GeoSense

Towards an OGC compliant DSS for Precision Farming with Geo-ICT and WSN

Indo-Japan Team Members

(presented by J Adinarayana, CSRE, IIT Bombay)

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CSRE Centre of Studies in Resources Engineering

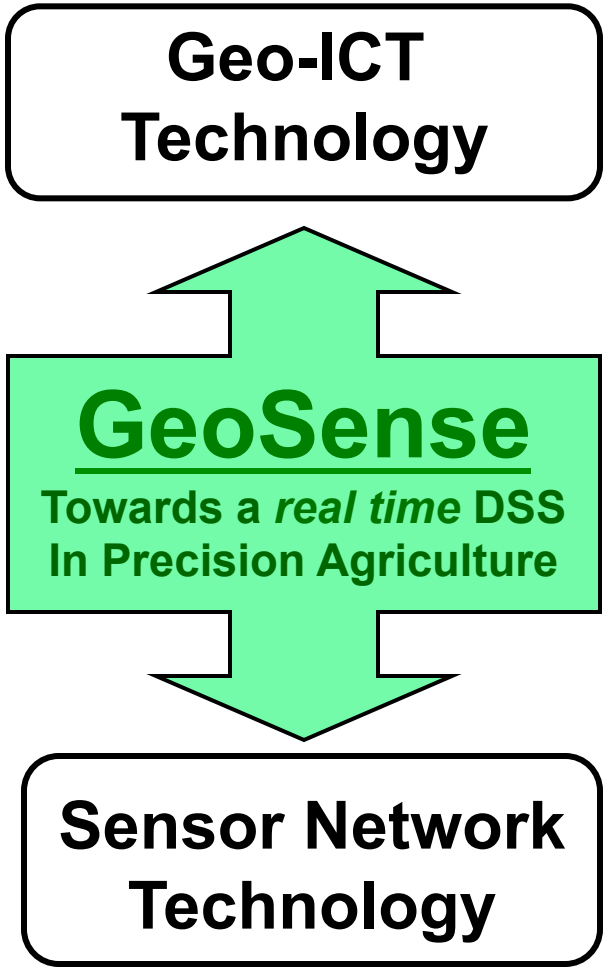
Team Leaders

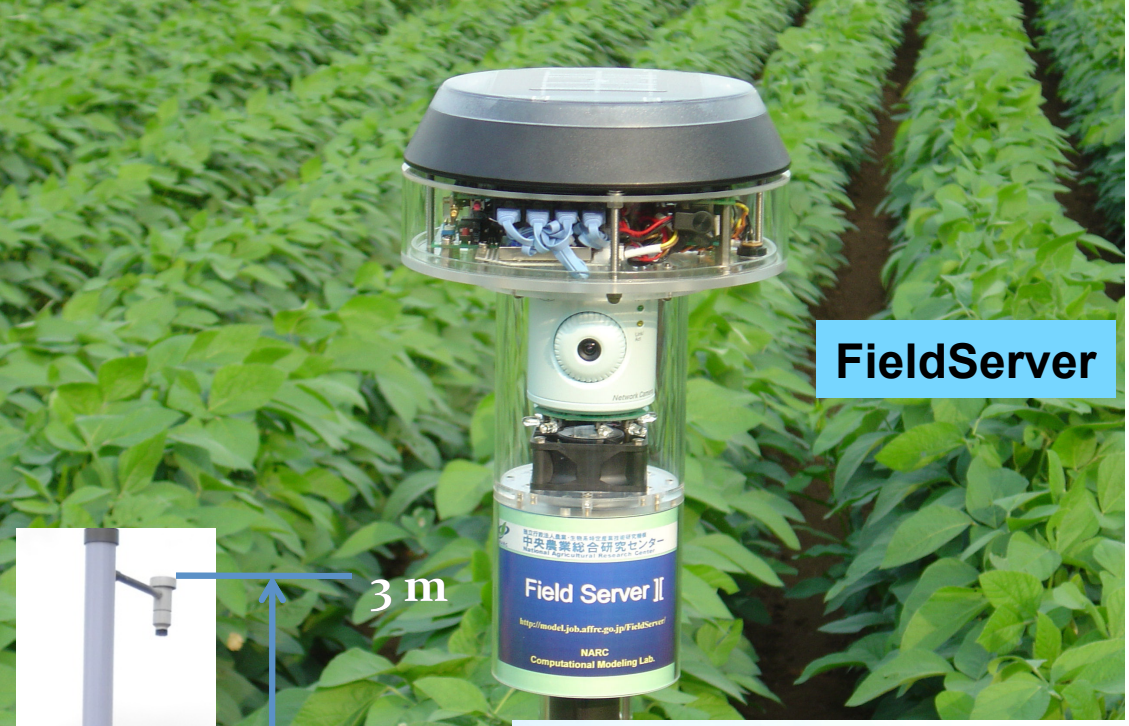
Challenges

- User
- Sensing Devices – Weather conditions
- Raw to Real sensory data/information
- Availability/development of different models
- ***Integration of Geo-ICT and SN***
- ***Development of a push-based real-time DSS in dynamic Ag and its related sectors***
- ***OGC complaint Sensor Web Enablement***

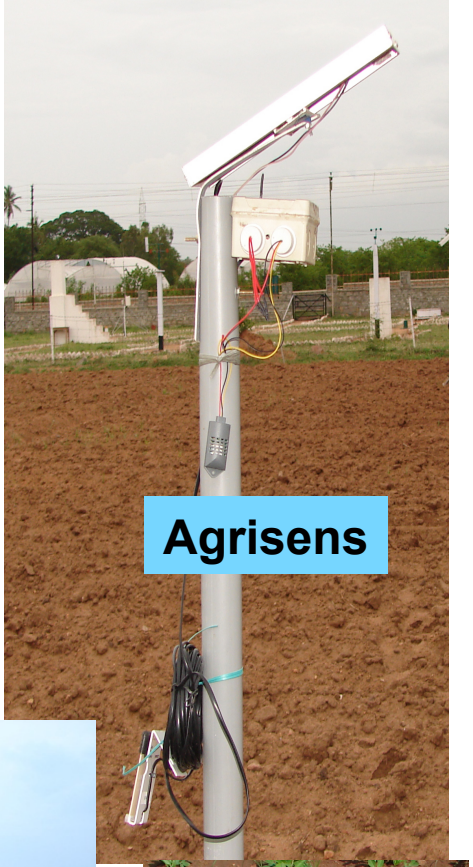
WSN status in Agriculture

- **WSN-based Agricultural Systems in India**
  - **GeoSense** **(GeoSense, 2011)**
  - COMMONSENSE-Net **(Prabhakar et al., 2010)**
  - uAgri **(uAgri, 2011)**
  - mKRISHI **(mKRISHI, 2011)**
- **Major areas of application in agriculture**
  - *Precision Agriculture, Horticulture, Animal husbandry, etc.*

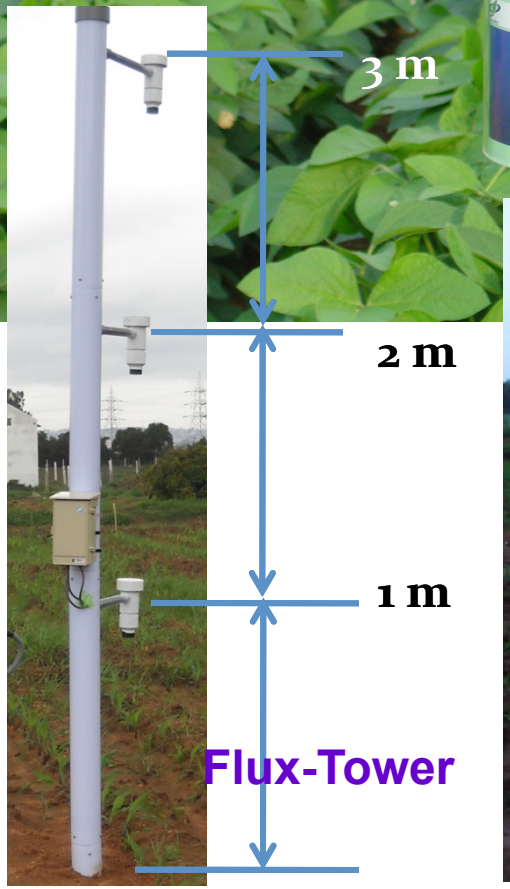

Geo-ICT
Technology
GeoSense
Towards a *real time* DSS
In Precision Agriculture
Sensor Network
Technology

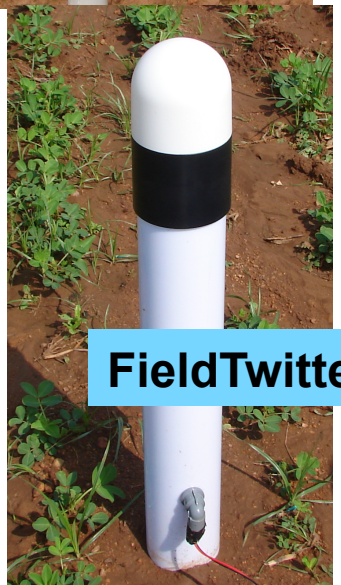


FieldServer



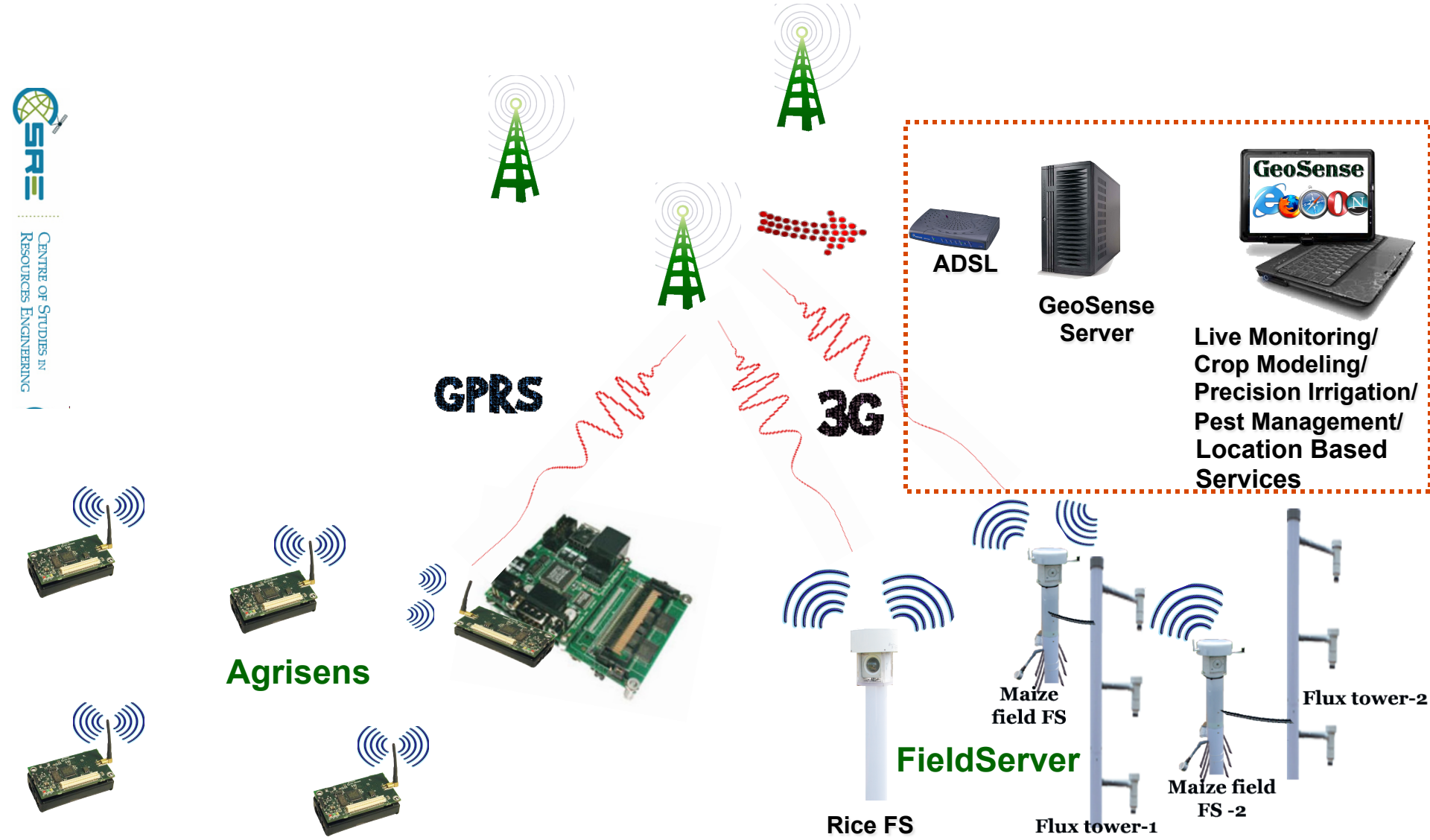
Agrisens





FieldTwitter

GeoSense Architecture

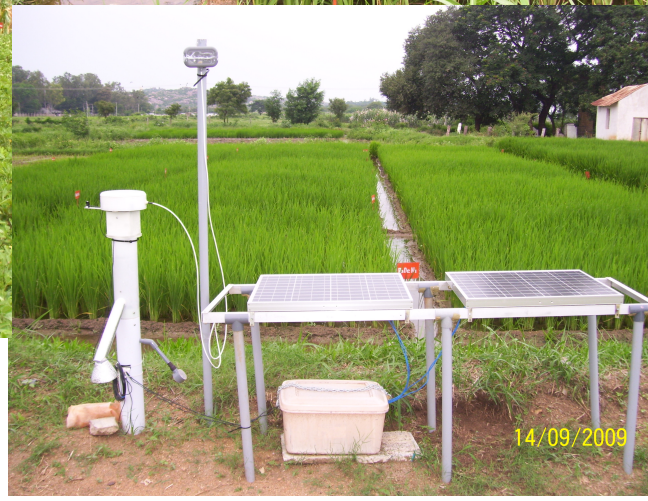


WSN Deployment at ANGRAU, Hyderabad *(Semi-arid tropics)*

GeoSense test crops and experiments

Precision Irrigation Experiments with AgriSens and FieldServer

Pest Management Experiments with Agrisens



Crop Yield Modeling Experiments with FieldServer

GeoSense Researches

① **Crop Modeling (Yield / PI) and *Real-time* DSS**
(D Sudharsan, PhD Student, CSRE)

② **Data Mining and WSN for Knowledge Discovery in Pest/Disease Management**
(Amiya Kumar Tripathy, PhD Student, CSRE)

③ **Energy Flux studies**
(Ketan Karandikar, MTech Student, CSRE)

④ **Preliminary Climate change studies**
(Arun Jose, M Tech student, CSRE)

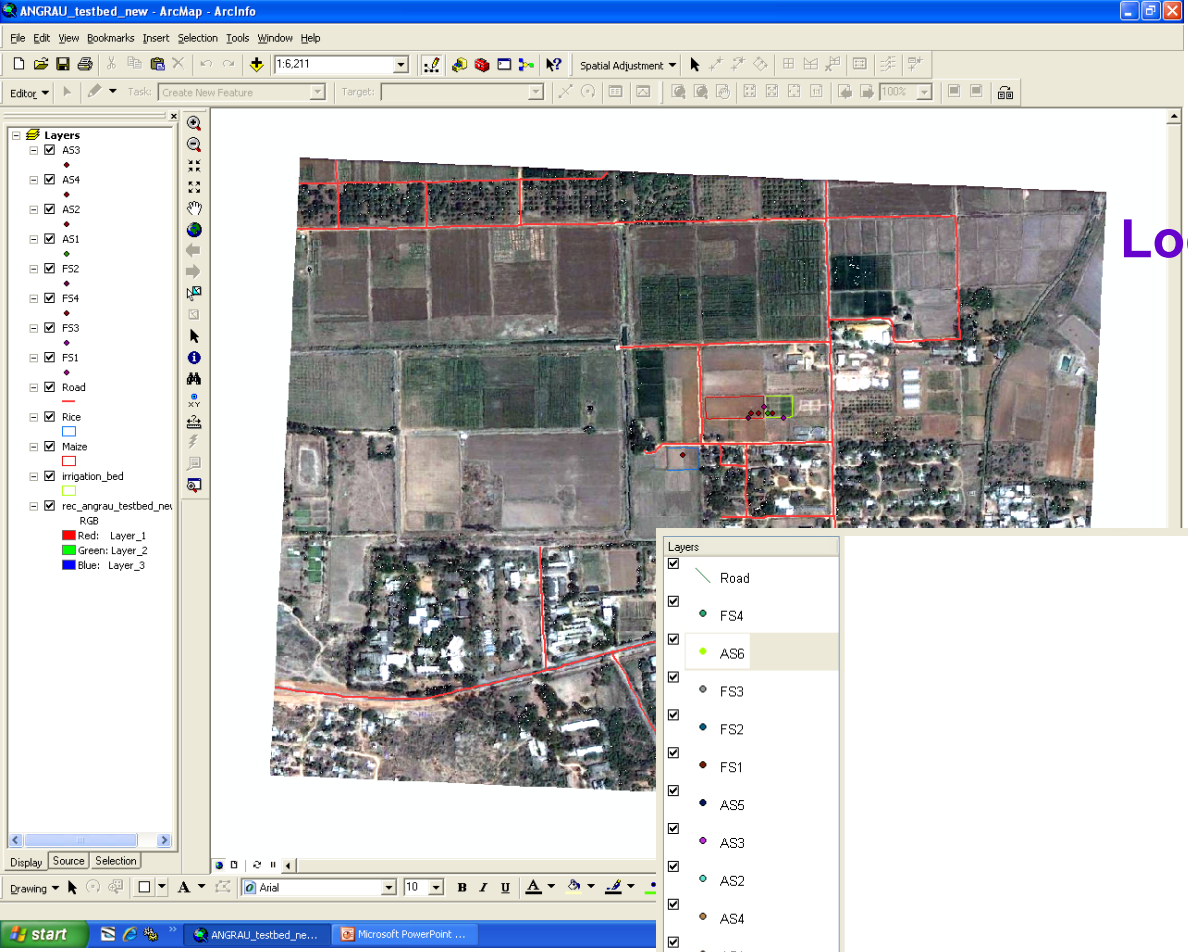
⑤ **Design and Development of WSN for Real-time remote monitoring**
(Naveen CPRG, M Tech Student, Elect. Engg)

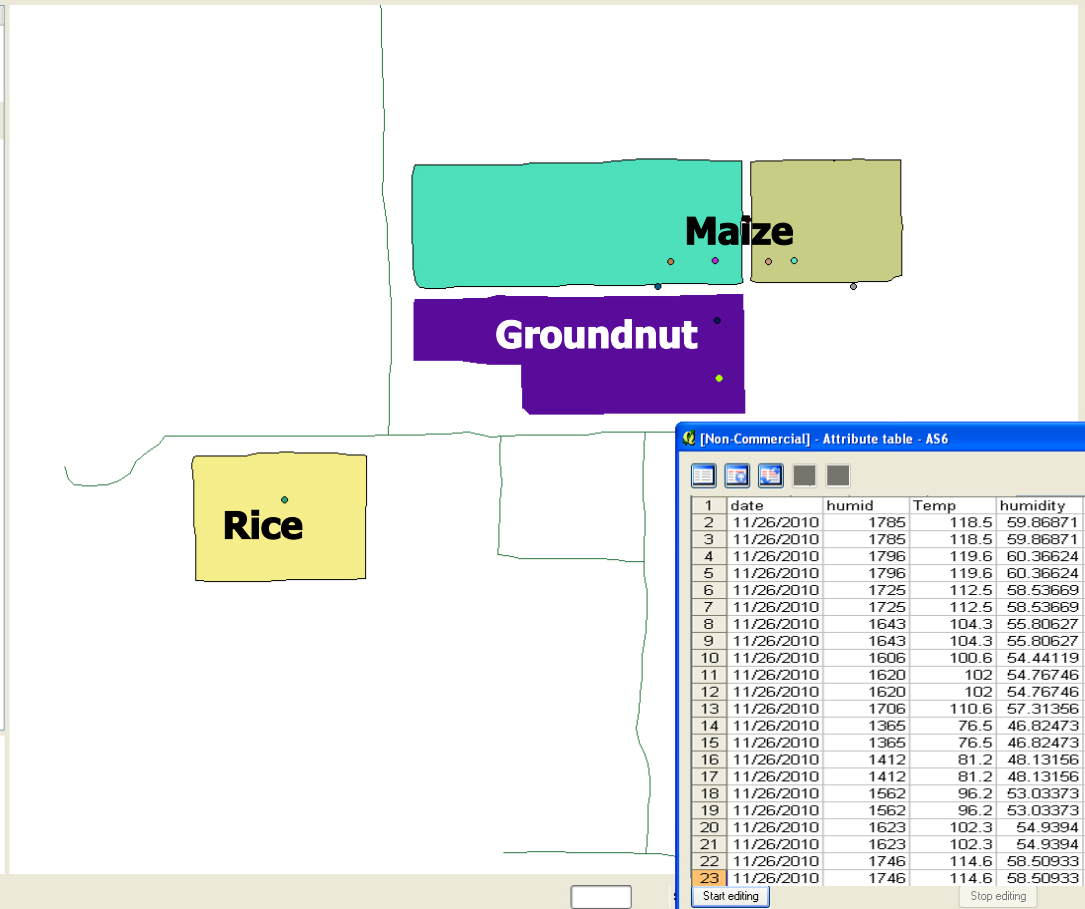
⑥ **Wireless Sensor Network using Openmoko**
(Ashwani Kr Ravi & Naveen Namdeo, M Tech Students, Elect. Engg)

⑦ **Wireless Sensor Networks and Image Processing for pest identification/count**
(S Devasekhar, M Tech Student, *Elect. Engg*)

⑧ **Sensor Web Enablement** ***(Suryakant S, PhD Student, CSRE)***

Location Based Sensory Data (in Google Map)





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5	11/26/2010	1796	119.6	60.36624
6	11/26/2010	1725	112.5	58.53669
7	11/26/2010	1725	112.5	58.53669
8	11/26/2010	1643	104.3	55.80627
9	11/26/2010	1643	104.3	55.80627
10	11/26/2010	1606	100.6	54.44119
11	11/26/2010	1620	102	54.76746
12	11/26/2010	1620	102	54.76746
13	11/26/2010	1706	110.6	57.31356
14	11/26/2010	1365	76.5	46.82473
15	11/26/2010	1365	76.5	46.82473
16	11/26/2010	1412	81.2	48.13156
17	11/26/2010	1412	81.2	48.13156
18	11/26/2010	1562	96.2	53.03373
19	11/26/2010	1562	96.2	53.03373
20	11/26/2010	1623	102.3	54.9394
21	11/26/2010	1623	102.3	54.9394
22	11/26/2010	1746	114.6	58.50933
23	11/26/2010	1746	114.6	58.50933

Location Based Sensory Data (in ALOV Web GIS)

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Cloud-Services in GeoSense

Dynamic Weather Information System - Mozilla Firefox

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Dynamic Weather Information System

http://geosense.dyndns-free.com:8091/server/geosense/gs.html

GeoSense

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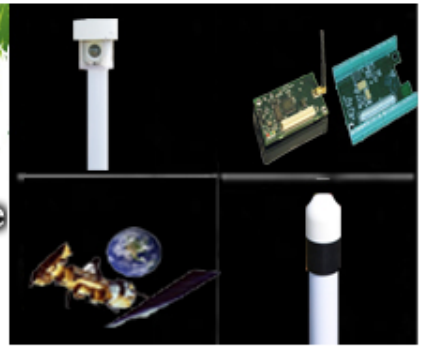
- Whats new
- Crop Mgnt
- Db Mgnt
- Contact

A Dynamic / Real to Near Real-Time Decision Support System for Precision Agriculture



GeoSense, developed with integration of Geogrpahical Information and Communication Technology (Geo-ICT) and Wireless Sensor Network (WSN) technologies, is a part of Indo-Japan Bilateral Multi-disciplinary initiative "Geo-ICT and Sensor Network based Decision Support Systems in Agriculture and Environment Assessment"

Currently GeoSense Assist on

- Rice Crop Yield modeling (Simriw & DSSAT) • Crop Water Requirement (Groundnut and Maize).
- Flux Tower based Energy Balance Studies (Maize) • Crop and Weather Relation (Bowen's Ratio)
- Near Real Time Pest/Disease Forecasting /Management

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View
Agrisens Data
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View
FieldServer Data
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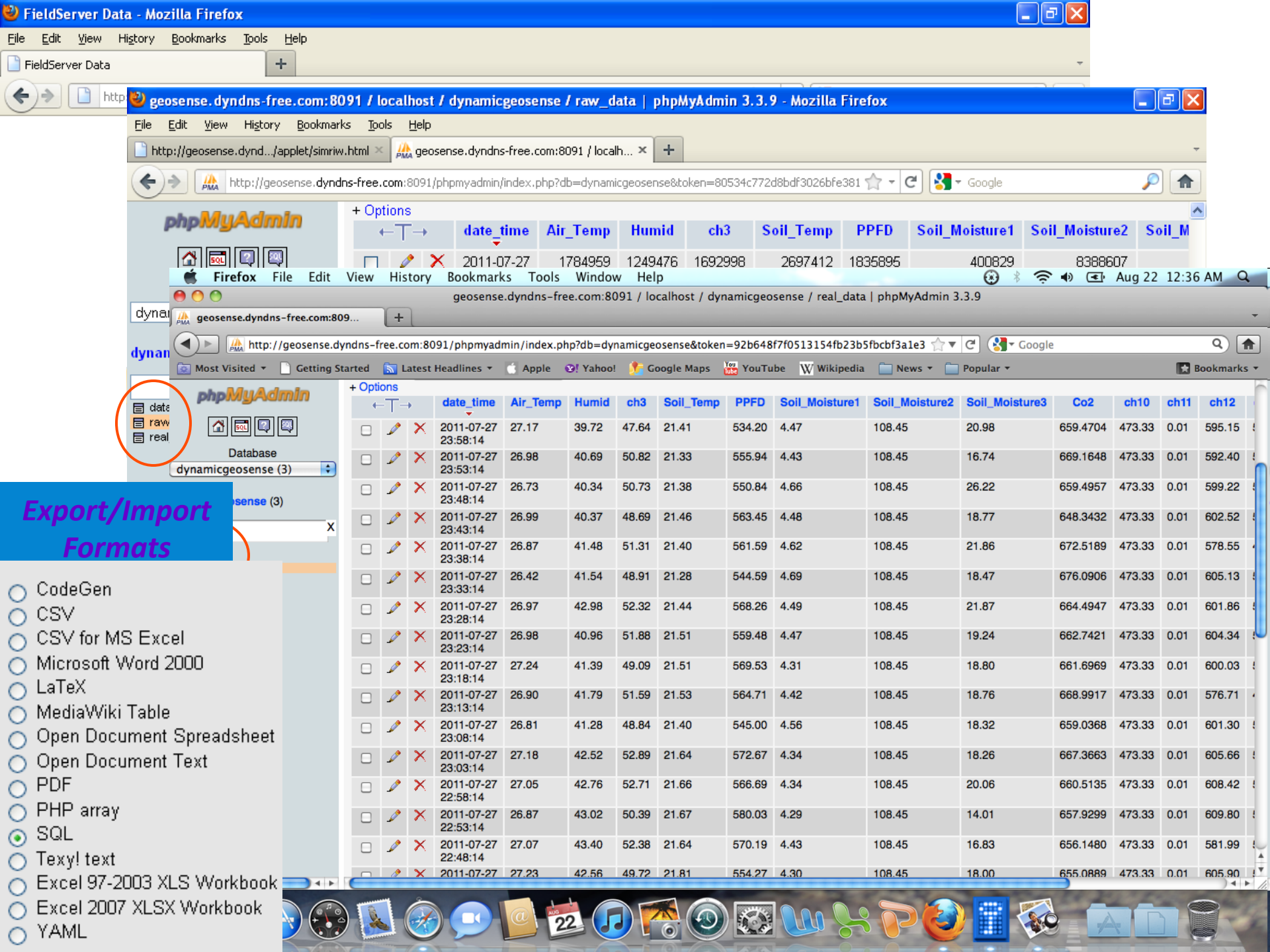
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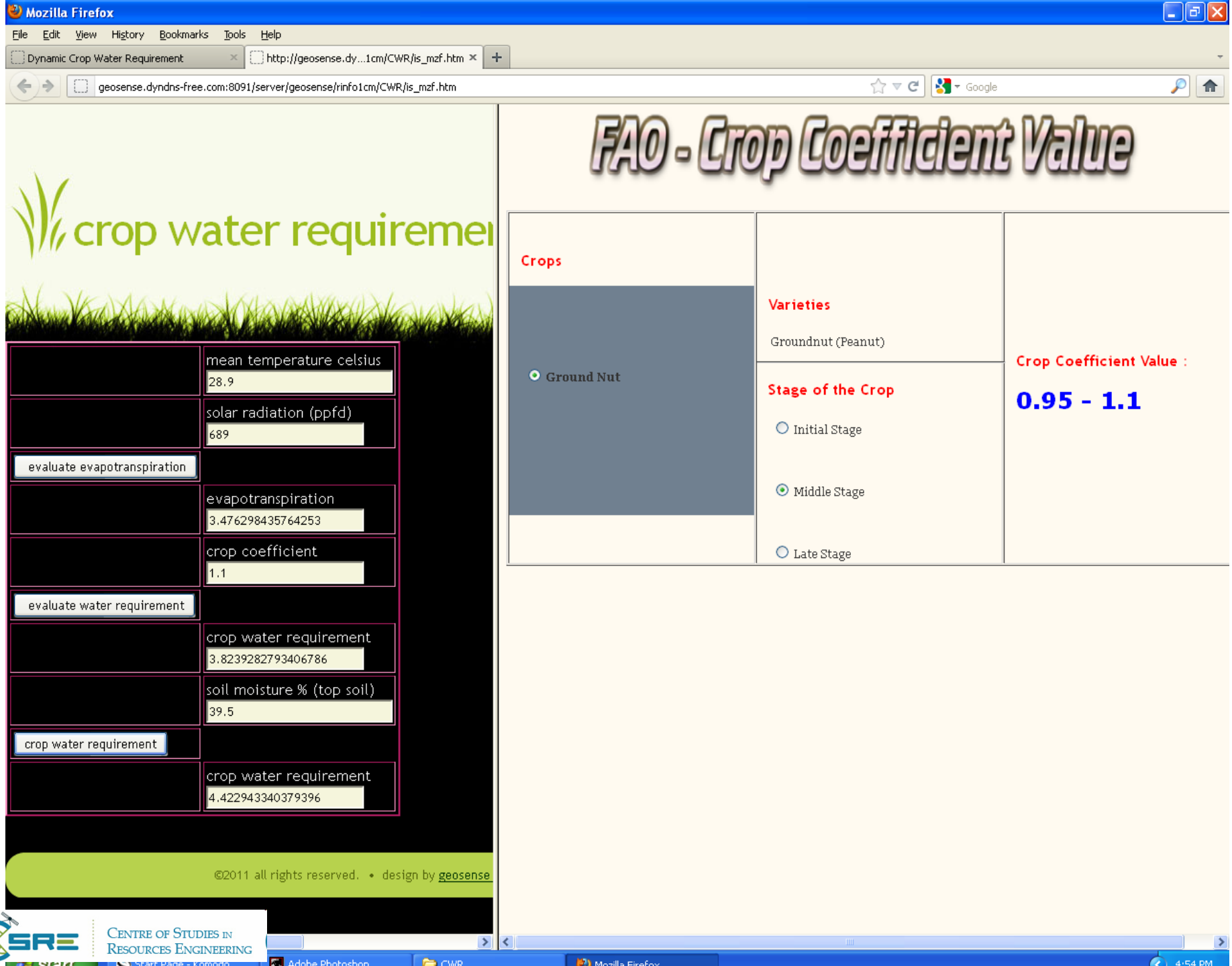
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FAO - Crop Coefficient Value
Crops
Ground Nut
Varieties
Groundnut (Peanut)
Stage of the Crop
Initial Stage
Middle Stage
Late Stage
Crop Coefficient Value :
0.95 - 1.1
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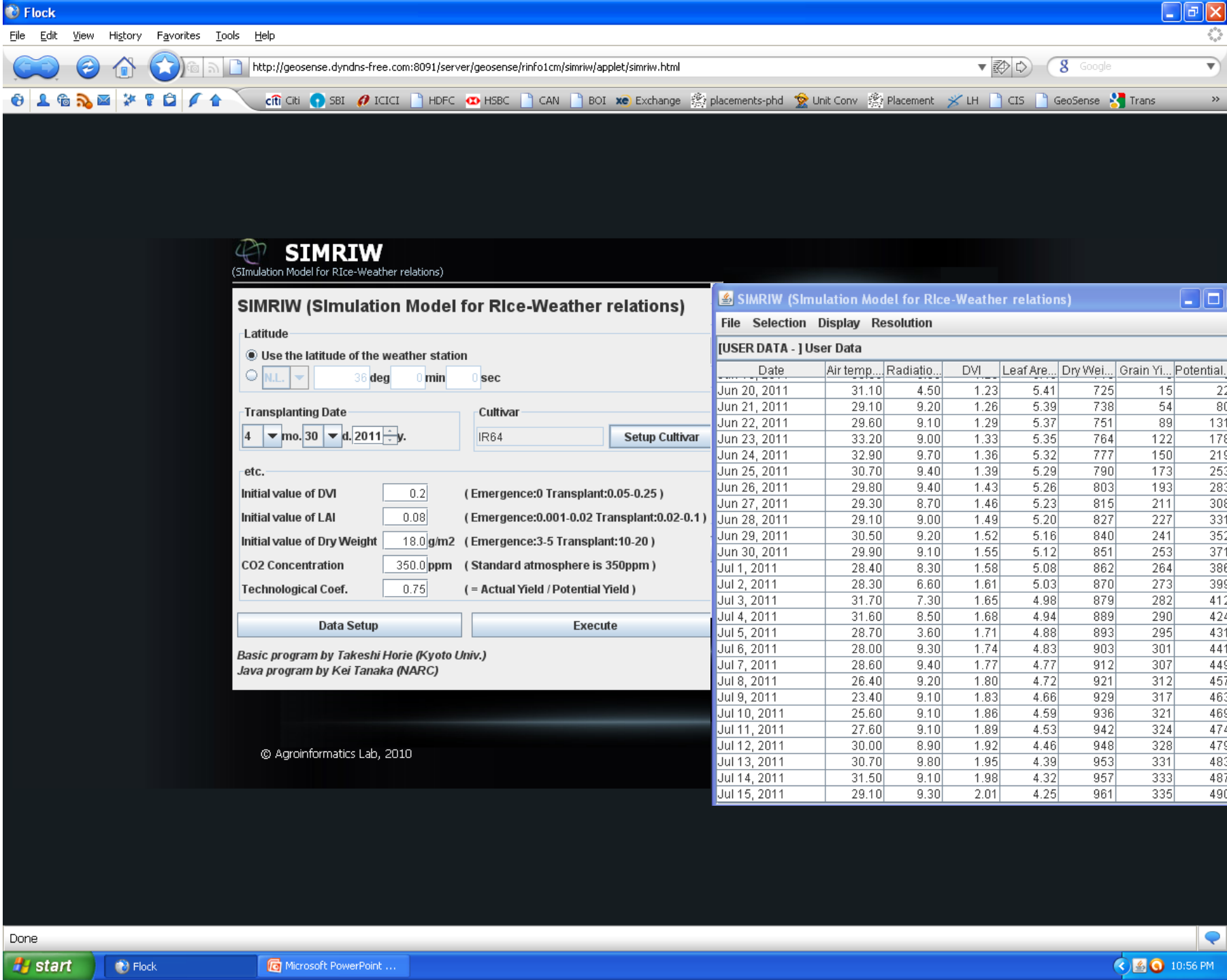
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SIMRIW
(SImulation Model for RIce-Weather relations)
SIMRIW (SImulation Model for RIce-Weather relations)
Latitude
Use the latitude of the weather station
N.L. 36 deg 0 min 0 sec
Transplanting Date
4 mo. 30 d. 2011 y.
Cultivar
IR64
Setup Cultivar
etc.
Initial value of DVI 0.2 (Emergence:0 Transplant:0.05-0.25)
Initial value of LAI 0.08 (Emergence:0.001-0.02 Transplant:0.02-0.1)
Initial value of Dry Weight 18.0 g/m2 (Emergence:3-5 Transplant:10-20)
CO2 Concentration 350.0 ppm (Standard atmosphere is 350ppm)
Technological Coef. 0.75 (= Actual Yield / Potential Yield)
Data Setup
Execute
Basic program by Takeshi Horie (Kyoto Univ.)
Java program by Kei Tanaka (NARC)
© Agroinformatics Lab, 2010
SIMRIW (SImulation Model for RIce-Weather relations)
File Selection Display Resolution
[USER DATA -] User Data
Date | Air temp... | Radiatio... | DVI | Leaf Are... | Dry Wei... | Grain Yi... | Potential...
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Jun 21, 2011 | 29.10 | 9.20 | 1.26 | 5.39 | 738 | 54 | 80
Jun 22, 2011 | 29.60 | 9.10 | 1.29 | 5.37 | 751 | 89 | 131
Jun 23, 2011 | 33.20 | 9.00 | 1.33 | 5.35 | 764 | 122 | 178
Jun 24, 2011 | 32.90 | 9.70 | 1.36 | 5.32 | 777 | 150 | 219
Jun 25, 2011 | 30.70 | 9.40 | 1.39 | 5.29 | 790 | 173 | 253
Jun 26, 2011 | 29.80 | 9.40 | 1.43 | 5.26 | 803 | 193 | 283
Jun 27, 2011 | 29.30 | 8.70 | 1.46 | 5.23 | 815 | 211 | 308
Jun 28, 2011 | 29.10 | 9.00 | 1.49 | 5.20 | 827 | 227 | 331
Jun 29, 2011 | 30.50 | 9.20 | 1.52 | 5.16 | 840 | 241 | 352
Jun 30, 2011 | 29.90 | 9.10 | 1.55 | 5.12 | 851 | 253 | 371
Jul 1, 2011 | 28.40 | 8.30 | 1.58 | 5.08 | 862 | 264 | 386
Jul 2, 2011 | 28.30 | 6.60 | 1.61 | 5.03 | 870 | 273 | 399
Jul 3, 2011 | 31.70 | 7.30 | 1.65 | 4.98 | 879 | 282 | 412
Jul 4, 2011 | 31.60 | 8.50 | 1.68 | 4.94 | 889 | 290 | 424
Jul 5, 2011 | 28.70 | 3.60 | 1.71 | 4.88 | 893 | 295 | 431
Jul 6, 2011 | 28.00 | 9.30 | 1.74 | 4.83 | 903 | 301 | 441
Jul 7, 2011 | 28.60 | 9.40 | 1.77 | 4.77 | 912 | 307 | 449
Jul 8, 2011 | 26.40 | 9.20 | 1.80 | 4.72 | 921 | 312 | 457
Jul 9, 2011 | 23.40 | 9.10 | 1.83 | 4.66 | 929 | 317 | 463
Jul 10, 2011 | 25.60 | 9.10 | 1.86 | 4.59 | 936 | 321 | 469
Jul 11, 2011 | 27.60 | 9.10 | 1.89 | 4.53 | 942 | 324 | 474
Jul 12, 2011 | 30.00 | 8.90 | 1.92 | 4.46 | 948 | 328 | 479
Jul 13, 2011 | 30.70 | 9.80 | 1.95 | 4.39 | 953 | 331 | 483
Jul 14, 2011 | 31.50 | 9.10 | 1.98 | 4.32 | 957 | 333 | 487
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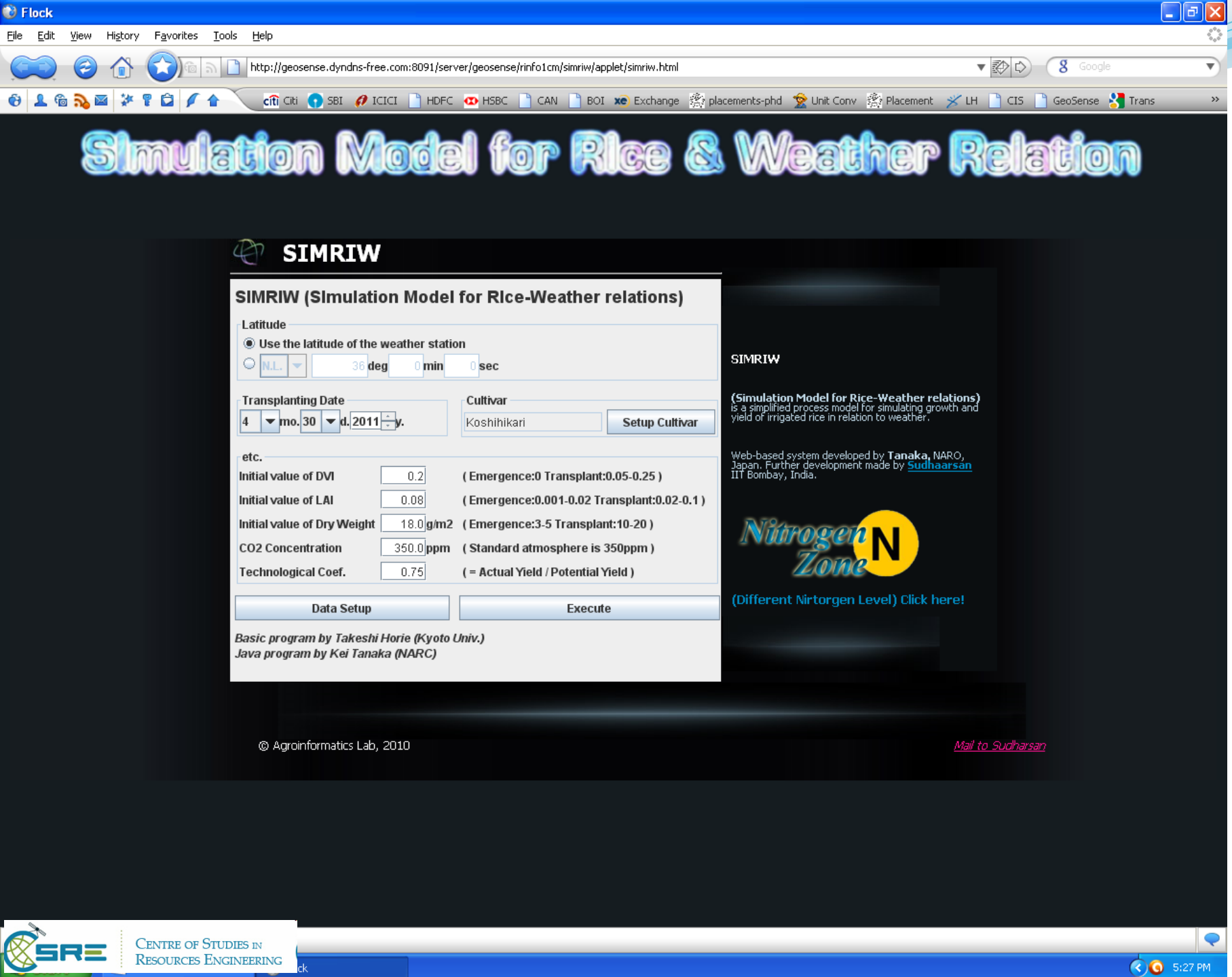
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Simulation Model for Rice & Weather Relation
SIMRIW
SIMRIW (SImulation Model for RIce-Weather relations)
Latitude
Use the latitude of the weather station
N.L. 36 deg 0 min 0 sec
Transplanting Date
4 mo. 30 d. 2011 y.
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Data Setup
Execute
Basic program by Takeshi Horie (Kyoto Univ.)
Java program by Kei Tanaka (NARC)
SIMRIW
(Simulation Model for Rice-Weather relations) is a simplified process model for simulating growth and yield of irrigated rice in relation to weather.
Web-based system developed by Tanaka, NARO, Japan. Further development made by Sudhaarsan IIT Bombay, India.
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© Agroinformatics Lab, 2010
Mail to Sudharsan
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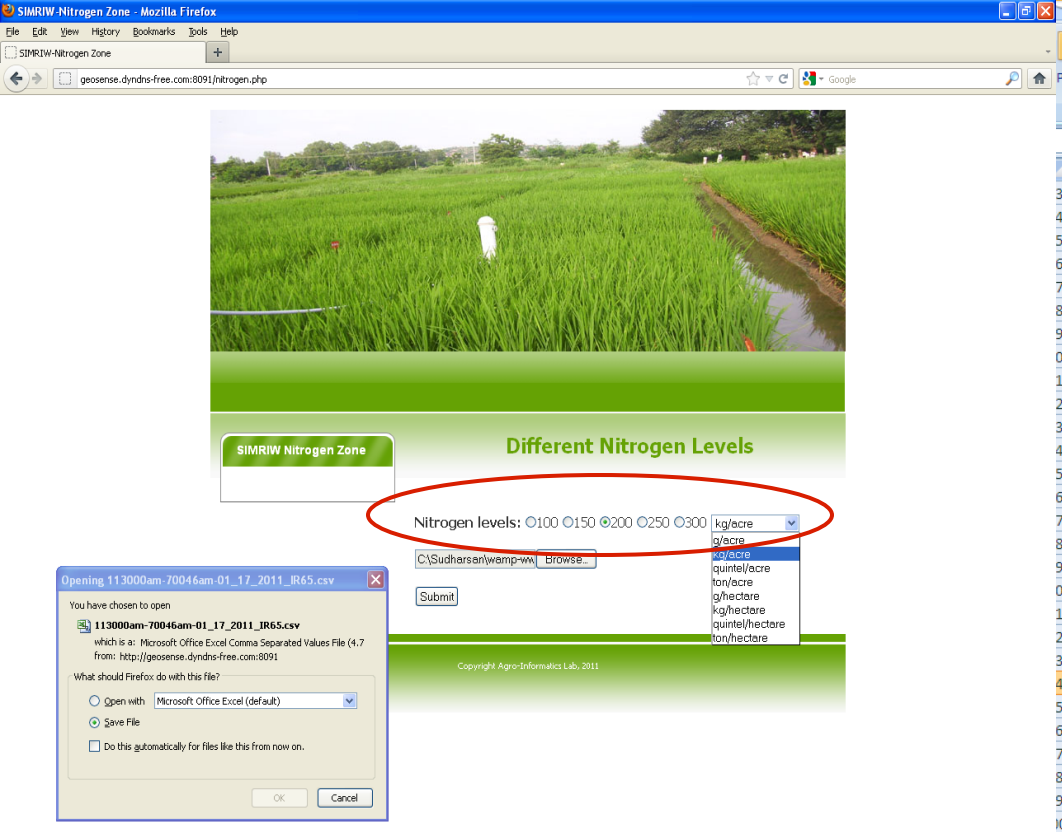

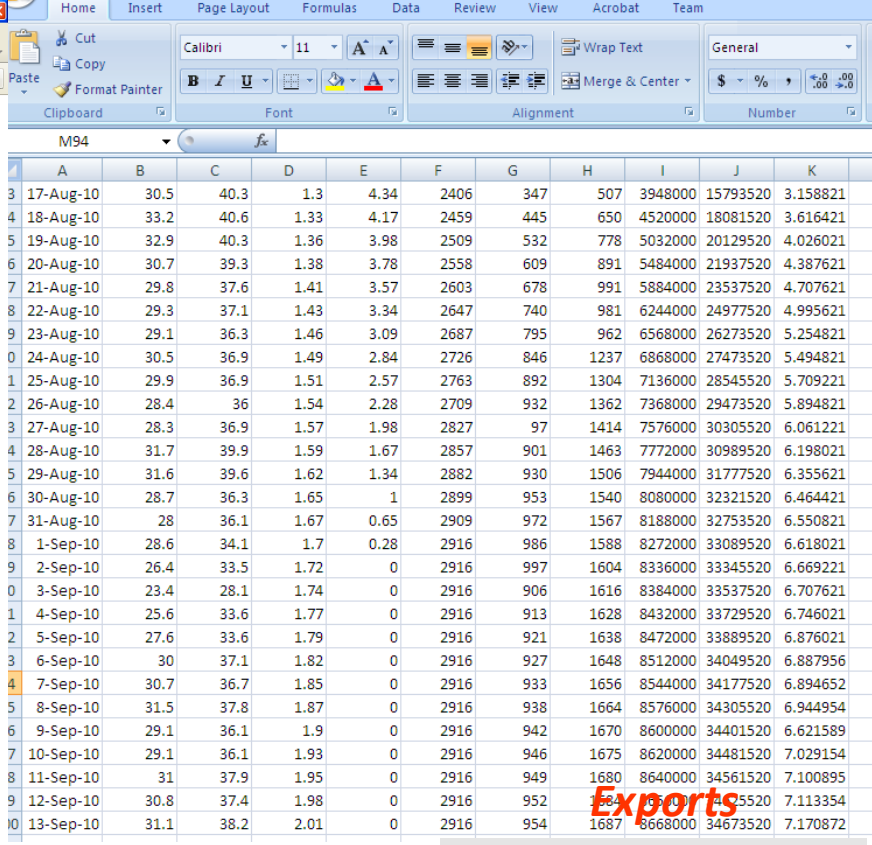

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8	22-Aug-10	29.3	37.1	1.43	3.34	2647	740	981	6244000	24977520	4.995621
9	23-Aug-10	29.1	36.3	1.46	3.09	2687	795	962	6568000	26273520	5.254821
0	24-Aug-10	30.5	36.9	1.49	2.84	2726	846	1237	6868000	27473520	5.494821
1	25-Aug-10	29.9	36.9	1.51	2.57	2763	892	1304	7136000	28545520	5.709221
2	26-Aug-10	28.4	36	1.54	2.28	2709	932	1362	7368000	29473520	5.894821
3	27-Aug-10	28.3	36.9	1.57	1.98	2827	97	1414	7576000	30305520	6.061221
4	28-Aug-10	31.7	39.9	1.59	1.67	2857	901	1463	7772000	30989520	6.198021
5	29-Aug-10	31.6	39.6	1.62	1.34	2882	930	1506	7944000	31777520	6.355621
6	30-Aug-10	28.7	36.3	1.65	1	2899	953	1540	8080000	32321520	6.464421
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3	6-Sep-10	30	37.1	1.82	0	2916	927	1648	8512000	34049520	6.887956
4	7-Sep-10	30.7	36.7	1.85	0	2916	933	1656	8544000	34177520	6.894652
5	8-Sep-10	31.5	37.8	1.87	0	2916	938	1664	8576000	34305520	6.944954
6	9-Sep-10	29.1	36.1	1.9	0	2916	942	1670	8600000	34401520	6.621589
7	10-Sep-10	29.1	36.1	1.93	0	2916	946	1675	8620000	34481520	7.029154
8	11-Sep-10	31	37.9	1.95	0	2916	949	1680	8640000	34561520	7.100895
9	12-Sep-10	30.8	37.4	1.98	0	2916	952	1684	8656000	34625520	7.113354
0	13-Sep-10	31.1	38.2	2.01	0	2916	954	1687	8668000	34673520	7.170872

Exports

N (kg/ha)	Grain Yields (t/ha)		
	Observed	Simulated	
		CERES-Rice	SIMRIW
100	6.70	5.62	6.35
150	6.52	6.15	6.35
200	7.20	7.31	7.26
250	6.95	7.76	7.02
300	7.35	7.94	7.17

- CodeGen
- CSV
- CSV for MS Excel
- Microsoft Word 2000
- LaTeX
- MediaWiki Table
- Open Document Spreadsheet
- Open Document Text
- PDF
- PHP array
- SQL
- Texy! text
- Excel 97-2003 XLS Workbook
- Excel 2007 XLSX Workbook
- YAML

Descision Support System for Agriculture Pest/Disease Management (Groundnut)

Main Page

THRIPS

Thrips are small plant pests in the insect order Thysanoptera. Pest thrips use their asymmetrical paired mouthparts to puncture cells on the leaf surface, and then to drink or suck plant juices.

It damages the chlorophyll content of the leaf terminals. Besides causing direct damage to the crop, Thrips are known to cause more indirect damage by attacking as vectors of viral disease viz, groundnut Bud Necrosis Virus (BNV).

Main Page

Diseases

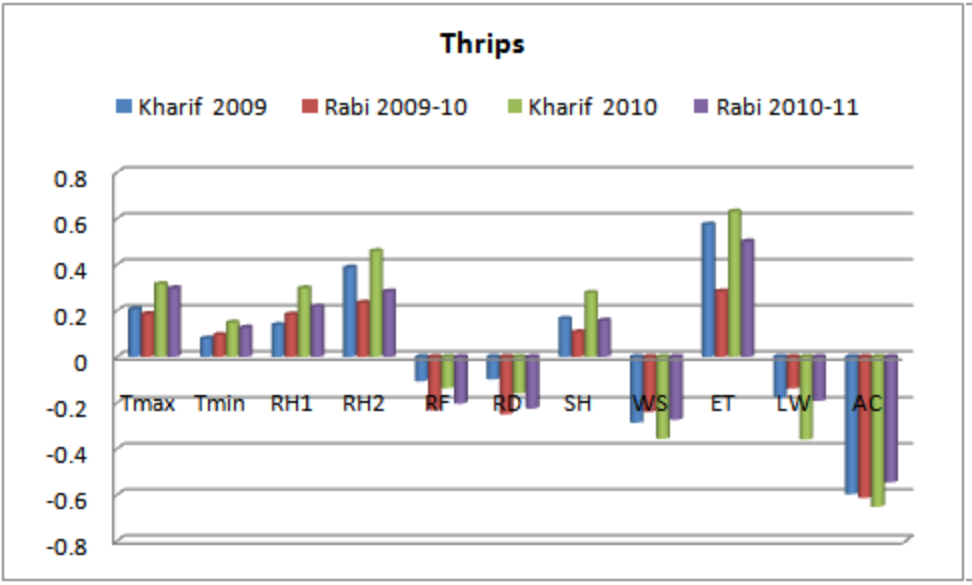
- Leaf Spot
- Bud Necrosis Virus (BNV)
- Rust

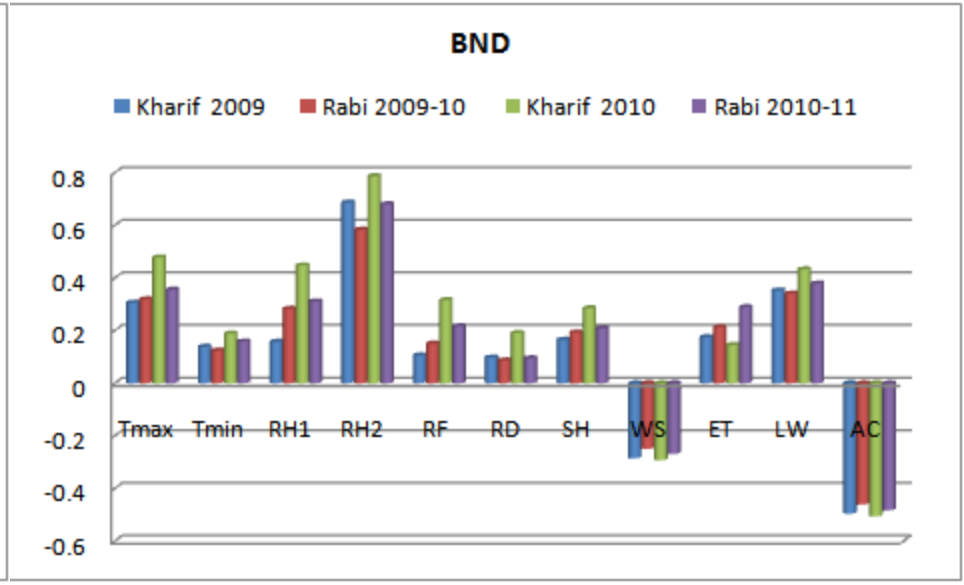
Development Map

This Project is under Development by Amiya Kumar Tripathy, November 2011.

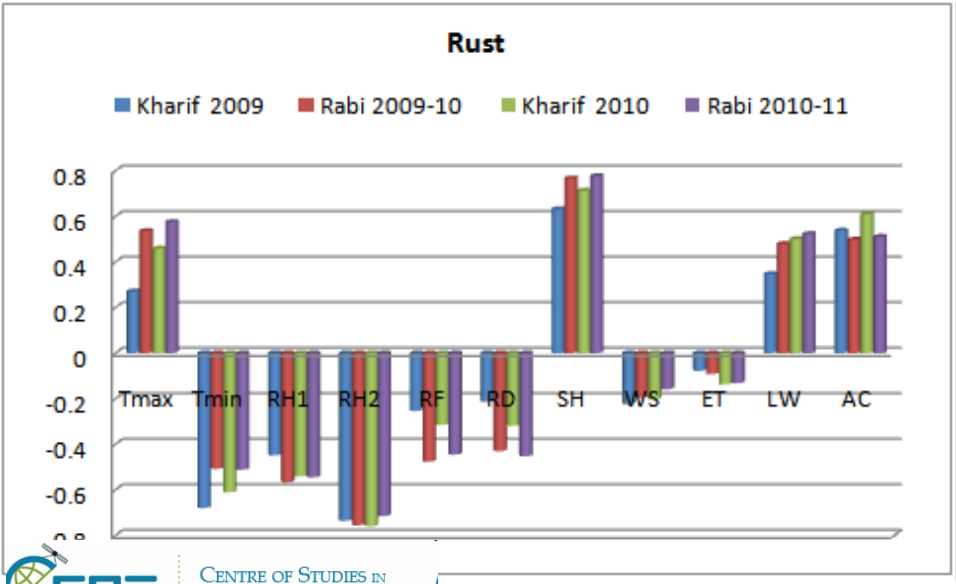
Temprature:

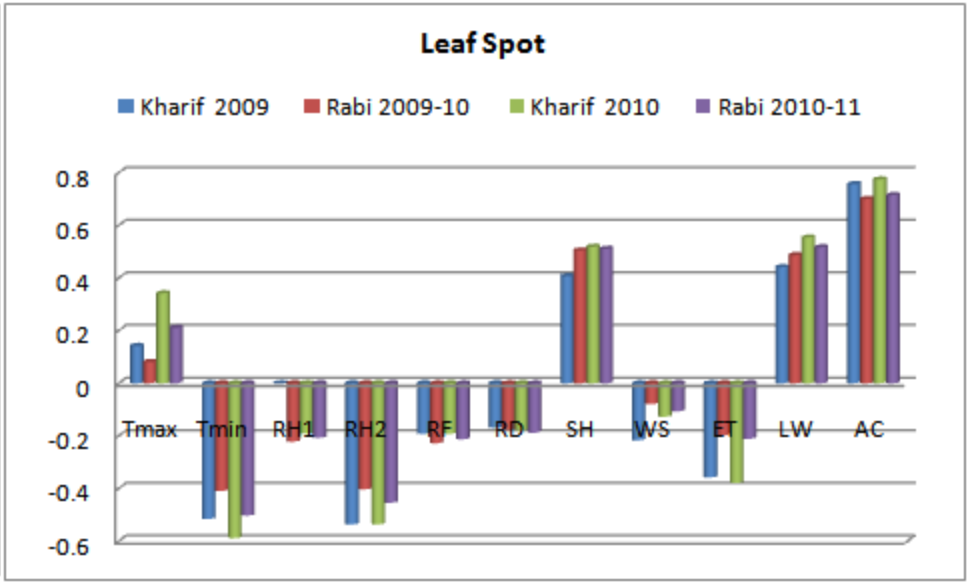
Value: 32 °C





Crop-Weather-Soil-Environment-Pest/Disease Correlation





Interpretation of Correlation index values
BNV, Thrips, Leaf Spot and Rust

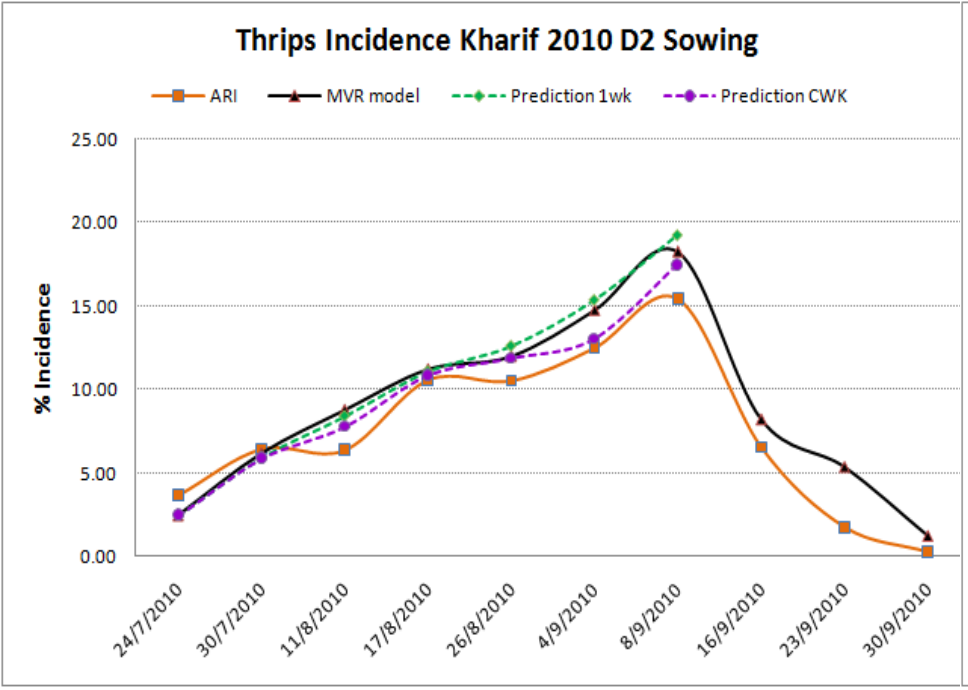
Correlation value (- 1 to +1)	Correlation Levels (Such as LS with RH_1)	Variables			
		BNV	**Thrips**	**Leaf Spot**	**Rust**
0.0 to 0.1 (+ve)	Negligible or No correlation	Rainy Days Rain Fall	Tmin Rainy Days Rainfall	RH_2	ET
0.0 to - 0.1(-ve)					
> 0.1 to 0.5 (+ve)	Moderate	RH_1 Sunshine Tmax, Tmin, ET, Leaf Wetness	Tmax, RH_2 Sunshine	Sunshine Tmax Leaf Wetness	Tmax Leaf Wetness
< - 0.1 to - 0.5 (-ve)		Wind Speed	Wind Speed RH_1 Leaf Wetness	ET Wind Speed Rainfall Rainy Days	RH_2 Wind Speed Rainfall Rainy Days
> 0.5 to 1(+ve)	Strong (Good Correlation)	RH_2	ET	Age of Crop	Age of Crop Sunshine
< -0.5 to - 1(-ve)		Age of the Crop	Age of Crop	RH_1 Tmin	RH_1 Tmin

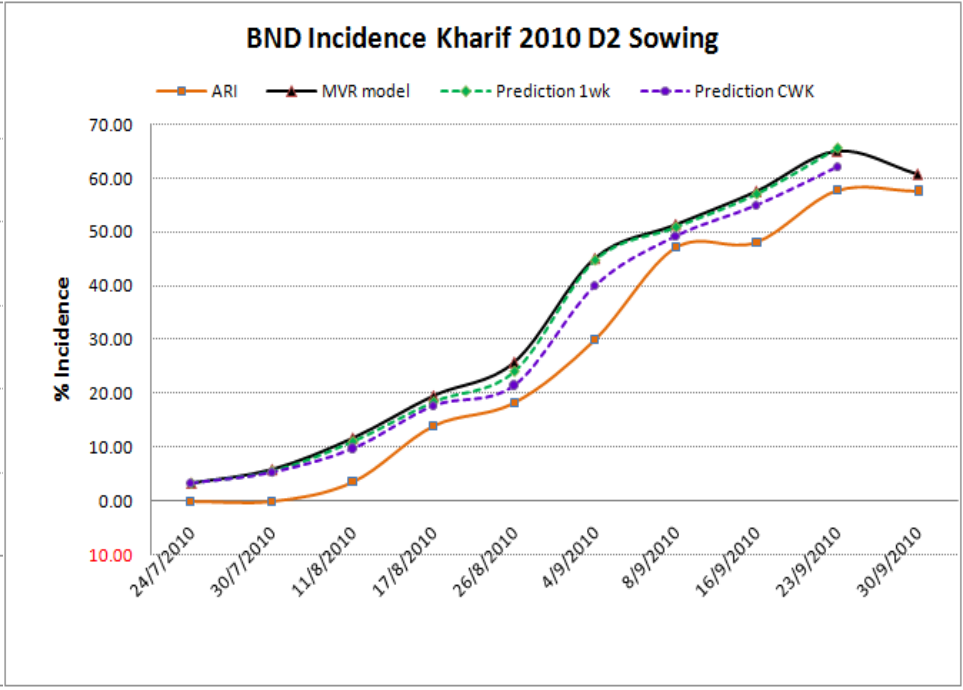
Evaluation of Various Pest/Disease Forewarning Models with Field Surveillance Data from the Test-bed (ARI)

1. **MVR (Multi-variant Regression Analysis (MVR)**

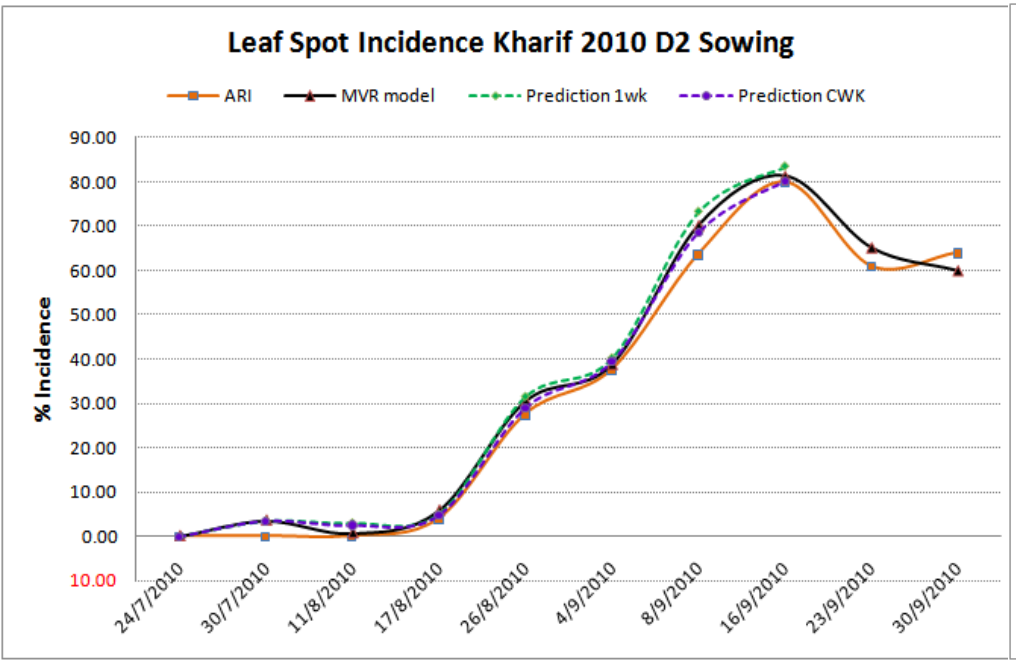
2. **One-week Historical trends (1-Wk)**

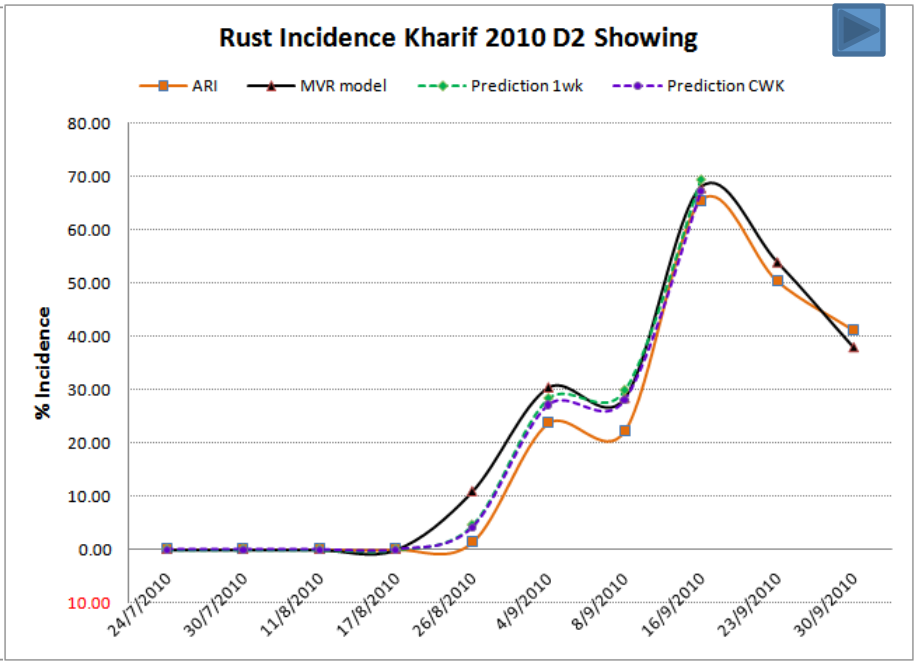
3. **Cumulative Weeks (CWK)**
   (with reference to weather-crop-environment and life cycle parameters)
   - Life Cycle
   - Season
   - Weather Parameter
   - Stages
   - Sowing Date
   - Incidence at flowering stage
   - Growing Degree Days
   - Previous Year Record
   - Correlation With Other Pest/Disease
   - Previous Season values



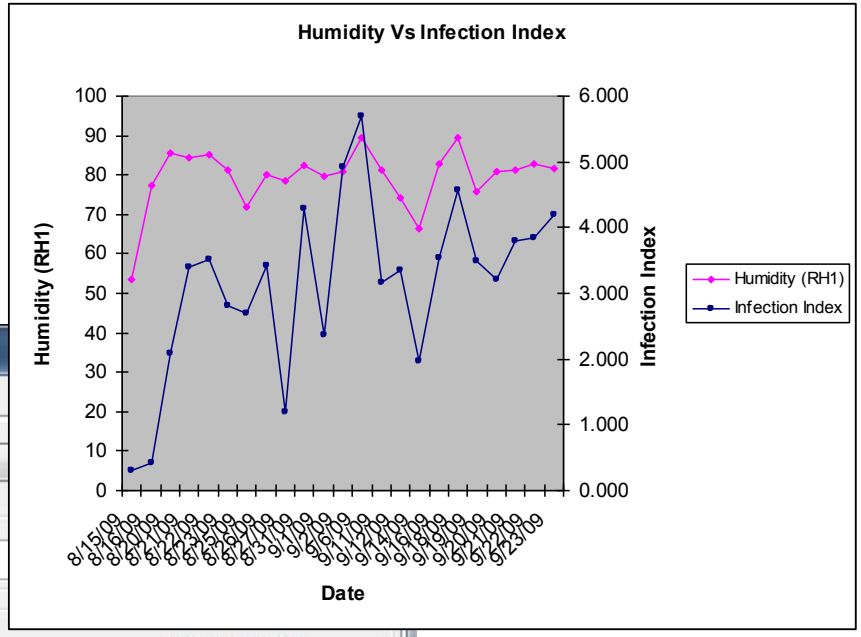


Pest/Disease Prediction with 1week and Cumulative w.r.t to Life Cycle and Weather





BNV-Weather Interaction Interface



Weka Explorer

Preprocess | Classify | Cluster | Associate | Select attributes | Visualize

Open file... | Open URL... | Open DB... | Generate... | Undo

Filter

Choose None

Current relation

Relation: weather
Instances: 14 Attributes: 5

Attributes

All | None | Invert | Pattern

No.	Name
1	outlook
2	temperature
3	humidity
4	windy
5	play

Remove

Selected attribute

Name: humidity Type: Numeric
Missing: 0 (0%) Distinct: 10 Unique: 7 (50%)

Statistic	Value
Minimum	65
Maximum	96
Mean	81.643
StdDev	10.285

Class: play (Nom) | Visualize All

65 80.5 96

Log x 0

If Humidity Increase to 80 then the BNV Infection will be Sevier

Introduction: WSN challenges

- Indigenous data and in Open Source Consortium (OSC) format
  - Syntactic and semantic heterogeneity
  - Increase difficulties in interoperability and data discovery

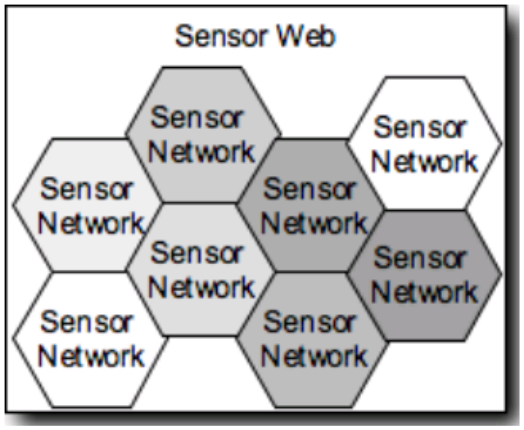
- Limited application oriented research base
  - unavailability of sensor system lineage and calibration curves to the user community

Introduction: Open Geospatial Consortium

- **an international, non-profit standardization organization comprising over 400 companies, governmental agencies and universities.** (Botts et al., 2006)
  - develop standards for geospatial web services
  - integrate Geospatial data from heterogeneous data sources
  - remove incompatibilities in structural, syntactical and semantic representation hindering interoperability

Sensor Web Enablement

- **Sensor Web**
  - **concept towards achieving a collaborative, coherent, consistent, and consolidated sensor data collection, fusion and distribution system**
  - **Internet for monitoring spatio- temporal phenomena appearing in the physical environment in real time**
- **Sensor**
  - **devices for the measurement of physical quantities.**
  - **All sensors from thermometer located at a fixed position to a complex hyper-spectral sensor on board of an Earth orbiting satellite**



Source: Botts et al. 2006

SWE Approach

(towards achieving a collaborative, coherent, consistent, and consolidated sensor data collection, fusion and distribution system)

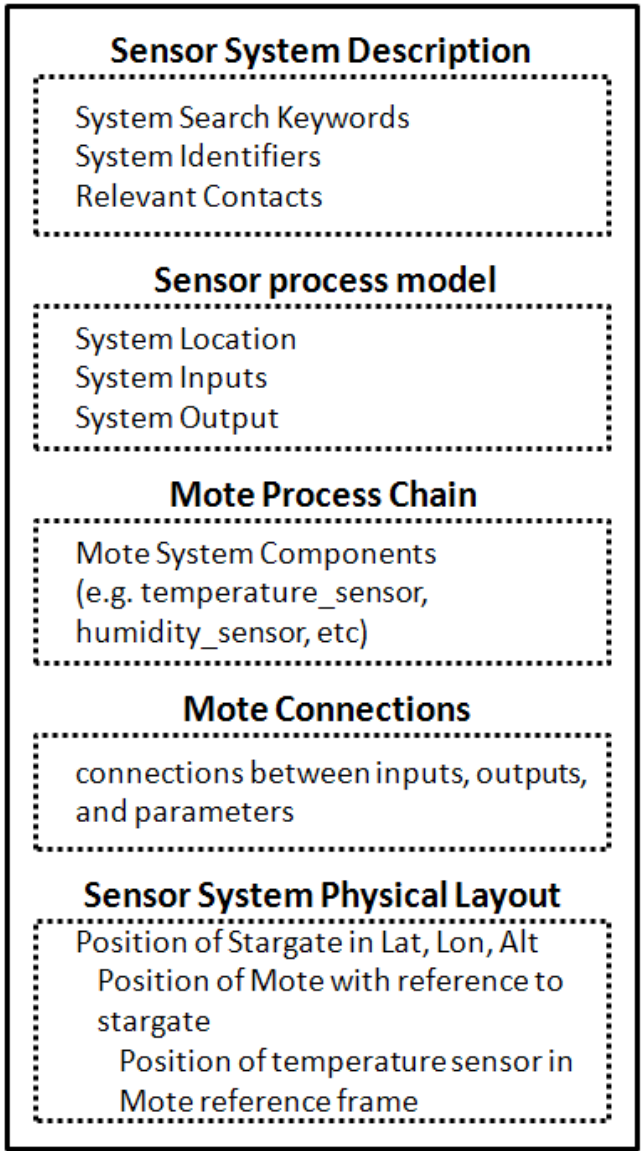
- **Three encodings (*XML representations*) to describe sensors and sensor observations**
  - **Sensor Model Language (SensorML) (to define entire sensing system)**
  - **Observations and Measurements Schema (O&M)**
  - **Transducer Markup Language (TransducerML)**
- **Four standard interface (*XMl requests*) definitions for web services**
  - **Sensor Observations Service (SOS) (visualization of sensory data in web)**
  - **Sensor Planning Service (SPS) (controlling remote sensors)**
  - **Sensor Alert Service (SAS)**
  - **Web Notification Services (WNS)**

  } **Trigger the uneven conditions through communication technology)**

SWE in GeoSense

- **GeoSense is currently based on Open Source Consortium (OSC) standards wherein each sensing system has diverse data formats and need for standardization with OGC SWE standards**

- **SensorML Framework**
  - **Sensor System Description**
  - **Sensor Process Model** {e.g. System Location (lat, long, parameter description i.e. air temp, soil temp, wet bulb, dry bulb, etc.); System Inputs temperature (id, description, etc.); System output temperature (minimum value, maximum value, accuracy, unit of measurement, etc.)}
  - **Sensor Process Chain** {e.g. System Components **temperature** (id, name of sensor, Geographic Markup Language - id (gml-id), unit of measurement (Celsius / Fahrenheit), range of data collection, measuring range least count (e.g. 01 degree, 0.1 degree, etc.), accuracy (e.g. +- 5 per cent), etc.)}
  - **Sensor Connections** {e.g. Connections of each sensor input from mote to sensor then Output from sensor to mote.)
  - **System physical layout** {e.g. Position of Stargate (lat, long, elevation), position of mote-1 with respect to stargate (lat, long, elevation), Position of each sensor on mote-1 (air temperature sensor on mast at 0.5 m., soil moisture sensor at 0.15 m depth in soil, etc.)}

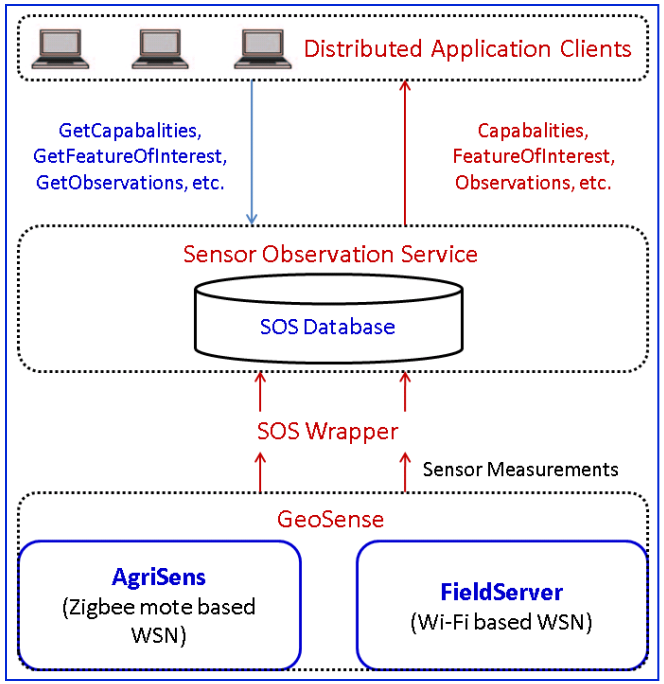


SensorML Framework for Agrisens

Service Oriented Architecture: Structure

- **SOS Wrapper**
  - Collects raw data from sensor systems
  - Converts to real values
  - Supports transactional SQL insert operation and stores in SOS database

- **Distributed Application Clients**
  - Facilitates the visualization of sensor data on web by executing standard XML-HTTP requests
  - Enables locating the sensor on OGC enabled Web Mapping Service
  - Provides table and/or graph plot visualizations

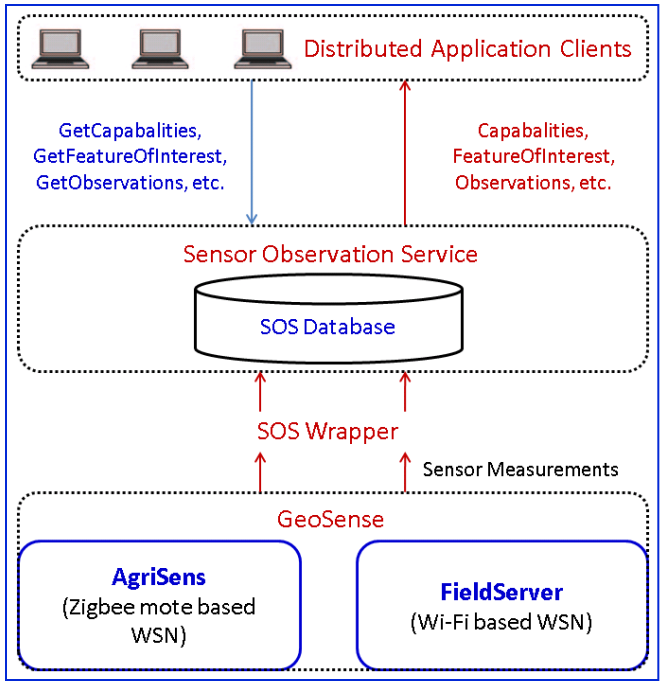


Service Oriented Architecture for GeoSense

Service Oriented Architecture: Structure

Sensor Observation Service

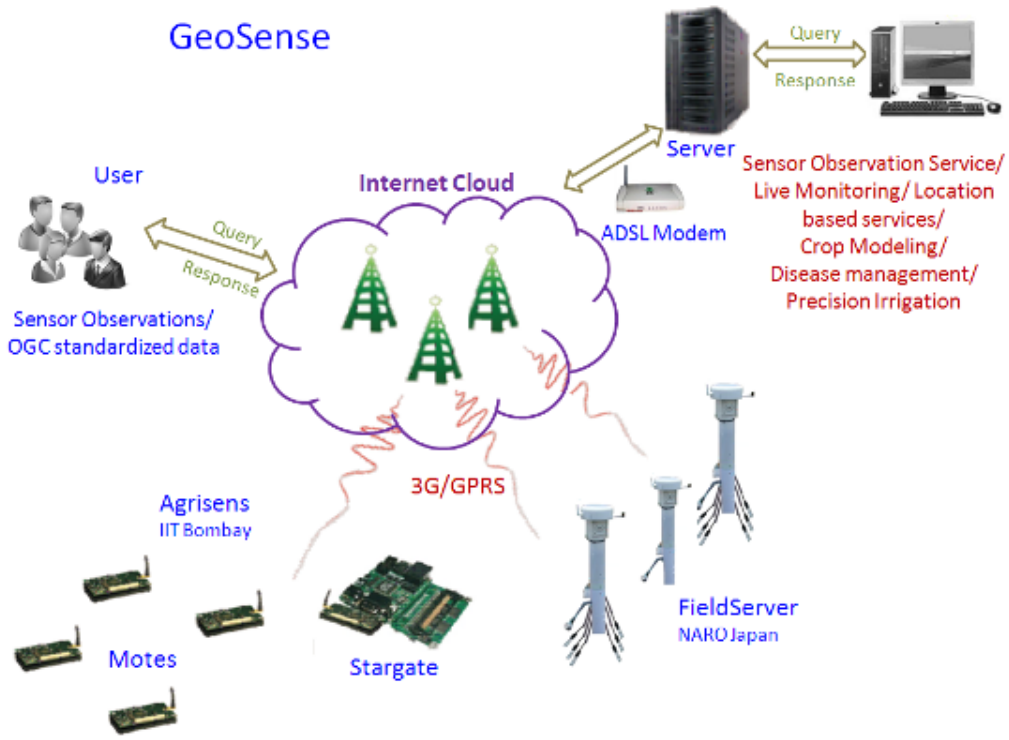
- Open source tools are used for implementing SOS
- Database architecture for SOS is obtained from 52NSOS API 3.1.1 (52North SOS, 2011)
- Eclipse based Java Integrated Development Environment (IDE) version Helios (Eclipse, 2011)
- Google Web Toolkit (GWT, 2011)
- Web server Apache Tomcat 7.0 (Apache Tomcat, 2011)
- Database server PostGIS 1.5 (PostGIS, 2011) in PostgreSQL 8.4 (PostgreSQL, 2011)



Service Oriented Architecture for GeoSense

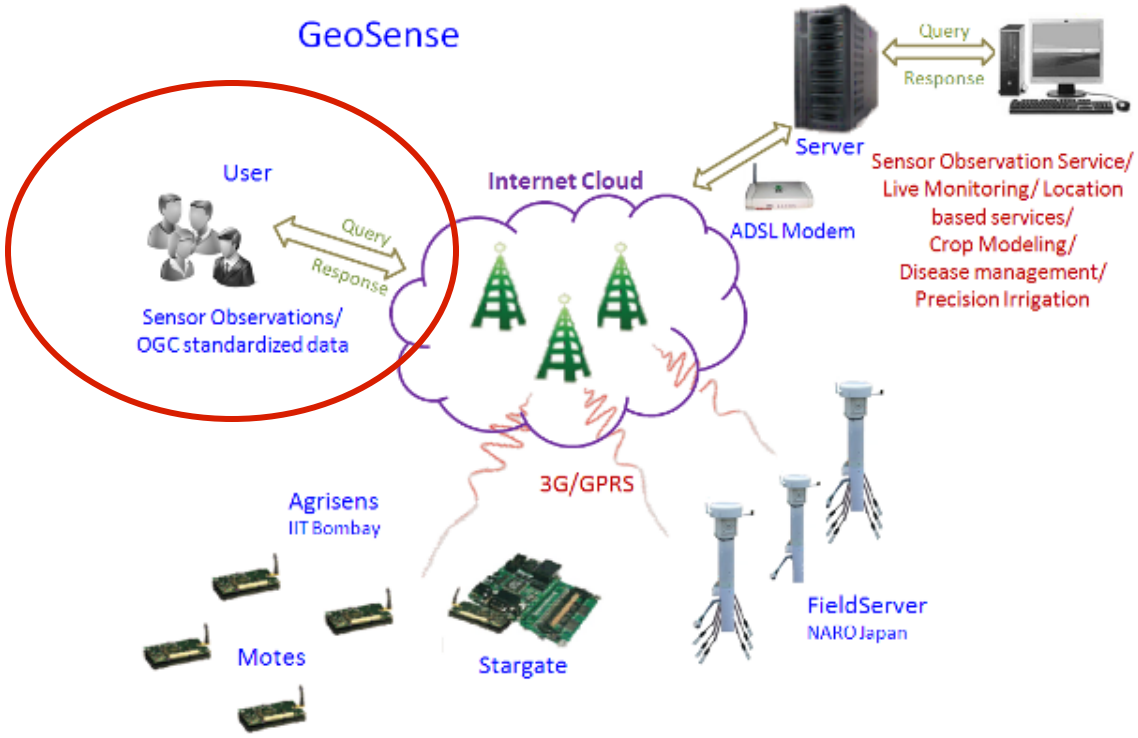
Service Oriented Architecture for GeoSense

GeoSense Architecture



Service Oriented Architecture for GeoSense

GeoSense Architecture



Prototype Demo on Sensor Observation Service

Steps

- Service on Get Capabilities
- Select sensor (Select Feature of Interest)
- Select duration
- Get Observation
  - Plot table or Chart (Time vs Observations)

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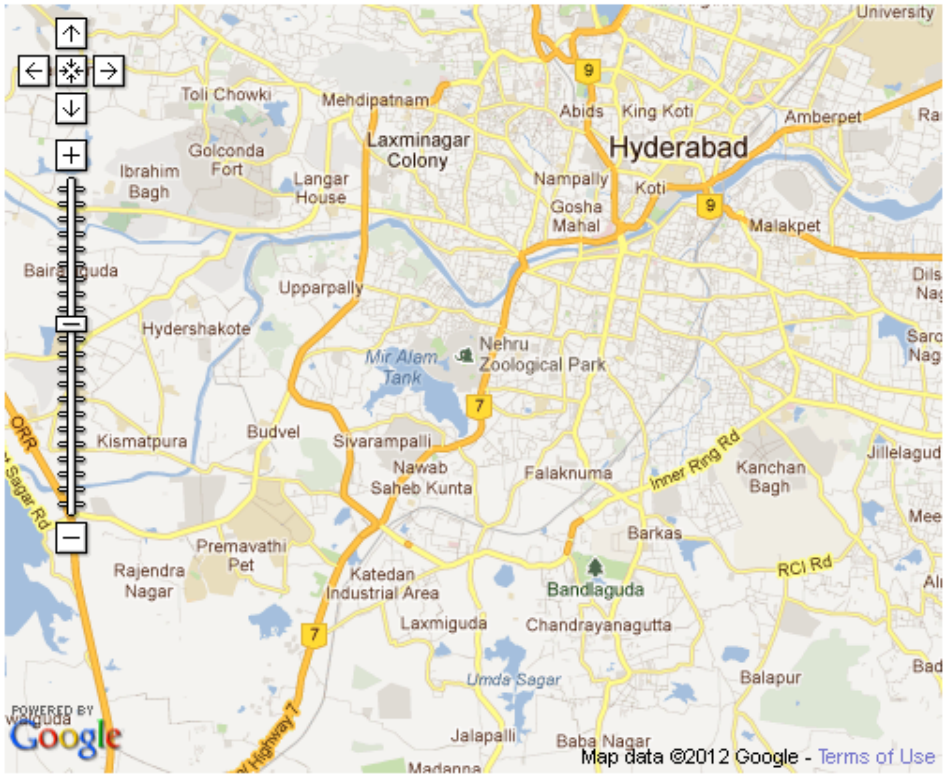
Service Oriented Architecture for GeoSense

Home **Sensor Observation Service** **Modeling Service** **Contact**

URL: http://localhost:8080/52nSOSv3_WAR/sos Get Capablities



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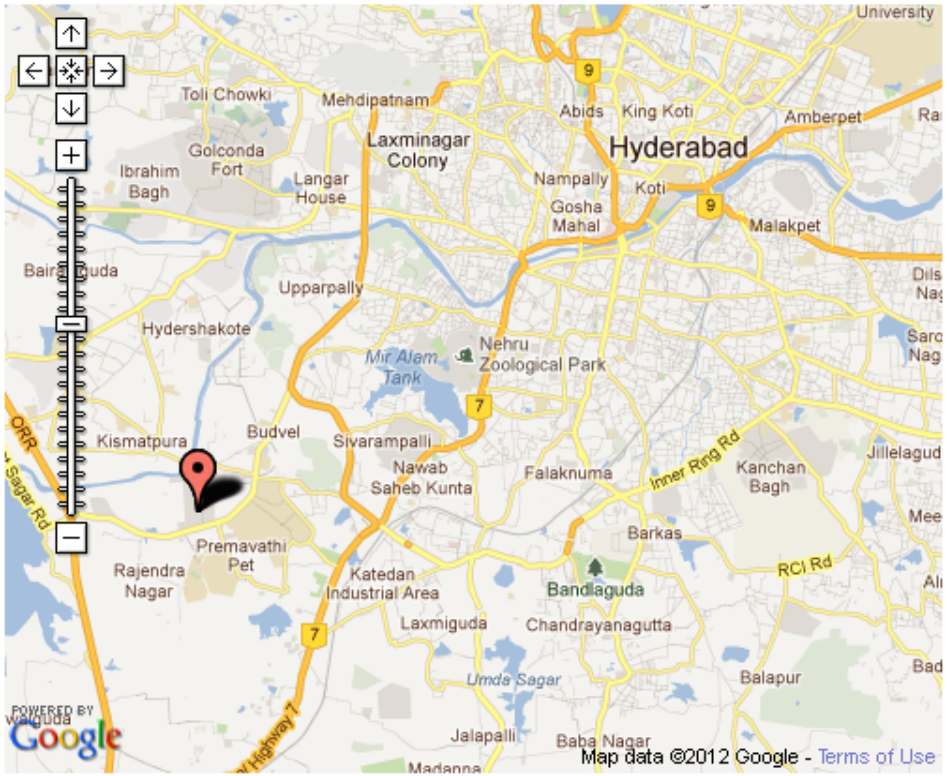

Select a Location

- Select a Location
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- 78.3984321 17.323917
- 78.3984322 17.323916
- 78.3984321 17.323915
- 78.398432 17.323916
- 78.398432 17.323915

start 6:40 AM

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Service Oriented Architecture for GeoSense

Home | Sensor Observation Service | Modeling Service | Contact

URL: http://localhost:8080/52nSOSv3_WAR/sos Get Capablities

78.3984321 17.323916

Select a sensor

- Select a sensor
- TEMPERATURE
- HUMIDITY
- LEAF_WETNESS

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Service Oriented Architecture for GeoSense

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URL: http://localhost:8080/52nSOSv3_WAR/sos Get Capablities

78.3984321 17.323916

TEMPERATURE

Enter begin DateTime as yyyy-mm-ddThh:mm:ss-04
data ranges from 2009-08-27T13:18:48.453-04:00

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To end DateTime 2009-11-07T07:22:36.844-05:00

show

start 6:40 AM

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2009-08-27T13:18:48.453-04:00

To end DateTime 2009-11-07T07:22:36.844-05:00

2009-08-27T17:18:48.453-04:00

show

Table | Chart

Date	Time	Sensor_id	Value
2009-08-27	13:18:48.453-04:00	foi_0921	25.99853515625
2009-08-27	13:20:45.620-04:00	foi_0921	25.99853515625
2009-08-27	13:35:24.541-04:00	foi_0921	24.47265625
2009-08-27	13:37:21.710-04:00	foi_0921	24.47265625

start 6:41 AM

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78.3984321 17.323916

TEMPERATURE

Enter begin DateTime as yyyy-mm-ddThh:mm:ss-04
data ranges from 2009-08-27T13:18:48.453-04:00

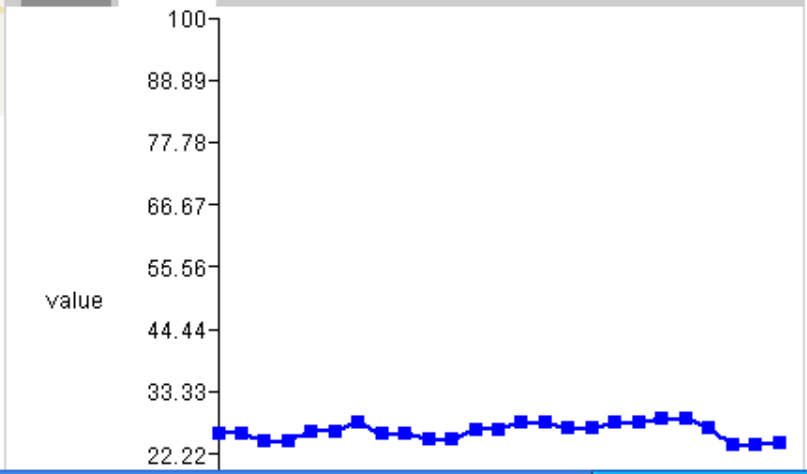
2009-08-27T13:18:48.453-04:00

To end DateTime 2009-11-07T07:22:36.844-05:00

2009-08-27T17:18:48.453-04:00

show

Table Chart



start Wi... 4 W Ja... G:... 2 F. To... Ge... et... 6:41 AM

Prototype Demo on Modeling Service

Steps

- Get Capabilities of service
- Select sensor
- Select duration
- Get Reference Evapotranspiration
  - using Hargreeves Method
  - Plot Table or Chart (Time vs Observations)

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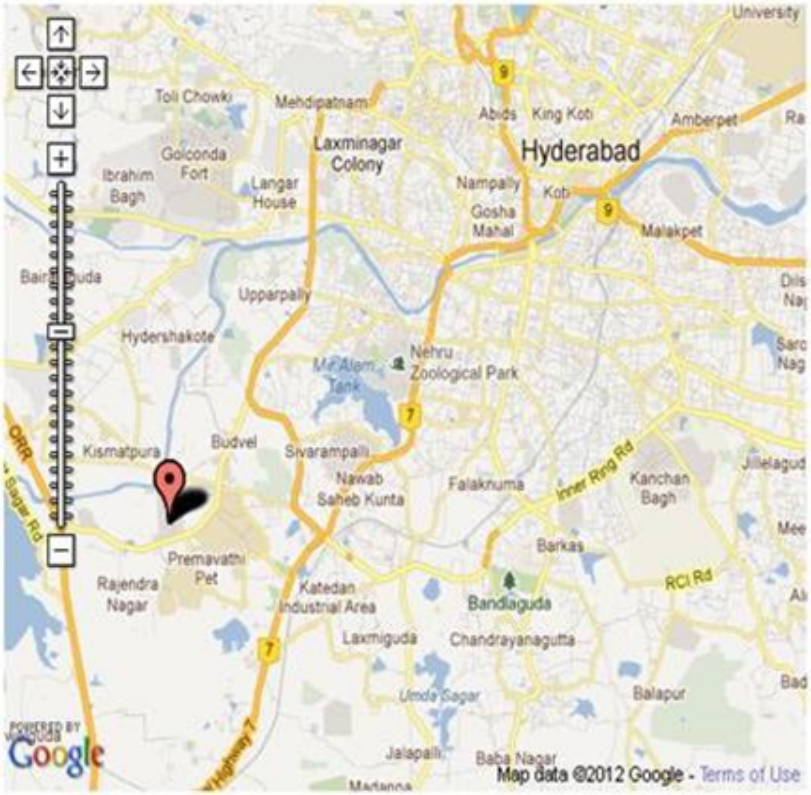
Service Oriented Architecture for GeoSense

Home Sensor Observation Service Modeling Service Contact

ET Calculations

URL: http://localhost:8080/52nSOSv3_WAR/sos Get Capablities



Select a Location

- Select a Location
- 78.3984321 17.323916
- 78.3984321 17.323917
- 78.3984322 17.323916
- 78.3984321 17.323915
- 78.398432 17.323916
- 78.398432 17.323915

start 6:42 AM

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Web Application Starter Project

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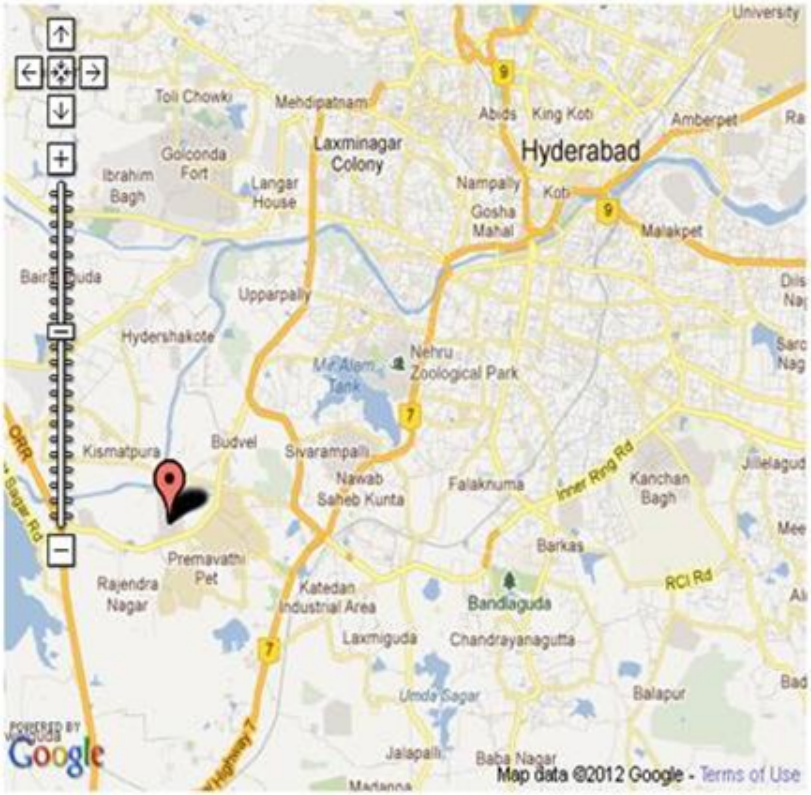
Service Oriented Architecture for GeoSense

Home **Sensor Observation Service** **Modeling Service** **Contact**

ET Calculations

URL: http://localhost:8080/52nSOSv3_WAR/sos Get Capablities



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2009-08-27T13:18:48.453-04:00

To end DateTime 2009-11-07T07:22:36.844-05:00

2009-08-27T17:18:48.453-04:00

show

start Wi... 4 W Ja... G:... 2 F. To... Ge... et... 6:42 AM

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File Edit View History Bookmarks Tools Help

Web Application Starter Project

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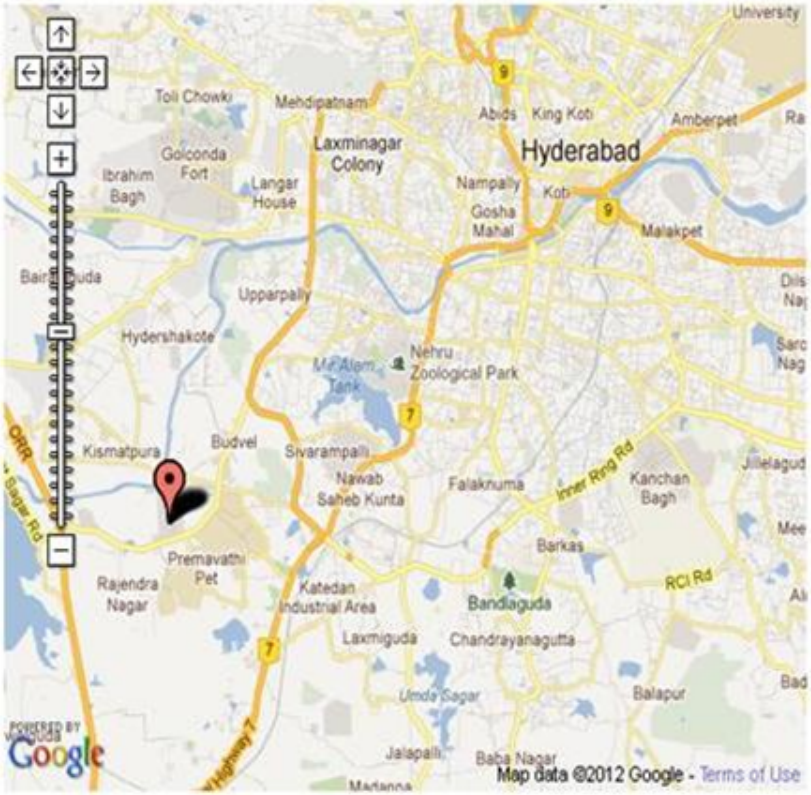
Service Oriented Architecture for GeoSense

Home | Sensor Observation Service | Modeling Service | Contact

ET Calculations

URL: http://localhost:8080/52nSOSv3_WAR/sos Get Capablities



78.3984321 17.323916

Enter begin DateTime as yyyy-mm-ddThh:mm:ss-04
data ranges from 2009-08-27T13:18:48.453-04:00

2009-08-27T13:18:48.453-04:00

To end DateTime 2009-11-07T07:22:36.844-05:00

2009-08-27T17:18:48.453-04:00

show

Table | Chart

Date	Time	Sensor_id	Value
2009-08-27	21:20:18.610-04:00	foi_0913	6.0565981657609
2009-08-27	21:22:15.780-04:00	foi_0913	6.0565981657609
2009-08-27	21:36:54.691-04:00	foi_0913	6.6802182404891
2009-08-27	21:38:51.870-04:00	foi_0913	6.6802182404891

start 6:42 AM

Web Application Starter Project - Mozilla Firefox

File Edit View History Bookmarks Tools Help

Web Application Starter Project

localhost:8080/agroinfo/war/Agroinfo.html?gwt.codesvr=127.0.0.1:9997

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Service Oriented Architecture for GeoSense

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ET Calculations

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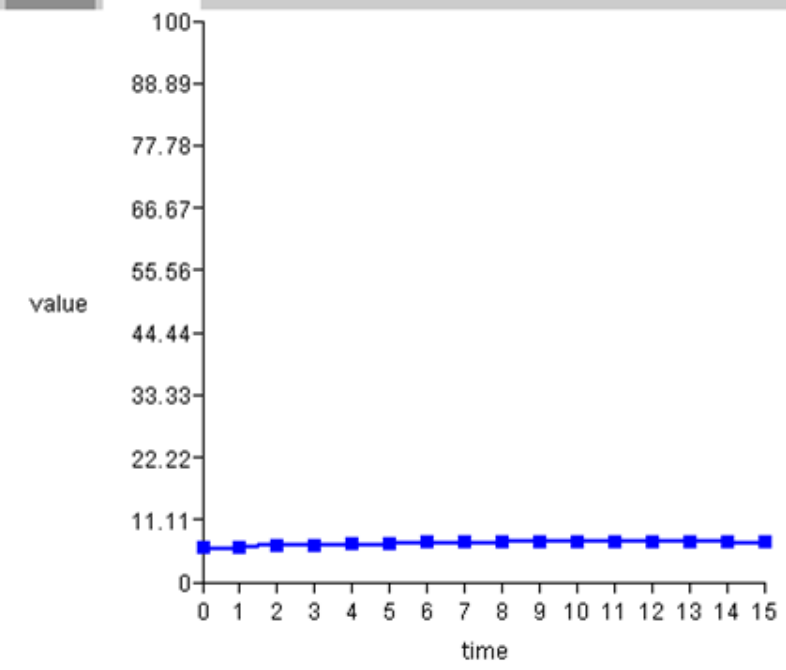
Table | Chart



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Modeling Service: A way forward

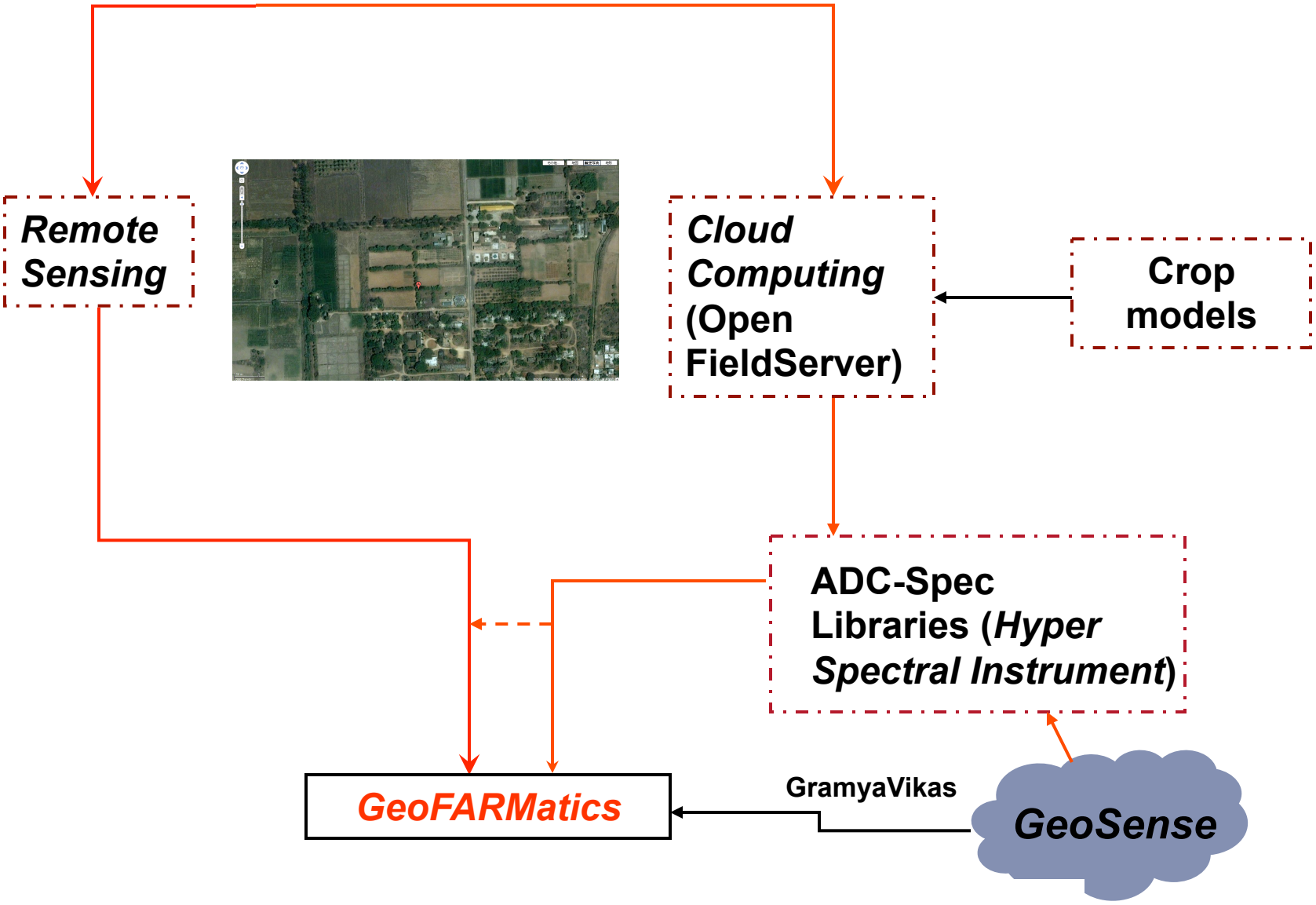
- Retrieving crop specific (water requirement, disease vulnerability, etc.) information and modeling services
- Implementing Sensor Alert Service (SAS) to send information through multi-modal communication (internet, mobile, etc.) platforms
- Enabling participatory sensing through integration of surveillance agricultural/ crop information into service database and utilizing for decision making

Conclusions

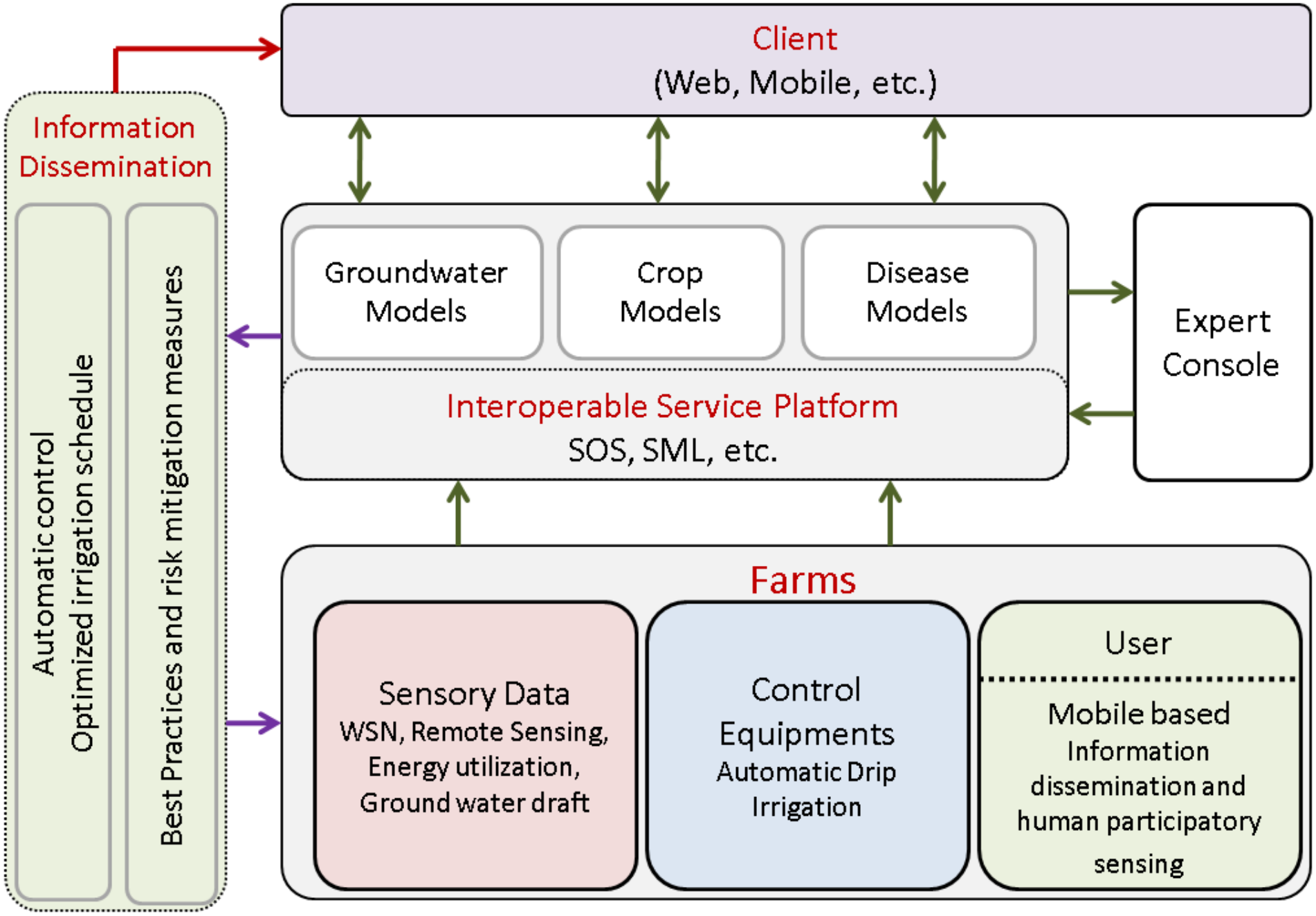
- Two different architectures of WSN having common application in agriculture are combined through the OGC SWE standards SensorML framework, ensuring interoperability and data discovery over web platform.
- The service provides accuracy, threshold, lineage, etc. of sensing system
- Interoperability and sensor data discovery improves the capabilities of researchers in WSN application fields (e.g. Agriculture, Environment, etc).
- Through open source tools it is cost effective to develop web-based crop information and modeling service.

Future challenges

- Need for implementation of efficient and robust algorithms to process the high resolution spatio-temporal distributed sensory data and use in various applications.
- Community based decentralized application of WSN for agricultural application (e.g. yield, pest and water management, etc.).
- Integration of proximal SN system with spatial (Remote Sensing) systems
- Development of Middleware (Eg. regional Ag-Met model)
- Farmers' level system (cloud-computing?)



GeoFARMatics through Multi-mode approach


Client
(Web, Mobile, etc.)
Information Dissemination
Automatic control
Optimized irrigation schedule
Best Practices and risk mitigation measures
Groundwater Models
Crop Models
Disease Models
Expert Console
Interoperable Service Platform
SOS, SML, etc.
Farms
Sensory Data
WSN, Remote Sensing, Energy utilization, Ground water draft
Control Equipments
Automatic Drip Irrigation
User
Mobile based
Information dissemination and human participatory sensing

Multi-national, multi-institutional and multi-disciplinary collaboration are the buzz words to solve / address a few open ICT solutions.

Thank You

http://geosense.dyndns-free.com:8091/server/

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Centre of Studies in Resources Engineering


その他...
地図
航空写真
地形
50 m
200 フィート
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