   971.334      70.088      1.076
 36.00     1.46    61.62    452   966.406      66.056      0.558
 42.00     0.01    62.49    328   977.209      65.319      1.754
 48.00    -1.54    63.41    313   983.930      56.822      2.727
 54.00    -3.59    64.77    322   984.627      58.328      1.874
 60.00    -9.91    66.07    323   988.185      57.894      2.052
 66.00   -20.91    66.02    316   976.560      57.989      2.565
 72.00   -28.89    66.19    319  1007.175      54.477      2.693
```

Overview

- Main programs

  startf, caltra, trace, select, density, lagranto

- Goodies

  trainfo, reformat, extract, mergetra, datelist, difference, list2lsl, lsl2list, timeres, lagrantohelp

- Documentation

  man pages, tutorial (PDF), reference guide (PDF)


A now a
tutorial
case study

A. Creating the starting positions

```
> more regionf
"1 -80 20 40 80"
```

Region 1: 80 W to 20 E, 40 N to 80 N

equidistant (80 km) in region 1

name and format of starting file

```
> create_startf 19891020_00 startf.2 'region.eqd(1,80) ...
                                ... @ level(100) @ hPa,agl' -changet
```

reference date

100 hPa above ground level

```
> head -10 startf.2
Reference date 19891020_0000 / Time range       0 min

  time      lon      lat      p      level
-----------------------------------------

   0.00   -79.61   40.45   862   100.000
   0.00   -78.66   40.45   860   100.000
   0.00   -77.71   40.45   873   100.000
   0.00   -76.76   40.45   886   100.000
   0.00   -75.82   40.45   893   100.000
```

the starting file can be itself a trajectory file

Further examples

[1] create_startf 19891020_00 startf 'point(-10,50) @ list(450,500,550) @ hPa'

Starting points are (longitude, latitude, pressure in hPa): (-10,50,450); (-10,50,500); (-10,50,550). No selection criterion is applied; the positions are written to file "startf".

[2] create_startf 19891020_00 startf 'line(-10,-5,40,50,10) @ level(450) @ hPa,agl'

10 points are equidistantly specified between lon/lat point (-10,40) and (-5,50); all trajectories start at 450 hPa above ground level - the surface pressure is taken from the primary file P19891020_00. The positions are saved in "startf".

[3] create_startf 19891020_00 startf 'box.grid(-10,-5,40,50) @ list(300,320) @ K'

All grid points in the box with the south-eastern lon/lat point (-10,40) and the north-eastern one (-5,50) are taken - the horizontal grid spacing is specfified in the primary file P19891020_00. In the vertical, two isentropic levels are chosen: 300 K and 320 K. The potential temperature for the calculation is taken from the secondary file S19891020_00.

[4] create_startf 19891020_00 startf 'shift(-10,40,1,1) @ profile(1000,200,100) @ hPa'

A profile of 100 equidistant levels between 1000 hPa and 200 hPa; in the horizontal the central lon/lat point (-10,40) is taken and four horizontally displaced ones, the diplacement being 1 degree in zonal and meridional direction.

[7] create_startf 19891020_00 startf 'polygon.grid(polygon) @ level(500) @ hPa

A polygon is specified in the file "polygon"; the different lines in the file are: -5. 45. / -10. 40. / 10. 40. / 10 50. / -10. 45. The first lon/lat point lies within the polygon, all other lon/lat points are the vertices of the polygon. All grid points within the polygon are taken as starting point, at level 500 hPa.

[8] create_startf 19891020_00 startf 'polygon.eqd(polygon,50) @ level(500) @ hPa

As in the previous example [7], except that the starting points are distributed equidistantly within the polygon. The horizontal distance between the starting points is 50 km in zonal and meridional direction.

[9] create_startf 19891020_00 startf 'shift(-10,40,1,1) @ profile(1000,200,100) @ hPa @ GT:TH:310'

As in example [4], but a selection criterion is additionally applied: only starting positions with potential temperature (TH) greater than (GT) 310 K are kept. Potential temperature must be available on the secondary file S19891020_00 and the file "tracevars" must have a line with "TH 1. 0 S". Further examples for selection criteria can be seen in **select.**

B. Calculating Trajectories

```
> caltra 19891020_00 19891023_00 startf.2 traj.4 -j
```

jumping flag set

start date

end date

starting positions

output trajectory in netCDF (4)

```
> reformat traj.4 traj.1
> more traj.1
Reference date 19891020_0000 / Time range    4320 min

  time      lon      lat      p
-----------------------------

   0.00   -79.61   40.45   862
   6.00   -80.57   43.23   791
  12.00   -82.23   45.89   782
  18.00   -84.94   47.07   744
```

reformat trajectory into ASCII (1) and then show it

```
> trainfo traj.4 list
```

show it without reformatting

[4] caltra 19891020_00 19891020_18 startf OUT -j -o 15 -t 15

As in example [3], but the output interval is set to 15 min with the optional argument "-o". Note that the output interval (15 min) must be a multiple of the time step, which is here set explicitely to 15 min with "-t".

[5] caltra 19891020_0130 19891020_1730 startf1 OUT -j -o 15 -t 15 -changet

Start from non-analysis time 01:30 UTC to non-analysis time 17:30 UTC. Furthermore, the times on the prinmary netCDF files are changed accordingly.

```
> trainfo traj.4 vars
time lon lat p

> trainfo traj.4 dim
3750            13              4

> trainfo trai.4 startdate
19891020_0000
```

use <trainfo> to get metadata for trajectory

- names of variables
- dimensions
- startdate
- ...

C. Preselecting Trajectories

```
> select traj.4 wcb.1 'GT:p:700:FIRST & LT:p(MIN):400:0 to 48'
```

pressure is larger than 700 hPa at first time

take all times from 0 to 48 h and take the minimum pressure for these times; then select trajectories where p(min) < 400 hPa

```
> select traj.4 wcb.1 'GT:p:700:FIRST & LT:p(MIN):400:0 to 48 & GT:DIST0:5000:48'
```

distance to starting position at time 48 h larger than 5000 km (DIST0 is implicit!)

```
> more regionf
# Starting positions
"1 -80  20 40 80"
# Target region
"2 20 30 50 60"

> select traj.4 wcb.1 'GT:p:700:FIRST & LT:p(MIN):400:0 to 48 & ...
                      ... TRUE:INREGION:2:42 to 54(ANY)'
```

trajectory is within region 2 at any time between 42 h and 54 h

D. Tracing along Trajectories

specify fields in <tracevar>

```
> more tracevars
PS     1.   0 P
Q   1000.   0 P
TH     1.   0 S
RH     1.   1 *
```

online calculation

```
> trace wcb.1 wcb.1
> more wcb.1
Reference date 19891020_0000 / Time range    4320 min

  time      lon      lat      p        PS         Q        TH        RH
 ------------------------------------------------------------------------

   0.00   -44.56    40.45    914  1014.093     9.664   294.921    86.667
   6.00   -41.22    38.95    885  1012.965     8.380   296.549    77.992
  12.00   -37.50    37.59    849  1014.056     8.565   299.122    81.321
  18.00   -33.54    36.76    823  1012.074     8.720   300.798    85.407
  24.00   -29.45    36.45    770  1012.254     7.666   303.487    85.262
```

```
> trace wcb.1 wcb.1 -f PV 1.
```

add extra column to trajectory file

```
> extract wcb.1 wcb.1 -var PS TH RH
```

extract columns from trajecory file

ONLINE CALCULATIONS

If the computation flag in the tracing file is set to 1, a meteorological field is calculated based upon the already traced fields and/or based on the fields on the primary and secondary P and S files. The following fields are implemented for online calculations:

- **TH**
  potential temperature (in K).
- **RHO**
  density (in kg/mˆ-3).
- **RH**
  relative humidity (in %).
- **THE**
  equivalent-potential temperature (in K).
- **LHR**
  latent heating rate (K per input time step, typically K/6h).
- **D[U,V,T,TH]DX**
  horizontal derivative d[U,V,T,TH]/dx in west-east direction along pressure surfaces - zonal distance in m. U=zonal wind component (m/s), V=meridional wind component (m/s), T=temperature (deg C or K), TH=potential temperature (K).
- **D[U,V,T,TH]DY**
  horizontal derivative d[U,V,T,TH]/dy in south-north direction along pressure surfaces -meridional distance in m.
- **D[U,V,T,TH]DP**
  vertical derivative d[U,V,T,TH]/dp - pressure p in Pa.
- **NSQ**
  squared Brunt-Vaisala frequence (in mˆ-2).
- **RELVORT**
  relative vorticity (in sˆ-1) - RELVORT = DVDX - DUDY.
- **ABSVORT**
  absolute vorticity (in sˆ-1) - ABSVORT = DVDX - DUDY + F, F being the Coriolis parameter.

- **DIV**
  horizontal divergence of the velocity field (in s^-1) - DIV = DUDX + DVDY.
- **DEF**
  horizontal deformation of the velocity field (in s^-1) - DEF = SQRT((DVDX + DUDY)^2 + (DUDX-DVDY)^2).
- **PV** Ertel potential vorticity (in PVU) - PV = g * (ABSVORT * DTHDP + DUDP * DTHDY - DVDP * DTHDX).
- **RI** Richardson number - RI = NSQ / (DUDP^2 + DVDP^2).
- **TI** tubulence indicator according to Ellrod & Knapp - TI = DEF * SQRT(DUDP^2 + DVDP^2) * (RHO * G).
- **DIR**
  wind direction relative to zonal flow: (U,V)=(1,1) -> 45 deg; (U,V)=(1,-1) -> -45 deg; (U,V)=(-1,-1) -> -135 deg; (U,V)=(-1,1) -> 135 deg. A westerly flow has 0 deg, a southerly flow 90 deg, and a northerly one -90 deg.
- **DIST0**
  spherical distance (in km) from starting position.
- **DIST**
  length of the trajectory (in km): integrated along great circle sections between the trajectory vertices.
- **HEAD**
  heading of the trajectory: (DX,DY)=(1,1) -> 45 deg; (DX,DY)=(1,-1) -> -45 deg; (DX,DY)=(-1,-1) -> -135 deg; (DX,DY)=(-1,1) -> 135 deg. A path increment to east has heading of 0 deg; to the north 90 deg; to the south -90 deg; and to the west -180 deg.

[3] trace INPTRA.1 OUTTRA.1 -f PV:-100HPA 1.

As in example [2], but the PV is taken at a position 100 hPa higher (lower pressure) than the air parcel's position.

- **field:+100km[lat]** - get field at trajectory position + 100 km shifted to north. A shift to south is obtained with field:-100km[lat].
- **field:+100km[lon]** - get field at trajectory position + 100 km shifted to east. A shift to west is obtained with field:-100km[lon].
- **field:+2[dlat]** - get field at trajectory position + 2 grid spacings dlat shifted to north. A shift to south is obtained with field:-2[dlat].
- **field:+2[dlon]** - get field at trajectory position + 2 grid spacings dlon shifted to east. A shift to west is obtained with field:-2[dlon].
- **field:+50hPa** - get field at trajectory position + 50 hPa shifted in vertical. A shift to lower pressures is obtained with field:-50hPa.
- **field:+1dp** - get field at trajectory position + 1 grid spacing DP shifted in vertical. A shift to lower pressures is obtained with field:-1dp. Note that DP is not fixed but varies with height.
- **field:+6h** - get field at trajectory position, but 6 h in the future. Shifts to the past are poeeible with field:-6h. In addition to hours (h), the time shift can be specified in minutes (min).

E. Final Selection of Trajectories

Is there a trajectory which reaches saturation ($RH > 99\%$)? The trajectories should be saved in a new trajectory file.

```
> select wcb.1 sat.1 'GT:RH:99:0 to 72(ANY)'
> more sat.1
Reference date 19891020_0000 / Time range    4320 min
```

time	lon	lat	p	PS	Q	TH	RH	PV
0.00	-72.98	40.45	918	1018.161	9.503	292.020	100.722	0.920
6.00	-76.45	43.14	879	986.319	8.723	294.933	92.837	1.101
12.00	-78.53	46.69	808	972.550	7.621	297.875	97.737	0.794
18.00	-80.08	48.70	770	973.957	6.147	297.914	97.912	1.078
24.00	-84.49	48.71	563	962.279	2.327	307.548	87.923	1.034
30.00	-87.89	43.32	377	977.415	0.319	314.210	65.759	0.108
36.00	-80.69	37.24	396	939.606	0.303	312.705	52.845	0.323
42.00	-73.05	39.00	477	1013.693	0.298	314.614	16.248	0.309
48.00	-67.62	47.21	488	970.025	0.442	312.975	23.890	0.463
54.00	-63.53	54.61	455	950.011	0.386	313.047	30.182	0.479
60.00	-53.79	58.53	447	1007.039	0.392	311.951	36.578	0.487
66.00	-38.79	59.08	452	1006.532	0.319	311.316	29.286	0.443
72.00	-27.72	55.51	493	1009.871	0.279	311.428	15.950	0.513

Get a list of all trajectories which pass through a circle around 20 W/40 N and radius 500 km.

```
> select wcb.1 indlist 'TRUE:INCIRCLE:-20,40,500:ALL(ANY)' -index
> more indlist
             4
             5
             6
            11
            12
            13
            14
            19
            20
            21
            22
            47
```

Hence, the trajectories 4,5,... pass through the circle. The trajectories themselves can be extracted in a second step with

```
> extract wcb.1 pass.1 -index indlist
```

where now the selected trajectories are written to the trajectory file *pass.1*.

Select all trajectories which pass at time 60 h over Switzerland! The coordinates of the Swiss boundary are listed in a file *borders.dat*:

```
> more borders.dat
8.55 47.45
7.942863 46.002075
7.949024 46.001195
7.956945 46.000022
7.984226 46.000022
7.989800 46.001489
8.000068 46.007356
8.011508 46.018503
...
```

The first line is a point (longitude, latitude) within Switzerland (Zurich), the other lines define the boundary of Switzerland (as 1373 points). With this polygon file, the selection command becomes

```
> select wcb.1 out.1 'TRUE:INPOLYGON:borders.dat:60'
```

We would like to select all trajectories which reach potential vorticity (PV) greather than 2 PVU at levels above 500 hPa. In a first attempt, this might be accomplished with the criterion

```
> select wcb.1 wcb.1 'GT:PV:2:ALL(ANY) & LT:p:500:ALL(ANY)'
```

wrong !!!

```
> select wcb.1 wcb.1 'GT:PV:2:1(TRIGGER) & LT:p:500:2(TRIGGER)' -trigger
```

```
> more wcb.1
Reference date 19891020_0000 / Time range    4320 min

  time      lon     lat     p        PS         RH        PV     TRIGGER
-------------------------------------------------------------------------

   0.00   -19.56   46.94   905  1005.242     83.514     0.291       0.000
   6.00   -14.72   48.17   892   999.182     88.325     0.242       0.000
  12.00   -10.58   50.53   862   993.145     97.718     0.293       0.000
  18.00    -7.22   53.02   792   972.076     99.216     0.738       0.000
  24.00    -3.71   55.89   724   956.135     93.218     1.076       0.000
  30.00    -0.19   58.87   629   971.334     70.088     1.076       0.000
  36.00     1.46   61.62   452   966.406     66.056     0.558       2.000
  42.00     0.01   62.49   328   977.200     65.319     1.754       2.000
  48.00    -1.54   63.41   313   983.930     56.822     2.727       3.000
```

```
> select wcb.1 wcb.1 'ALL:TRIGGER:1,2:ALL(ANY)'
```

- **VAR**

take the variance over the selected times: e.g. **GT:lat(VAR):10:ALL** selects all trajectories for which the variance of latitude (lat) over all times (ALL) is greater than 10.

- **DIFF**

take difference between two times: e.g. **GT:p(DIFF):600:FIRST,LAST** selects all trajectories wich have a pressure difference p(FIRST)-p(LAST) greater than 600 hPa between the first and last time - corresponding to an ascending air stream. Correspondingly **GT:p(DIFF):600:LAST,FIRST** finds a descending air stream.

- **NONE**

at no time: e.g. **IN:lat:-20,20:ALL(NONE)** selects all trajectories which never stay in the equatorial band. **OUT:lat:-20,20:FIRST(NONE)** selects the trajectories which are not outside the equatorial

- **DIST**

length of the trajectory (in km), integrated along great circle sections between the trajectory vertices: e.g. **GT:DIST:1000:LAST** tests whether the total path length of the trajectory (DIST) exceeds 1000 km.

- **|** logical or: e.g. **GT:lat:34:FIRST | GT:lon:50:FIRST** selects the trajectories to the north of 34 N or to the east of 50 E at first time. Several selection criteria can be combined with '|'. Note that locical OR has a lower priority than logical AND, i.e. in an expression like T1 | T2 & T3 first the expression T2 & T3 is evaluated and only then logically OR-combined with T1.

- **INREGION**

specification of target regions in a region file (default "regionf") - please consider the documentation of "create_startf" for details concerning the format of the region file. As an example, if a region 1 is defined on the region file, the criterion **TRUE:INREGION:1:18** selects all trejactories which are within region 1 at time 18 h.

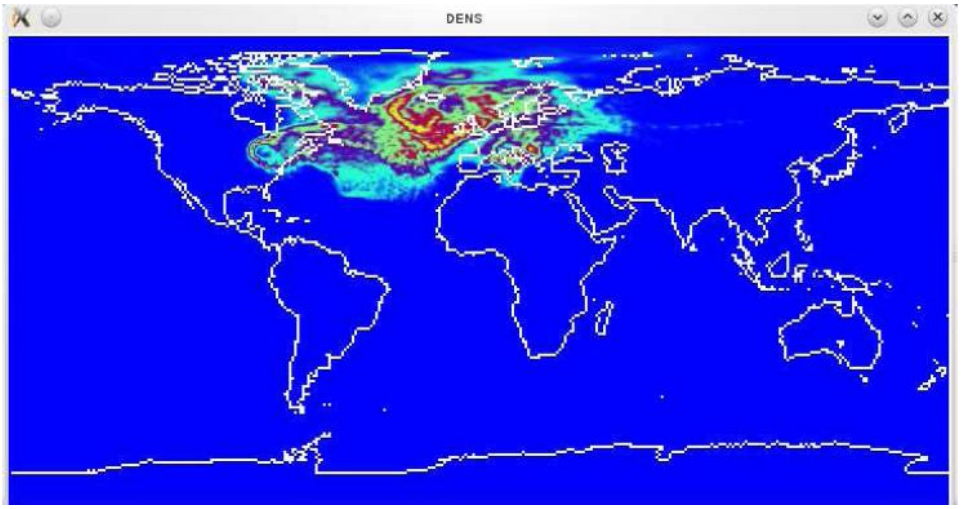
… and many more options (5 pages in reference guide)

```
c     ------------------------------------------------------------------------  %)
c     SPECIAL:WCB:ascent,first,last                                              %)
c         : Detect Warm Conveyor Belts (WCB); the air stream must ascend at least %)
c         : <ascent=param(1)> hPa between the two times <first=param(2)> and     %)
c         : <last=param(3)>. Note, the lowest pressure is allowed to occur at any %)
c         : time between <first> and <last>.                                     %)
c     ------------------------------------------------------------------------  %)
```

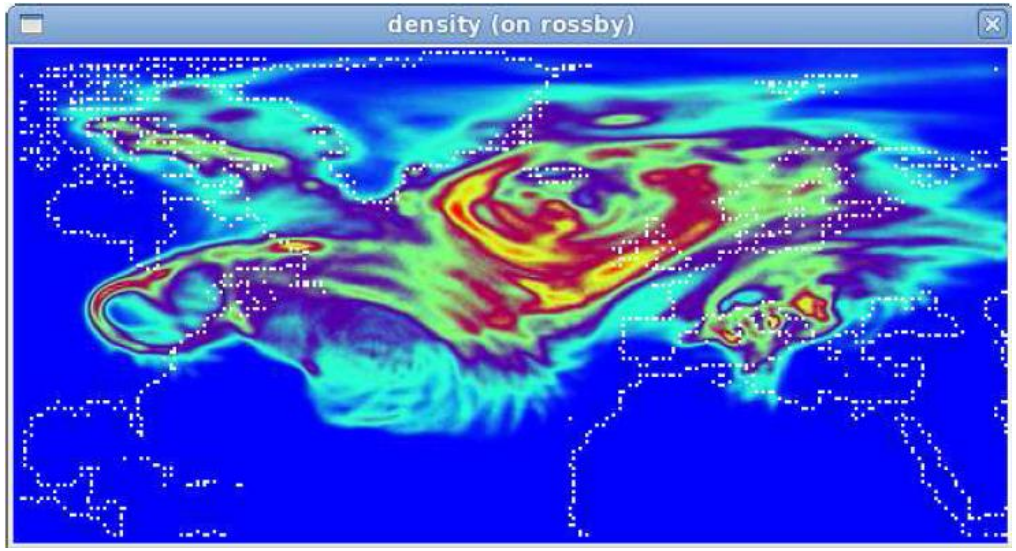
```
      if ( cmd.eq.'WCB' ) then

c        Reset the flag for selection
         flag = 0

c        Pressure is in the 4th column
         ip = 4

c        Get indices for times <first> and <last>
         i0 = 0
         i1 = 0
         do i=1,ntim
            if ( param(2).eq.times(i) ) i0 = i
            if ( param(3).eq.times(i) ) i1 = i
         enddo
         if ( (i0.eq.0).or.(i1.eq.0) ) then
            print*,' ERROR: invalid times in SPECIAL:WCB... Stop'
            stop
         endif

c        Check for ascent
         do i=i0+1,i1
            if ( ( tra(1,ip)-tra(i,ip) ) .gt. param(1) ) flag = 1
          enddo

       endif
```

F. Gridding of Trajectories

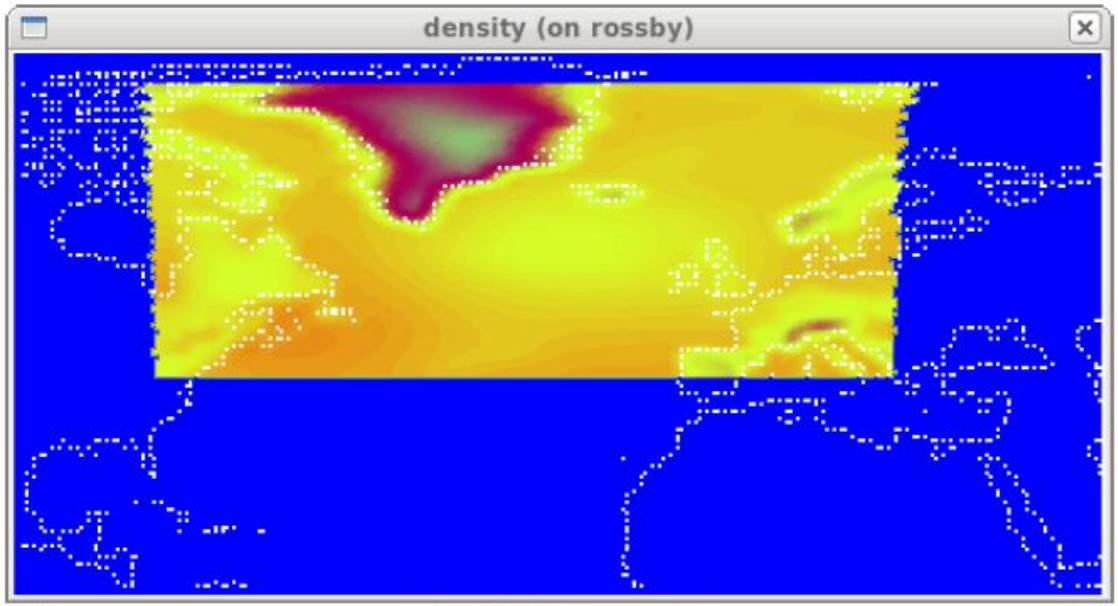
```
> density wcb.1 densisty
> ncview density
```



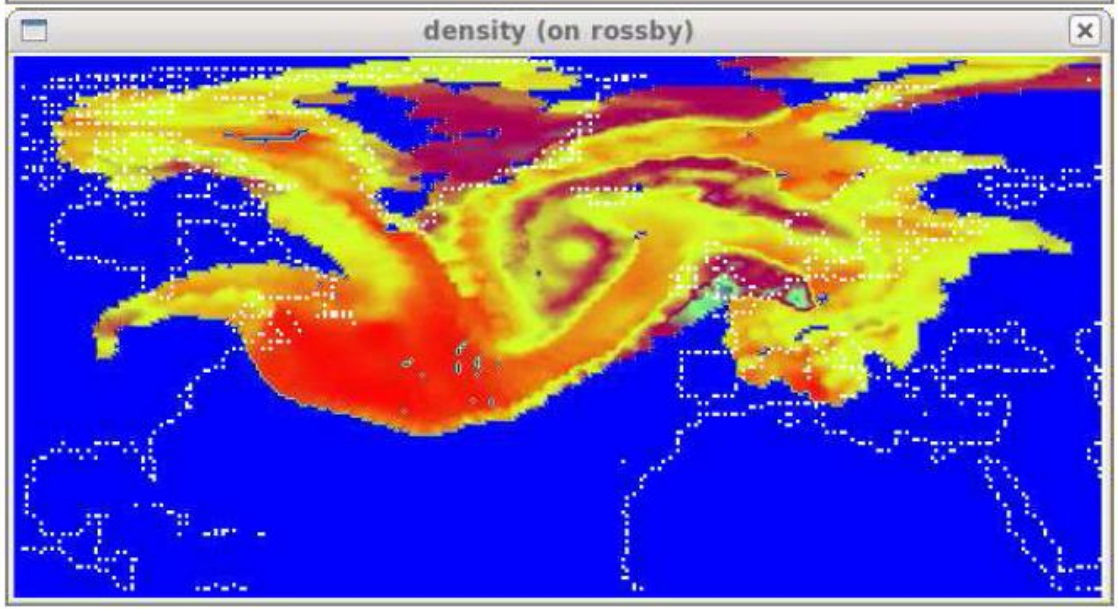

```
> density traj.1 density -latlon 300 150 -100 10 0.5 0.5 -create -interp 1 h
```



```
> density traj.1 density -create -latlon 300 150 -100 10 0.5 0.5 -field p -time 0.00
> density traj.1 density  -field p -time 24.00
> density traj.1 density  -field p -time 48.00
```



time 0



time 24 h

[4] density TRAJECTORY DENSITY -interp 20 km

as in exaxmple [1], but the trajectories are interpolated to a 20-km distance interval.

[5] density TRAJECTORY DENSITY -interp 1 deg

as in exaxmple [1], but the trajectories are interpolated to a 1 deg distance interval. If the output grid (as specified in option "-latlon" or "-rotated") has the same spacing (1 deg) as given in "-interp 1 deg", a continuous line is drawn.

[6] density TRAJECTORY DENSITY -radius 100 km

the trajectory points are spread out over a circle with radius 100 km; this is equivalent to a smoothing of the resulting density field. Note that in a equidistant cylindrical projection, the circles become distorted towards the pole. If this is not appropriate, the option **-radius 2 deg** can be given, which is independent of geographical latitude.

[2] density TRAJECTORY DENSITY -latlon dynamic

as in example [1], but now the lon/lat grid is automatically adapted to the range of the trajectory file.

[8] density TRAJECTORY DENSITY -rotated 30 50 401 0.1 -interp 0.2 deg

all trajectory times are gridded, but this time onto a rotated lon/lat grid; for instance, an interesting feature was found at (lon=30,lat=50). The new coordinate system, a rotated lon/lat grid, is centered at this point and spreads from 20 W to 20 W and from 20 S to 20 N, comprising 401 grid points in rotated longitude and latitude direction. The new grid resolution is 0.1 degrees, which was taken into account in the interpolation to 0.2 deg intervals between trajectory points.

G. Can we use <lagranto>?

„ Yes, we can!“

```
> lagranto local 19891020_00 19891024_18 startf nil -changet
```

run Lagranto in local directory

no selection criterion

```
> ls -l ntr_19891020_00_f114_local_startf_nil/
-rw-r--r-- 1 michaesp wheel 5328945 2011-03-21 14:03 lsl_19891020_00
-rw-r--r-- 1 michaesp wheel   68195 2011-03-21 14:03 runscript.logfile
-rwxr--r-- 1 michaesp wheel    1025 2011-03-21 14:02 runscript.sh*
```

three different files will be saved

1. output trajectory file (lsl_19891020_00)
2. log file (runscript.logfile)
3. run script (runscript.sh)

```
> lagranto local 19891020_00 19891024_18 startf nil -changet -prep
```

← prepare, but do not run

```
> lagranto tutorial 19891020_00 19891024_18 startf nil -changet
```

the input files are not expected in the local directory, but are specified by means of a case identifier. For instance, a case has the identifier *tutorial*. Then Lagranto will expect the input netCDF P and S files to be located in

```
> ls -l ${HOME}/cdf/tutorial
/home/sprenger/cdf/tutorial/P19891020_00
/home/sprenger/cdf/tutorial/P19891020_06
/home/sprenger/cdf/tutorial/P19891020_12
/home/sprenger/cdf/tutorial/P19891020_18
/home/sprenger/cdf/tutorial/P19891021_00
/home/sprenger/cdf/tutorial/P19891021_06
/home/sprenger/cdf/tutorial/P19891021_12
/hom
```

and all the other input files (starting positions, tracing file, region file, polygon specification) are expected in

```
> ls -l ${HOME}/tra/tutorial
startf
tracevars
```

files in the <tra> directory

1. startf
2. tracevars
3. polygon files
4. region files

The output of the trajectory calculation will be written to the following output directory, where now the case identifier *tutorial* is part of the directory name:

```
> cd /home/michaesp/tra/tutorial/ntr_19891020_00_f114_tutorial_startf_nil
> ls -1
-rw-r--r-- 1 michaesp wheel 5328945 2011-03-21 14:03 lsl_19891020_00
-rw-r--r-- 1 michaesp wheel   68195 2011-03-21 14:03 runscript.logfile
-rwxr--r-- 1 michaesp wheel    1025 2011-03-21 14:02 runscript.sh*
```

„And now for something completely different!“

Goodies !!!

- trainfo - metainformation about trajectories
- reformat - change format of trajectory file
- extract - extract columns, times or single trajectories
- difference - get the difference between two trajectory files
- mergetra - merge two trajectory files
- list2lsl - change (lon,lat,p) list to trajectory file
- lsl2list - write trajectory positions to (lon,lat,p) list
- datelist - create and handle date lists
- timeres - change time resolution of trajectory file (interpolation)
- lagrantohelp - show help pages

> lagrantohelp trainfo

NAME

trainfo - write meta-information for a trajectory file

SYNOPSIS

trainfo *trafile* [*option*].

DESCRIPTION

Write meta-information for a trajectory file *trafile* to screen. If no option is given, all meta-information is written, otherwise the specific piece of information is passed with *option*.

PARAMETERS

trafile

name of the input trajectory file

OPTIONAL ARGUMENTS

- **dim**

  dimensions of the trajectory file: #tra, #ntimes, #ncolumns.

- **ntra**

  number of trajectories.

- **ntim**

  number of times.

- **ncol**

  number of columns (including time, longitude, latitude, pressure).

- **vars**

  list of field names (columns) on the trajectory file.

- **refdate**

  reference date in format (YYYYMMDD_HHMM).

- **times**

  list of times (relative to the referencec date). Times are given in format: HH.MM.

- **startdate**

  starting date for the trajectory calculation (in format YYYYMMD_HHMM).

- **enddate**

  end date for the trajectory calculation (in format YYYYMMD_HHMM).

- **timerange**

  time range (in minutes) of the trajectories.

- **list** list all trajectories.

EXAMPLES

[1] trainfo file dim

Given a trajectory file with name "file", write the three dimensions of the file to screen. The dimensions are: number of trajectories, number of times and number of columns.

AUTHOR

Written by Michael Sprenger and Heini Wernli (January 2011)

```
> datelist stdout -create 19891020_00 19891023_00
 19891020_00
 19891020_06
 19891020_12
 ...
 19891022_06
 19891022_12
 19891022_18
 19891023_00
```

COMPARING DATE LISTS

-overlap file1 file1

determine the overlap of two date lists.

-onlyin1 file1 file1

determine the dates which only occur in date list 1, but not in datelist 2

-onlyin2 file1 file1

determine the dates which only occur in date list 2, but not in datelist 1

Examples

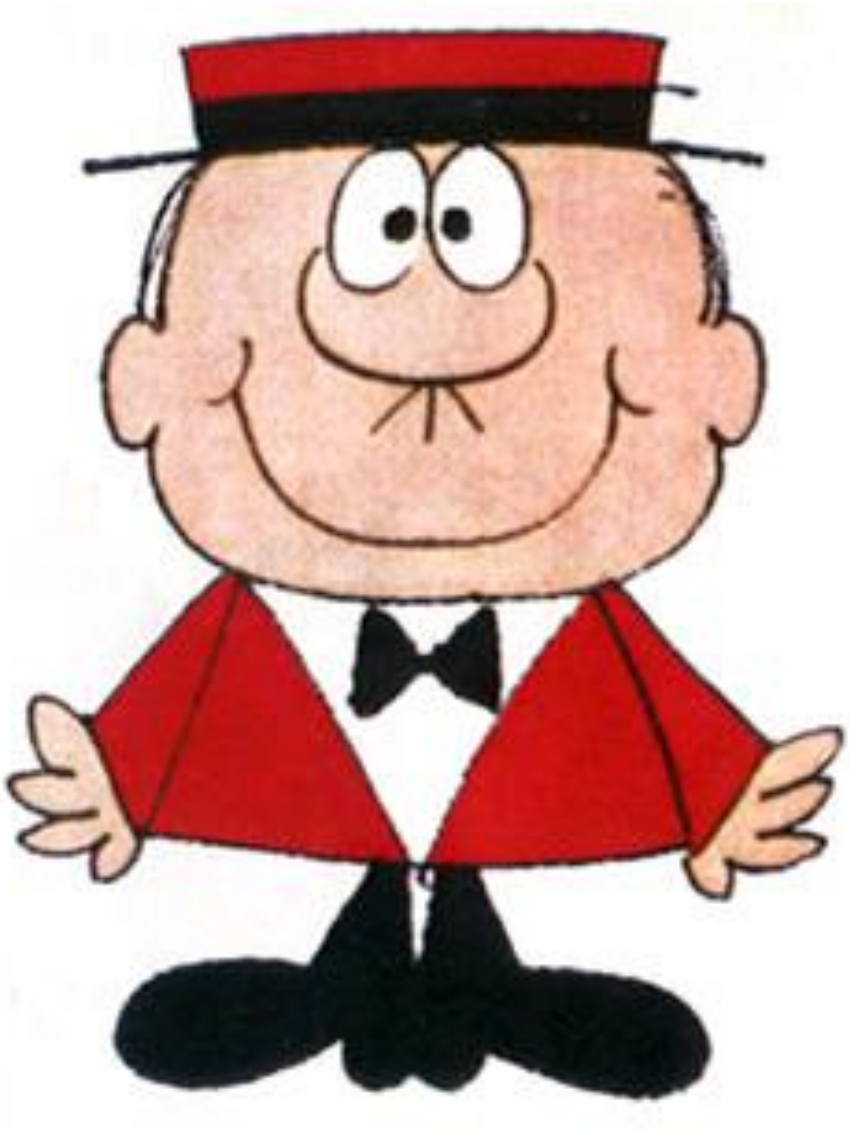
[1] datelist screen -indir ./

look for dates in the current directory and write them to screen

[2] datelist dates -create 19890101_00 20110101_00 -interval 2

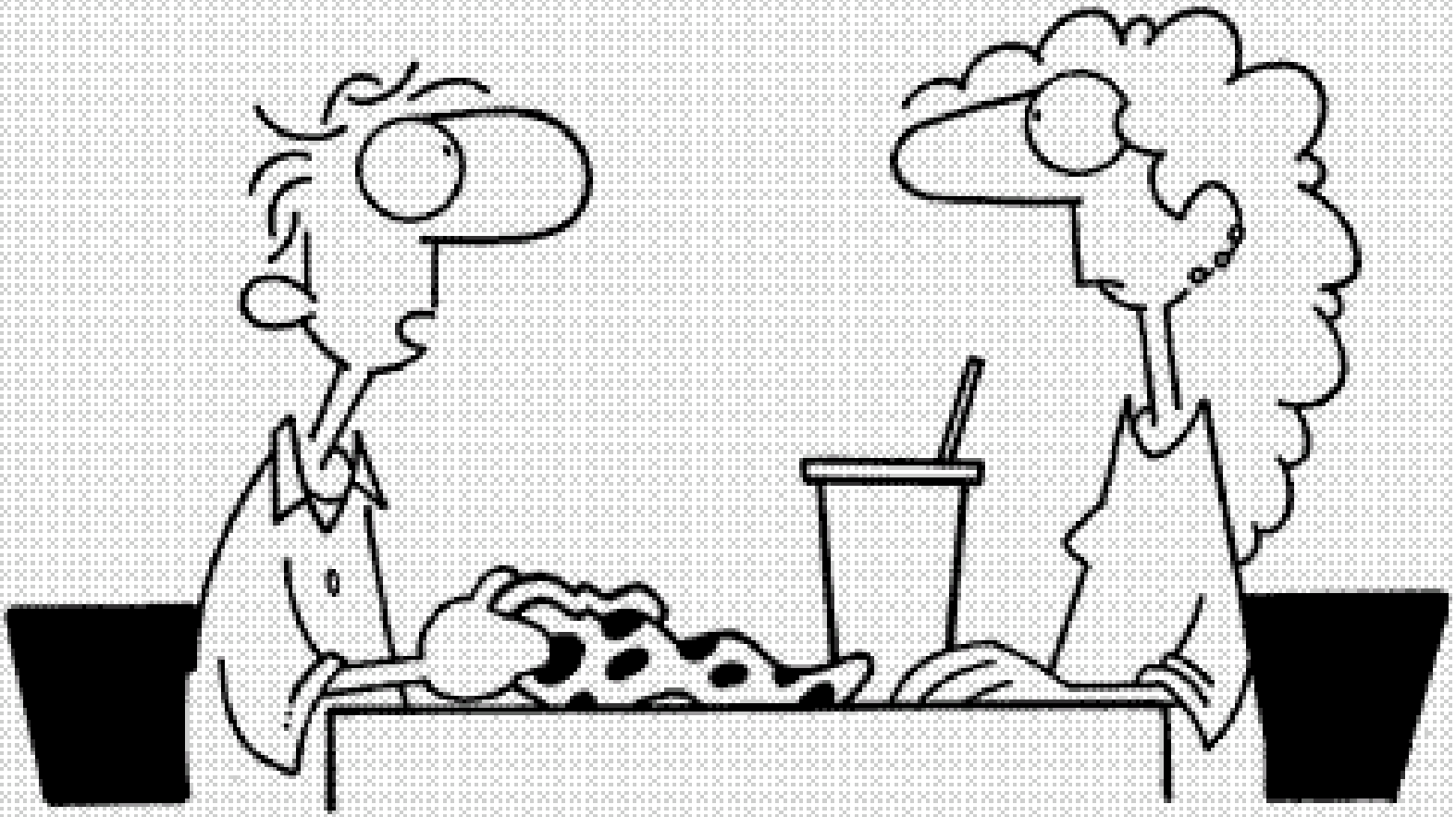
creates dates from 00 UTC, 1 January 1989 to 00 UTC, 1 January 2011 with an interval of 2 hours. The output will be written to the file 'dates'.

Working with Trajectories in Fortran - Libraries



tra(1:ntra,1:ntim,1:ncol)

```
c     Read parameters
      open(10,file='reformat.param')
       read(10,*) inpfile
       read(10,*) outfile
       read(10,*) ntra,ntim,ncol
      close(10)

c     Determine the formats
      call mode_tra(inpmode,inpfile)
      if (inpmode.eq.-1) inpmode=1
      call mode_tra(outmode,outfile)
      if (outmode.eq.-1) outmode=1

c     Allocate memory
      allocate(tra(ntra,ntim,ncol),stat=stat)
      if (stat.ne.0) print*,'*** error allocating array tra      ***'

c     Read inpufile
      call ropen_tra(fid,inpfile,ntra,ntim,ncol,refdate,vars,inpmode)
      call read_tra (fid,tra,ntra,ntim,ncol,inpmode)
      call close_tra(fid,inpmode)

c     Write output file
      call wopen_tra(fid,outfile,ntra,ntim,ncol,refdate,vars,outmode)
      call write_tra(fid,tra,ntra,ntim,ncol,outmode)
      call close_tra(fid,outmode)
```



"IT MAKES NO SENSE TO WORRY ABOUT THE FUTURE.
BY THE TIME YOU GET THERE, IT'S THE PAST!"

- compact trajectory format (JPEG compression - Harald!)
- interface to CF-netCDF and ECMWF GRIB
- trace fields along 3d-box around air parcel (min, max, sum, …)
- stochastic or physical wind fluctuations (turbulence)
- webLagranto
- cosmoLagranto
- gridding of the type time vs PV, lat vs p, TH vs RH,…
- goody <residence>: time within region/polygon
- goody <distance>: distance from specified point
- extension forward and backward of an existing trajectory
- …

"Ask not what Lagranto can do for you.

Ask what you can do for Lagranto!"

- compare sample trajectories of old and new Lagranto - report any discrepancy!!!

- the online calculation of fields needs some thorough testing. Help!!

- report any bug, inconsistency, counter-intuitive behaviour of any program….

- read the tutorial and reference guide: whoever finds most errors wins a Haribo Gummibärli-Pack. I have written the tutorial and the reference guide, but I have never read it!!!

-bring in or implement new ideas what can be done with trajectories

- **don‘t give up, if it doesn‘t work! It‘s not yet perfect….**