

Responding to environmental emergencies in real time at the Canadian Meteorological Center using SPI

(as a management and visualisation tool for global to local scale emergencies)

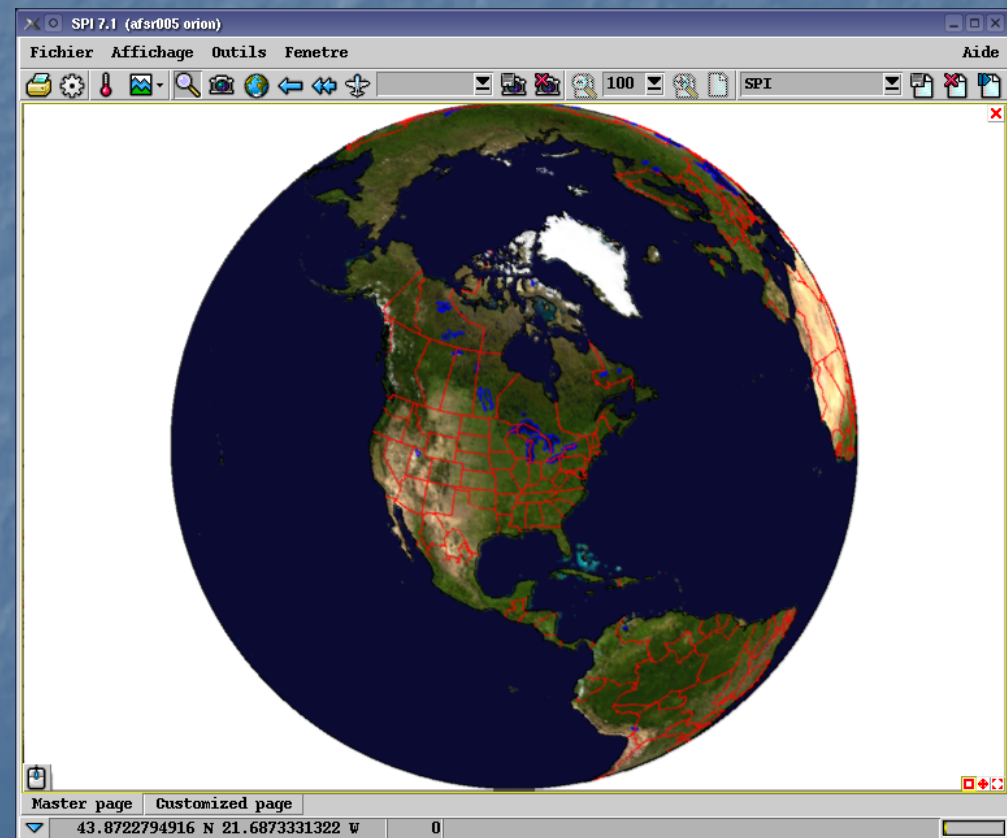
Jean-Philippe Gauthier Bilodeau



Outline



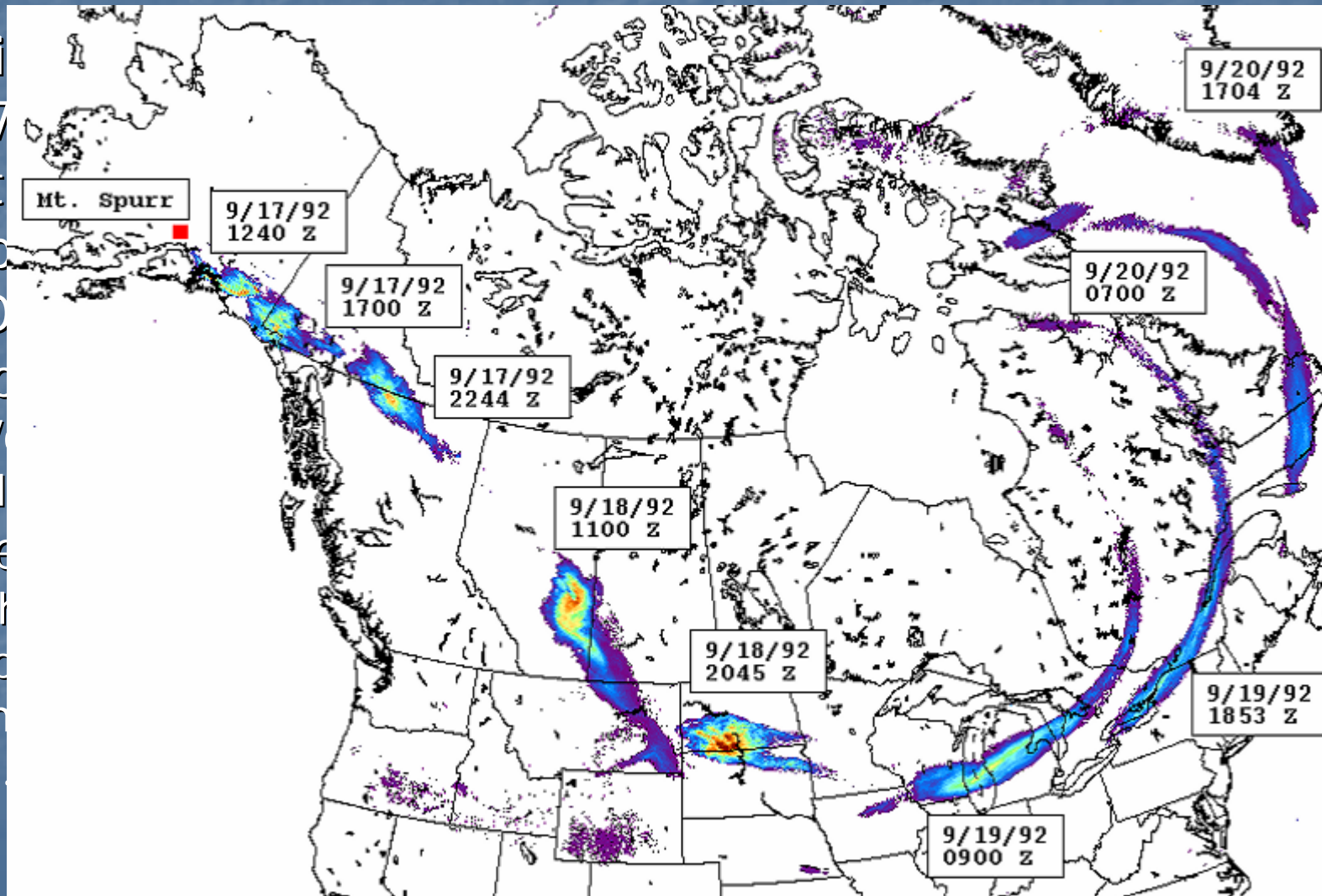
- Who are we
- Context of development
- Requirements
- Key features
- Architecture
- Functionalities
- Tools
- Scripting
- Upcoming
- Conclusion



Who are we (within CMC)



- Envi
- 24/7
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- Glob
- R&D
- Offic
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- ...



Official 24/7 EER mandates



SPI 7.2.deb (TRAJ) (afsr005 hydrus)

Fichier Affichage Outils Fenetre

TRAJ Produits

700 hPa
3175.3
3213.0
3360.8
3590.0
4113.1
4383.5
4240.2
4256.9
4257.1
4075.8
3988.4
3889.6
4182.9
4834.1
4958.7
5439.1
5876.6
6053.8
6137.9
6064.5
5974.4
5894.7
5768.9
5679.2

500 hPa
5891.4
5936.9
6353.2
6880.3
7399.3
7883.2
8193.6
8277.4
8126.8
8210.1
8793.7
9238.1
9400.5
9185.2
9023.3
9153.8
9260.8
9253.4
9240.5
9248.7
9487.0
9636.9
9652.4
9673.4

250 hPa
8958.7
10851.3
11030.9
11483.1
11666.6
11456.0
11217.2
11202.2
11271.6
11336.5
11408.1
11454.8
11415.4
11283.7
11136.6
11030.6
10949.4
10892.2
10872.5
10819.1
10725.9
10659.4
10559.8
10384.7

Hauteur/Temp - Height/
09/05
11000
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0

Service Météorologique du Canada
Meteorological Service of Canada

Prevision de la
Trajectory fore
Popocate
Depart / st
De / fr
Intervalle / ty

Master page Customized page
20.5282655652 N 88.6701073138 W 26.0

SPI 7.2.deb (RSMC) (afsr005 hydrus)

Fichier Affichage Outils Fenetre

RSMC Produits

Source name : Vancouver
Source location : 48.880 N 122.738 W
Date of release : Tue Jun 14 2005, 19 UTC

Service Météorologique du Canada
Meteorological Service of Canada

48 Hrs time integrated dose for inhalat:
valid Thu Jun 16 2005, 18 UTC

Release scenario

Isotope : 137-Cs
Time function : CONSTANT
Duration : 6 H
Horizontal distribution: GAUSSIAN
Grid length : 50 Km
TEST/EXERCISE

Total release
Height of release
Vertical distribution
Standard deviation (Hor
Maximum value at 0
RESULTS BASED ON DEFAULT

Master page Customized page
53.8588485114 N 110.9226113800 W 0.0

SPI 7.2.deb (VAAC) (afsr005 hydrus)

Fichier Affichage Outils Fenetre

VAAC 42.48 Produits

FORECAST OF VISUAL VOLCANIC ASH PLUME
PREVISION DU PANACHE VISIBLE DE CENDRES VOLCANIQUES

Service Météorologique du Canada
Meteorological Service of Canada

42H FORECAST - PREVISION 42H
FL600
FL350

48H FORECAST - PREVISION 48H
FL600
FL350

42H FORECAST - PREVISION 42H
FL350
FL200

48H FORECAST - PREVISION 48H
FL350
FL200

42H FORECAST - PREVISION 42H
SURFACE

48H FORECAST - PREVISION 48H
SURFACE

Source : Popocatepetl 19 01 N 98 37 W
Eruption : Wed Oct 26 2005, 1300Z
Duration : 1 hour(s)
Ash cloud top: 17200
Cycle : (10, 0, 18, 10, VC)

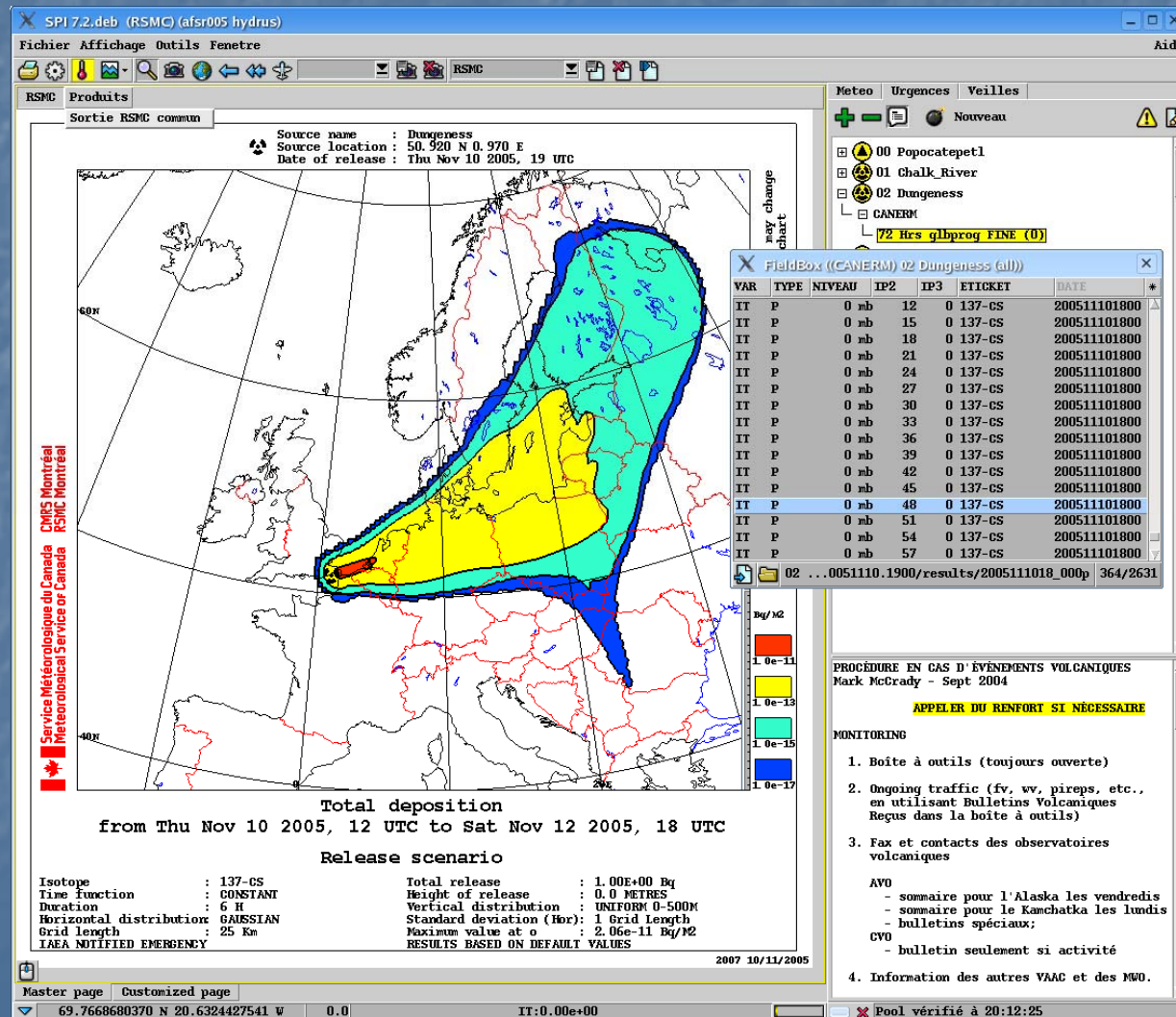
FOR GUIDANCE ONLY
NOT AN OFFICIAL FORECAST
SEE CURRENT SIGMET FOR WARNING AREA

Master page Customized page
16.9697385429 S 87.2964562108 W 0.0

RSMC Response process



Nuclear

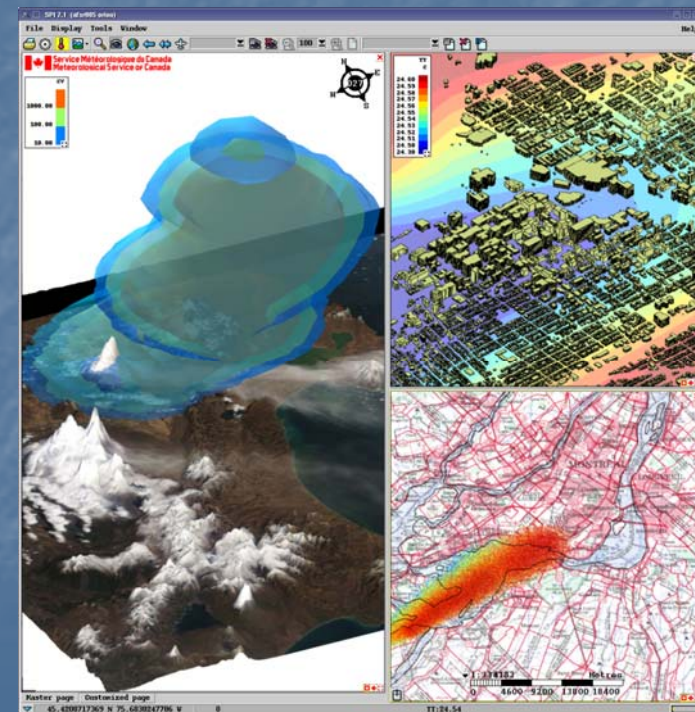


Context of development



- What we had
 - Non interactive script processes
 - Limited and fixed capabilities
- Emerging needs
 - New higher resolution scales
 - New dispersion models
 - New data types
- Quick response suitability
- Flexible functionalities
- Development and analysis
- Single do-it-all tool

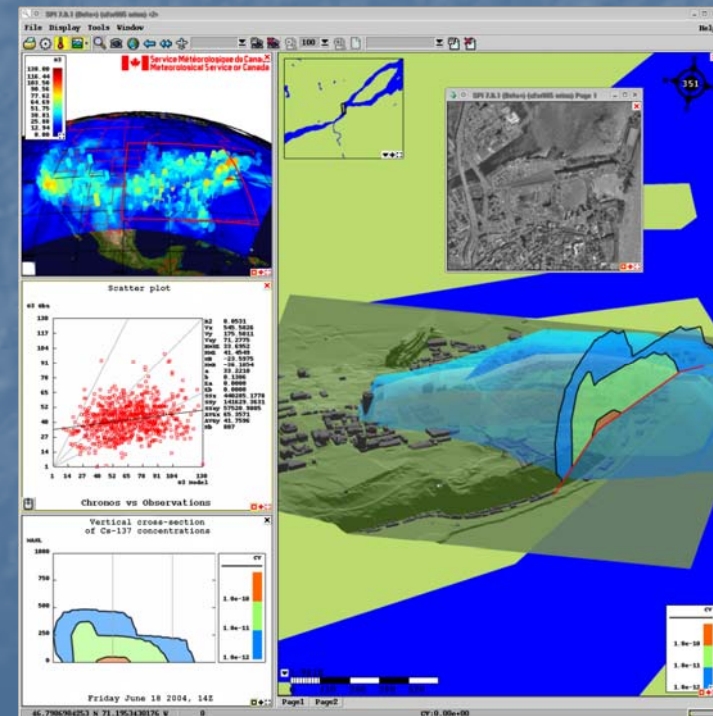
```
xterm
Do you want to execute the model (Yes/No) ? : Yes
Are you sure (Yes/No) ? : Yes
Are you really sure (Yes/No) : %`&#`!@S#
```



Requirements



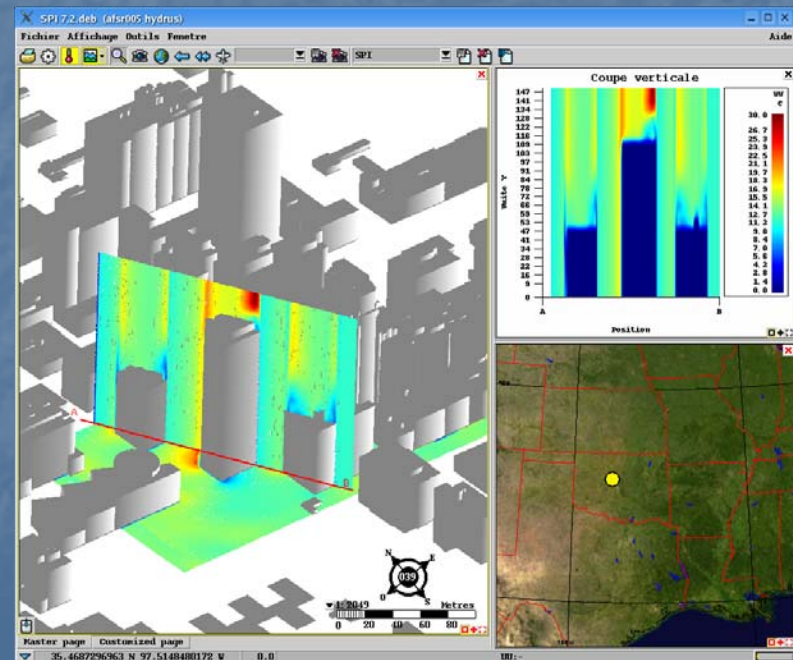
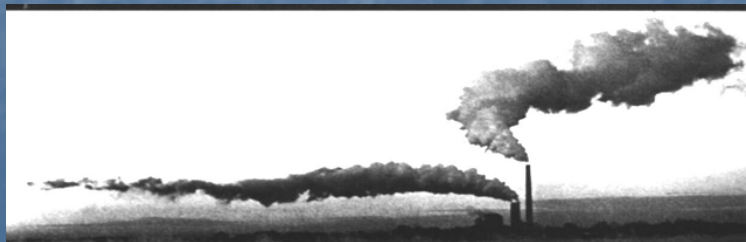
- Stability / Robustness
- Efficiency
- Extensibility / Flexibility
- Simplicity / Support workload
- Ease of use
- Scripting / Automatisation
- Portability (Software – Hardware)





Highly specialized needs

- EER models integration
- Databases integration for EER needs
- Resolution scope (Global – Local)
- 3D – 4D
- Interactivity
- Performance (>20 fps)
- Response / Development





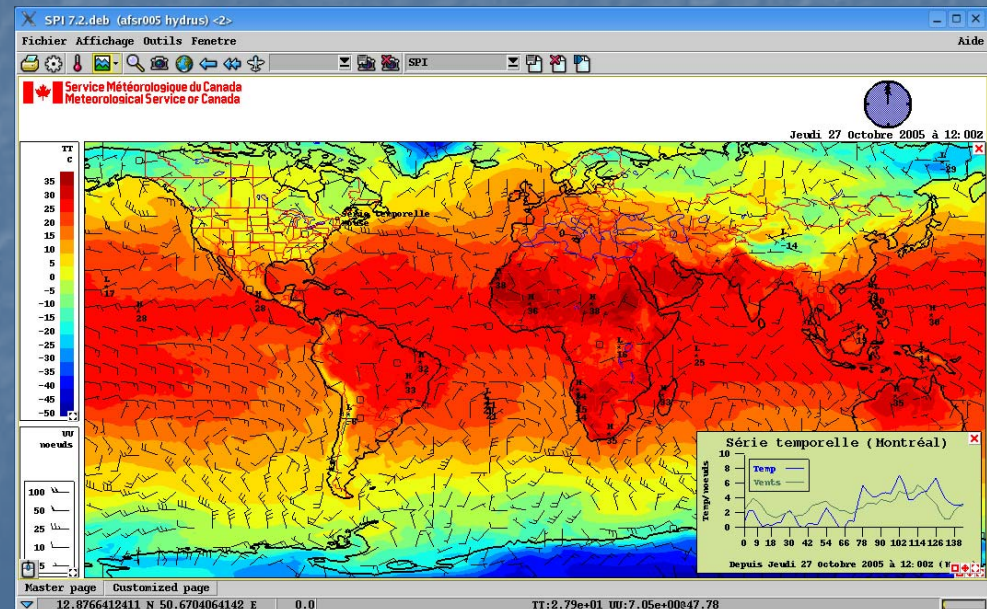
In house development (Why is it such a good idea for us)

- By in house we mean within the division
- Complete knowledge of the application
- Bug fixing within minutes, not months
- New needs answered within hours or days
- Handling of specific situations on the fly
- Development process simple
- Project management simplified

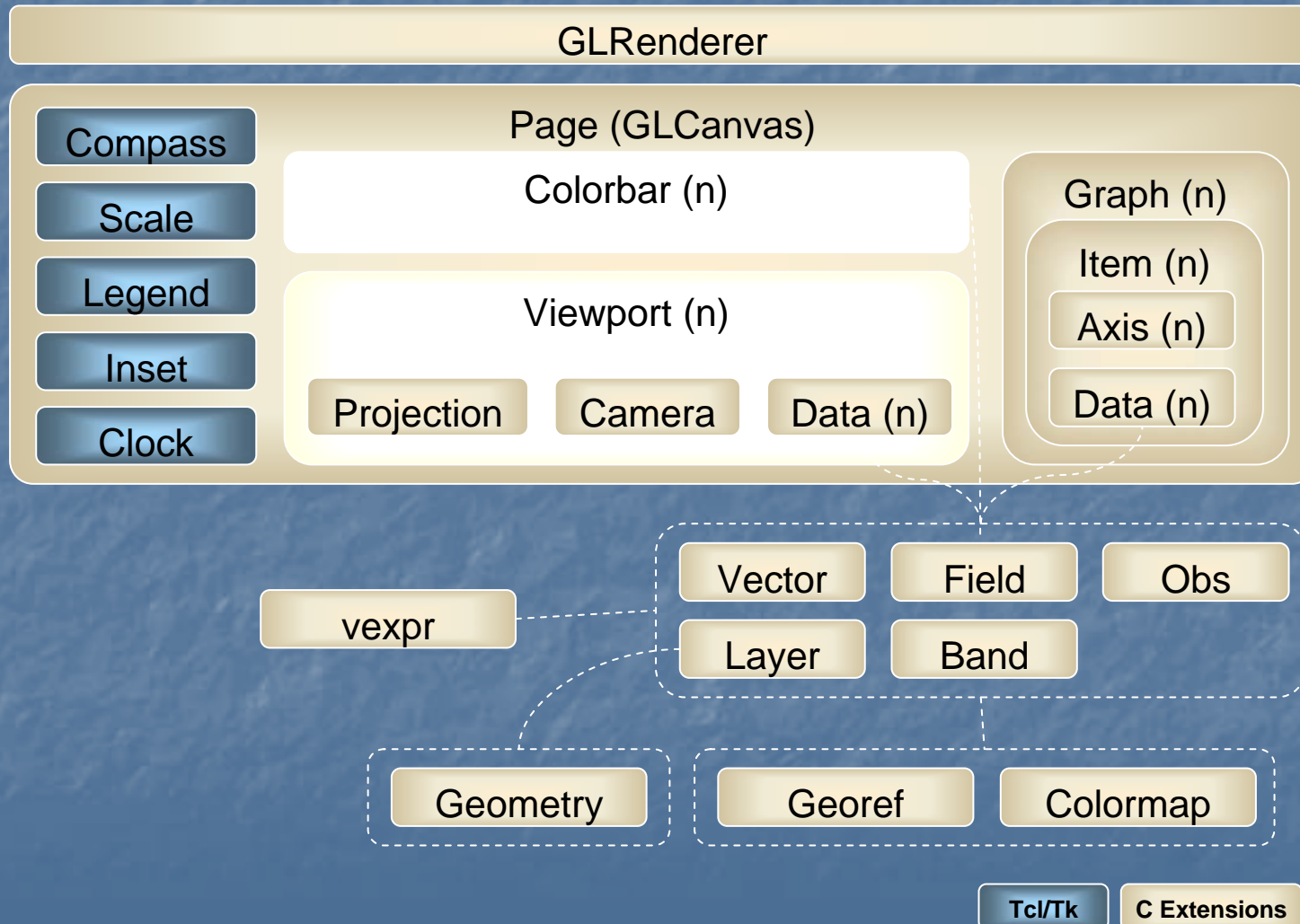
Key features



- Page concept
- Visualisation and Data objects
- Viewport / Projection / Camera
- Layering vs Real world
- Always 3D
- Interactivity
- Layouts
- Scripting
- WYSIWYG



Architecture (Objet)



Functionalities



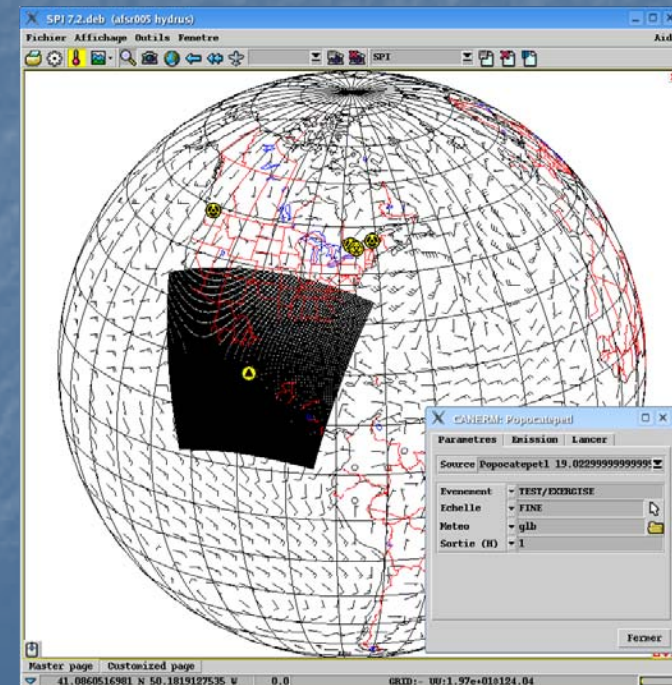
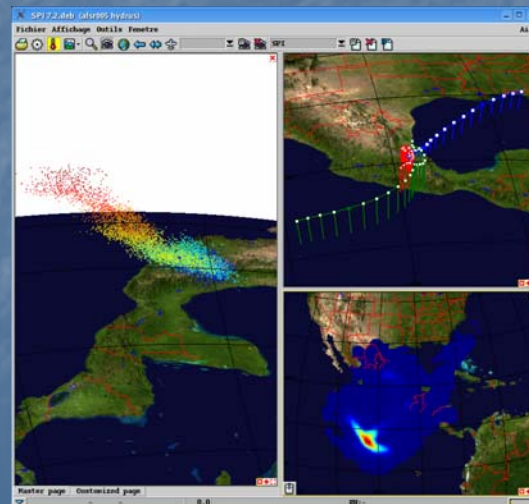
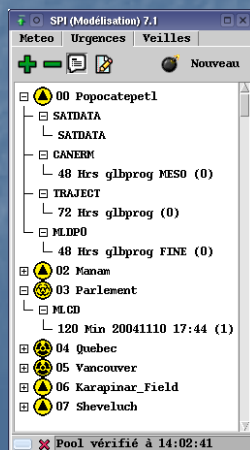
- Visualisation, modeling and analysis
- Multiple pages
- Page layout design/management
- Interactive objects
- Interactive product
- Meteorological, Dispersion and Geographical data
- Automatisation (Macro/Script)
- Batch product (>500 maps a day)
- Export static and geo-referenced





Functionalities (Modeling)

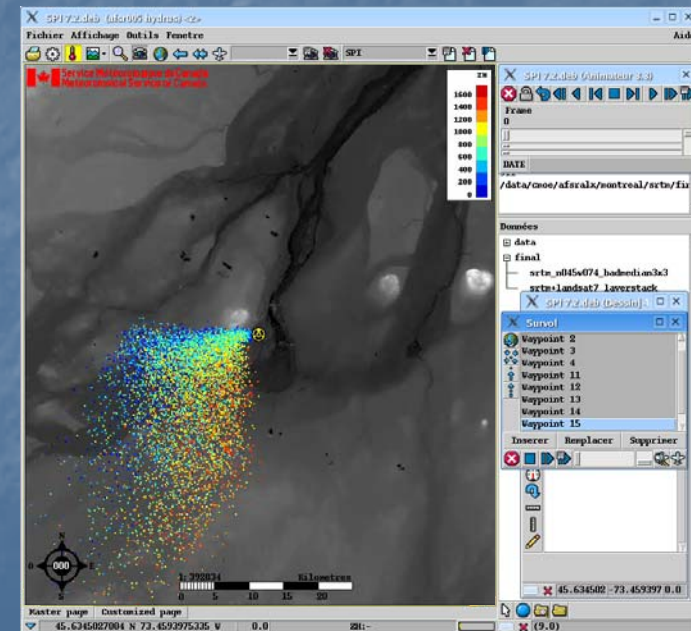
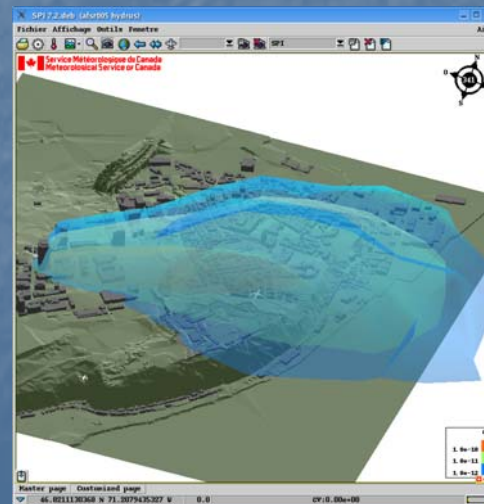
- Trajectories, Eulerian, Lagrangian
- Interface Plug-in structure
- Interactive input parameter selection
- Remote or local model execution
- Output management





Functionalities (Visualisation)

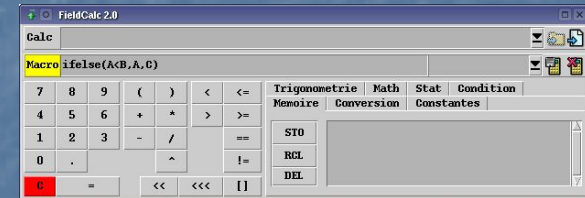
- Model Data (Meteorological and dispersion)
- Observation Data
- Geographical Data (Vector, Raster)
 - 1:50000 and 1:250000 topographic maps Canadian coverage
- Multiple viewport
- Always 3D
- 3D Objects
- Volume
- Fly-bys



Functionalities (Analysis)



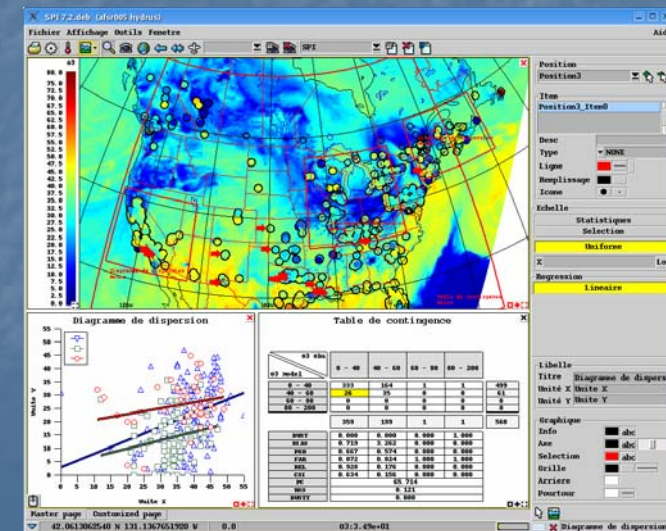
- Vectorial expression parser
 - Arithmetic, statistic, logical,...



- Graphs

- Cross-Section, Vertical profile, Time profile, Time Series, Scatter plot, Contingency diagram, ...

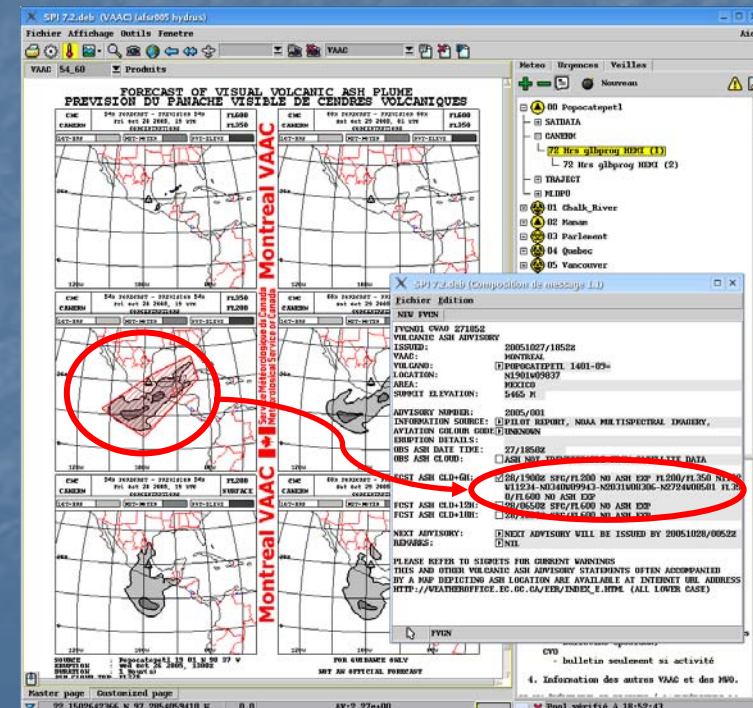
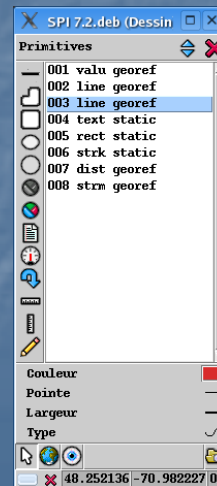
- Easy observation data integration
- Data manipulation functionalities



Tools



- Extension architecture
- Animator
- Drawing
- Geographical Data Manager
- Macro Manager
- Console
- Message Writer
- Your tool



Scripting



- Same language than application itself (TCL)
- Extended for our needs
- Maximum versatility
- Access to all of application functions
- Simple self contained data objects
- Powerful, simple and efficient
- Not only mapping but processing
- Replace binaries with unified scripts

```
file:/home/afsr/005/public_html/SPI/Demo/FSTD_CalcES2HR.tcl [modified] - Kate
File Edit Project Document View Bookmarks Tools Settings Help
foreach field [fstdfield find 1 -1 "" -1 -1 -1 "" "ES"] {
#---- Lire les champs d'entree
fstdfield read ES 1 $field
fstdfield read TT [lindex $field 0] [fstdfield define ES -DATEO] [fstdfield define
#---- Effectuer les calculs
vexpr TT min(TT,-20.0)
vexpr ES clamp(ES,0.0,20.0)
vexpr PV 10*(9.4041-2354.0/(TT+273.0))
vexpr HR 10*(9.4041-2354.0/((TT-ES)+273.0))/PV
#---- Redefinir le NOMVAR en consequence
fstdfield define PV -NOMVAR "PV"
fstdfield define HR -NOMVAR "HR"
#---- Ecrire les champs resultants
fstdfield write PV 2 -16 True
fstdfield write HR 2 -16 True
}
Line: 60 Col: 33 INS NORM file:/home/afsr/005/public_html/SPI/Demo/FSTD_CalcES2HR.tcl
```

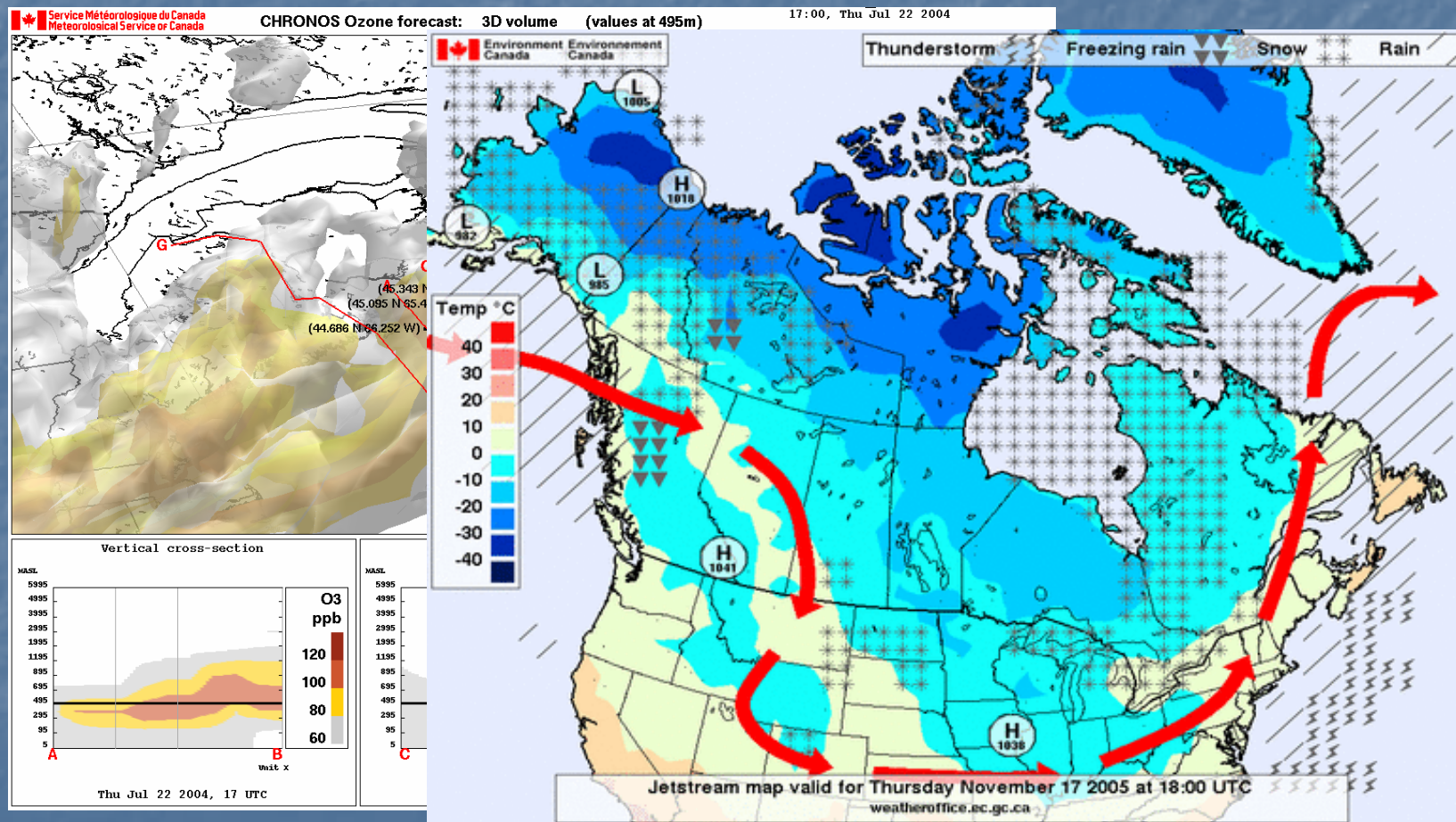
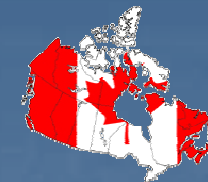
Upcoming



- Pixel/vertex shaders
- Thread
- More GIS Capabilities
- Add Cache/Performance on raster
- New graph types (box plot, 3D graphs, ...)
- Performance, ... yet again
- Distribution setup (LGPL)

- Demo

If (Time left > 2Min) then



Conclusion



- Operational EER response tool developed at CMC over the past 6 years
- Used in a 24/7 highly specialized environment
- Flexible design for easy expansion to meet emerging needs in high resolution modeling
- User-friendliness and performance to meet strict operational requirements
- Integration of global to local meteorological, dispersion and GIS data
- Advanced functionalities and flexibility for R&D purposes