User Manual

working with raster data

Version 1.0

10.10.2013

Author: Dirk Zacher

Faculty for Mathematics and Computer Science

Database Systems for New Applications

58084 Hagen, Germany

Table of Contents

1 Introduction

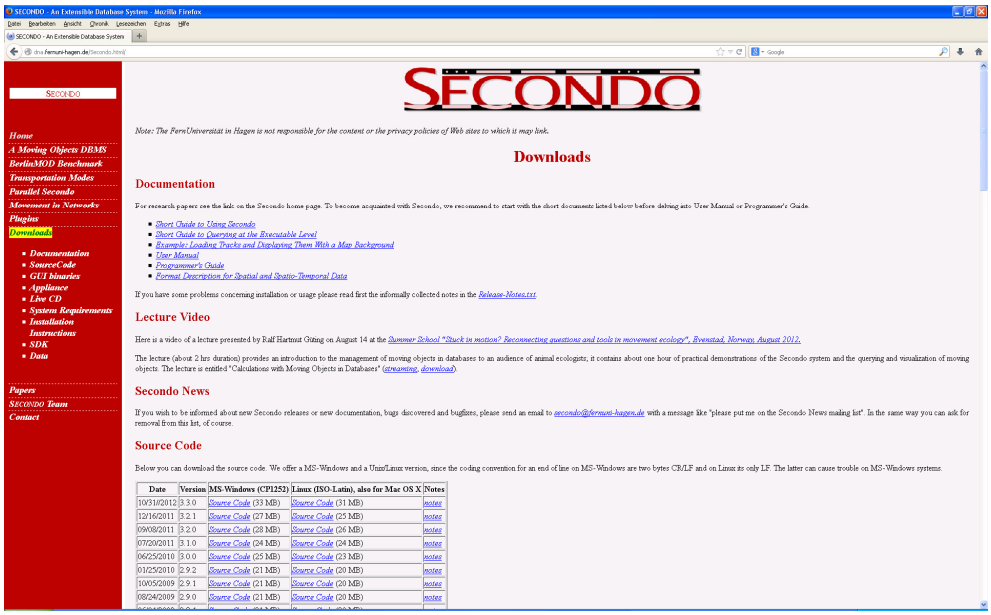
SECONDO is an extensible database management system (DBMS). It contains two algebras supporting work with raster data, Raster2 algebra and Tile algebra. Both algebras provide similar data types and operators for raster data. The main difference between Raster2 algebra and Tile Algebra lies in the implementation and usage of data types of these algebras.
In Raster2 algebra an object contains many raster data, for example height data at coordinates North 50 East 7 through North 52 East 10 in Germany. In contrast, a Tile algebra object normally contains less raster data than a Raster2 algebra object, because Tile algebra data types were implemented as attribute data types. Thus Tile algebra data types can be used in relations in contrast to Raster2 algebra data types.
Display of Raster2 algebra data types and Tile algebra data types in SECONDO GUI was implemented identical to ensure comparable visualisation.
It is also possible to work with objects of Raster2 algebra and objects of Tile algebra at the same time. For this purpose Tile algebra provides operators tiles and toraster2. These operators allow the conversion of a Raster2 algebra object to a corresponding Tile algebra object and the reverse conversion of a Tile algebra object to a corresponding Raster2 algebra object.

2 Quick Start – learning by doing

The following chapter describes how to work with the SECONDO system and particularly how to work with raster data in SECONDO.

Work through the following steps:

1. If you do not have a SECONDO installation, go to the SECONDO download page http://dna.fernuni-hagen.de/Secondo.html and select an installation suitable for your platform, for example Linux, Mac OS X or Microsoft Windows.

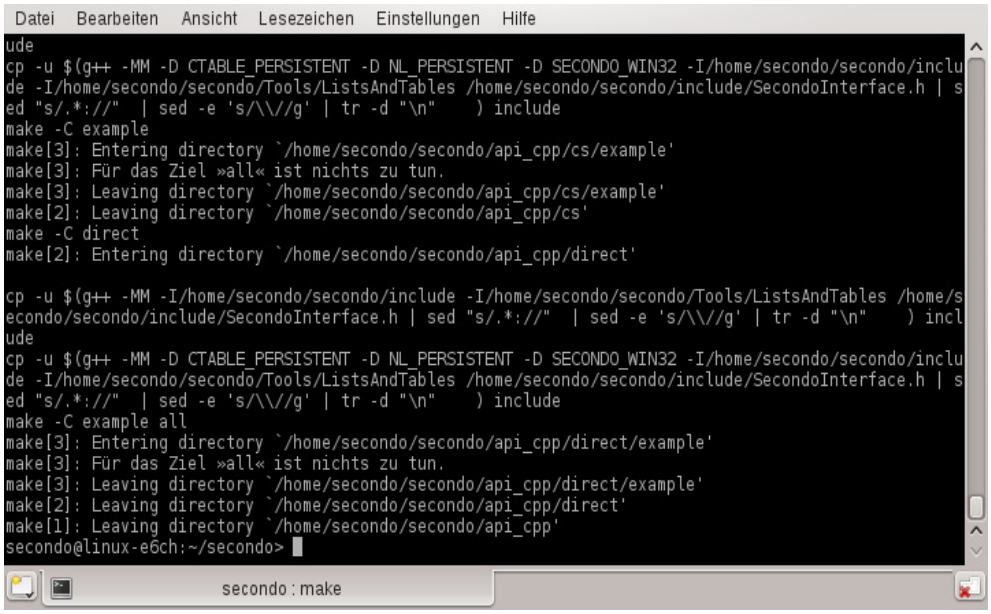


2. If necessary, get the latest version of SECONDO from the web site and extract it, preferably into the directory $HOME/secondo.

3. Open a shell window and change into the SECONDO directory by command cd secondo.

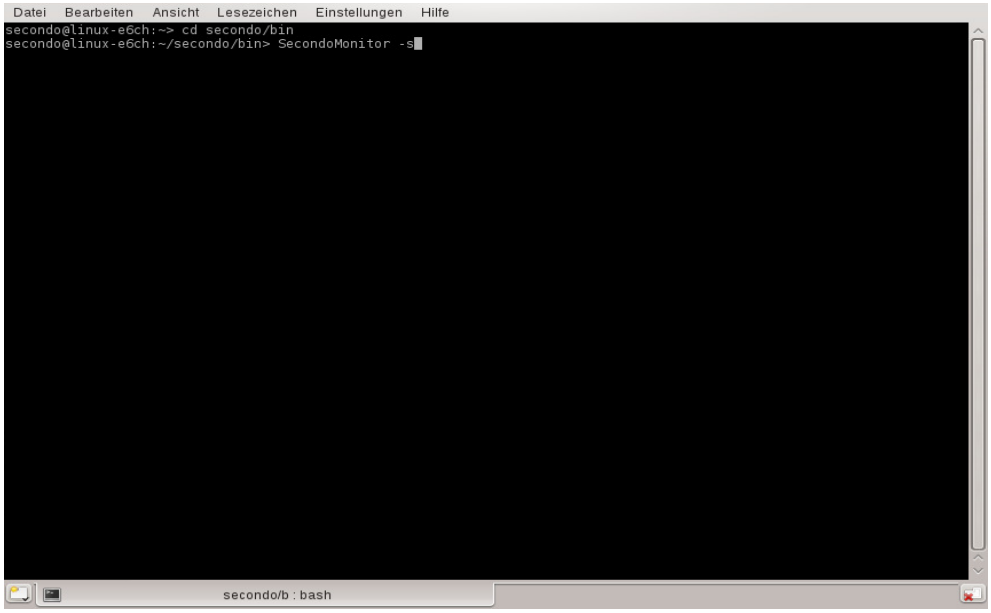
4. If the location of SECONDO system is not the directory $HOME/secondo, you need to set an environment variable to this directory.
On Windows installations this can be done by command setvar $PWD,
on Linux use command secroot.
In any case what happens is export SECONDO_BUILD_DIR=$PWD.

5. Compile your SECONDO system by command make.

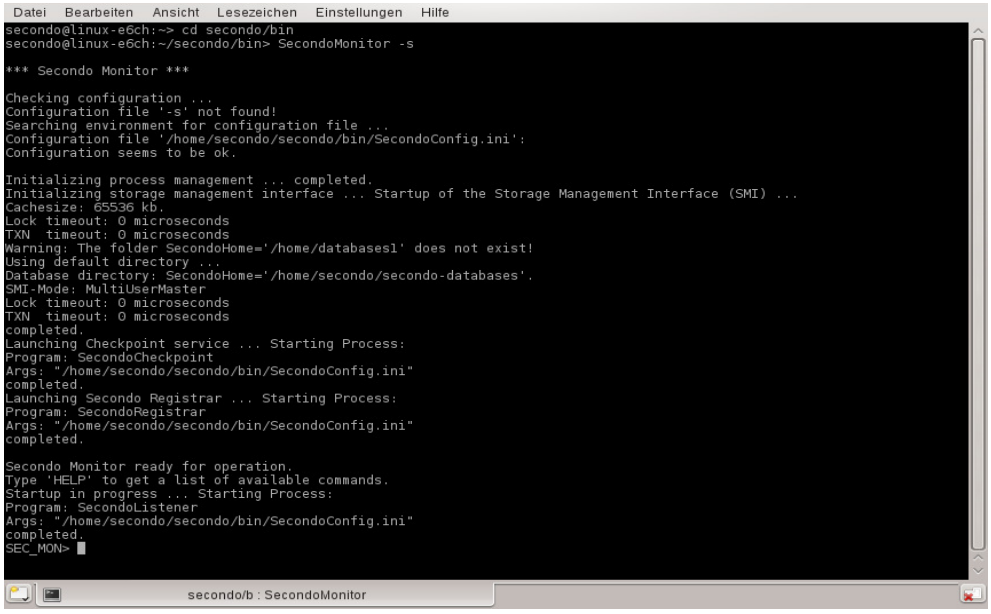


After compile a runnable SECONDO system is available.

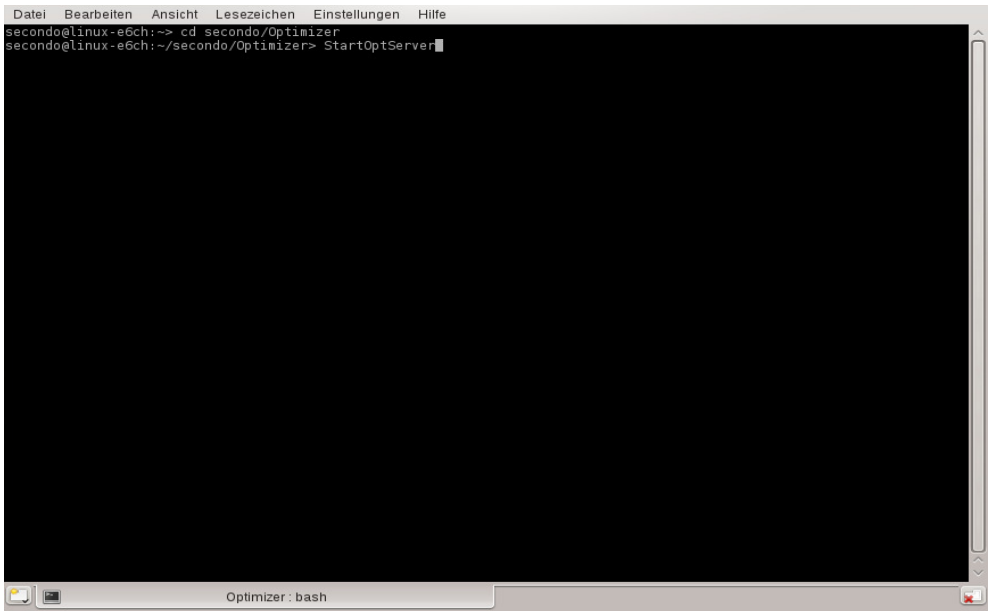
6. Open a new shell window, change into directory secondo/bin by command cd secondo/bin and execute command SecondoMonitor –s.



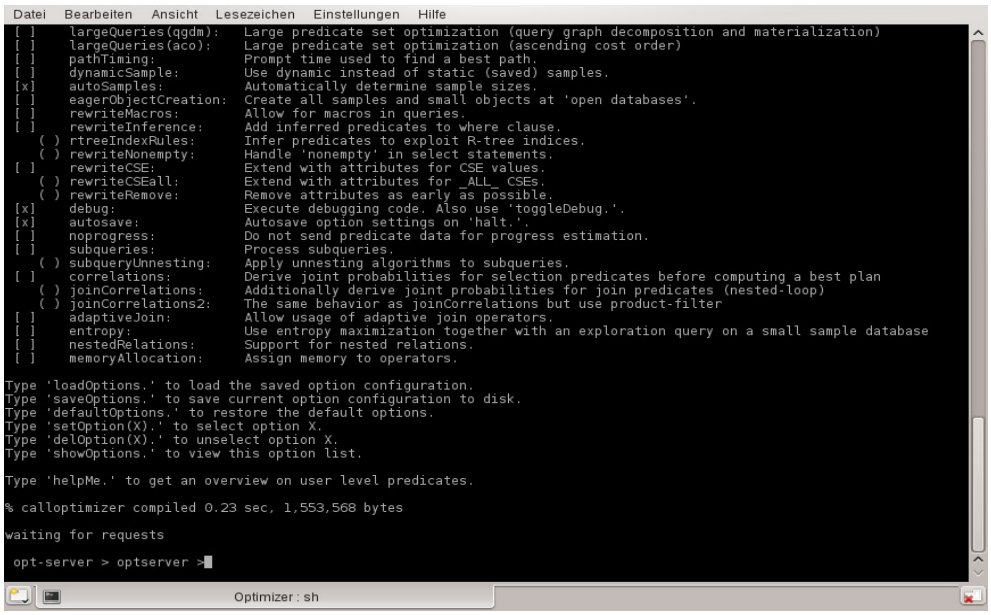
Command SecondoMonitor –s starts a process listening for user interfaces to register with the kernel.



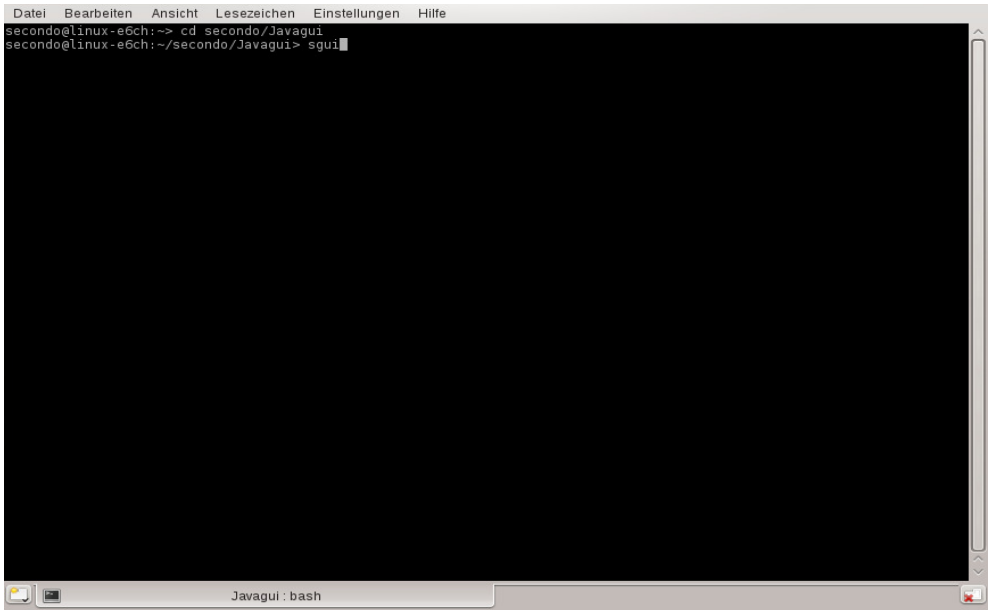
7. Open a new shell window, change into directory secondo/Optimizer by command cd secondo/Optimizer and execute command StartOptServer.



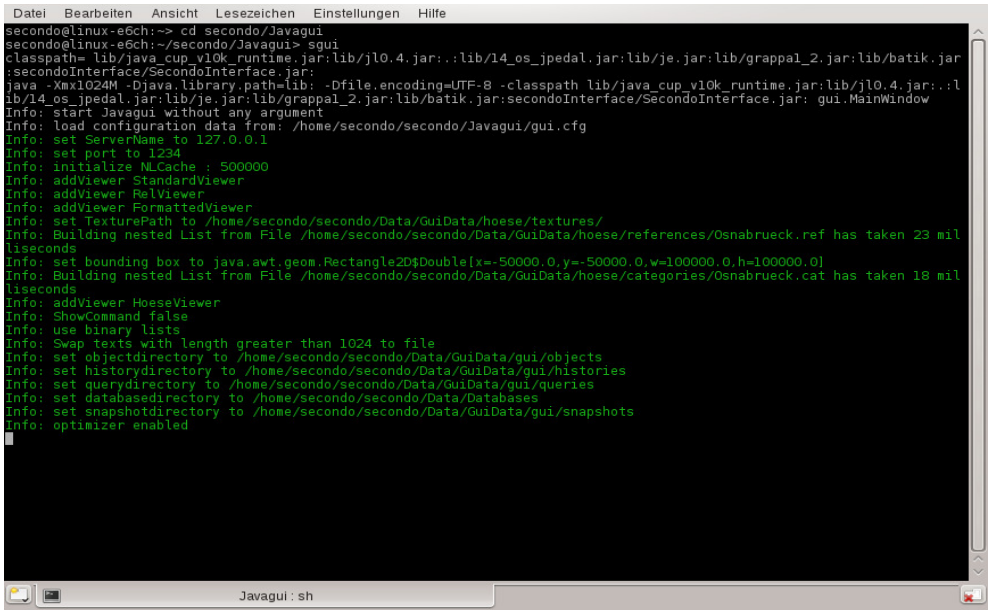
Command StartOptServer starts the optimizer process.

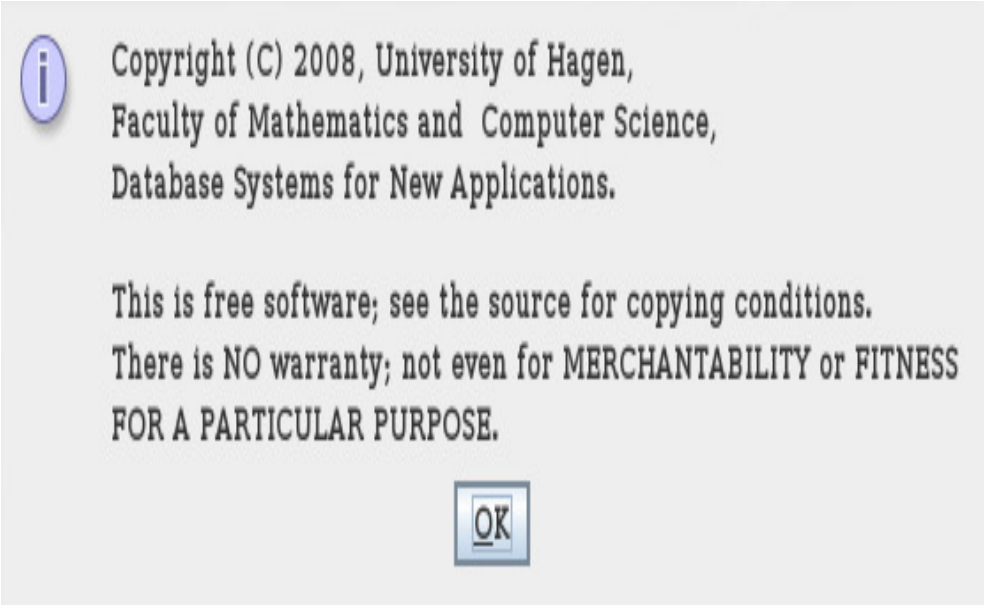


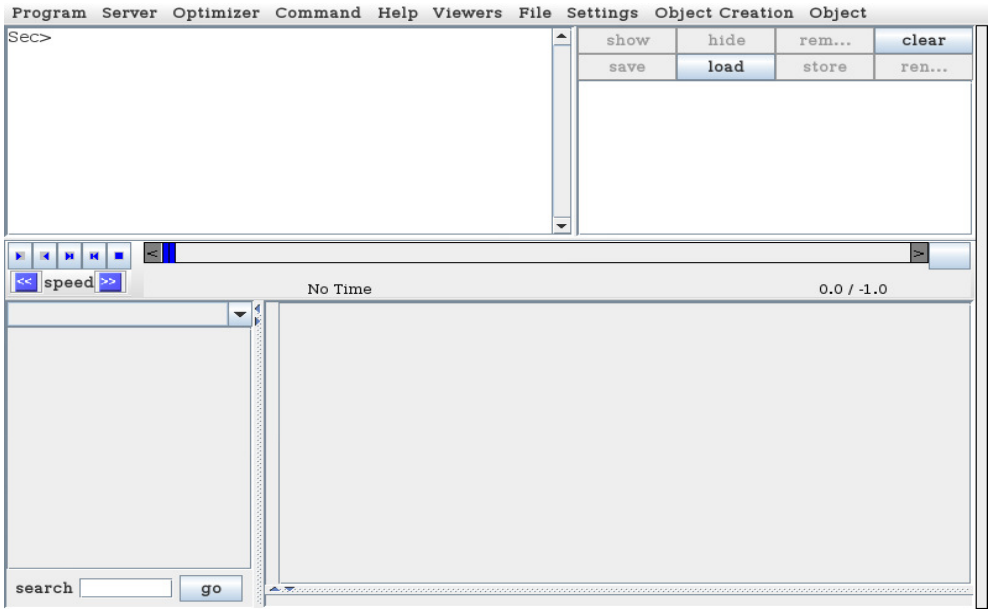
8. Open a new shell window, change into directory secondo/Javagui by command cd secondo/Javagui and execute command sgui.



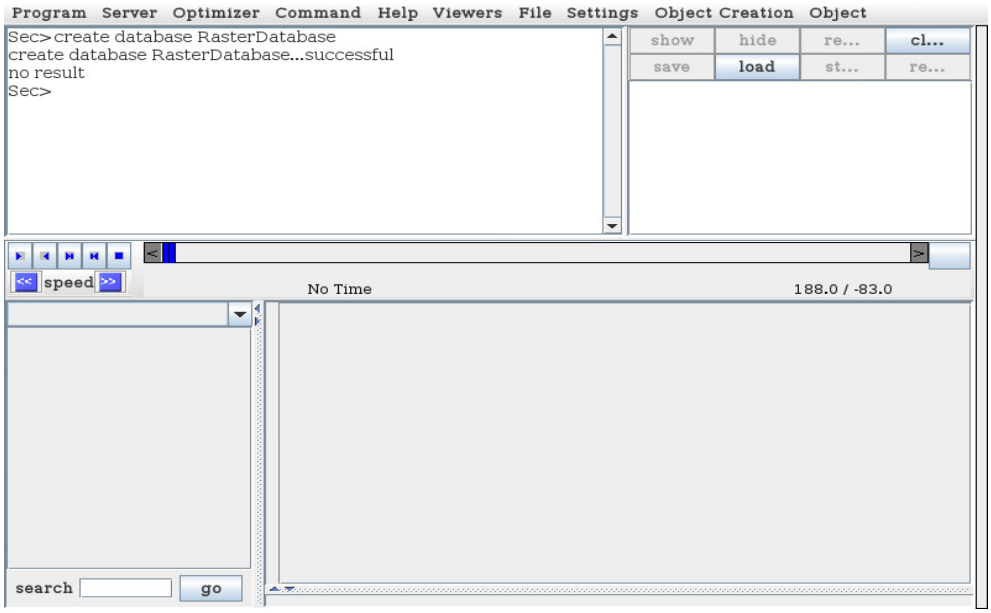
Command sgui starts the graphical user interface of SECONDO.



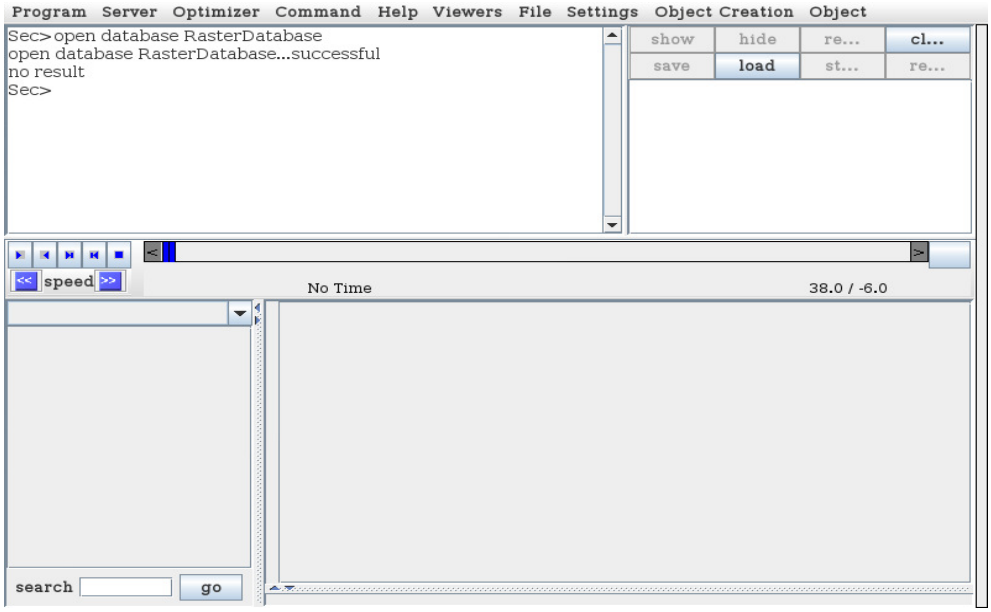

Copyright (C) 2008, University of Hagen,
Faculty of Mathematics and Computer Science,
Database Systems for New Applications.
This is free software; see the source for copying conditions.
There is NO warranty; not even for MERCHANTABILITY or FITNESS
FOR A PARTICULAR PURPOSE.
OK


Program Server Optimizer Command Help Viewers File Settings Object Creation Object
Sec>
show
hide
rem...
clear
save
load
store
ren...
speed
No Time
0.0 / -1.0
search
go

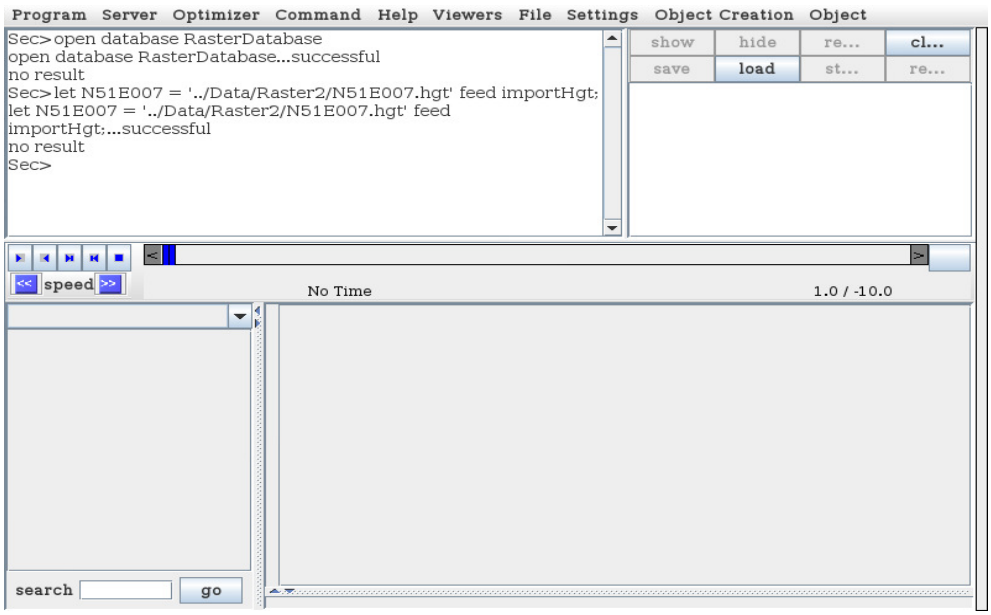
9. At the command window in the upper left area of the SECONDO GUI execute command create database RasterDatabase.



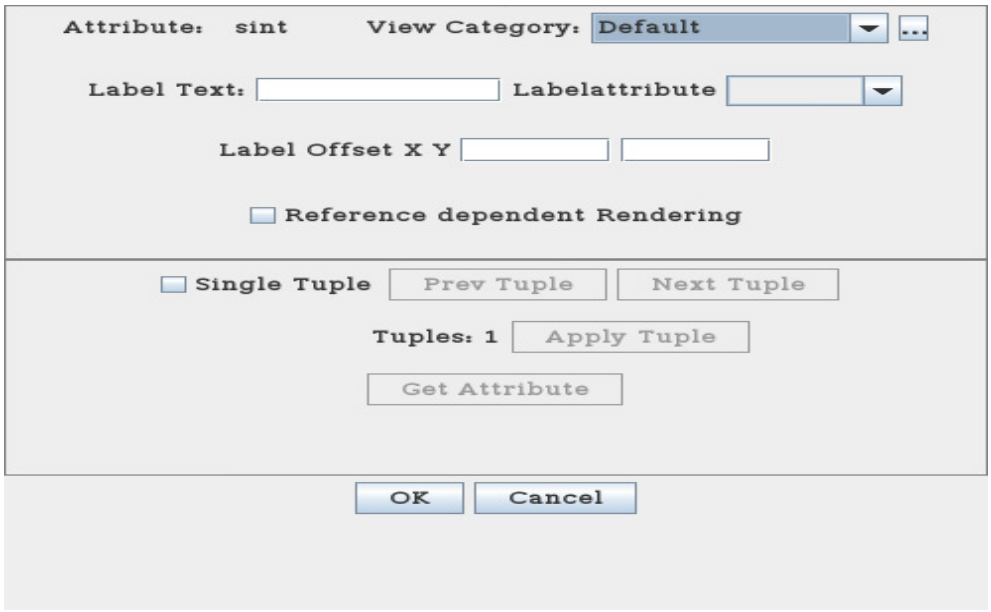
10. Open database RasterDatabase by command open database RasterDatabase.

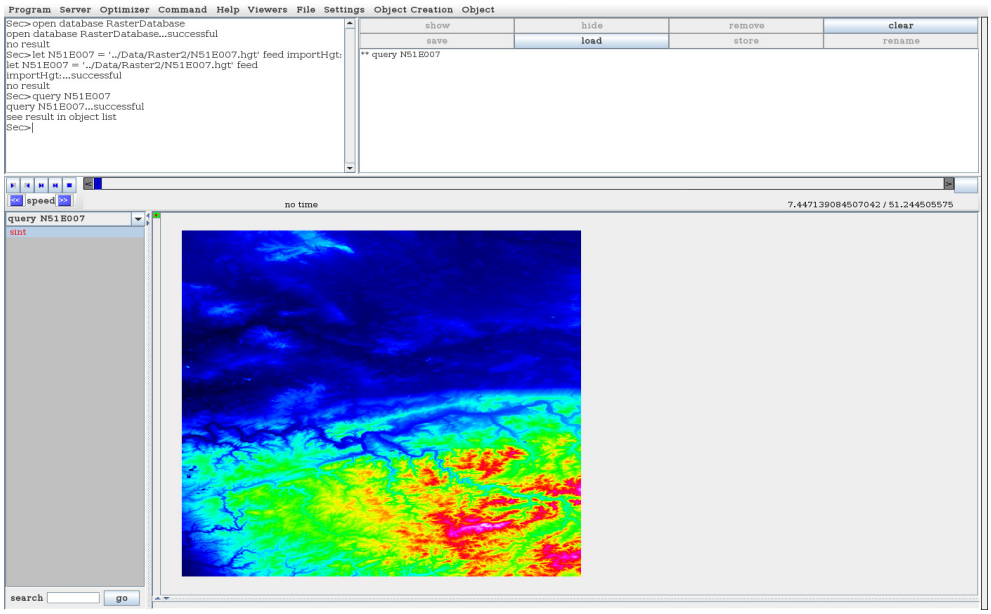


11. Import raster data of hgt format from file secondo/Data/Raster2/N51E007.hgt into a Raster2 algebra object of type sint by command
let N51E007 = '../Data/Raster2/N51E007.hgt' feed importHgt.

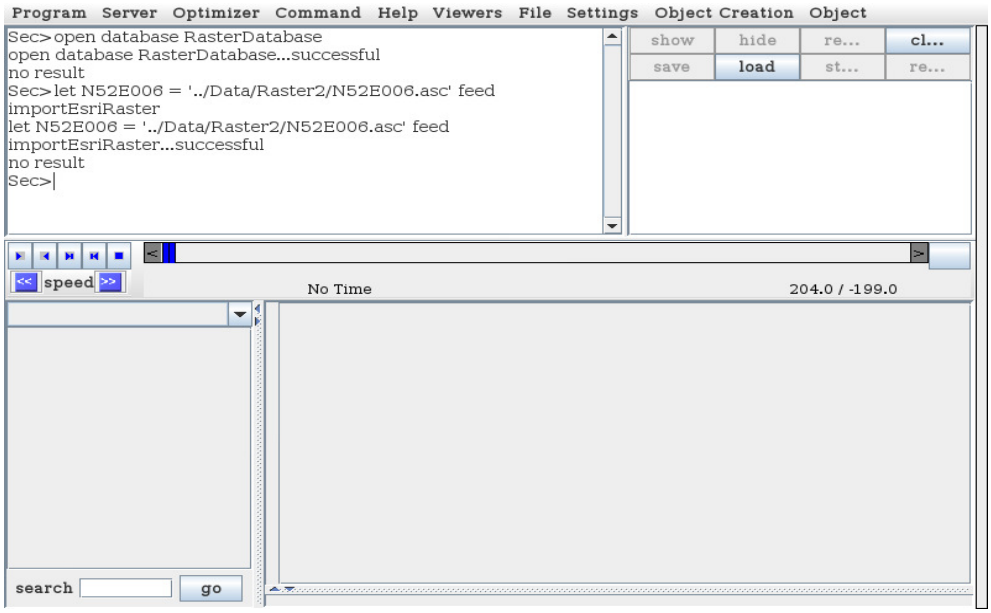


12. Display Raster2 algebra N51E007 object of type sint in Hoese Viewer by command
query N51E007.

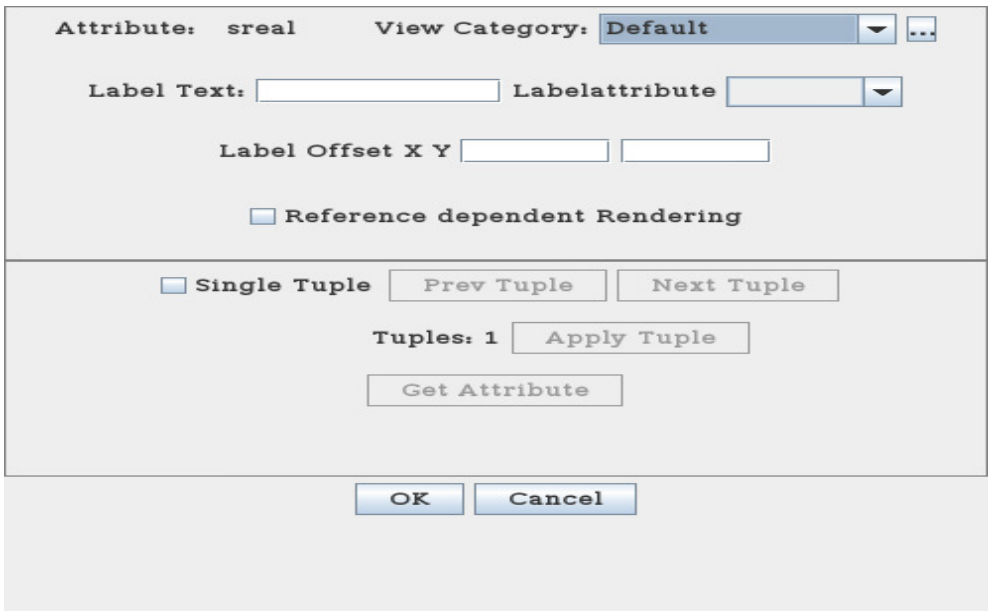


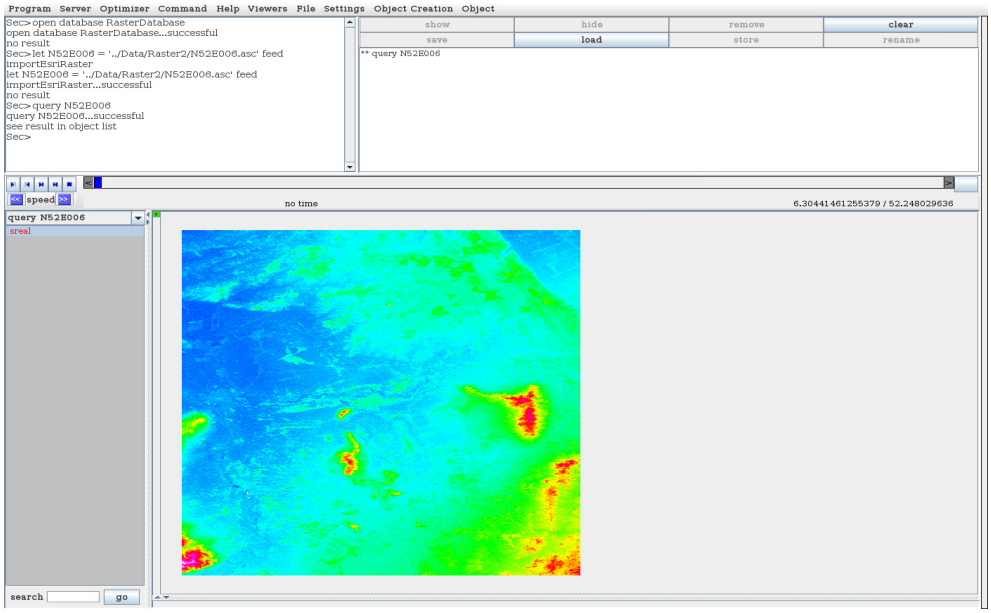


13. Import raster data of esri raster format from file secondo/Data/Raster2/N52E006.asc into a Raster2 algebra object of type sreal by command
let N52E006 = '../Data/Raster2/N52E005.asc' feed importEsriRaster.

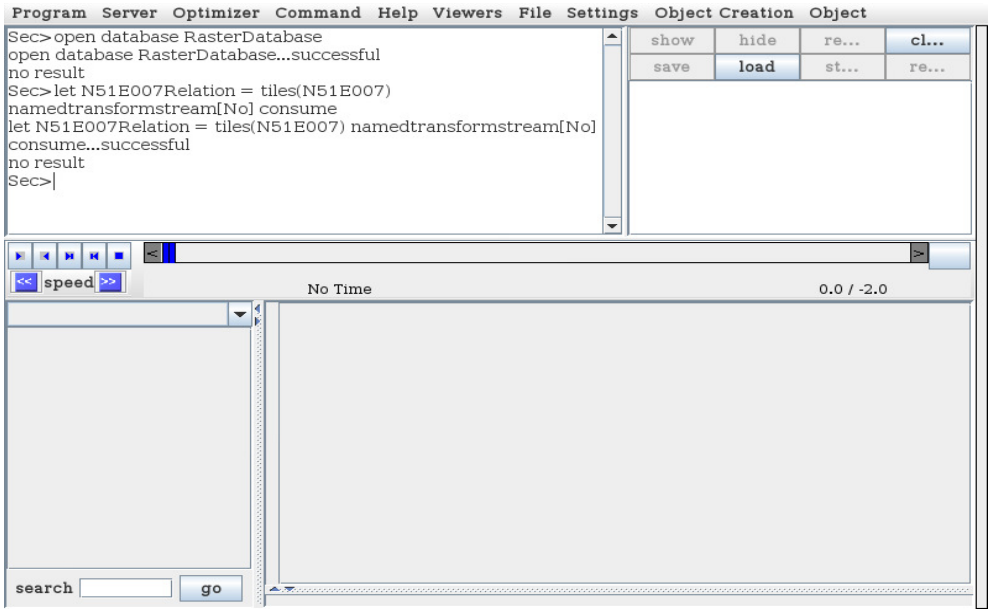


14. Display Raster2 algebra N52E006 object of type sreal in Hoese Viewer by command query N52E006.

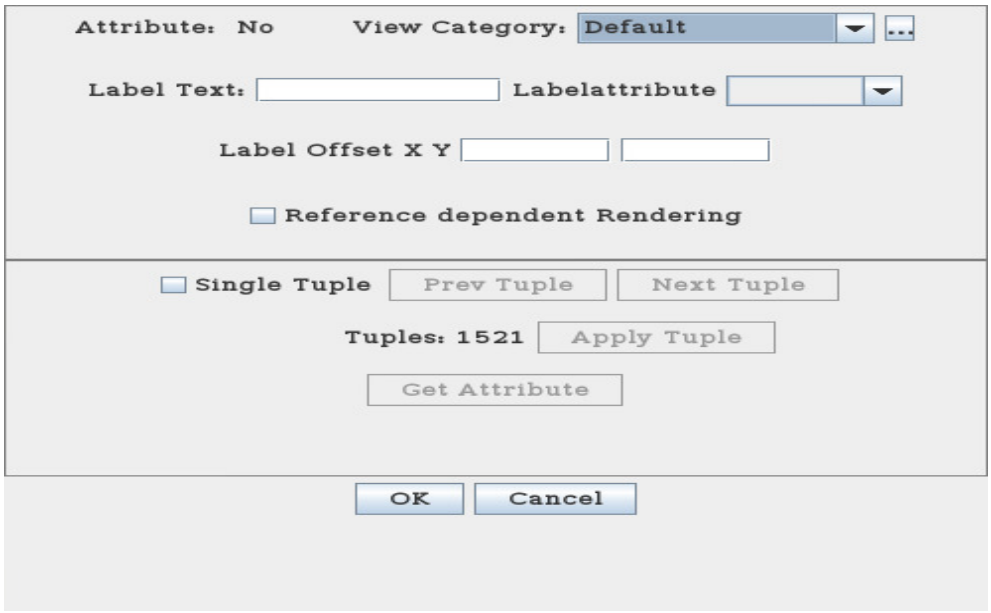


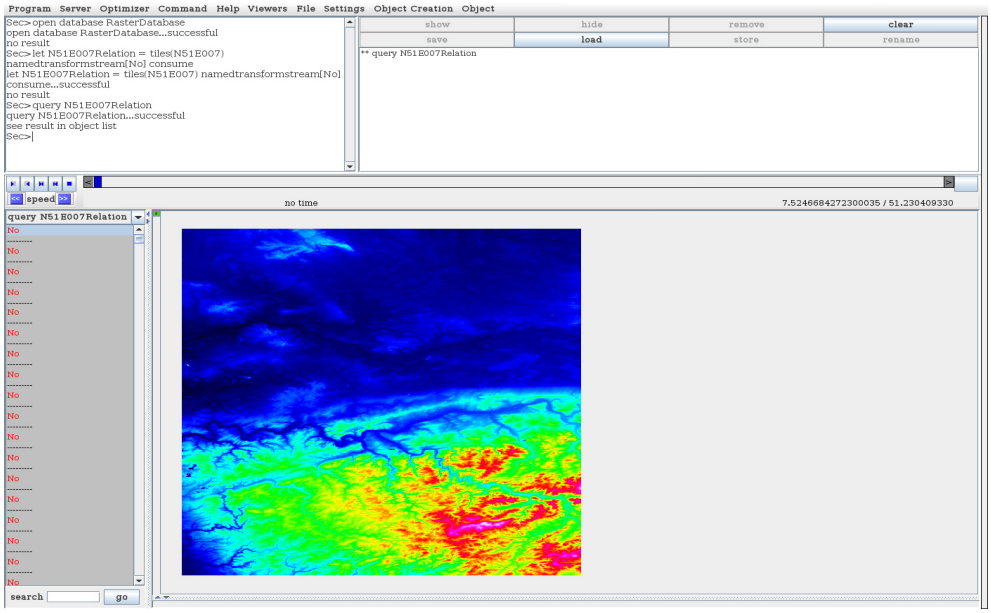


15. Convert Raster2 algebra N51E007 object of type sint into a relation of Tile algebra tint objects and save result in N51E007Relation object by command let N51E007Relation = tiles(N51E007) namedtransformstream[No] consume.

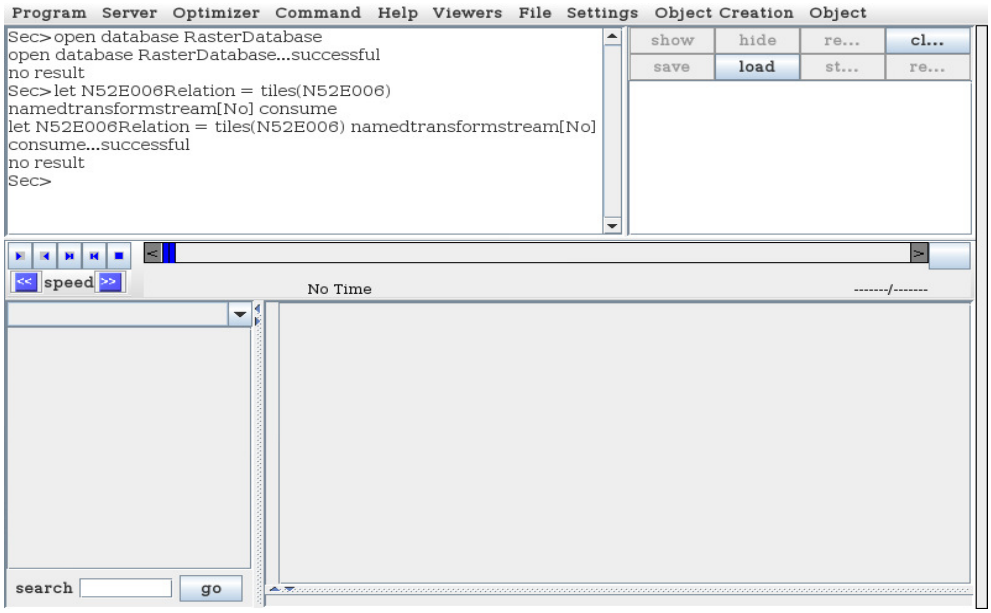


16. Display relation N51E007Relation of Tile algebra tint objects in Hoese Viewer by command query N51E007Relation.

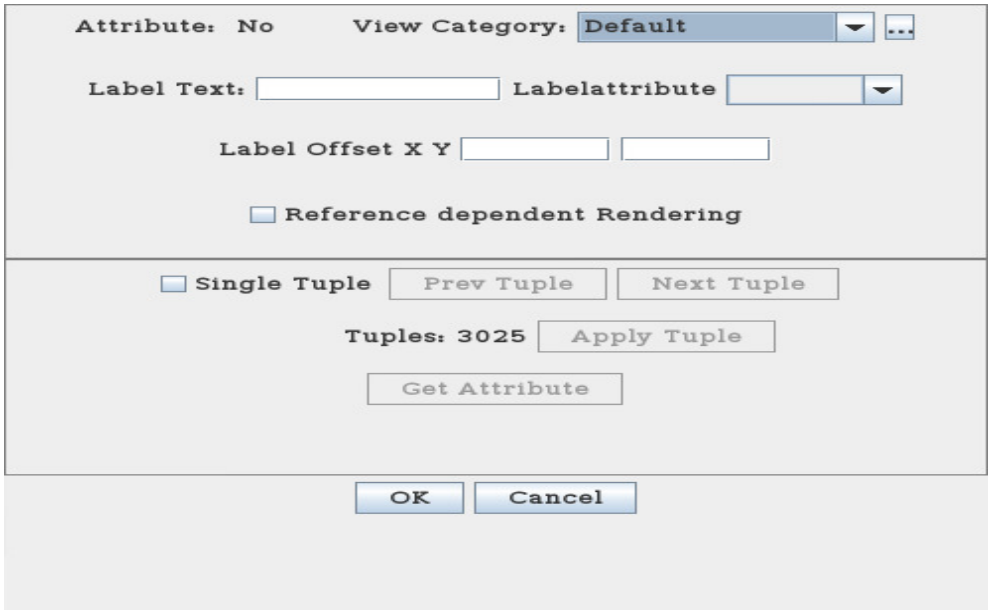


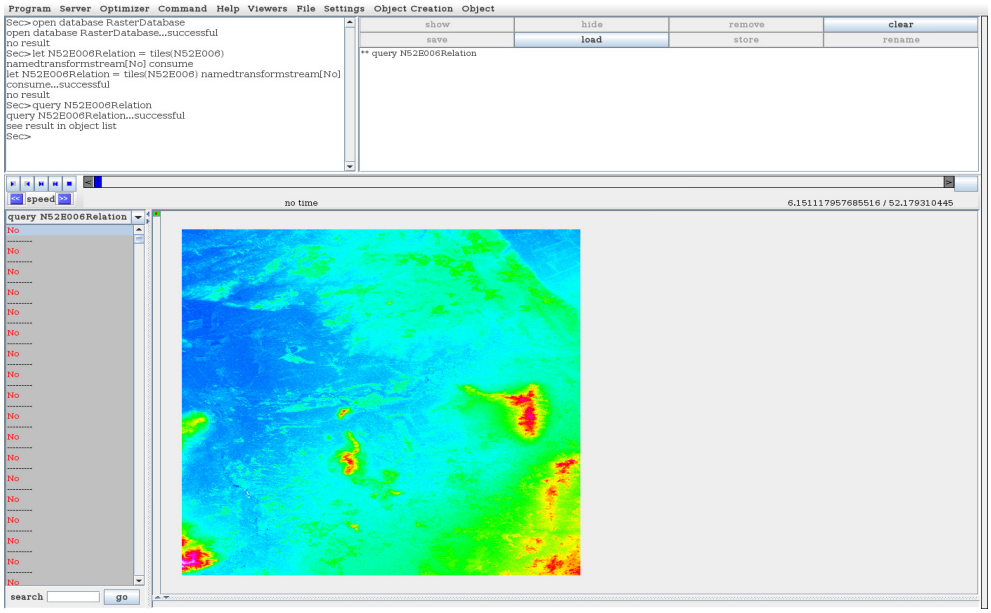


17. Convert Raster2 algebra N52E006 object of type sreal into a relation of Tile algebra treal objects and save result in N52E006Relation object by command let N52E006Relation = tiles(N52E006) namedtransformstream[No] consume.

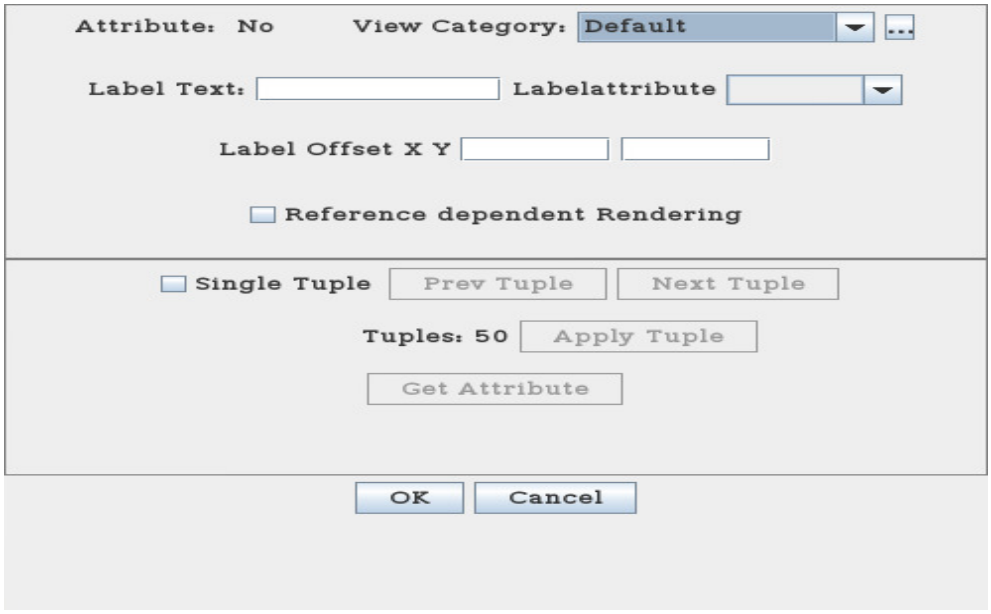


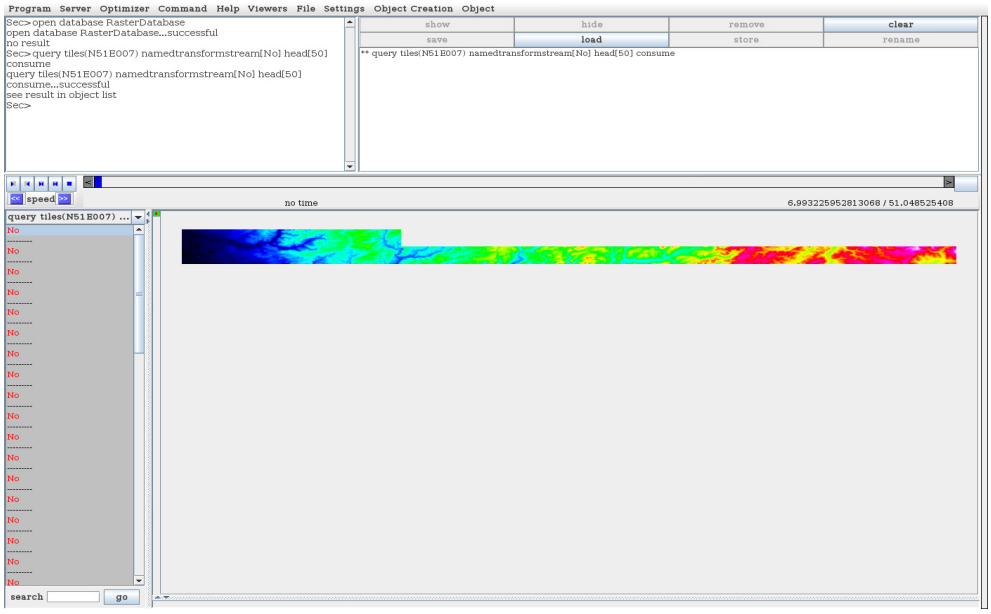
18. Display relation N52E006Relation of Tile algebra treal objects in Hoese Viewer by command query N52E007Relation.



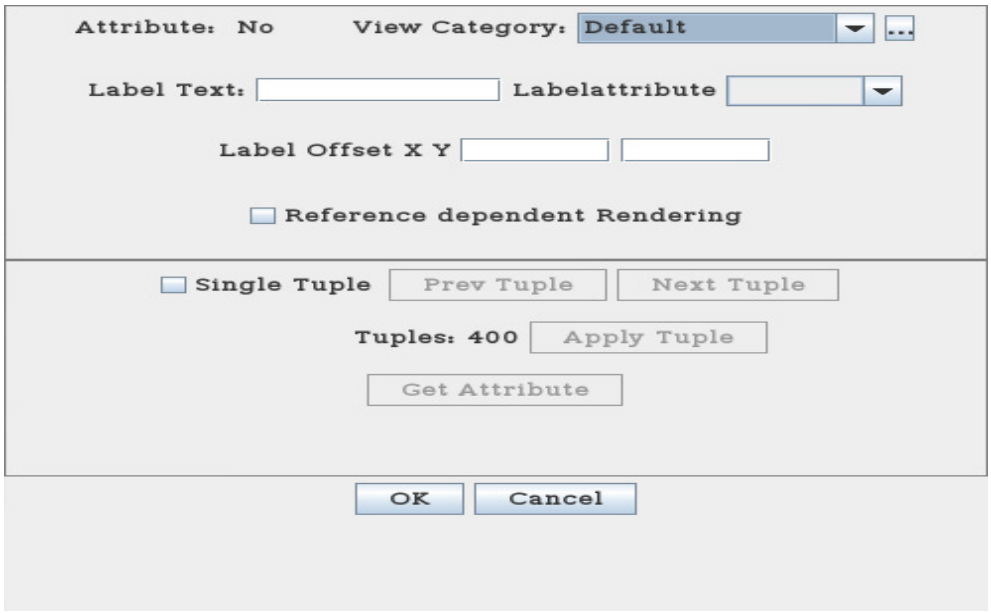


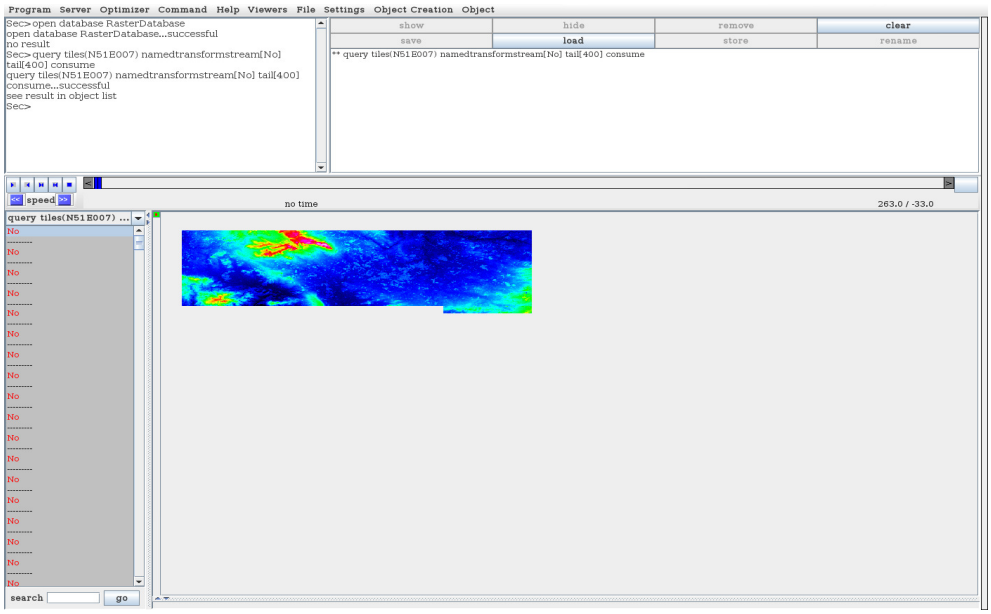
19. Convert Raster2 algebra N51E007 object of type sint into a relation of Tile algebra tint objects and display the first 50 tiles by command query tiles(N51E007) namedtransformstream[No] head[50] consume.



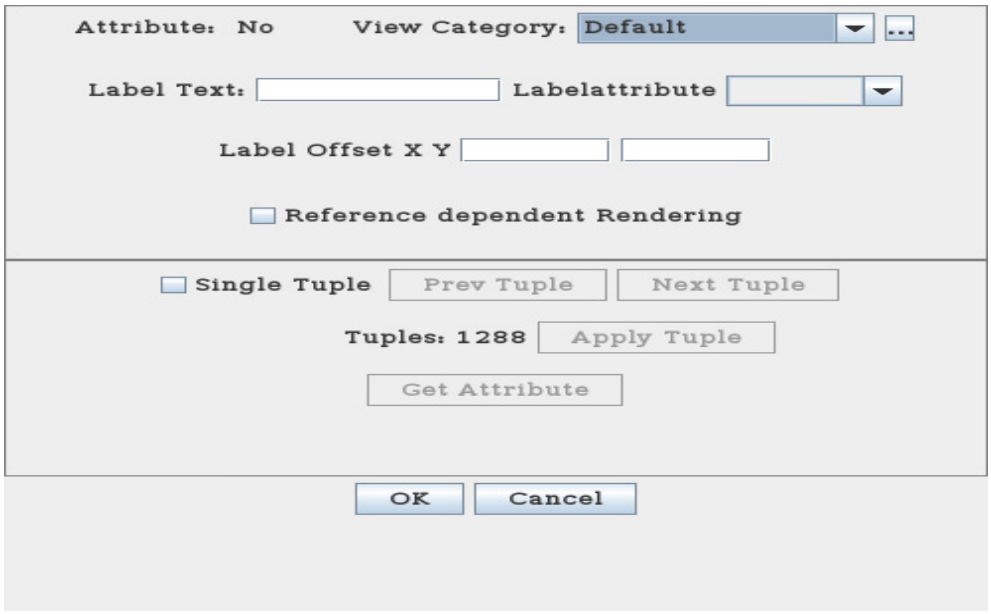


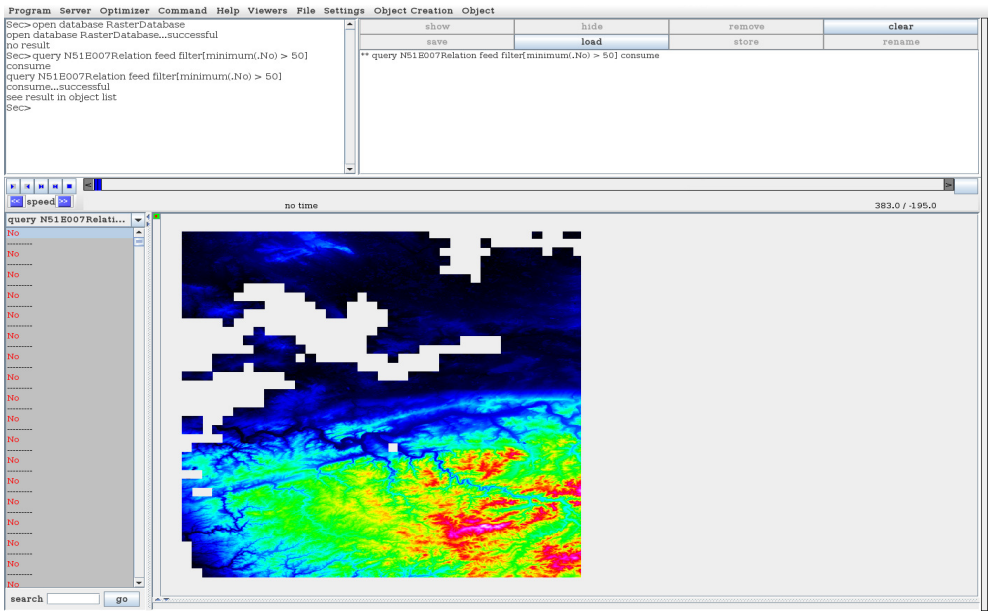
20. Convert Raster2 algebra N51E007 object of type sint into a relation of Tile algebra tint objects and display the last 400 tiles by command query tiles(N51E007) namedtransformstream[No] tail[400] consume.



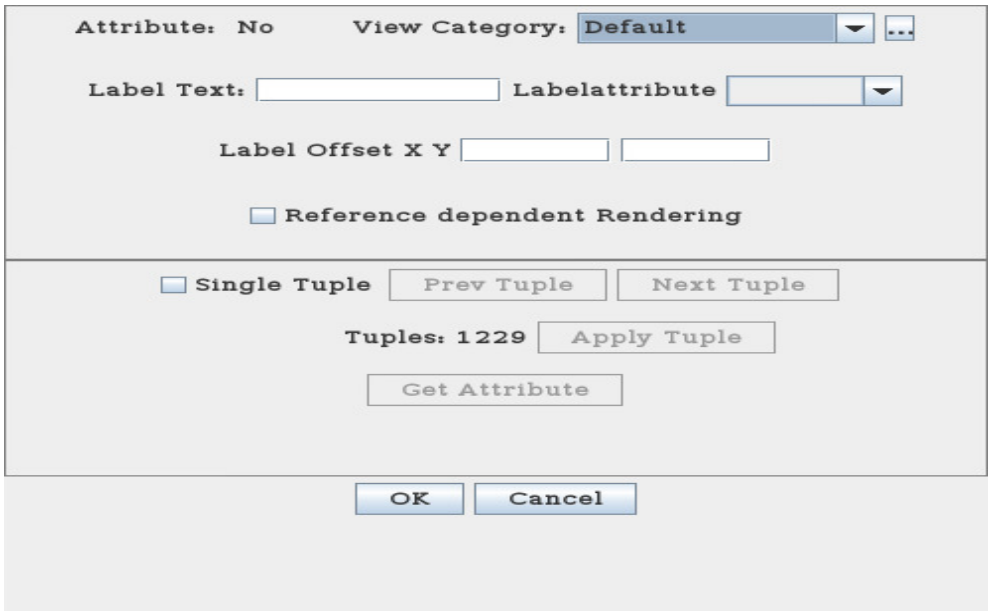


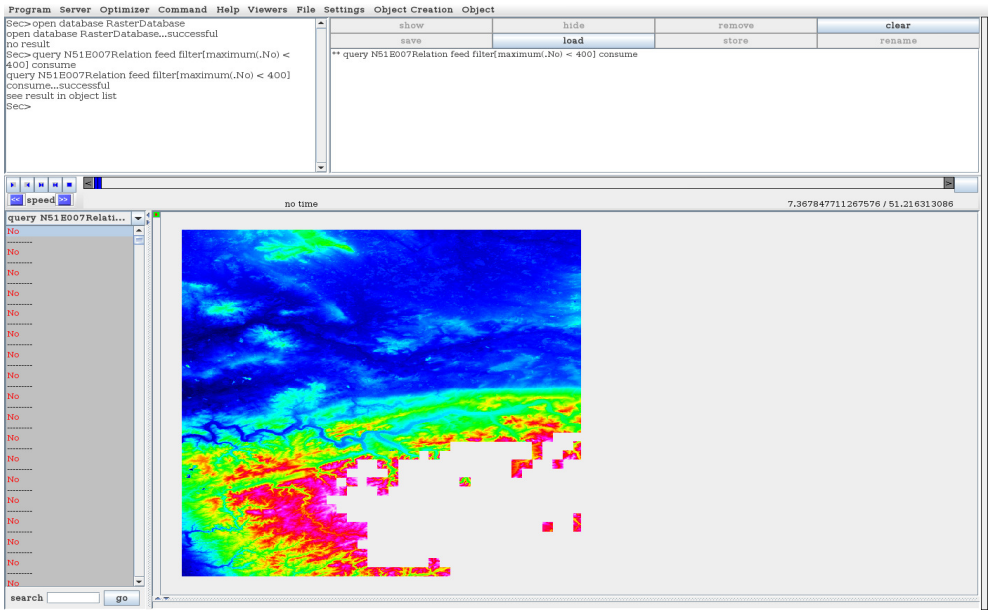
21. Display all tiles of N51E007Relation of Tile algebra tint objects whose minimum is greater than 50 by command
query N51E007Relation feed filter[minimum(.No) > 50] consume.



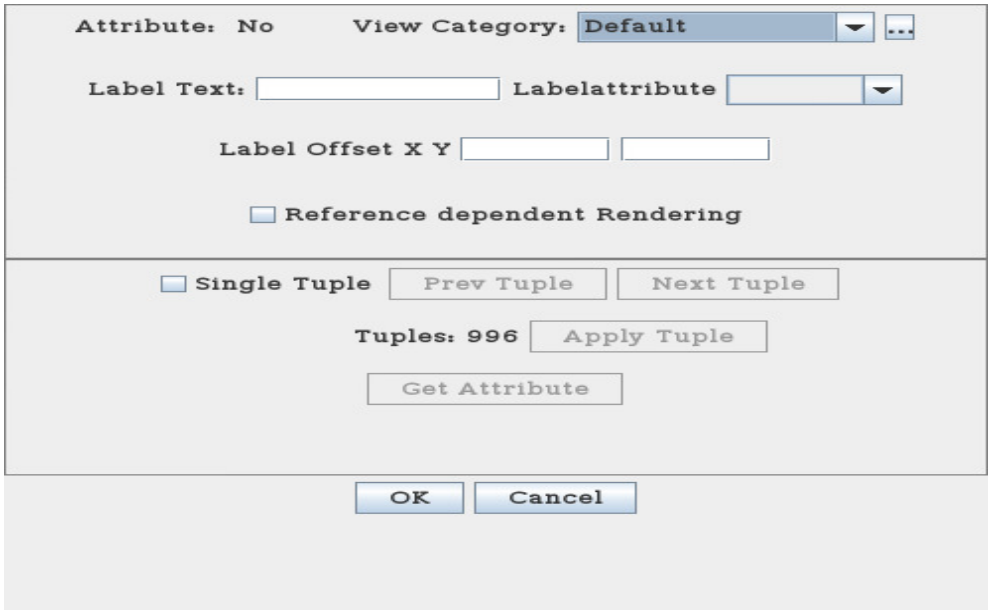


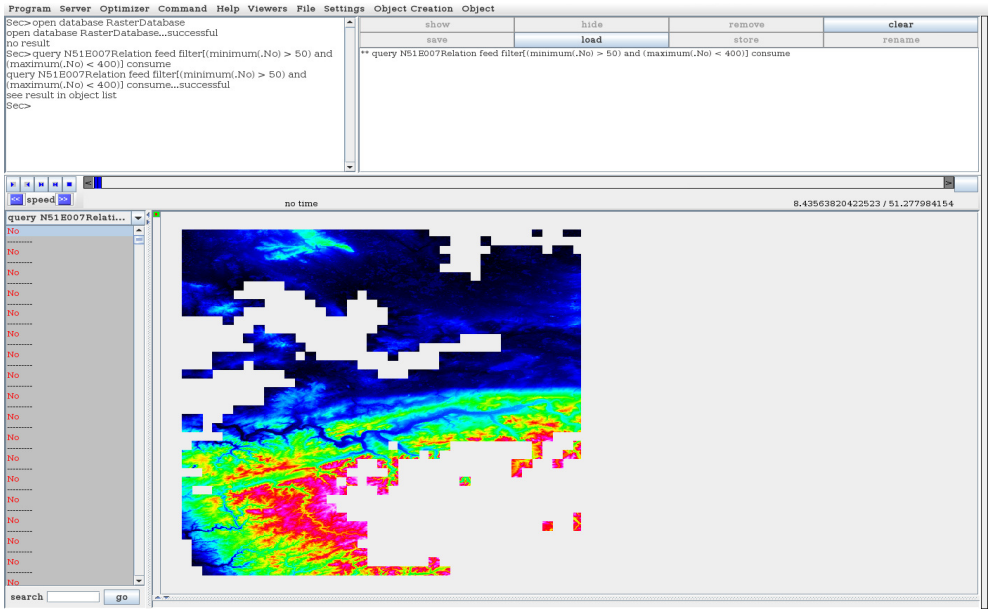
22. Display all tiles of N51E007Relation of Tile algebra tint objects whose maximum is less than 400 by command
query N51E007Relation feed filter[maximum(.No) < 400] consume.



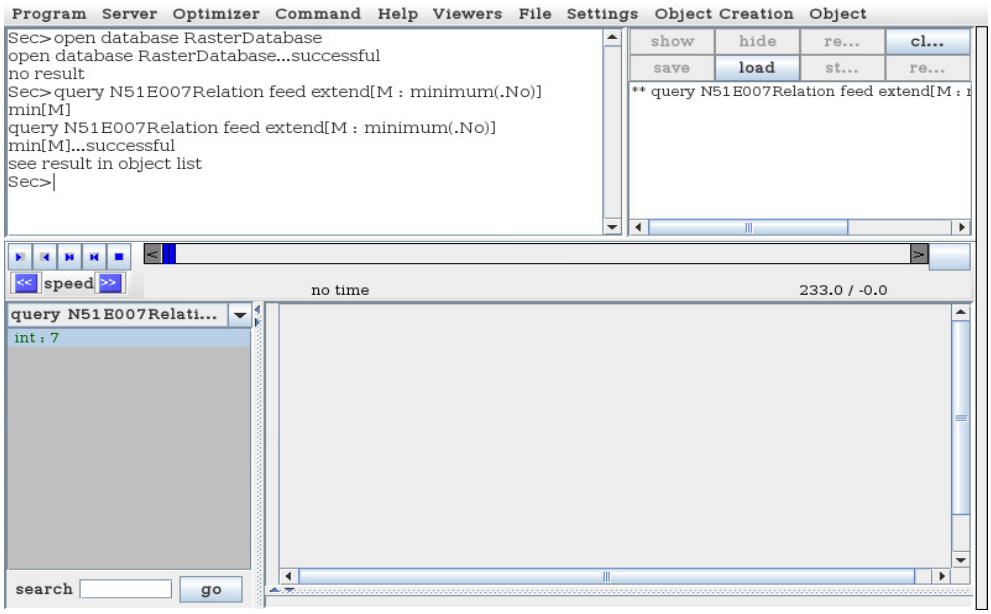


23. Display all tiles of N51E007Relation of Tile algebra tint objects whose minimum is greater than 50 and maximum is less than 400 by command query N51E007Rleation feed filter[(minimum(.No) > 50) and (maximum(.No) < 400)] consume.

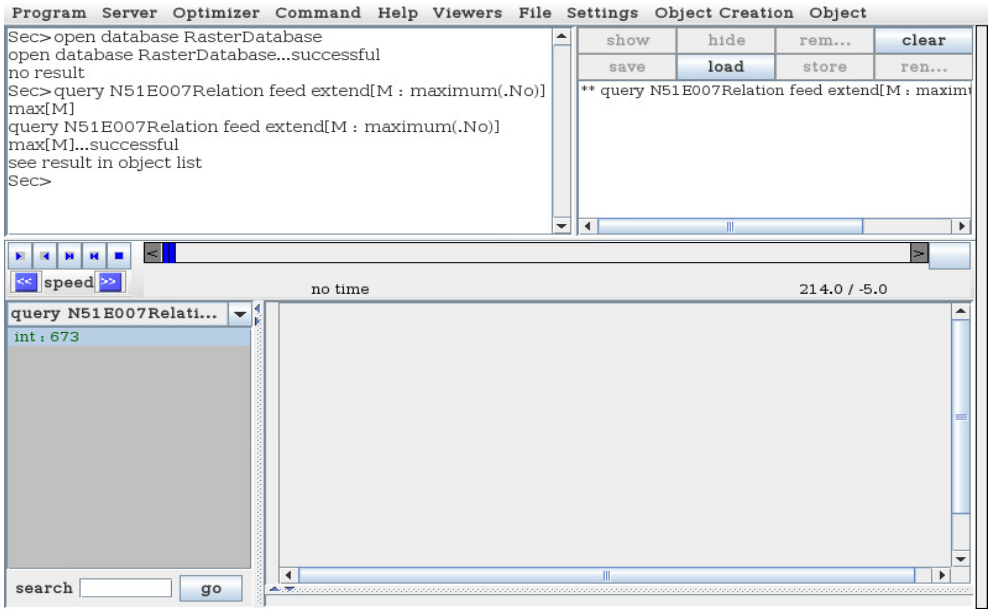




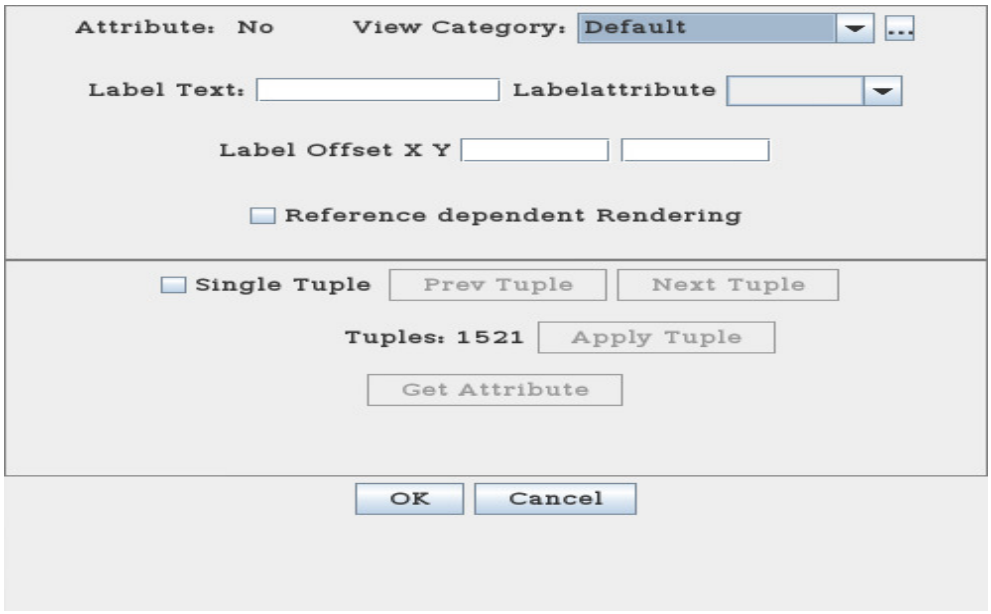
24. Display minimum value of all tiles of N51E007Relation by command query N51E007Relation feed extend[M : minimum(.No)] min[M].

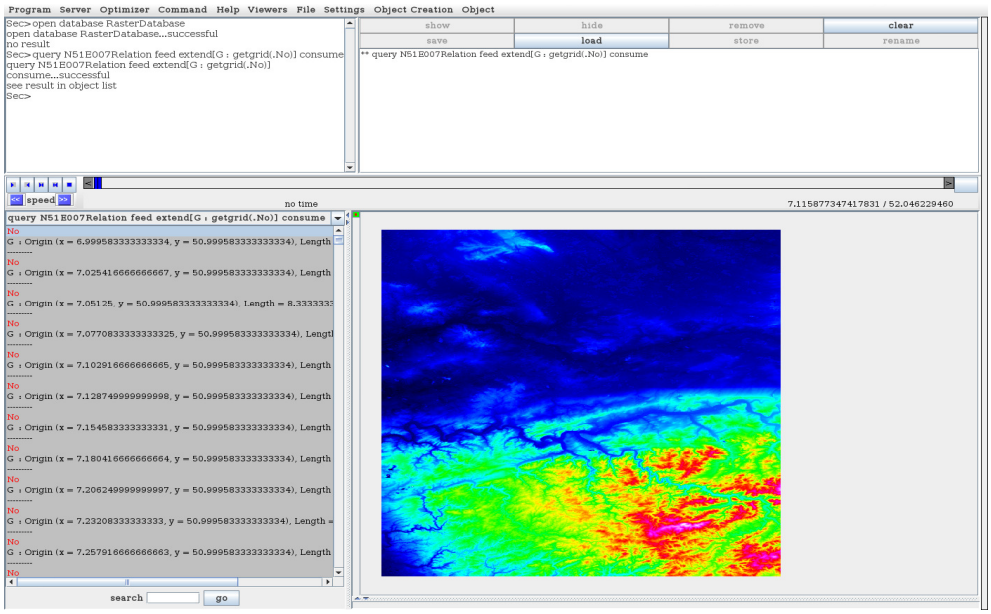


25. Display maximum value of all tiles of N51E007Relation by command query N51E007Relation feed extend[M : maximum(.No)] max[M].

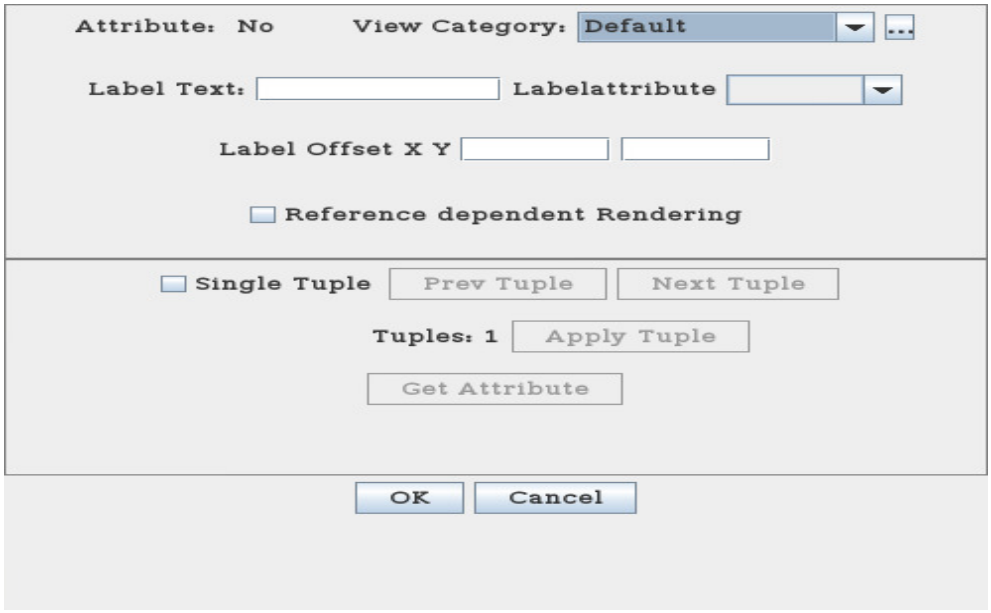


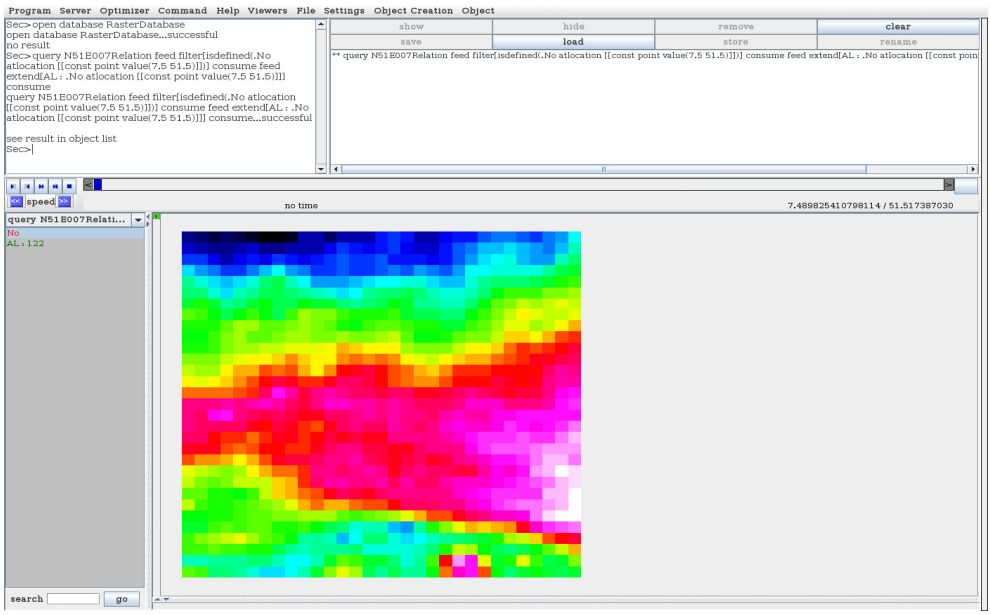
26. Display grid values of all tiles of N51E007Relation by command query N51E007Relation feed extend[G : getgrid(.No)] consume.



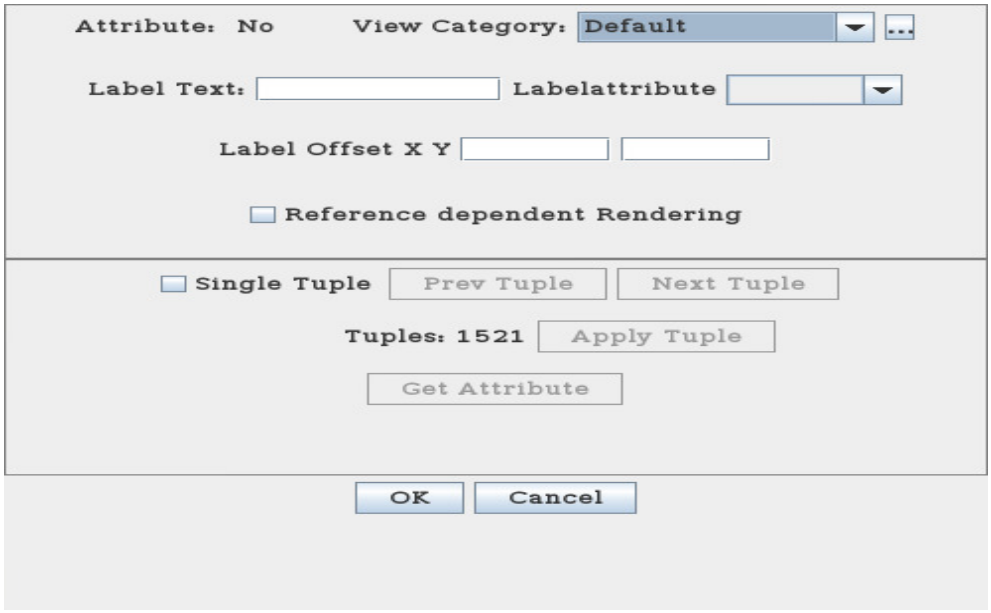


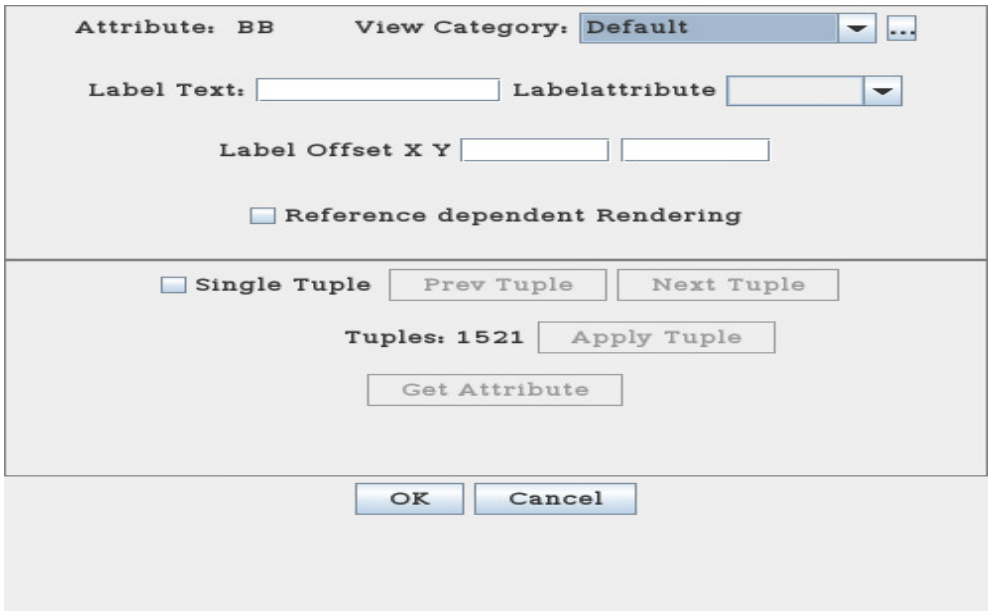
27. Display tile of N51E007Relation that contains a defined value at location x = 7.5 and y = 51.5 and display this value by command query N51E007Relation feed filter[isdefined(.No atlocation [[const point value(7.5 51.5)]])] consume feed extend[AL : .No atlocation [[const point value(7.5 51.5)]]] consume.

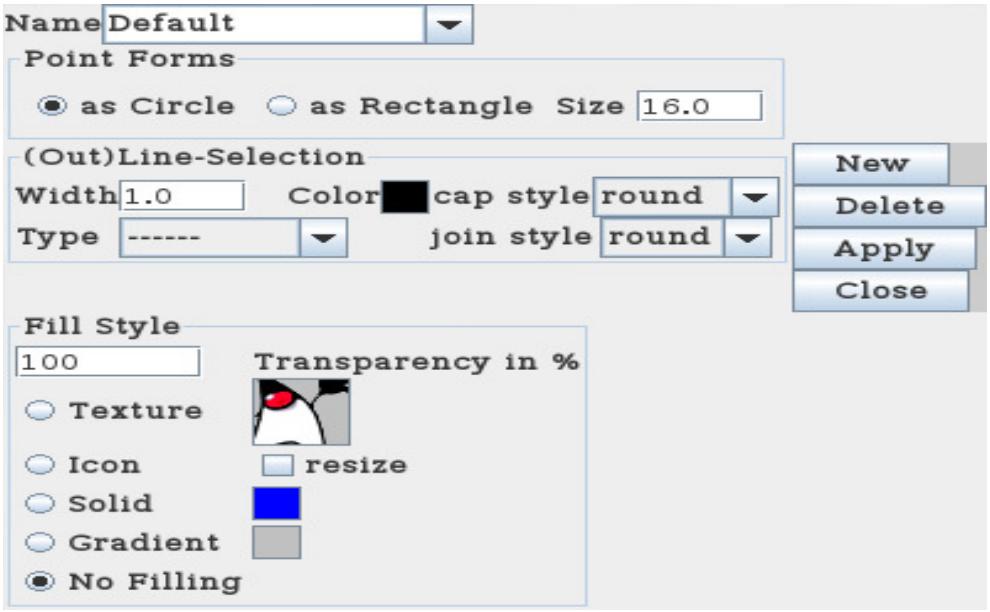


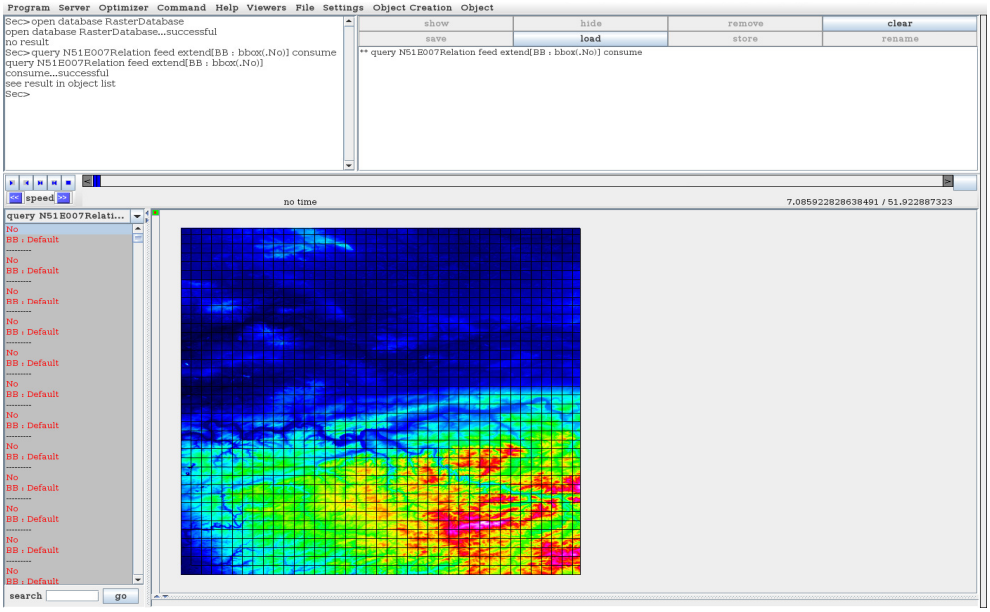


28. Display all tiles of N51E007Relation and corresponding bounding boxes by command query N51E007Relation feed extend[BB : bbox(.No)] consume.







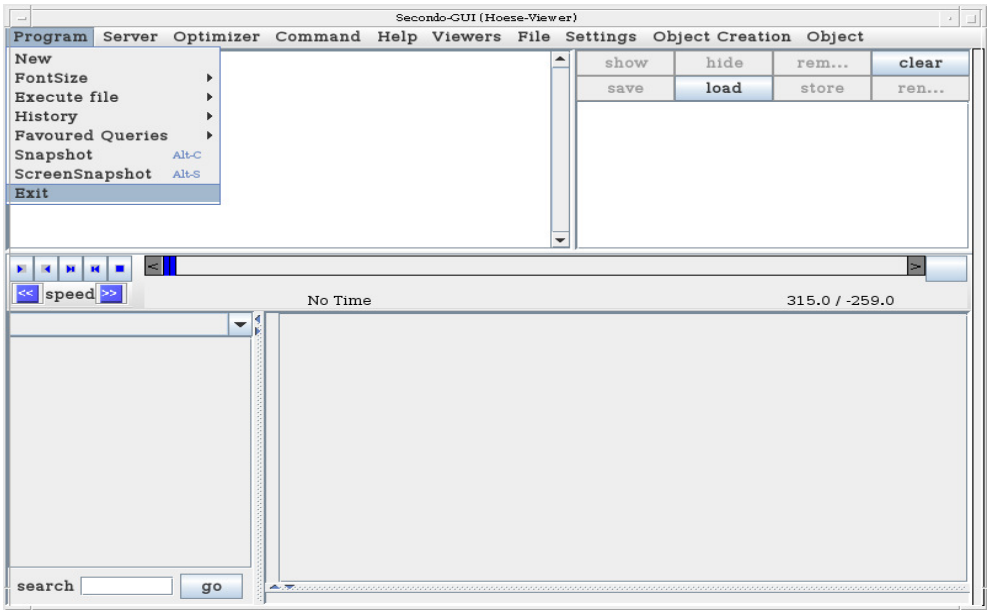


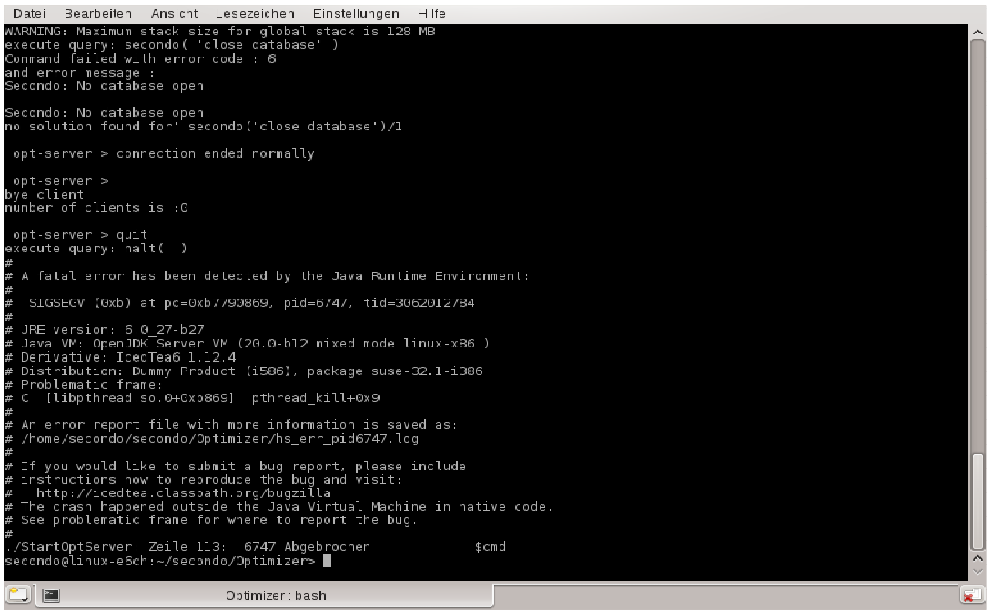
29. To get more information about the SECONDO system and available algebras, types and operations, execute the following commands at the command interface in the SECONDO GUI:

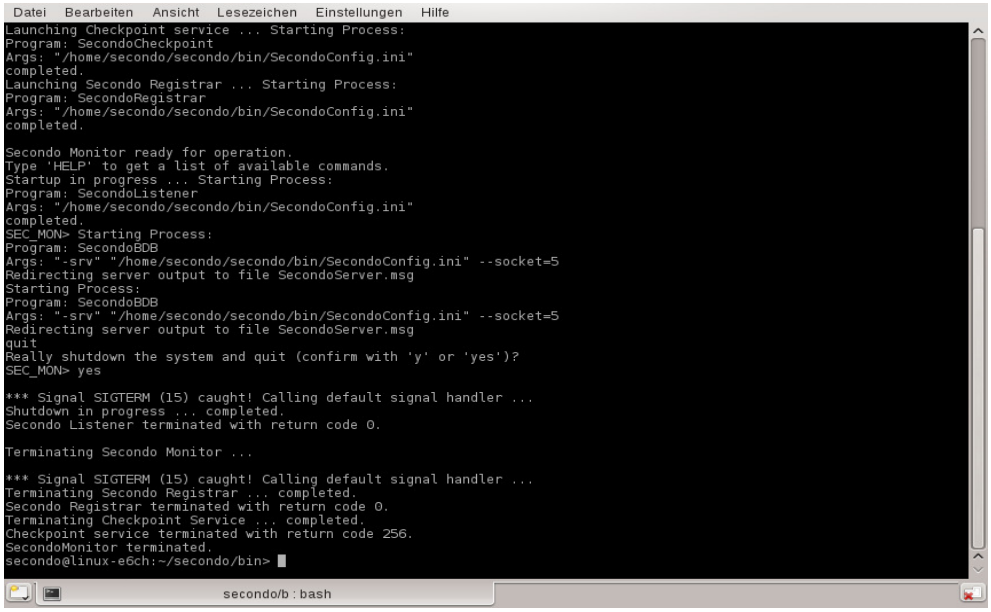
    list algebras
    list algebra Raster2Algebra
    list algebra TileAlgebra
    list type constructors
    list operators

    It is also possible to find a particular operator, for example, operator atlocation by command
    query SEC2OPERATORINFO feed filter[.Name contains “atlocation”] consume

30. Terminate SECONDO GUI by main menu command Program -> Exit, Secondo optimizer by command quit in the optimizer shell window and Secondo Monitor by command quit followed by yes in the SECONDO Monitor shell window.






Datei Bearbeiten Ansicht Lesezeichen Einstellungen Hilfe
Launching Checkpoint service ... Starting Process:
Program: SecondoCheckpoint
Args: "/home/secondo/secondo/bin/SecondoConfig.ini"
completed.
Launching Secondo Registrar ... Starting Process:
Program: SecondoRegistrar
Args: "/home/secondo/secondo/bin/SecondoConfig.ini"
completed.
Secondo Monitor ready for operation.
Type 'HELP' to get a list of available commands.
Startup in progress ... Starting Process:
Program: SecondoListener
Args: "/home/secondo/secondo/bin/SecondoConfig.ini"
completed.
SEC_MON> Starting Process:
Program: SecondoBDB
Args: "-srv" "/home/secondo/secondo/bin/SecondoConfig.ini" --socket=5
Redirecting server output to file SecondoServer.msg
Starting Process:
Program: SecondoBDB
Args: "-srv" "/home/secondo/secondo/bin/SecondoConfig.ini" --socket=5
Redirecting server output to file SecondoServer.msg
quit
Really shutdown the system and quit (confirm with 'y' or 'yes')?
SEC_MON> yes
*** Signal SIGTERM (15) caught! Calling default signal handler ...
Shutdown in progress ... completed.
Secondo Listener terminated with return code 0.
Terminating Secondo Monitor ...
*** Signal SIGTERM (15) caught! Calling default signal handler ...
Terminating Secondo Registrar ... completed.
Secondo Registrar terminated with return code 0.
Terminating Checkpoint Service ... completed.
Checkpoint service terminated with return code 256.
SecondoMonitor terminated.
secondo@linux-e6ch:~/secondo/bin>
secondo/b : bash

3 Reference Manual

3.1 Tile algebra data types

The following chapter describes all Tile algebra data types.
These data types can be classified into four data type categories:

grid data types
spatial data types
moving spatial data types
instant spatial data types

3.1.1 Grid data types

Tile algebra contains the following grid data types:

tgrid
mtgrid

Data type tgrid represents a 2-dimensional grid definition with x origin, y origin and the length of a grid cell.

Data type mtgrid represents a 3-dimensional grid definition with x origin, y origin, length of a grid cell and a duration value for the time dimension.

Operator toraster2 is executable on grid data types.

3.1.2 Spatial data types

Spatial data types contain values characterized by a x-coordinate and a y-coordinate. Square size of x-dimension and y-dimension of a spatial data types is restricted by the size of a memory page.

Tile algebra contains the following spatial data types:

tint
treal
tbool
tstring

Data type tint represents a tile of integer values of size 31 x 31 which are stored in a Flob and contains a tgrid object as 2-dimensional grid definition, a minimum value and a maximum value.

Data type treal represents a tile of double values of size 22 x 22 which are stored in a Flob and contains a tgrid object as 2-dimensional grid definition, a minimum value and a maximum value.

Data type tbool represents a tile of char values of size 63 x 63 which are stored in a Flob and contains a tgrid object as 2-dimensional grid definition, a minimum value and a maximum value.

Data type tstring represents a tile of string values of size 31 x 31 which are stored optimized as unique strings in a Flob and contains a tgrid object as 2-dimensional grid definition, a minimum value and a maximum value.

Operators atlocation, atrange, bbox, CELL1, CELL2, CELLS, getgrid, matchgrid, minimum, maximum, map, map2 and t2mt are executable on spatial data types.

3.1.3 Moving spatial data types

Moving spatial data types contain values characterized by a x-coordinate, a y-coordinate and a time-coordinate. Square size of x-dimension and y-dimension of a moving spatial data types is restricted by the size of a memory page. Size of time-dimension of a moving spatial data type has the constant value of 10.

Tile algebra contains the following moving spatial data types:

mtint
mtreal
mtbool
mtstring

Data type mtint represents a tile of integer values of size 31 x 31 x 10 which are stored in a Flob and contains a mtgrid object as 3-dimensional grid definition, a minimum value and a maximum value.

Data type mtreal represents a tile of double values of size 22 x 22 x 10 which are stored in a Flob and contains a mtgrid object as 3-dimensional grid definition, a minimum value and a maximum value.

Data type mtbool represents a tile of char values of size 63 x 63 x 10 which are stored in a Flob and contains a mtgrid object as 3-dimensional grid definition, a minimum value and a maximum value.

Data type mtstring represents a tile of string values of size 31 x 31 x 10 which are stored optimized as unique strings in a Flob and contains a mtgrid object as 3-dimensional grid definition, a minimum value and a maximum value.

Operators atinstant, atlocation, atperiods, atrange, bbox, CELL1, CELL2, CELLS, deftime, getgrid, matchgrid, minimum, maximum, map and map2 are executable on moving spatial data types.

3.1.4 Instant spatial data types

Instant spatial data types contain values characterized by a x-coordinate and a y-coordinate at corresponding instant value. Square size of x-dimension and y-dimension of an instant spatial data types is restricted by the size of a memory page.

Tile algebra contains the following instant spatial data types:

itint
itreal
itbool
itstring

Data type itint represents a tile of integer values of size 31 x 31 which are stored in a Flob and contains a tgrid object as 2-dimensional grid definition, a minimum value, a maximum value and a corresponding instant value.

Data type itreal represents a tile of double values of size 22 x 22 which are stored in a Flob and contains a tgrid object as 2-dimensional grid definition, a minimum value, a maximum value and a corresponding instant value.

Data type itbool represents a tile of char values of size 63 x 63 which are stored in a Flob and contains a tgrid object as 2-dimensional grid definition, a minimum value, a maximum value and a corresponding instant value.

Data type itstring represents a tile of string values of size 31 x 31 which are stored optimized as unique strings in a Flob and contains a tgrid object as 2-dimensional grid definition, a minimum value, a maximum value and a corresponding instant value.

Operators inst and val are executable on instant spatial data types.

3.2 Tile algebra operators

The following chapter describes all Tile algebra operators.

3.2.1 atinstant

Operator atinstant returns the values of a moving spatial data type object
for an instant time point in the form of an instant spatial data type object.

syntax:

_ atinstant _

signatures:

mtint × instant → itint
mtreal × instant → itreal
mtbool × instant → itbool
mtstring × instant → itstring

example:

query [const mtint value ((0.0 0.0 1.0 2.0) (2 2 2) (0 0 0 (0 1 2 3 4 5 6 7)))] atinstant
create_instant(2.0);

3.2.2 atlocation

Operator atlocation returns the value at a location point of a spatial data type object or the value(s) at a location point of a moving spatial data type object.

syntax:

_ atlocation [_, _]

signatures:

tint × point → int
treal × point → real
tbool × point → bool
tstring × point → string
mtint × point → mint
mtreal × point → mreal
mtbool × point → mbool
mtstring × point → mstring
mtint × point × instant → int
mtreal × point × instant → real
mtbool × point × instant → bool
mtstring × point × instant → string

examples:

query [const tint value ((0.0 0.0 1.0) (2 2) (0 0 (0 1 2 3)) (29 29 (4 5 6 7)))] atlocation [[const point value (1.5 1.5)]];

query [const mtint value ((0.0 0.0 1.0 1.0) (2 2 2) (0 0 0 (0 1 2 3 4 5 6 7)))] atlocation [[const point value (1.5 1.5)]];

query [const mtint value ((0.0 0.0 1.0 1.0) (2 2 1) (0 0 0 (0 1 2 3)) (29 29 9 (4 5 6 7)))] atlocation [[const point value (1.5 1.5)] , [const instant value "2000-01-03-00:00:00.001"]];

3.2.3 atperiods

Operator atperiods restricts the values of a moving spatial data type object to given periods.

syntax:

atperiods(_)

signatures:

mtint × periods → mtint
mtreal × periods → mtreal
mtbool × periods → mtbool
mtstring × periods → mtstring

example:

query [const mtint value ((2.0 2.0 1.0 2.0) (2 2 1) (0 0 0 (0 1 2 3)) (29 29 9 (4 5 6 7)))]
atperiods [const periods value (("2000-01-03" "2000-01-05" TRUE FALSE))];

3.2.4 atrange

Operator atrange returns the values at range of a rectangle of a spatial data type object, the values at range of a rectangle of a moving spatial data type object or the values at range of a rectangle, a begin instant value and an end instant value of a moving spatial data type object.

syntax:

_ atrange [_,_,_]

signatures:

tint × rect → tint
treal × rect → treal
tbool × rect → tbool
tstring × rect → tstring
mtint × rect → mtint
mtreal × rect → mtreal
mtbool × rect → mtbool
mtstring × rect → mtstring
mtint × rect × instant × instant → mtint
mtreal × rect × instant × instant → mtreal
mtbool × rect × instant × instant → mtbool
mtstring × rect × instant × instant → mtstring

examples:

query [const tint value ((2.0 2.0 1.0) (2 2) (0 0 (0 1 2 3)) (29 29 (4 5 6 7)))] atrange [[const rect value (3.0 31.0 3.0 31.0)]];

query [const mtint value ((2.0 2.0 1.0 1.0) (2 2 1) (0 0 0 (0 1 2 3)) (29 29 9 (4 5 6 7)))] atrange [[const rect value (3.0 31.0 3.0 31.0)]];

query [const mtint value ((2.0 2.0 1.0 1.0) (2 2 1) (0 0 0 (0 1 2 3)) (29 29 9 (4 5 6 7)))] atrange [[const rect value (2.5 31.5 2.5 31.5)], [const instant value "2000-01-03"], [const instant value "2000-01-04"]];

3.2.5 bbox

Operator bbox returns the bounding box rectangle of a spatial data type object or the bounding box rectangle of a moving spatial data type object.

syntax:

bbox(_)

signatures:

tint → rect
treal → rect
tbool → rect
tstring → rect
mtint → rect3
mtreal → rect3
mtbool → rect3
mtstring → rect3

examples:

query bbox([const tint value ((1.1 2.2 1.0) (2 2) (0 0 (0 1 2 3)) (28 28 (4 5 6 7)))]);

query bbox([const mtint value ((1.0 1.0 1.0 1.0) (2 2 1) (0 0 0 (0 1 2 3)) (8 8 9 (4 5 6 7)))]);

3.2.6 CELL1

Operator CELL1 is a type mapping operator.

signatures:

tint × ... → int
treal × ... → real
tbool × ... → bool
tstring × ... → string
mtint × ... → int
mtreal × ... → real
mtbool × ... → bool
mtstring × ... → string

example:

query [const tint value ((0.0 0.0 1.0) (1 1) (0 0 (1)))] map [fun(n: CELL1) n * 2];

3.2.7 CELL2

Operator CELL2 is a type mapping operator.

signatures:

tint × tint × ... → int
tint × treal × ... → real
tint × tbool × ... → bool
tint × tstring × ... → string
tint × mtint × ... → int
tint × mtreal × ... → real
tint × mtbool × ... → bool
tint × mtstring × ... → string
treal × tint × ... → int
treal × treal × ... → real
treal × tbool × ... → bool
treal × tstring × ... → string
treal × mtint × ... → int
treal × mtreal × ... → real
treal × mtbool × ... → bool
treal × mtstring × ... → string
tbool × tint × ... → int
tbool × treal × ... → real
tbool × tbool × ... → bool
tbool × tstring × ... → string
tbool × mtint × ... → int
tbool × mtreal × ... → real
tbool × mtbool × ... → bool
tbool × mtstring × ... → string
tstring × tint × ... → int
tstring × treal × ... → real
tstring × tbool × ... → bool
tstring × tstring × ... → string
tstring × mtint × ... → int
tstring × mtreal × ... → real
tstring × mtbool × ... → bool
tstring × mtstring × ... → string

mtint × tint × ... → int
mtint × treal × ... → real
mtint × tbool × ... → bool
mtint × tstring × ... → string
mtint × mtint × ... → int
mtint × mtreal × ... → real
mtint × mtbool × ... → bool
mtint × mtstring × ... → string
mtreal × tint × ... → int
mtreal × treal × ... → real
mtreal × tbool × ... → bool
mtreal × tstring × ... → string
mtreal × mtint × ... → int
mtreal × mtreal × ... → real
mtreal × mtbool × ... → bool
mtreal × mtstring × ... → string
mtbool × tint × ... → int
mtbool × treal × ... → real
mtbool × tbool × ... → bool
mtbool × tstring × ... → string
mtbool × mtint × ... → int
mtbool × mtreal × ... → real
mtbool × mtbool × ... → bool
mtbool × mtstring × ... → string
mtstring × tint × ... → int
mtstring × treal × ... → real
mtstring × tbool × ... → bool
mtstring × tstring × ... → string
mtstring × mtint × ... → int
mtstring × mtreal × ... → real
mtstring × mtbool × ... → bool
mtstring × mtstring × ... → string

example:

query [const tint value ((0.0 0.0 1.0) (1 1) (0 0 (1)))] [const tint value ((0.0 0.0 1.0) (1 1) (0 0 (1)))] map2 [fun(n: int, m: CELL2) n + m];

3.2.8 CELLS

Operator CELLS is a type mapping operator.

signatures:

tint × ... → rel(tuple([Elem : int]))
treal × ... → rel(tuple([Elem : real]))
tbool × ... → rel(tuple([Elem : bool]))
tstring × ... → rel(tuple([Elem : string]))
mtint × ... → rel(tuple([Elem : int]))
mtreal × ... → rel(tuple([Elem : real]))
mtbool × ... → rel(tuple([Elem : bool]))
mtstring × ... → rel(tuple([Elem : string]))

example:

query [const tint value ((0.0 0.0 1.0) (1 1) (0 0 (1)))] matchgrid[[const tgrid value (0.0 0.0 0.5)], fun(c: CELLS) c feed avg[Elem], FALSE];

3.2.9 compose

Operator compose merges a mpoint object and a spatial data type object into a moving data type object.

syntax:

_ compose _

signatures:

mpoint × tint → mint
mpoint × treal → mreal
mpoint × tbool → mbool
mpoint × tstring → mstring
mpoint × mtint → mint
mpoint × mtreal → mreal
mpoint × mtbool → mbool
mpoint × mtstring → mstring

example:

query [const mpoint value ((("2000-01-03-00:00:00.000" "2000-01-05-00:00:00.000" TRUE FALSE) (0.5 0.5 1.5 1.5)) (("2000-01-05-00:00:00.000" "2000-01-07-00:00:00.000" TRUE FALSE) (10.5 10.5 10.0 10.0)) (("2000-01-07-00:00:00.000" "2000-01-09-00:00:00.000" TRUE FALSE) (1.0 1.0 0.5 0.5)))] compose [const tint value ((0.0 0.0 1.0) (2 2) (0 0 (0 1 2 3)) (2 2 (4 5 6 7)))];

3.2.10 deftime

Operator deftime returns the defined periods of a moving spatial data type object.

syntax:

deftime(_)

signatures:

mtint → periods
mtreal → periods
mtbool → periods
mtstring → periods

example:

query deftime([const mtint value ((0.0 0.0 1.0 1.0) (1 1 1) (0 0 0 (1)) (1 1 1 (1)))]);

3.2.11 fromline

Operator fromline creates a stream of tbool objects from a line object and a tgrid object.

syntax:

fromline(_,_)

signature:

line × tgrid → stream(tbool)

example:

query fromline([const line value ((64.0 14.2 284 44.2))], [const tgrid value (10.0 10.0 2.0)]) count;

3.2.12 fromregion

Operator fromregion creates a stream of tbool objects from a region object and a tgrid object.

syntax:

fromregion(_,_)

signature:

region × tgrid → stream(tbool)

example:

query fromregion([const region value ((((0.0 1.0) (1.0 0.0) (2.0 0.0) (3.0 1.0) (3.0 2.0) (2.0 3.0) (1.0 3.0) (0.0 2.0) (0.0 1.0))))], [const tgrid value (0.0 0.0 1.0)]) count

3.2.13 getgrid

Operator getgrid returns the tgrid object of a spatial data type object or the mtgrid object of a moving spatial data type object.

syntax:

getgrid(_)

signatures:

tint → tgrid
treal → tgrid
tbool → tgrid
tstring → tgrid
mtint → mtgrid
mtreal → mtgrid
mtbool → mtgrid
mtstring → mtgrid

examples:

query getgrid([const tint value ((0.0 1.0 2.0) (2 2) (0 0 (0 1 2 3)) (29 29 (4 5 6 7)))]);

query getgrid([const mtint value ((0.0 1.0 2.0 3.0) (2 2 1) (0 0 0 (0 1 2 3)) (29 29 9 (4 5 6 7)))]);

3.2.14 inst

Operator inst returns the instant value of an instant spatial data type object.

syntax:

inst(_)

signatures:

itint → instant
itreal → instant
itbool → instant
itstring → instant

example:

query inst([const itint value ((instant "2013-05-13") ((0.0 0.0 1.0) (2 2) (0 0 (0 1 2 3)) (29 29 (4 5 6 7))))]);

3.2.15 map

Operator map maps a spatial data type object to another spatial data type object or a moving spatial data type object to another moving spatial data type object.

syntax:

_ map[_]

signatures:

tint × (int → int) → tint
tint × (int → real) → treal
tint × (int → bool) → tbool
tint × (int → string) → tstring
treal × (real → int) → tint
treal × (real → real) → treal
treal × (real → bool) → tbool
treal × (real → string) → tstring
tbool × (bool → int) → tint
tbool × (bool → real) → treal
tbool × (bool → bool) → tbool
tbool × (bool → string) → tstring
tstring × (string → int) → tint
tstring × (string → real) → treal
tstring × (string → bool) → tbool
tstring × (string → string) → tstring
mtint × (int → int) → mtint
mtint × (int → real) → mtreal
mtint × (int → bool) → mtbool
mtint × (int → string) → mtstring
mtreal × (real → int) → mtint
mtreal × (real → real) → mtreal
mtreal × (real → bool) → mtbool
mtreal × (real → string) → mtstring
mtbool × (bool → int) → mtint
mtbool × (bool → real) → mtreal
mtbool × (bool → bool) → mtbool
mtbool × (bool → string) → mtstring
mtstring × (string → int) → mtint
mtstring × (string → real) → mtreal
mtstring × (string → bool) → mtbool
mtstring × (string → string) → mtstring

example:

query [const tint value ((0.0 0.0 1.0) (1 1) (0 0 (1)))] map [. * 2];

3.2.16 map2

Operator map2 combines a spatial data type object and a spatial data type object to a new spatial data type object, a spatial data type object and a moving spatial data type object to a new moving spatial data type object, a moving spatial data type object and a spatial data type object to a new moving spatial data type object or a moving spatial data type object and a moving spatial data type object to a new moving spatial data type object.

syntax:

_ _ map2[_]

signatures:

tint × tint × (int × int → int) → tint
tint × tint × (int × int → real) → treal
tint × tint × (int × int → bool) → tbool
tint × tint × (int × int → string) → tstring
tint × treal × (int × real → int) → tint
tint × treal × (int × real → real) → treal
tint × treal × (int × real → bool) → tbool
tint × treal × (int × real → string) → tstring
tint × tbool × (int × bool → int) → tint
tint × tbool × (int × bool → real) → treal
tint × tbool × (int × bool → bool) → tbool
tint × tbool × (int × bool → string) → tstring
tint × tstring × (int × string → int) → tint
tint × tstring × (int × string → real) → treal
tint × tstring × (int × string → bool) → tbool
tint × tstring × (int × string → string) → tstring
treal × tint × (real × int → int) → tint
treal × tint × (real × int → real) → treal
treal × tint × (real × int → bool) → tbool
treal × tint × (real × int → string) → tstring
treal × treal × (real × real → int) → tint
treal × treal × (real × real → real) → treal
treal × treal × (real × real → bool) → tbool
treal × treal × (real × real → string) → tstring
treal × tbool × (real × bool → int) → tint
treal × tbool × (real × bool → real) → treal
treal × tbool × (real × bool → bool) → tbool
treal × tbool × (real × bool → string) → tstring
treal × tstring × (real × string → int) → tint
treal × tstring × (real × string → real) → treal
treal × tstring × (real × string → bool) → tbool
treal × tstring × (real × string → string) → tstring

tbool × tint × (bool × int → int) → tint
tbool × tint × (bool × int → real) → treal
tbool × tint × (bool × int → bool) → tbool
tbool × tint × (bool × int → string) → tstring
tbool × treal × (bool × real → int) → tint
tbool × treal × (bool × real → real) → treal
tbool × treal × (bool × real → bool) → tbool
tbool × treal × (bool × real → string) → tstring
tbool × tbool × (bool × bool → int) → tint
tbool × tbool × (bool × bool → real) → treal
tbool × tbool × (bool × bool → bool) → tbool
tbool × tbool × (bool × bool → string) → tstring
tbool × tstring × (bool × string → int) → tint
tbool × tstring × (bool × string → real) → treal
tbool × tstring × (bool × string → bool) → tbool
tbool × tstring × (bool × string → string) → tstring
tstring × tint × (string × int → int) → tint
tstring × tint × (string × int → real) → treal
tstring × tint × (string × int → bool) → tbool
tstring × tint × (string × int → string) → tstring
tstring × treal × (string × real → int) → tint
tstring × treal × (string × real → real) → treal
tstring × treal × (string × real → bool) → tbool
tstring × treal × (string × real → string) → tstring
tstring × tbool × (string × bool → int) → tint
tstring × tbool × (string × bool → real) → treal
tstring × tbool × (string × bool → bool) → tbool
tstring × tbool × (string × bool → string) → tstring
tstring × tstring × (string × string → int) → tint
tstring × tstring × (string × string → real) → treal
tstring × tstring × (string × string → bool) → tbool
tstring × tstring × (string × string → string) → tstring
tint × mtint × (int × int → int) → mtint
tint × mtint × (int × int → real) → mtreal
tint × mtint × (int × int → bool) → mtbool
tint × mtint × (int × int → string) → mtstring
tint × mtreal × (int × real → int) → mtint
tint × mtreal × (int × real → real) → mtreal
tint × mtreal × (int × real → bool) → mtbool
tint × mtreal × (int × real → string) → mtstring
tint × mtbool × (int × bool → int) → mtint
tint × mtbool × (int × bool → real) → mtreal
tint × mtbool × (int × bool → bool) → mtbool
tint × mtbool × (int × bool → string) → mtstring
tint × mtstring × (int × string → int) → mtint
tint × mtstring × (int × string → real) → mtreal
tint × mtstring × (int × string → bool) → mtbool
tint × mtstring × (int × string → string) → mtstring

treal × mtint × (real × int → int) → mtint
treal × mtint × (real × int → real) → mtreal
treal × mtint × (real × int → bool) → mtbool
treal × mtint × (real × int → string) → mtstring
treal × mtreal × (real × real → int) → mtint
treal × mtreal × (real × real → real) → mtreal
treal × mtreal × (real × real → bool) → mtbool
treal × mtreal × (real × real → string) → mtstring
treal × mtbool × (real × bool → int) → mtint
treal × mtbool × (real × bool → real) → mtreal
treal × mtbool × (real × bool → bool) → mtbool
treal × mtbool × (real × bool → string) → mtstring
treal × mtstring × (real × string → int) → mtint
treal × mtstring × (real × string → real) → mtreal
treal × mtstring × (real × string → bool) → mtbool
treal × mtstring × (real × string → string) → mtstring
tbool × mtint × (bool × int → int) → mtint
tbool × mtint × (bool × int → real) → mtreal
tbool × mtint × (bool × int → bool) → mtbool
tbool × mtint × (bool × int → string) → mtstring
tbool × mtreal × (bool × real → int) → mtint
tbool × mtreal × (bool × real → real) → mtreal
tbool × mtreal × (bool × real → bool) → mtbool
tbool × mtreal × (bool × real → string) → mtstring
tbool × mtbool × (bool × bool → int) → mtint
tbool × mtbool × (bool × bool → real) → mtreal
tbool × mtbool × (bool × bool → bool) → mtbool
tbool × mtbool × (bool × bool → string) → mtstring
tbool × mtstring × (bool × string → int) → mtint
tbool × mtstring × (bool × string → real) → mtreal
tbool × mtstring × (bool × string → bool) → mtbool
tbool × mtstring × (bool × string → string) → mtstring
tstring × mtint × (string × int → int) → mtint
tstring × mtint × (string × int → real) → mtreal
tstring × mtint × (string × int → bool) → mtbool
tstring × mtint × (string × int → string) → mtstring
tstring × mtreal × (string × real → int) → mtint
tstring × mtreal × (string × real → real) → mtreal
tstring × mtreal × (string × real → bool) → mtbool
tstring × mtreal × (string × real → string) → mtstring
tstring × mtbool × (string × bool → int) → mtint
tstring × mtbool × (string × bool → real) → mtreal
tstring × mtbool × (string × bool → bool) → mtbool
tstring × mtbool × (string × bool → string) → mtstring
tstring × mtstring × (string × string → int) → mtint
tstring × mtstring × (string × string → real) → mtreal
tstring × mtstring × (string × string → bool) → mtbool
tstring × mtstring × (string × string → string) → mtstring

mtint × tint × (int × int → int) → mtint
mtint × tint × (int × int → real) → mtreal
mtint × tint × (int × int → bool) → mtbool
mtint × tint × (int × int → string) → mtstring
mtint × treal × (int × real → int) → mtint
mtint × treal × (int × real → real) → mtreal
mtint × treal × (int × real → bool) → mtbool
mtint × treal × (int × real → string) → mtstring
mtint × tbool × (int × bool → int) → mtint
mtint × tbool × (int × bool → real) → mtreal
mtint × tbool × (int × bool → bool) → mtbool
mtint × tbool × (int × bool → string) → mtstring
mtint × tstring × (int × string → int) → mtint
mtint × tstring × (int × string → real) → mtreal
mtint × tstring × (int × string → bool) → mtbool
mtint × tstring × (int × string → string) → mtstring
mtreal × tint × (real × int → int) → mtint
mtreal × tint × (real × int → real) → mtreal
mtreal × tint × (real × int → bool) → mtbool
mtreal × tint × (real × int → string) → mtstring
mtreal × treal × (real × real → int) → mtint
mtreal × treal × (real × real → real) → mtreal
mtreal × treal × (real × real → bool) → mtbool
mtreal × treal × (real × real → string) → mtstring
mtreal × tbool × (real × bool → int) → mtint
mtreal × tbool × (real × bool → real) → mtreal
mtreal × tbool × (real × bool → bool) → mtbool
mtreal × tbool × (real × bool → string) → mtstring
mtreal × tstring × (real × string → int) → mtint
mtreal × tstring × (real × string → real) → mtreal
mtreal × tstring × (real × string → bool) → mtbool
mtreal × tstring × (real × string → string) → mtstring
mtbool × tint × (bool × int → int) → mtint
mtbool × tint × (bool × int → real) → mtreal
mtbool × tint × (bool × int → bool) → mtbool
mtbool × tint × (bool × int → string) → mtstring
mtbool × treal × (bool × real → int) → mtint
mtbool × treal × (bool × real → real) → mtreal
mtbool × treal × (bool × real → bool) → mtbool
mtbool × treal × (bool × real → string) → mtstring
mtbool × tbool × (bool × bool → int) → mtint
mtbool × tbool × (bool × bool → real) → mtreal
mtbool × tbool × (bool × bool → bool) → mtbool
mtbool × tbool × (bool × bool → string) → mtstring
mtbool × tstring × (bool × string → int) → mtint
mtbool × tstring × (bool × string → real) → mtreal
mtbool × tstring × (bool × string → bool) → mtbool
mtbool × tstring × (bool × string → string) → mtstring

mtstring × tint × (string × int → int) → mtint
mtstring × tint × (string × int → real) → mtreal
mtstring × tint × (string × int → bool) → mtbool
mtstring × tint × (string × int → string) → mtstring
mtstring × treal × (string × real → int) → mtint
mtstring × treal × (string × real → real) → mtreal
mtstring × treal × (string × real → bool) → mtbool
mtstring × treal × (string × real → string) → mtstring
mtstring × tbool × (string × bool → int) → mtint
mtstring × tbool × (string × bool → real) → mtreal
mtstring × tbool × (string × bool → bool) → mtbool
mtstring × tbool × (string × bool → string) → mtstring
mtstring × tstring × (string × string → int) → mtint
mtstring × tstring × (string × string → real) → mtreal
mtstring × tstring × (string × string → bool) → mtbool
mtstring × tstring × (string × string → string) → mtstring
mtint × mtint × (int × int → int) → mtint
mtint × mtint × (int × int → real) → mtreal
mtint × mtint × (int × int → bool) → mtbool
mtint × mtint × (int × int → string) → mtstring
mtint × mtreal × (int × real → int) → mtint
mtint × mtreal × (int × real → real) → mtreal
mtint × mtreal × (int × real → bool) → mtbool
mtint × mtreal × (int × real → string) → mtstring
mtint × mtbool × (int × bool → int) → mtint
mtint × mtbool × (int × bool → real) → mtreal
mtint × mtbool × (int × bool → bool) → mtbool
mtint × mtbool × (int × bool → string) → mtstring
mtint × mtstring × (int × string → int) → mtint
mtint × mtstring × (int × string → real) → mtreal
mtint × mtstring × (int × string → bool) → mtbool
mtint × mtstring × (int × string → string) → mtstring
mtreal × mtint × (real × int → int) → mtint
mtreal × mtint × (real × int → real) → mtreal
mtreal × mtint × (real × int → bool) → mtbool
mtreal × mtint × (real × int → string) → mtstring
mtreal × mtreal × (real × real → int) → mtint
mtreal × mtreal × (real × real → real) → mtreal
mtreal × mtreal × (real × real → bool) → mtbool
mtreal × mtreal × (real × real → string) → mtstring
mtreal × mtbool × (real × bool → int) → mtint
mtreal × mtbool × (real × bool → real) → mtreal
mtreal × mtbool × (real × bool → bool) → mtbool
mtreal × mtbool × (real × bool → string) → mtstring
mtreal × mtstring × (real × string → int) → mtint
mtreal × mtstring × (real × string → real) → mtreal
mtreal × mtstring × (real × string → bool) → mtbool
mtreal × mtstring × (real × string → string) → mtstring

mtbool × mtint × (bool × int → int) → mtint
mtbool × mtint × (bool × int → real) → mtreal
mtbool × mtint × (bool × int → bool) → mtbool
mtbool × mtint × (bool × int → string) → mtstring
mtbool × mtreal × (bool × real → int) → mtint
mtbool × mtreal × (bool × real → real) → mtreal
mtbool × mtreal × (bool × real → bool) → mtbool
mtbool × mtreal × (bool × real → string) → mtstring
mtbool × mtbool × (bool × bool → int) → mtint
mtbool × mtbool × (bool × bool → real) → mtreal
mtbool × mtbool × (bool × bool → bool) → mtbool
mtbool × mtbool × (bool × bool → string) → mtstring
mtbool × mtstring × (bool × string → int) → mtint
mtbool × mtstring × (bool × string → real) → mtreal
mtbool × mtstring × (bool × string → bool) → mtbool
mtbool × mtstring × (bool × string → string) → mtstring
mtstring × mtint × (string × int → int) → mtint
mtstring × mtint × (string × int → real) → mtreal
mtstring × mtint × (string × int → bool) → mtbool
mtstring × mtint × (string × int → string) → mtstring
mtstring × mtreal × (string × real → int) → mtint
mtstring × mtreal × (string × real → real) → mtreal
mtstring × mtreal × (string × real → bool) → mtbool
mtstring × mtreal × (string × real → string) → mtstring
mtstring × mtbool × (string × bool → int) → mtint
mtstring × mtbool × (string × bool → real) → mtreal
mtstring × mtbool × (string × bool → bool) → mtbool
mtstring × mtbool × (string × bool → string) → mtstring
mtstring × mtstring × (string × string → int) → mtint
mtstring × mtstring × (string × string → real) → mtreal
mtstring × mtstring × (string × string → bool) → mtbool
mtstring × mtstring × (string × string → string) → mtstring

examples:

query [const tint value ((0.0 0.0 1.0) (1 1) (0 0 (1)))] [const tint value ((0.0 0.0 1.0) (1 1) (0 0 (1)))] map2 [fun(n: int, m: int) n + m];

query [const tint value ((0.0 0.0 1.0) (1 1) (0 0 (1)))] [const mtint value ((0.0 0.0 1.0 1.0) (1 1 1) (0 0 0 (1)) (0 0 9 (1)))] map2 [fun(n: int, m: int) n + m];

query [const mtint value ((0.0 0.0 1.0 1.0) (1 1 1) (0 0 0 (1)) (0 0 9 (1)))] [const tint value ((0.0 0.0 1.0) (1 1) (0 0 (1)))] map2 [fun(n: int, m: int) n + m];

query [const mtint value ((0.0 0.0 1.0 1.0) (1 1 1) (0 0 0 (1)) (0 0 9 (1)))] [const mtint value ((0.0 0.0 1.0 1.0) (1 1 1) (0 0 0 (1)) (0 0 9 (1)))] map2 [fun(n: int, m: int) n + m];

3.2.17 matchgrid

Operator matchgrid applies a user function to a spatial data type object or a moving spatial data type object.

syntax:

_ matchgrid [_, _, _]

signatures:

tint × tgrid × (rel(tuple([Elem : int])) → int) × bool → tint
tint × tgrid × (rel(tuple([Elem : int])) → real) × bool → treal
tint × tgrid × (rel(tuple([Elem : int])) → bool) × bool → tbool
tint × tgrid × (rel(tuple([Elem : int])) → string) × bool → tstring
treal × tgrid × (rel(tuple([Elem : real])) → int) × bool → tint
treal × tgrid × (rel(tuple([Elem : real])) → real) × bool → treal
treal × tgrid × (rel(tuple([Elem : real])) → bool) × bool → tbool
treal × tgrid × (rel(tuple([Elem : real])) → string) × bool → tstring
tbool × tgrid × (rel(tuple([Elem : bool])) → int) × bool → tint
tbool × tgrid × (rel(tuple([Elem : bool])) → real) × bool → treal
tbool × tgrid × (rel(tuple([Elem : bool])) → bool) × bool → tbool
tbool × tgrid × (rel(tuple([Elem : bool])) → string) × bool → tstring
tstring × tgrid × (rel(tuple([Elem : string])) → int) × bool → tint
tstring × tgrid × (rel(tuple([Elem : string])) → real) × bool → treal
tstring × tgrid × (rel(tuple([Elem : string])) → bool) × bool → tbool
tstring × tgrid × (rel(tuple([Elem : string])) → string) × bool → tstring
mtint × mtgrid × (rel(tuple([Elem : int])) → int) × bool → mtint
mtint × mtgrid × (rel(tuple([Elem : int])) → real) × bool → mtreal
mtint × mtgrid × (rel(tuple([Elem : int])) → bool) × bool → mtbool
mtint × mtgrid × (rel(tuple([Elem : int])) → string) × bool → mtstring
mtreal × mtgrid × (rel(tuple([Elem : real])) → int) × bool → mtint
mtreal × mtgrid × (rel(tuple([Elem : real])) → real) × bool → mtreal
mtreal × mtgrid × (rel(tuple([Elem : real])) → bool) × bool → mtbool
mtreal × mtgrid × (rel(tuple([Elem : real])) → string) × bool → mtstring
mtbool × mtgrid × (rel(tuple([Elem : bool])) → int) × bool → mtint
mtbool × mtgrid × (rel(tuple([Elem : bool])) → real) × bool → mtreal
mtbool × mtgrid × (rel(tuple([Elem : bool])) → bool) × bool → mtbool
mtbool × mtgrid × (rel(tuple([Elem : bool])) → string) × bool → mtstring
mtstring × mtgrid × (rel(tuple([Elem : string])) → int) × bool → mtint
mtstring × mtgrid × (rel(tuple([Elem : string])) → real) × bool → mtreal
mtstring × mtgrid × (rel(tuple([Elem : string])) → bool) × bool → mtbool
mtstring × mtgrid × (rel(tuple([Elem : string])) → string) × bool → mtstring

examples:

query [const tint value ((0.0 0.0 1.0) (1 1) (0 0 (1)))] matchgrid[[const tgrid value (0.0 0.0 0.5)], fun(cell: rel(tuple([Elem : int]))) cell feed avg[Elem], FALSE];

query [const mtint value ((0.0 0.0 1.0 2.0) (1 1 1) (0 0 0 (1)))] matchgrid[[const mtgrid value (0.0 0.0 0.5 (duration (1 0)))], fun(cell: rel(tuple([Elem : int]))) cell feed avg[Elem], FALSE];

3.2.18 maximum

Operator maximum returns the maximum value of a spatial data type object or a moving spatial data type object.

syntax:

maximum(_)

signatures:

tint → int
treal → real
tbool → bool
tstring → string
mtint → int
mtreal → real
mtbool → bool
mtstring → string

examples:

query maximum([const tint value ((0.0 0.0 1.0) (2 2) (0 0 (0 1 2 3)) (29 29 (4 5 6 7)))]);

query maximum([const mtint value ((0.0 0.0 1.0 1.0) (2 2 1) (0 0 0 (0 1 2 3)) (29 29 9 (4 5 6 7)))]);

3.2.19 minimum

Operator minimum returns the minimum value of a spatial data type object or a moving spatial data type object.

syntax:

minimum(_)

signatures:

tint → int
treal → real
tbool → bool
tstring → string
mtint → int
mtreal → real
mtbool → bool
mtstring → string

examples:

query minimum([const tint value ((0.0 0.0 1.0) (2 2) (0 0 (0 1 2 3)) (29 29 (4 5 6 7)))]);

query minimum([const mtint value ((0.0 0.0 1.0 1.0) (2 2 1) (0 0 0 (0 1 2 3)) (29 29 9 (4 5 6 7)))]);

3.2.20 t2mt

Operator t2mt adds a time dimension to a spatial data type object and returns resulting moving spatial data type object.

syntax:

t2mt(_, _, _, _)

signatures:

tint × duration × instant × instant → mtint
treal × duration × instant × instant → mtreal
tbool × duration × instant × instant → mtbool
tstring × duration × instant × instant → mtstring

example:

query t2mt([const tint value ((0.0 0.0 1.0) (1 1) (0 0 (1)))], [const duration value (0 43200000)], [const instant value "2000-01-03"], [const instant value "2000-01-04"]);

3.2.21 tiles

Operator tiles converts a Raster2 algebra grid2 object to a Tile algebra tgrid object,
a Raster2 algebra grid3 object to a Tile algebra mtgrid object,
a Raster2 algebra spatial data type object to a stream of Tile algebra spatial data type objects,
a Raster2 algebra moving spatial data type object to a stream of Tile algebra moving spatial data type objects or a Raster2 algebra instant spatial data type object to a stream of Tile algebra instant spatial data type objects.

syntax:

tiles(_)

signatures:

grid2 → tgrid
grid3 → mtgrid
sint → stream(tint)
sreal → stream(treal)
sbool → stream(tbool)
sstring → stream(tstring)
msint → stream(mtint)
msreal → stream(mtreal)
msbool → stream(mtbool)
msstring → stream(mtstring)
isint → stream(itint)
isreal → stream(itreal)
isbool → stream(itbool)
isstring → stream(itstring)

examples:

query tiles([const grid2 value (1.2 3.4 5.6)]);

query tiles([const grid3 value (1.2 3.4 5.6 (duration (7 0)))]);

query tiles([const sint value ((0.0 0.0 1.0) (2 2) (0 0 (0 1 2 3)) (60 60 (4 5 6 7)))]) count;

query tiles([const msint value ((0.0 0.0 1.0 1.0) (2 2 1) (0 0 0 (0 1 2 3)) (60 60 9 (4 5 6 7)))]) count;

query tiles([const isint value ((instant "2013-05-13") ((0.0 0.0 1.0) (2 2) (0 0 (0 1 2 3)) (60 60 (4 5 6 7))))]) count;

3.2.22 toraster2

Operator toraster2 converts a Tile algebra tgrid object to a Raster2 algebra grid2 object,
a Tile algebra mtgrid object to a Raster2 algebra grid3 object,
a stream of Tile algebra spatial data type objects to a Raster2 algebra spatial data type object,
a stream of Tile algebra moving spatial data type objects to a Raster2 algebra moving spatial
data type object or a stream of Tile algebra instant spatial data type objects to
a Raster2 algebra instant spatial data type object.

syntax:

toraster2(_)

signatures:

tgrid → grid2
mtgrid → grid3
stream(tint) → sint
stream(treal) → sreal
stream(tbool) → sbool
stream(tstring) → sstring
stream(mtint) → msint
stream(mtreal) → msreal
stream(mtbool) → msbool
stream(mtstring) → msstring
stream(itint) → isint
stream(itreal) → isreal
stream(itbool) → isbool
stream(itstring) → isstring

examples:

query toraster2([const tgrid value (1.2 3.4 5.6)]);

query toraster2([const mtgrid value (1.2 3.4 5.6 (duration (7 0)))]);

query toraster2(tiles([const sint value ((-10.0 -10.0 1.0) (1 1) (0 0 (0)) (31 0 (1)) (0 31 (2)) (61 61 (3)))]));

query toraster2(tiles([const msint value ((-10.0 -10.0 1.0 1.0) (1 1 1) (0 0 0 (0)) (10 0 0 (1)) (0 10 0 (2)) (19 19 9 (3)))]));

query toraster2(tiles([const isint value ((instant "2013-05-13") ((-10.0 -10.0 1.0) (1 1) (0 0 (0)) (31 0 (1)) (0 31 (2)) (61 61 (3))))]));

3.2.23 toregion

Operator toregion maps a tbool object to a region object.

syntax:

_ toregion

signature:

tbool → region

3.2.24 val

Operator val returns the spatial data type object of an instant spatial data type object.

syntax:

val(_)

signatures:

itint → tint
itreal → treal
itbool → tbool
itstring → tstring

example:

query val([const itint value ((instant "2013-05-13") ((0.0 0.0 1.0) (2 2) (0 0 (0 1 2 3)) (29 29 (4 5 6 7))))]);

References

[BT12] Betreuerteam
Rasterdaten in Secondo, Aufgabenbeschreibung Phase 2
FernUniversität Hagen, November 2012

[G11] Ralf Hartmut Güting
A Short Guide to Writing Executable Queries in SECONDO
FernUniversität Hagen, April 2011

[GAB+12] Ralf Hartmut Güting, Dirk Ansorge, Thomas Behr, Christian Düntgen, Simone Jandt, Markus Spiekermann
SECONDO User Manual, Version 3.1
FernUniversität Hagen, März 2012

[GBA+04] Ralf Hartmut Güting, Thomas Behr, Victor Almeida, Zhiming Ding, Frank Hoffmann, Markus Spiekermann
SECONDO: An Extensible DBMS Architecture and Prototype
FernUniversität Hagen, 2004

[GBJ+12] Ralf Hartmut Güting, Thomas Behr, Simone Jandt, Fabio Valdés
Fachpraktikum Erweiterbare Datenbanksysteme Wintersemester 2012/13
Aufgabe der Phase 2 “Rasterdaten”
FernUniversität Hagen, November 2012

[ST11] SECONDO Team
A Database System for Moving Objects
FernUniversität Hagen, August 2011