Diva workshop 2013

New developments

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Acknowledgements: SeaDataNet, EMODnet Chemistry, EMODnet Biology, STARESO
Diva developments: summary

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- Non-Gaussian distributed variables OK
- 4-dimensional generalisation OK: divand
- Spatially correlated observations errors In progress
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Releases: 4.5.1 – March 2013

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- Advection constraint with linear decay rate and local sources
- `divadetrend`: change in the detrending order
- Two new error calculations
  - `divacpme`: quick & better than original poor man’s error
  - `divaexerr`: almost exact error calculation, much faster than the exact calculation
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- Two new error calculations
- Simplified procedure for installation/compilation + tests
- Housekeeping of the code
  (simplifications, error messages, cleaning up of code, further optimisations, elimination of depreciated tools)
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- \texttt{divadetrend}: change in the detrending order
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- Simplified procedure for installation/compilation + tests
- Housekeeping of the code
- Updated user guide (augmented with examples and new tool descriptions)
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- `divadoxml` adapted to new specifications from IFREMER
Releases: 4.6.1 – June 2013

Current official version
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- Two additional solvers
  - parallel version
  - iterative version
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- Optimisations of file exchanges for use with ODV
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Current official version

- Two additional solvers
  - parallel version
  - iterative version
- Optimisations for large data sets
- Optimisations of file exchanges for use with ODV
- Highly optimised new version of the grid generator
Better, faster, stronger . . .

Mesh:
very fine meshes in a few seconds
Better, faster, stronger . . .

Analysis:
2 million data
≈ 1 minute
Better, faster, stronger . . .

Solvers:
- Direct
- Parallel
- Iterative
Better, faster, stronger . . .

Mesh: $\approx 100 \times$ faster
Analysis: $\approx 5-10 \times$ faster

$\rightarrow$ also quicker in ODV
Releases: 4.7.1 – expected November 2013

Beta testers . . .

BETA TESTERS

WHY U NO REPORT THIS PROBLEM
Releases: 4.7.1 – expected November 2013

Developed features

- Correlated observational errors
Releases: 4.7.1 – expected November 2013

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- Better file structures
  (input and driver better separated from command) in 4D loops
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- Better file structures
- Automatic selection of solver (parallel, serial, iterative) depending on the problem type and size
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- Automatic selection of solver (parallel, serial, iterative)
- Retrieval of topographies from Diva-on-web
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Developed features

- Correlated observational errors
- Better file structures
- Automatic selection of solver (parallel, serial, iterative)
- Retrieval of topographies from Diva-on-web
- Improved version of the almost exact error calculation with boundary effects
- Incorporation of metadata (EDMO-CDI identifier, space-time location) into 4D NetCDF files of climatologies
Scientific developments – innovations

4-dimensional generalisation: divand

- Derivation of the kernel for $n$ dimensions
- Additional constraint
- Algorithms (primal and dual formulations)

Released code version available at:
http://modb.oce.ulg.ac.be/mediawiki/index.php/Divand
Scientific developments – innovations

Spatially correlated observations

**Ideally:** observation errors not correlated

**Reality:** clusters of observations (cruises, . . .)

**Consequence:** observations error covariance matrix is not diagonal
Scientific developments – innovations

New error computation

Poor man’s error: quick, but error underestimation
Real covariance: correct error estimation but very slow
Now: two quicker/more accurate methods
Scientific developments – innovations

Adaptation to altimetry data

- Particular temporal/spatial coverage
- Input files: NetCDF
- Modified data weights according to time of measurement
Scientific developments – innovations

Python plotting tools

- Free alternative to matlab/octave
- Easily deals with NetCDF
- Publication quality figures with Matplotlib

Publications

Detrending:

Recognizing temporal trends in spatial interpolation: an application to the Black Sea Cold Intermediate Layer and mixed layer depth
A. Capet, C. Troupin, J. Carstensen, M. Grégoire & J.-M. Beckers
*Ocean Dynamics*
Under revision
Diva-nd:
divand-1.0: n-dimensional variational data analysis for ocean observations
A. Barth, J.-M. Beckers, C. Troupin, A. Alvera-Azcárate & L. Vandenbulcke
*Geoscientific Model Development*
Under revision
Publications

Error field:

Approximate and efficient methods to assess error fields in spatial gridding with Diva (Data Interpolating Variational Analysis)
J.-M. Beckers, A. Barth, C. Troupin & A. Alvera-Azcárate
*Journal of Atmospheric and Oceanic Technology*
Under revision
DivaonedepthODV4

Introduction

Purpose: **Handling of files with no vertical axis**
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For instance, a BODC file:

```
//Data documentation at http://www.bodc.ac.uk/data/documents/series/7011/
//SDN_parameter_mapping
//<subject>SDN:LOCAL:Chronological Julian Date</subject><object>
SDN:P011::CJDY1101</object><units>SDN:P061::UTAA</units>
//<subject>SDN:LOCAL:CurrDir</subject><object>SDN:P011::
LCDAELO1</object><units>SDN:P061::UABB</units>
//<subject>SDN:LOCAL:CurrSpd</subject><object>SDN:P011::
LCSAELO1</object><units>SDN:P061::UVBB</units>
//
```


PBISOP/SB1 B1/328/MB * 1971-08-30T10:31:00.000 -5.6166 54.9833 7011 43 148 2441194.438194 1 280.60 1 4.90 1

```plaintext
2441194.445139 1 266.90 1 5.50 1
2441194.452083 1 193.00 1 6.70 1
2441194.459027 1 185.40 1 9.50 1
2441194.465972 1 176.60 1 13.50 1
2441194.472916 1 174.00 1 15.30 1
2441194.479861 1 170.50 1 18.10 1
```

...
The script performs several preliminary tests:

1. Pressure axis? ⇒ exit
2. Depth axis? ⇒ exit
3. No metadata file? ⇒ exit + warning
4. Else? ⇒ file with no vertical axis

- CurrDir, CurrSpd and a vertical axis? ⇒ special case (see later)
DivaonedepthODV4

Step 2 - Variables averaging

**Scalar** variables
- simple arithmetic average

**Vectorial** variable
- only for current speed (currdir & currspd) (→ future upgrade)
- polar coordinate system ⇒ Cartesian coordinate system (u_star & v_star)
- simple arithmetic average
A new file…

- The new file has the extension “_bis.txt” instead of “.txt”
- There are only two data line left, containing the mean values of the variables
- Currspd and Currdir become u_star and v_star
- A column “Depth [m]” is added
A new file…

- The new file has the extension “_bis.txt” instead of “.txt”
- There are only two data line left, containing the mean values of the variables
- Currspd and Currdir become u_star and v_star
- A column “Depth [m]” is added

…and with a new depth axis

1. the average of “minimum instrument depth” and “maximum instrument depth” is computed
2. the file “contour.depth” is read and the two nearest depths are written in the new file
Step 3 - Writing a new data file

A new file:

//Data documentation at http://www.bodc.ac.uk/data/documents/series/7011/
//SDN_parameter_mapping
//<subject>SDN:LOCAL:Chronological Julian Date</subject><object>
SDN:P011::CJDY1101</object><units>SDN:P061::UTAA</units>
//<subject>SDN:LOCAL:CurDir</subject><object>SDN:P011::
LCDAEL01</object><units>SDN:P061::UABB</units>
//<subject>SDN:LOCAL:CurrSpd</subject><object>SDN:P011::
LCSAEL01</object><units>SDN:P061::UVBB</units>

-10.02333087929292929292 1 3.46943974242424242424 1 150
2441194.445139 1 -10.02333087929292929292 1 3.46943974242424242424 1 100

The following files are also modified:

varlist u_star and v_star are added to the list
datasource the old files are replaced by the new ones (“_bis”)
Tests and warnings

- no depth in the metadata file ⇒ exit + warning
- more than one scalar variable ⇒ exit + warning (⇒ future upgrade)
- time series exceeds the user-defined period ⇒ warning

Speed and vertical axis

- Same procedure than “speed without vertical axis”…
- …except that there is no averaging in this case
→ also included in the divaonedepthODV4 script
DivaonedepthODV4

How to use it?

- DivaonedepthODV4 is called by divadoall (4D analysis) for every data file
- The script is called only if the extraction flag is set to 1 (driver file)

How to disable it?

2 options:

1. set the extraction flag to 0 in the driver file
2. set the variable “onedepth” to “no” in divadoall (≈ line 222)