Non Linear Differential Location (NLDiffLoc) a tool of NLLoc

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## **References:**

## NLLoc (http://alomax.free.fr/nlloc/)

## NLDiffLoc: Grazia De Landro, Ortensia Amoroso, Tony Alfredo Stabile, Emanuela Matrullo, Antony Lomax, Aldo Zollo, High-precision differential earthquake location in 3-D models: evidence for a rheological barrier controlling the microseismicity at the Irpinia fault zone in southern Apennines, Geophysical Journal International, Volume 203, Issue 3, December 2015, Pages 1821–1831, https://doi.org/10.1093/gji/ggv397

# **NLDiffLoc Quick Start Guide:**

1. Locate the seismicity by using NLLoc, in order to obtain the initial locations, and put the output files in the /Loc folder;
2. Create a folder /Loc/sum in which you have to put all the \*sum\* NLLoc outputs;
3. In the folder /Loc run Loc2ddct, a tool that creates the NLDiffLoc inputs, whit the command:

$ Loc2ddct <add\_file\_list> <output\_file\_root> max\_event\_dist weight\_min

As an example, whit the command:

$ Loc2ddct \*.grid0.loc NLDL\_inp 5 0.1

the tool calculates the differential travel-times between events within 5 km of inter-distance and with a minimum weight of the obtained differential time of 0.1, and creates output files named as:

* NLDL\_inp.ct (Differential times),
* NLDL\_inp.hyp (Initial locations),
* NLDL\_inp.xyz (Event couple connections).

1. Construct/adapt the NLDiffLoc control file.

The new command lines respect to the NLLoc regard the definition of initial locations path (file NLDL\_inp.hyp) and the specification of Metropolis search features:

# NLDiffLoc ===================================================================

# $DOC$ NLDiffLoc -------------------------------------------------------------

# input initial hypocenters filename

# (DLOC\_HYPFILE <hypos file> hypos\_type num\_hypo\_fix num\_hypo\_free

# (char[]) hypos\_type : (NLLOC\_SUM HYPODD\_INIT)

# (int) num\_hypo\_fix : index of single hypo to fix, others are free (-1 none fixed)

# (int) num\_hypo\_free : index of single hypo to free for inversion, others are fixed (-1 all free, except num\_hypo\_fix)

#

# 1D layer model initial hypocenter

DLOC\_HYPFILE /your\_path/NLDL\_inp.hyp NLLOC\_SUM -1 -1

# $DOC$ NLDiffLoc -------------------------------------------------------------

# search type

# (DLOC\_SEARCH search\_type <params>)

# (char[]) search\_type (MET (Metropolis))

# <params>:

# MET NumSamples BeginSave NumSkip Step(km) Velocity(km/s) InitialTemperature

# (int) NumSamples : maximum number of accepted Metropolis samples

# (int) BeginSave : number of accepted Metropolis samples at which to begin saving samples to form pdf scatter cloud

# (0 < BeginSave < NumSamples)

# (int) NumSkip : number of accepted Metropolis samples to skip between sample saves

# (double) Step(km) : nominal Metropolis x,y,z,ot\*v step size when temperature = 1.0

# (double) Velocity(km/s) : velocity to convert ot to distance

# (double) InitialTemperature : starting temperature; temperature will vary linearly from InitialTemperature->1.0

# when nSample varies from 0->BeginSave (InitialTemperature >= 1.0)

# During inversion, temperature is multiplied into active Metropolis Step and by LOCQUAL2ERR errors.

#

DLOC\_SEARCH MET 20000 10000 20 0.005 6.0 5.0 10.0

# END NLDiffLoc ================================================================

1. Run NLDiffLoc with the command:

$ NLDiffLoc your\_path\_NLDLcontrolfile/NLDiffLoc.in