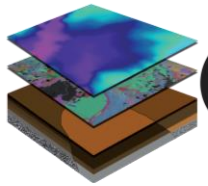
9 Giugno 2016 - Università degli Studi di Salerno - ex Facoltà di Scienze - Edificio F3 Aula P1 Livello -1

CONFERENZA 2016 AMFM GIS ITALIA

"Sviluppo di sistemi geospaziali di supporto alle decisioni. Le esperienze del CRISP a supporto della pianificazione agricola e territoriale"

Giuliano Langella, Piero Manna, Angelo Basile, Fabio Terribile

Interdipartmental Research Center



CRISP

on Earth Critical Zone

CRISP

PREMESSA:

La nostra attenzione è sui "**modelli**" e quindi sul know-how condensato nel **calcolo**, nello **sviluppo di modelli** più o meno avanzati e nella generazione di nuovi dati necessari a **supportare le decisioni**. Quindi a noi non interessa lo sviluppo di ~~**una infrastruttura cibernetica geospaziale**~~ anzi siamo svincolati da essa. In definitiva ci orientiamo verso sistemi atti a **garantire/offrire una interoperabilità dei processi**.

- Il **CRISP** è un centro di ricerca interdipartimentale di UNINA sulla zona critica radicale :: DIA, DISTAR, CNR
- tra le varie attività del centro, abbiamo quella di sviluppare sistemi geospaziali di supporto alle decisioni via web
- alcuni esempi operativi sono il:
  - ✓ SOILCONSWEB :: progetto EU LIFE+, 3.3M finanziato, 5 anni
    http://95.110.192.55/life/
  - ✓ SOIL MONITOR :: nessun progetto, auto-finanziato, 3 anni
    http://soilmonitor.it
  - ✓ WATSUP :: proposal EU LIFE-IP, 19M (step #2), 8 anni

INTRODUZIONE

- mi occupo di ricerca e sviluppo di modelli geospaziali statistici e fisicamente basati con/senza calcolo parallelo (GPU computing, CUDA)

- alcuni esempi di calcolo geospaziale automatico e/o ad alta prestazione riguardano

SOILCONSWEB

  - ✓ suolo, clima (geostatistics, artificial intelligence, PRISM-like, …)
  - ✓ modelli di simulazione fisicamente basati (rischio attacco fito-parassiti, sistema suolo-pianta-atmosfera)
  - ✓ zonazione viticola

- esempio di combinazione WebGIS con GPU computing

Soil Monitor

  - ✓ Consumo di suolo con framework CUDA

Automatic Digital Mapping

cvSISE

✓ cvSISE :: digital **soil** mapping → post-SOILCONSWEB

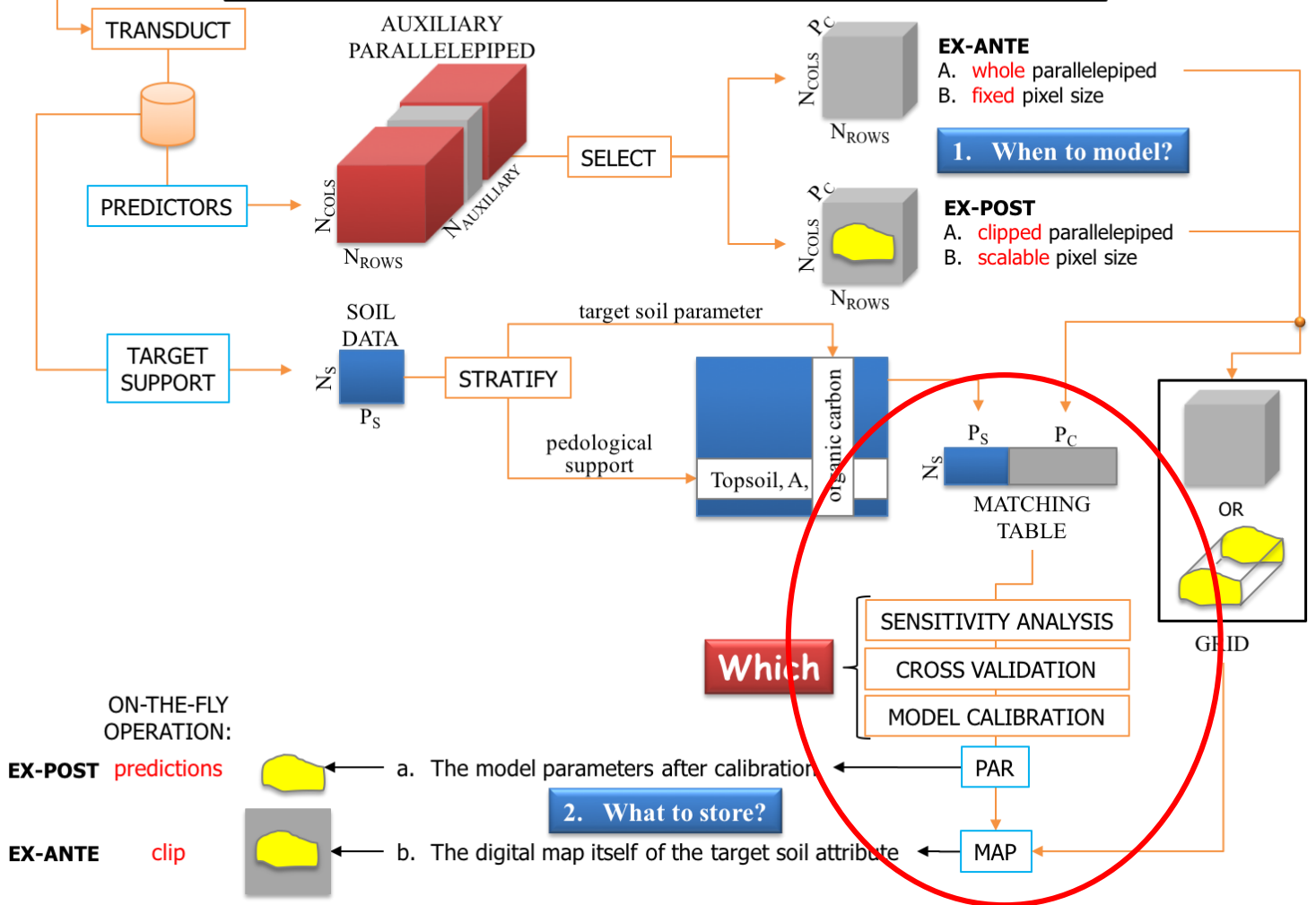
DSM 2012, Sydney :: geostatistics (REML-EBLUP Regression Kriging)

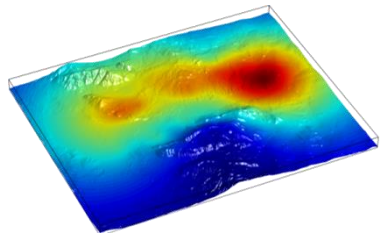
WB SDSS

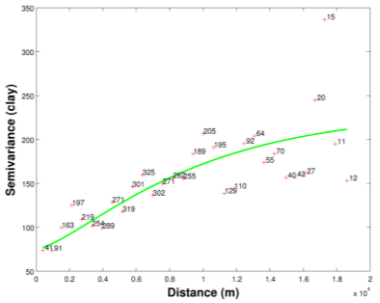
query…

Requirements for the DSM procedure

How DSM







REML EBLUP RK

Automatic Digital Mapping

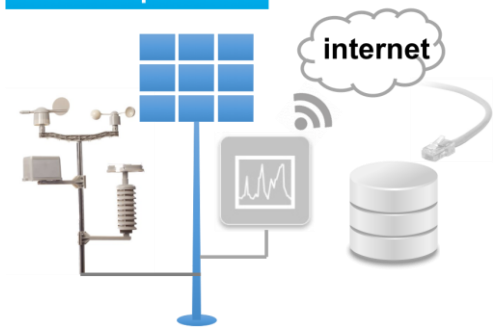
✓ digital **climatic** mapping → SOILCONSWEB, Regione Campania

AIAM 2014, Rome :: PRISM-like

EGU 2016, Vienna :: HPC & PRISM-like

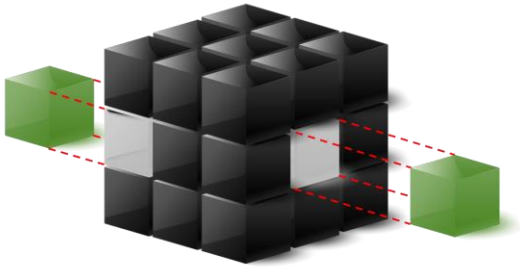
WeatherProg

Step 1



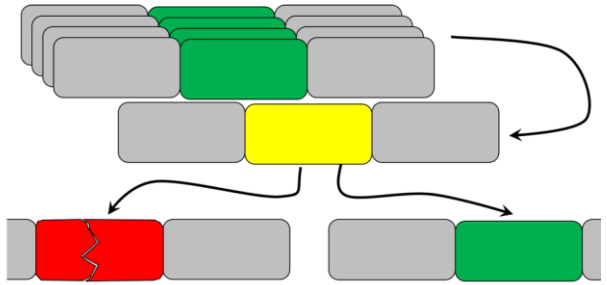
data retrieval

Step 2



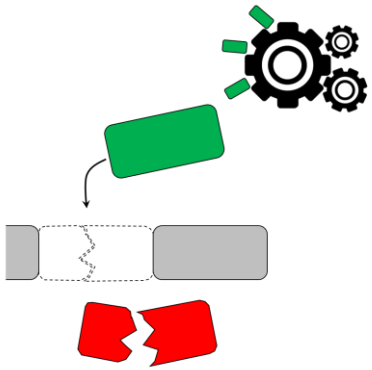
decoding and database ingestion

Step 3



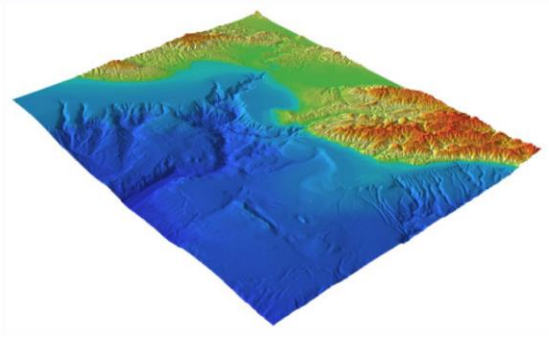
data quality checks

Step 4



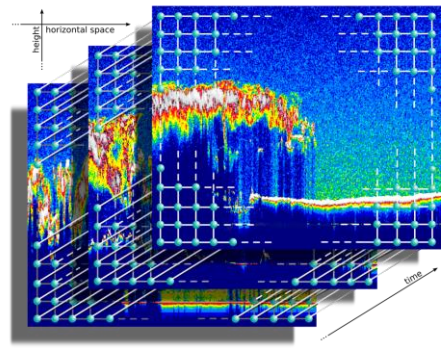
data infilling

Step 5

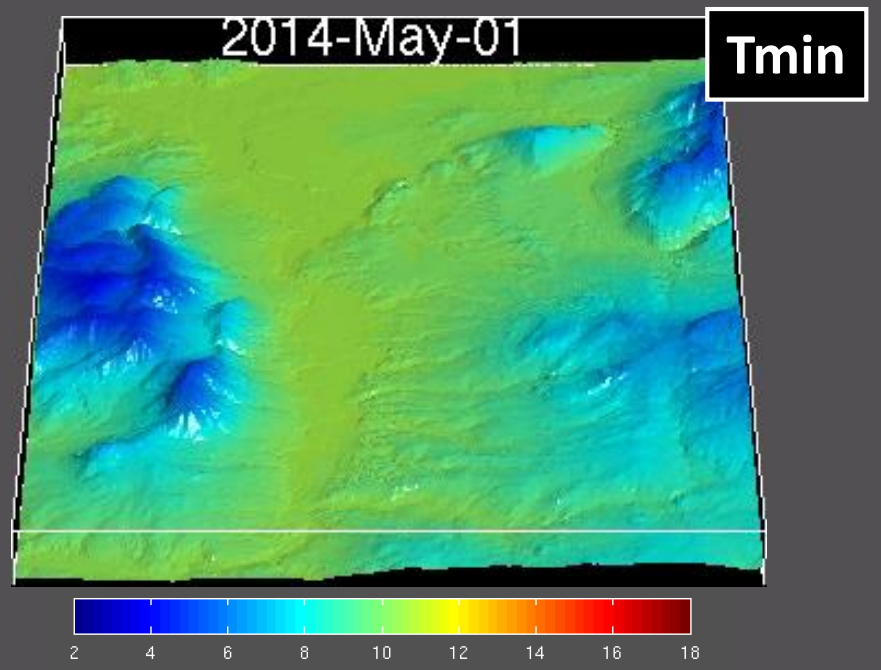


geospatial mapping

Step 6



raster database


2014-May-01
Tmin
2
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6
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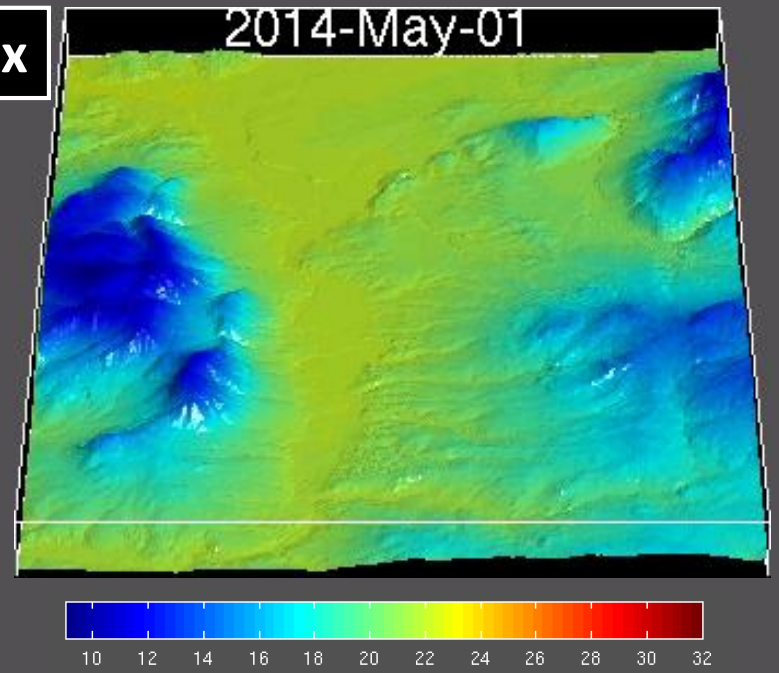
18


Tmax
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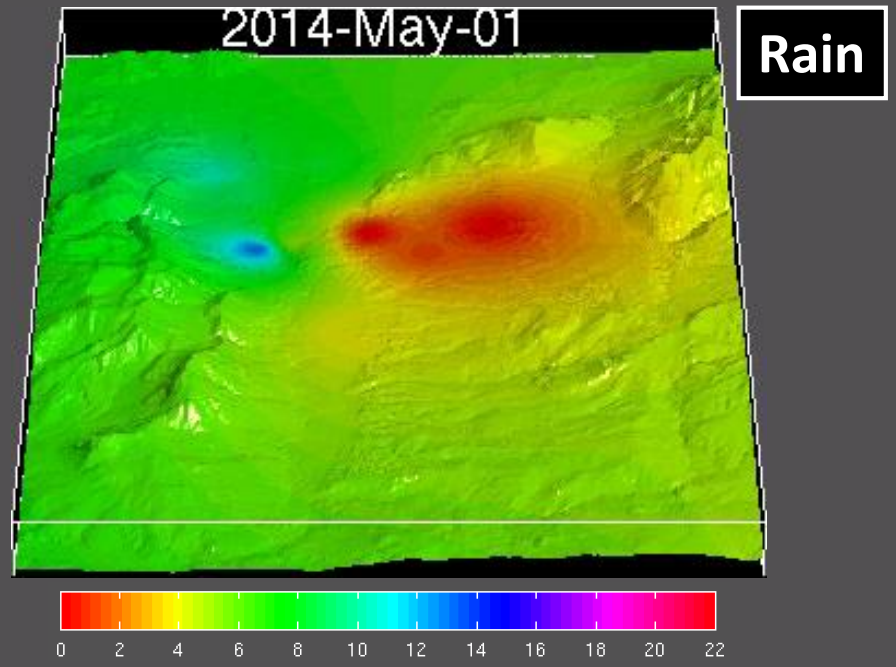
32


2014-May-01
Rain
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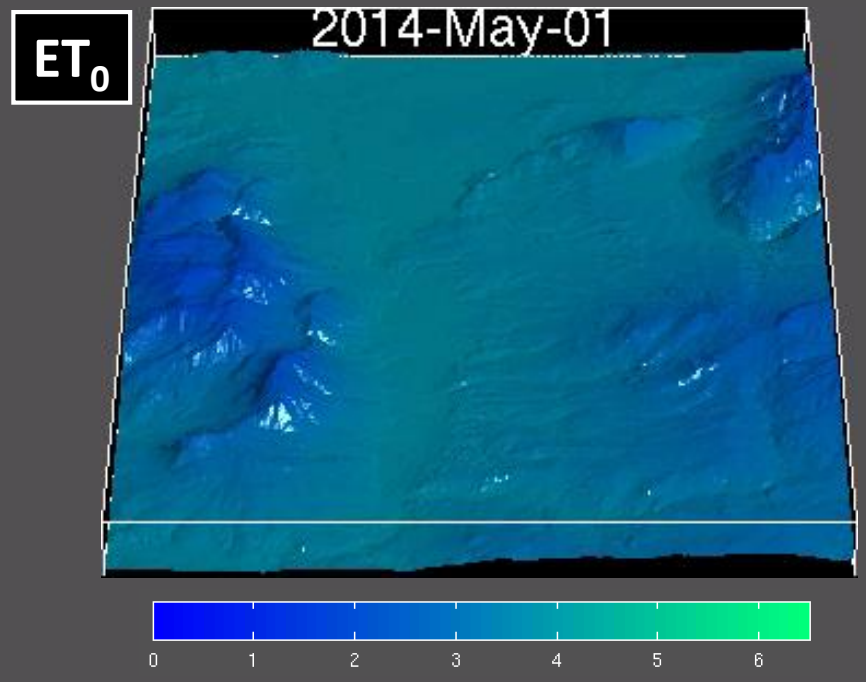

ET_0
2014-May-01
0
1
2
3
4
5
6

Modelli Di Simulazione Fisicamente Basati

CLIENT

SERVER

DATABASE

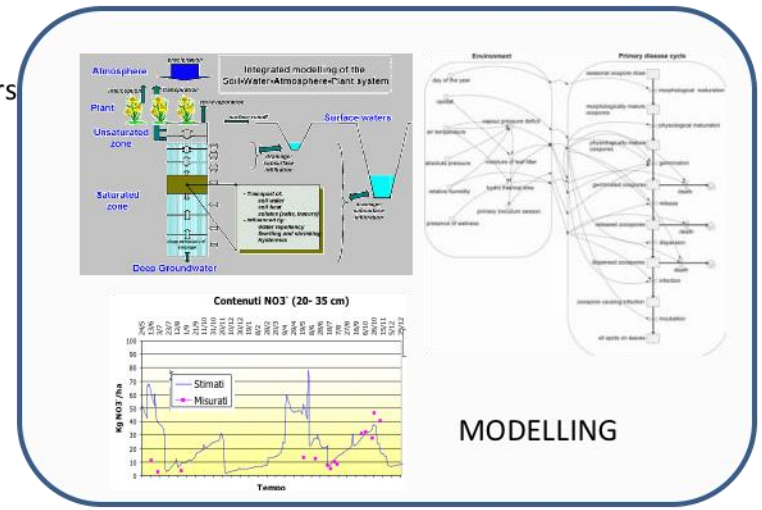
System answer

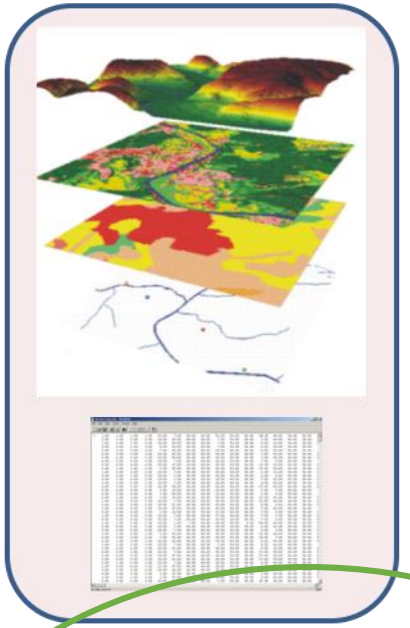
Manage maps, process data, dymamic modelling simulation

Query

Users

- Agricultural managers
- Local Authorities
- Policy Makers





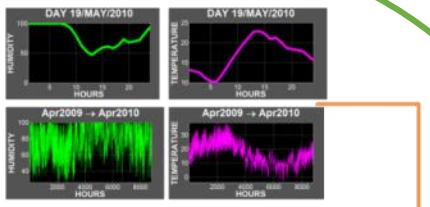
- Thematic maps : climate data, soil data, etc.

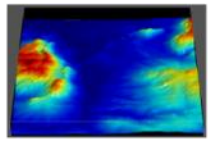
Raster and vector format;

- Raw data

monitoring network

DB





inference

Gaps / Anomalies

The database is constantly updated: i.e. daily spatialized climate data deriving by monitoring network

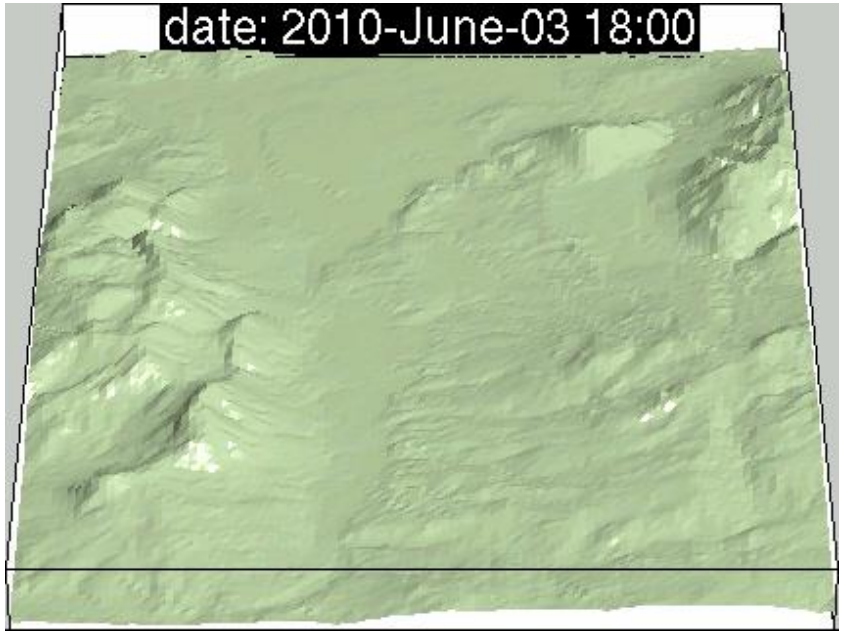
clima

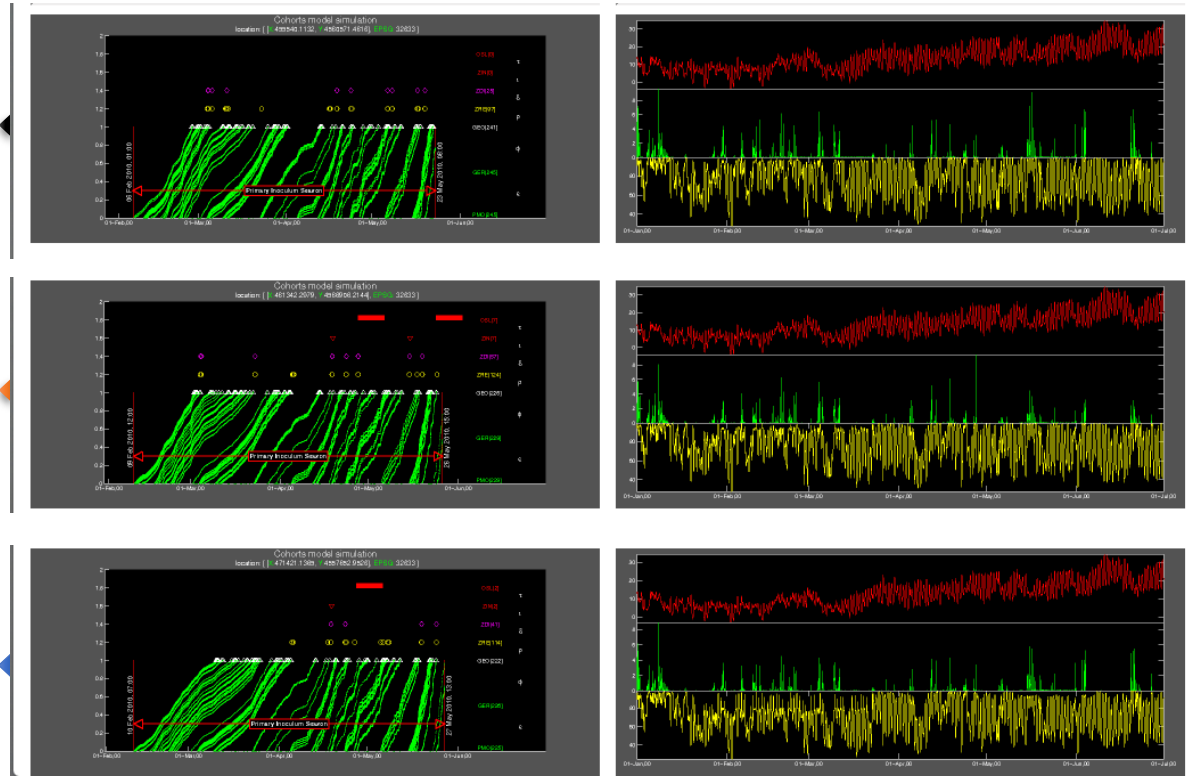
Modelli Di Simulazione Fisicamente Basati

✓ phytopathological risk of infection → e.g. P. viticola

http://weatherprog4u.com

GeoProc Service





dynamic sim of phytopathogens (hourly)

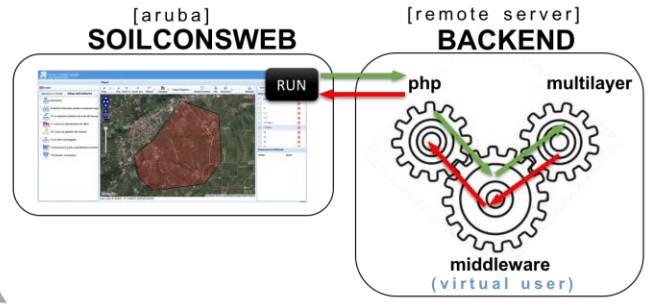
WeatherProg

Modelli Di Simulazione Fisicamente Basati

✓ soil-plant-atmosphere system modelling → post-SOILCONSWEB

dynamic sim of soil water/solute transport

multilayer – WBSDSS



Multilayer

php: *{trasmettitore}*
- Riceve gli input dall'app
- Effettua «la» chiamata del middleware

middleware: *{neurone}*
- Riceve due tipi di input (irr., fert., …, N-app)
- Prepara i config di multilayer
- Lancia multilayer

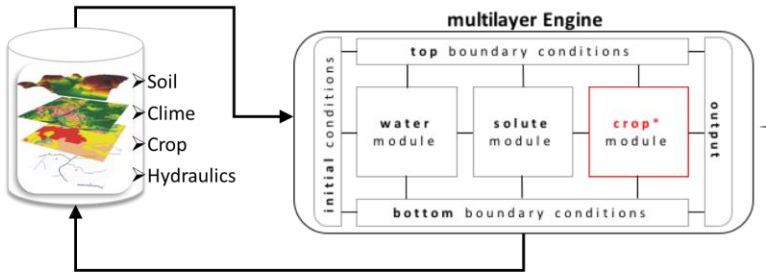
multilayer: *{muscolo}*
- run

php: *{trasmettitore}*
- Riceve il pacchetto dal middleware
- Aggiorna la app con le info contenute nel pacchetto

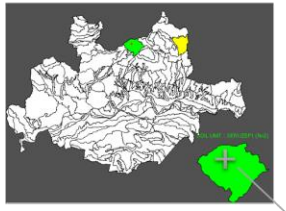
middleware: *{neurone}*
- elabora due tipi di output (irr., fert., …, N-app)
- Prepara in un pachetto le info e le passa al php

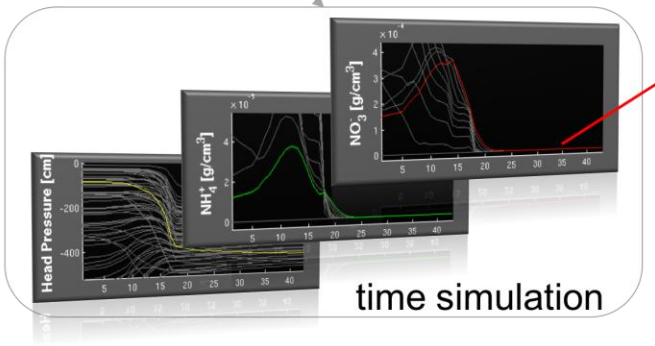
multilayer: *{muscolo}*
- genera output

multilayer – desktop

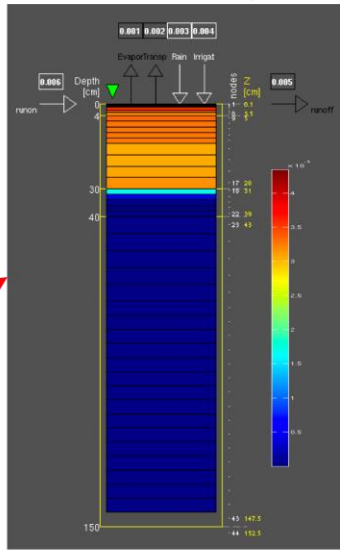


multilayer – GIS



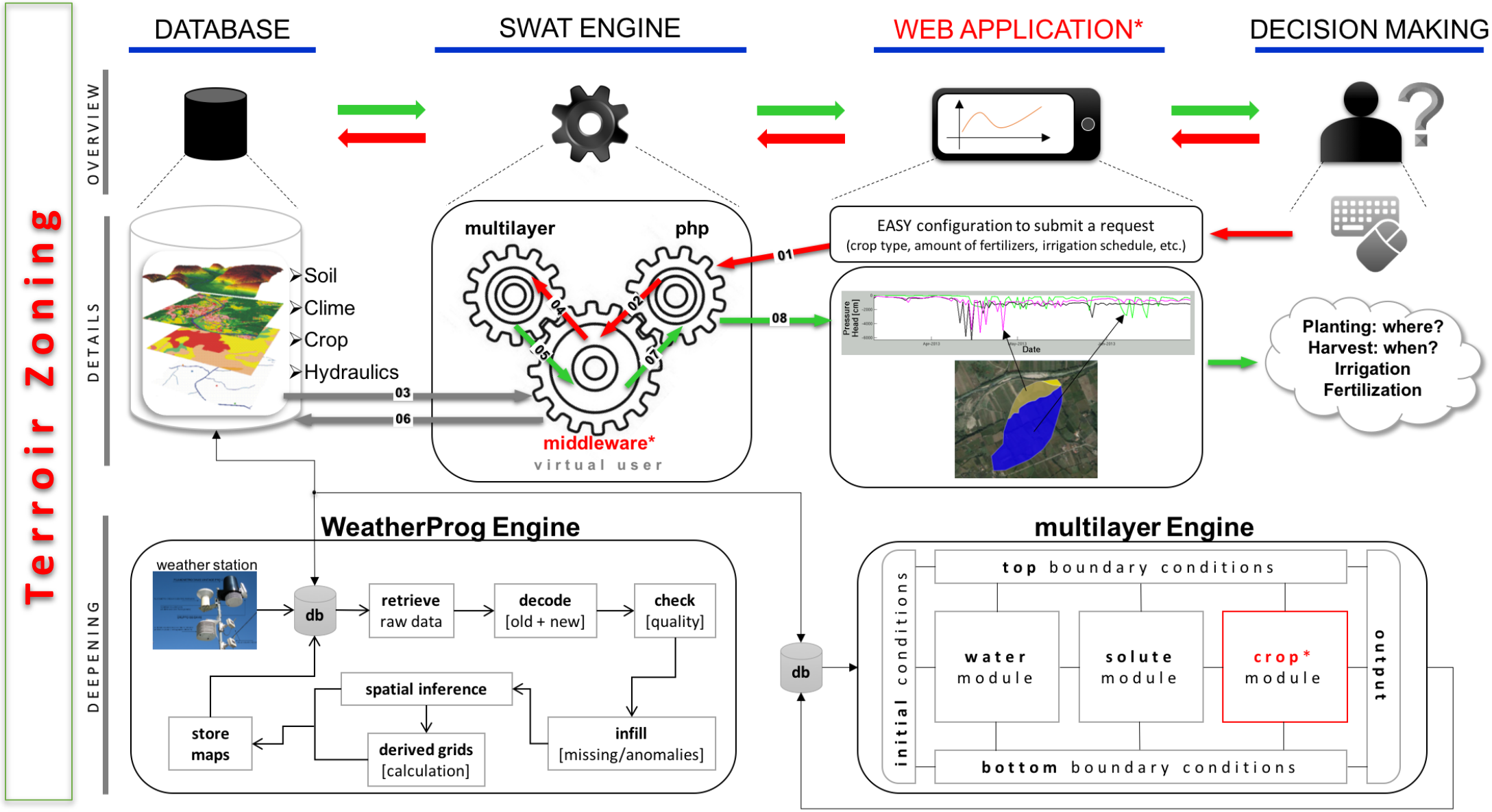


video :: NO_3^-



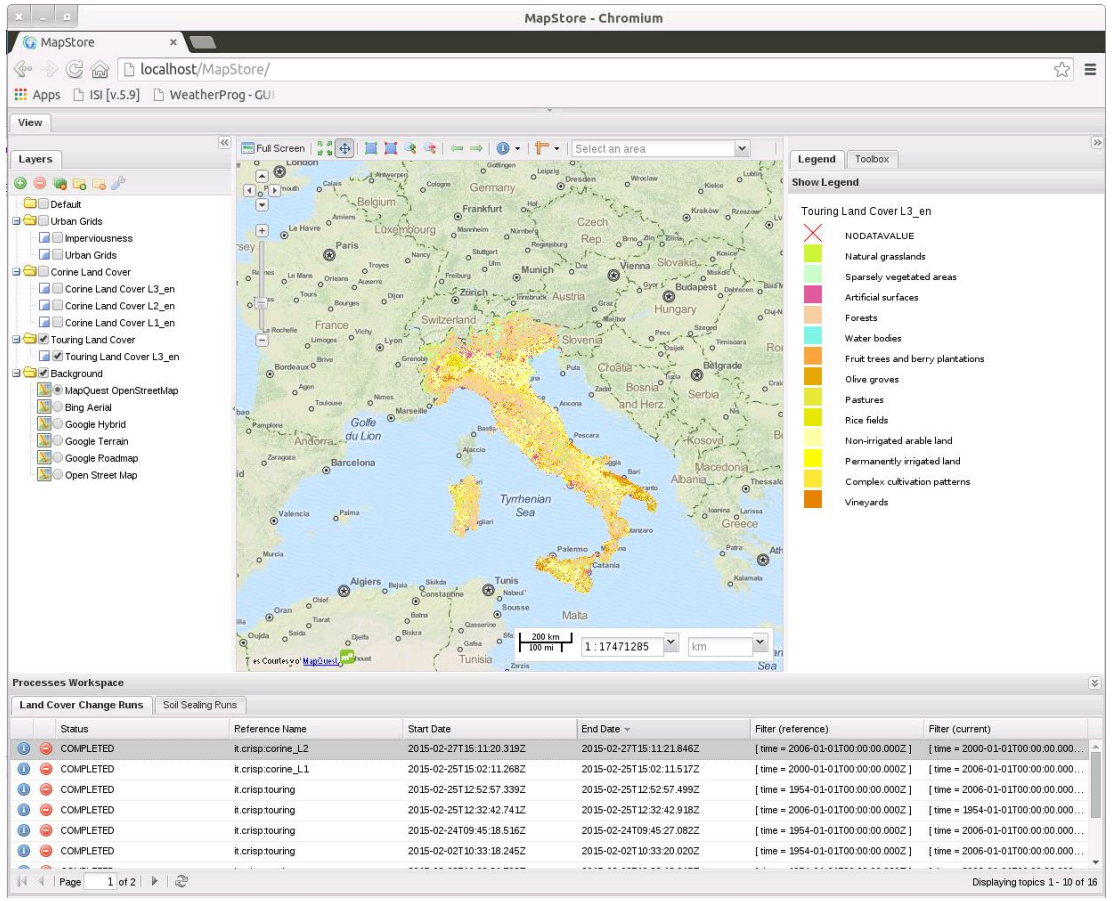
Modelli Di Simulazione Fisicamente Basati

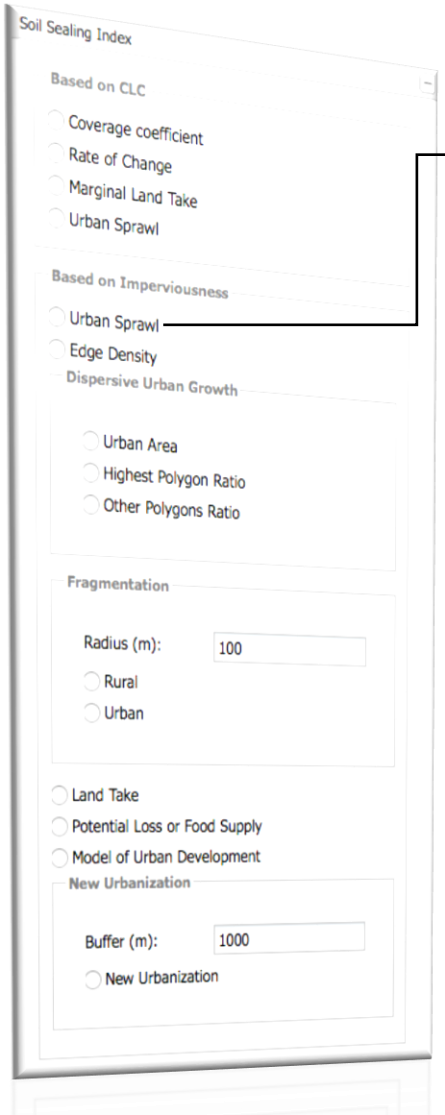
✓ viticulture :: Aglianico (VT), Terroir Congress July 2016 (Portland, USA)



Soil Monitor

- ✓ Soil Sealing :: Scala Italia, Senato il 28-Giu-2016
  - CRISP, GeoSolutions, ISPRA, INU





$$urban.sprawl = \frac{S_{ud}}{S_{ut}}$$

SOIL MONITOR

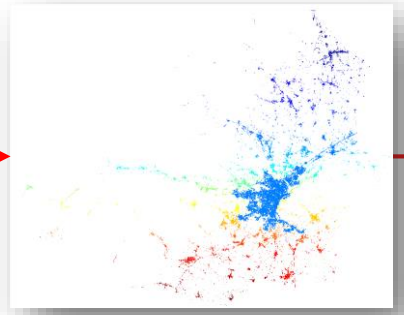
Superficie Urbana Discontinua[CUDA calculations :: S_{UD}]

pixel

BIN * ROI

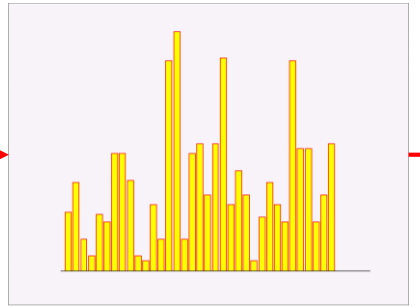
CCL algorithm

LABELED

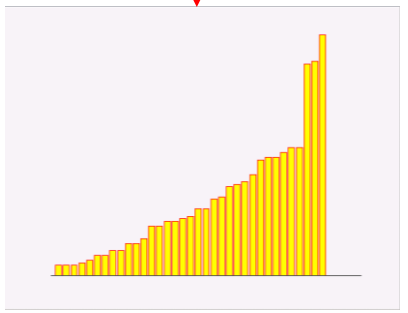


patch

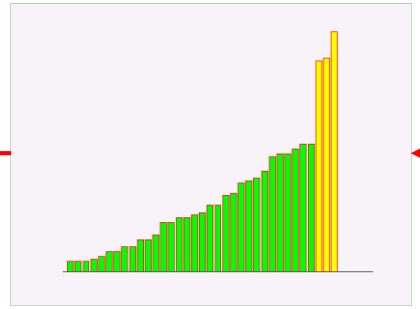
histogram



sort



P90



sum

S_{UD} = 147,3 ha

[Rows, Cols] = [15001, 12001]

kernels for Connected Component Labeling

-0-	filter_roi	30	[msec]
-1-	intra_tile_labeling	120	[msec]
-2-	stitching_tiles	170	[msec]
-3-	root_equivalence	370	[msec]
-4-	intra_tile_re_label	30	[msec]
-5-	count_labels	70	[msec]
-6-	labels__1_to_N	250	[msec]
-7-	intratile_relabel_1toN	20	[msec]
-8-	del_duplicated_lines	30	[msec]
-9-	histogram	2620	[msec]
	Total time:	3710	[msec]