

A new version of DDHB

Alex Deckmyn, December 2007

1 Introduction

The main purpose of this re-coding was to produce a unified approach for all the various ddhb scripts. In stead of writing (or more likely adapting) an existing script, only a standardised budget description must be written. The code should be flexible enough for most purposes.

The script continues to use the DDHT and DDHI programs.

2 DDHB overview

DDHB is a unified script to create (plots of) budgets. A basic call is
ddhb -v CT -i DZ_46_niv_domaine_6.lfa

where we provide the chosen main variable and an input file. At this point, ddhb searches for a file CT.fbl which contains a detailed description of the budget components etc. This file is searched for in subdirectories of the basic ddhb directory, which is in the environment variable **DDHB_BPS**. Other possible options are the choice of vertical variable (Z or P) and an alternative conversion list (see above).

In fact this -v option is very flexible: the argument can be any string XXXXX, provided there is a file XXXXX.fbl . *I propose this may be used to make distinctions for different physics packages, e.g. QTarpege.fbl .*

Summary of options:

- -v XX: main variable (CT,QL,QT,EC...)
- -i inputfile: the input file (.lfa file)
- -F liscfile: (optional) an alternative file with field information. Default is **\$DDHI_LIST**.
- -d bpsdir: (optional) the directory to look for XX.list. By default, the current directory and subdirectories of **\$DDH_BPS** are searched.
- -Z--P: (optional) the choice of vertical variable. Default is Z.

3 What you need

Some environment variables must be set:

- A directory DDHB_BPS in which the different subdirectories (arpege, aladin, arome...) contain the budget list files. Typically, these files will have a name like CTxxx.fbl, where xxx can be anything, but for example describes the level of detail or an alternative budget list for surface variables.
- A file DDHI_LIST containing the conversion propoerties for all fields. (This is the file that used to be called liste_conversion).

4 Budget list structure

The budget list gives a full description of the budget components, the unit, etc. The field smay be either tendencies or fluxes. As long as the naming conventions are followed, the conversion of fluxes to tendencies is taken care of by the code. The "main variable" and its components are denoted by their 2 letter code.

Below is an example budget list (keywords are underlined).

```
BUDGET_LIST Temperature Budget # this title appears in the graph  
#UNIT K/day          # OPTIONAL: without this line, the unit is taken from the
```

```

field list.
#COEF 1.          # OPTIONAL: if we change the units, this is the extra
factor
RESIDUAL Residual # OPTIONAL: this is an alternative name given to the
# residual in the budget.
TENDENCY Tendency # OPTIONAL: this is an alternative name given to the
# main tendency.
#SUM Compsum      # OPTIONAL: if this is given, the sum of the budget
components is
# also plotted in the graph, with the given
name.
MAIN CT
CT +              # The variable CT is the only component of this main
tendency.
# The "+" sign is not really necessary, as this is the
default.
# "-" signifies a negative contribution.
BEGIN_BLOCK Dynamics # Every budget component MUST have a name
FCTFLUVERTDYN +
TCTDELTAP        +
TCTDIVFLUHOR    +
TCTCONVERSI2    +
BEGIN_BLOCK Resolved microphysics
FCTPRECCSSTL
FCTPRECCSSTN
TCTCONVERSI3
FCTPRECISTL
FCTPRECISTN
BEGIN_BLOCK sgs microphysics
FCTPRECCSCOL
FCTPRECCSCON
FCTPRECICOL
FCTPRECICON
BEGIN_BLOCK SGS.TRANSPORT
FCTTURCONV
BEGIN_BLOCK Radiation: solar
FCTRAYSOL1
BEGIN_BLOCK Radiation: IR
FCTRAYER1
BEGIN_BLOCK TURBULENCE
FCTTUR

```

5 Some Caveats

Some aspects of tendency budgets are very difficult to describe in a completely unified way. There are some points that should be taken into account.

1. **TxxDELTAP** This pseudo-field was included in several ddhb scripts to compensate the "divergence of horizontal fluxes" in the dynamics budget. It is impossible for ddhb to know exactly where to put this (the names of the budgets are free), so this field *must be provided in the budget file*. On the other hand, in case this field isn't required, a script may delete it. This could easily be coded using grep.
2. The conversion list is not very user friendly. Every entry has exactly 139 characters, the first four are

rather cryptic. Not all the fields entering the budget have to be in the list, but the main tendency (TxxM) must be defined. I am assuming a "BIIP" prefix for all tendency components. This seems to be correct for all cases except pressure itself.

3. The budget lists may in fact have various names. For instance, CTsurf.list could be used for a budget list at the surface. In general, the option `-v XXX` causes `ddhb` to look for a file `XXX.list`.
4. `DDHT -cCALC` does not accept variables that are not in the `lfa` file. It stops completely. So it is important that the budget file does not contain any other fields than are present in the `lfa` file. Fields of type `TxxDELTA` are an exception. The routine `ddhb_checklist` can be used to check a `fbl` file.
5. The `-d` option now requires a complete directory path, not just the name of a subdirectory of `$DDHB_BPS`.
6. `ddhb_checklist` only checks whether a `fbl` file is correct (i.e. doesn't require non-existent fields). It doesn't look any further.

6 Technical overview

In this section I describe a bit of the internal workings of the `DDHB` routines. An ordinary user may never have to read this, but anyone wishing to adapt the code

The `ddhb` script calls a number of programs to perform subtasks. As in the previous version, `DDHT` and `DDHI` are called for calculating the budgets and exporting them to `ascii` format. The difference is that now there is only one call to these programs.

The input scripts to `DDHT` and `DDHI` are constructed by `ddhb_makelists` (see below).

6.1 The budget parser

The subroutine `parse_fbl.F90`, called by `ddhb_makelists` (and `ddhb_checklist`), reads a budget file line by line, and returns all the information.

Changes to the format (e.g. different keywords or extensions to the syntax) can be very easily introduced by editing this source file.

6.2 Checking a fbl file

The program `ddhb_checklist` is called by the `ddhb` script when searching for a suitable `fbl` file. It simply calls the `fbl` parser and then checks whether all desired fields are present in the `lfa` inputfile. It returns with exit status 0 if the file is OK, and status 1 otherwise.

6.3 The DDHT call

There is only one call to `ddhb` now, and it uses the `-cCALC` option. For some cases the `-cSEPAR_PR_COMPL` was used in the old scripts, but this option is not general enough. It doesn't allow for the case where the main variable is the sum of different parts (e.g. total water as the some of vapour, liquid and snow). Also, in some cases (e.g. autoconversion) a number of variables may need a negative sign.

All fields starting with "F" are supposed to be fluxes and automatically converted.

Below is a script created by `ddhb`:

```
0
VCT0  +
ECR "VCT0 "
0
VCT1  +
```

```

ECR"VCT1 "
0
FCTFLUVERTDYN F>V +
TCTDELTAP      +
TCTDIVFLUHOR   +
TCTCONVERSI2   +
ECR"TCTCOMPL01 "
0
FCTPRECCSSTL   F>V +
FCTPRECCSSTN   F>V +
TCTCONVERSI3   +
FCTPRECISTL    F>V +
FCTPRECISTN    F>V +
ECR"TCTCOMPL02 "
+
0
FCTPRECCSCOL   F>V +
FCTPRECCSCON   F>V +
FCTPRECICOL    F>V +
FCTPRECICON    F>V +
ECR"TCTCOMPL03 "
+
0
FCTTURCONV     F>V +
ECR"TCTCOMPL04 "
+
0
FCTRAYSOL1     F>V +
ECR"TCTCOMPL05 "
+
0
FCTRAYER1      F>V +
ECR"TCTCOMPL06 "
+
0
FCTTUR         F>V +
ECR"TCTCOMPL07 "
+
COMPLEMENT
ECR"TCTRESIDUAL "

```

6.4 The DDHI call

DDHI is used to extract the budget into ascii files. As explained before, it now also needs a list (default **\$DDHI_LIST**).

DDHB creates a temporary file `ddhi_list.tmp` that names the different components. This is necessary because DDHI can only extract fields if it knows their normalisation etc. In the old DDHB version, all different budget components were named `TxxCOMPLEMENT` and extracted separately. Now they have a specific name, but this is not in the default conversion list. *The temporary file requires the main variable `TxxM` to be in the normal conversion list, because it actually copies part of that line.*

The normalisation factor (zcoef) is taken from the standard conversion list. If there is an additional coefficient in the budget list, the two are multiplied before writing to `ddhi_list.tmp`. *This does mean we have to check that ZCOEF still fits the f18.6 format. If it doesn't, we have to increase the IECHLOG factor.*

DDHB also creates a simple script `lc.ddhi` to extract the different components. Below is a script created by ddhb:

```
VCTM
TCTCOMPL01/dynamics
TCTCOMPL02/res microphysics
TCTCOMPL03/sgs microphysics
TCTCOMPL04/SGS.TRANSPORT
TCTCOMPL05/Radiation: solar
TCTCOMPL06/Radiation: IR
TCTCOMPL07/TURBULENCE
TCTRESIDUAL/Residual
```

6.5 Graphics documentation

The DDHB script no longer calls a graphical routine itself. But it does create all the necessary input files exactly as before.

The ascii data is in files `budget.<filename.lfa>.<budget component>.dta`. The file `zddhb.graph.doc` describes the final graph. This last file is created partially by `ddhb_makelists` (this partial output is in `ddhb_graph`) and then attached to the headers created in the main `ddhb` ksh script.

6.6 Other temporary files

The DDHB script (and more specifically the `ddhb_makelists` program) creates a few more temporary files. There is a shell script that renames the DDHI output files, to give them more meaningful names.