Time Series in Precision Agriculture

August 2020

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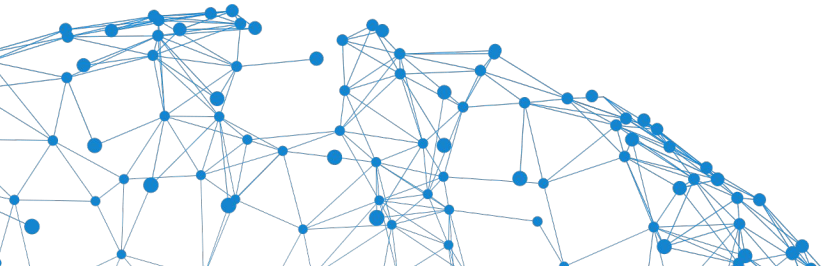
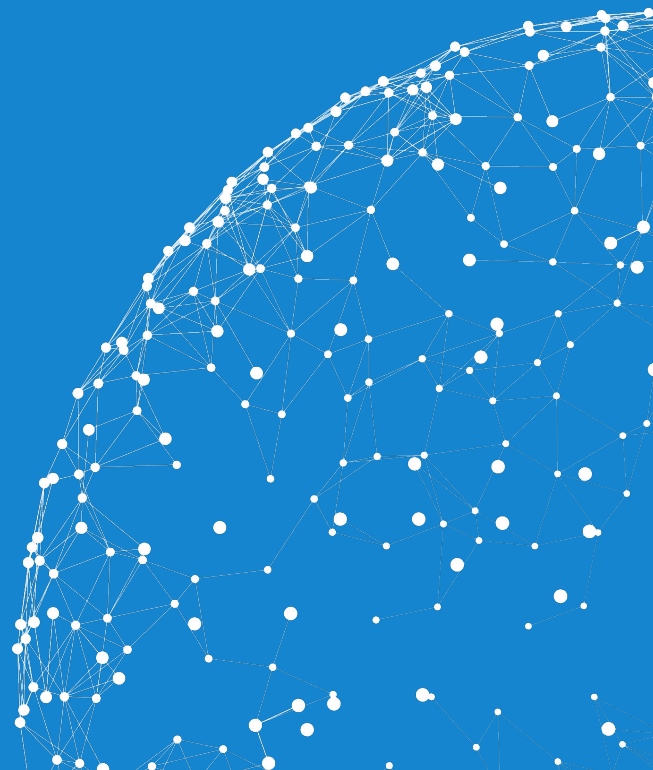
AGENDA

- Use case: Frost prediction and classification
- Other solutions
- Technologies Involved
- Conclusions



Use case: Frost prediction and classification



LOSANDES

Jueves, 31 de marzo de 2016

Nación declaró Emergencia Agropecuaria para Mendoza

La habilita a recibir no menos de $ 40 millones para asistir a productores por heladas y granizo. Subsidiarán pérdidas por enfermedades como la botritis.

Miguel Ángel Flores Isuani - mflores@losandes.com.ar

Junto a Catamarca, Mendoza se convirtió ayer en la novena provincia bajo el paraguas de la declaración de la Emergencia Agropecuaria, que le garantiza la llegada de fondos para asistir a los productores de distintos oasis afectados por el granizo y las lluvias durante la temporada.

Fue al cabo de la tercera reunión del año de la Comisión Nacional de Emergencia y Desastre Agropecuario (Cemeda), que en lo que va del 2016 ya le había asegurado asistencia financiera nacional a La Rioja, Corrientes, Chaco, Entre Ríos, Córdoba, Santa Fe y Formosa a par

"Tratamos los decretos de Mendoza y Catamarca porqu
daños. Fue un trabajo en conjunto con las provincias pa

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NOTICIAS CLIMA MERCADOS URUGUAY PARAGUAY BRASIL IN

:: Noticias Regionales

A+ A-

Mendoza

Más de 13.200 hectáreas dañadas por heladas

Los productores afectados tanto por heladas como por granizo deberán hacer las denuncias de ambos accidentes climáticos.

INFOCAMPO.COM.AR | GENERAL

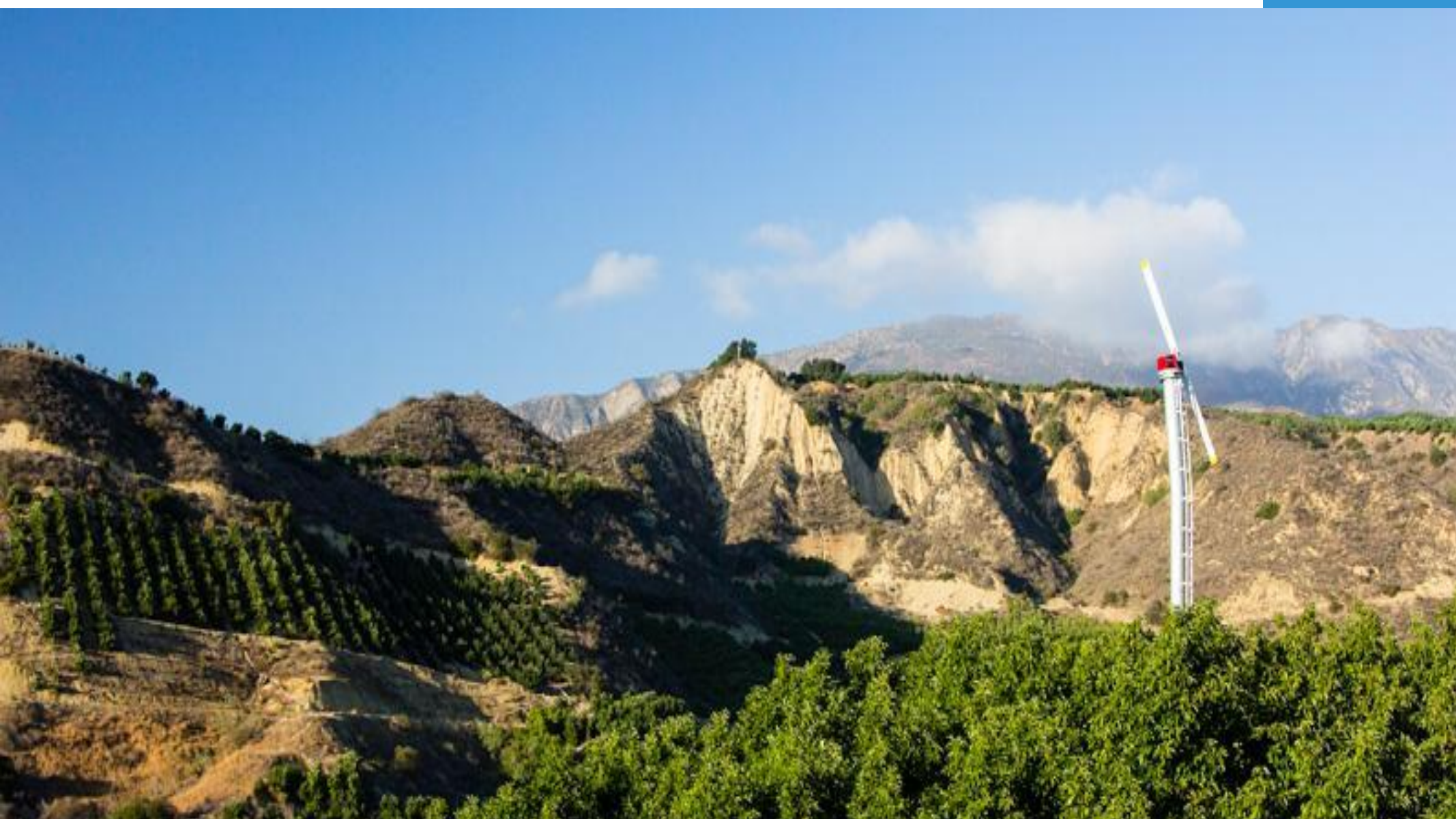
Por las heladas, Mendoza perdió el 70% de la cosecha de ciruelas

De todas maneras, se destinarán a la exportación unas 10.000 toneladas remanentes en stock de la temporada anterior.

Feb 6, 2017 | 07:46

Imprimir

Noticias de General: anterior



How to predict frost from collected data

Linear regression to predict the minimum temperature that will occur on nights with clear skies and no cold fronts (radiation frosts), method of Snyder and Melo-Abreu[1,2].

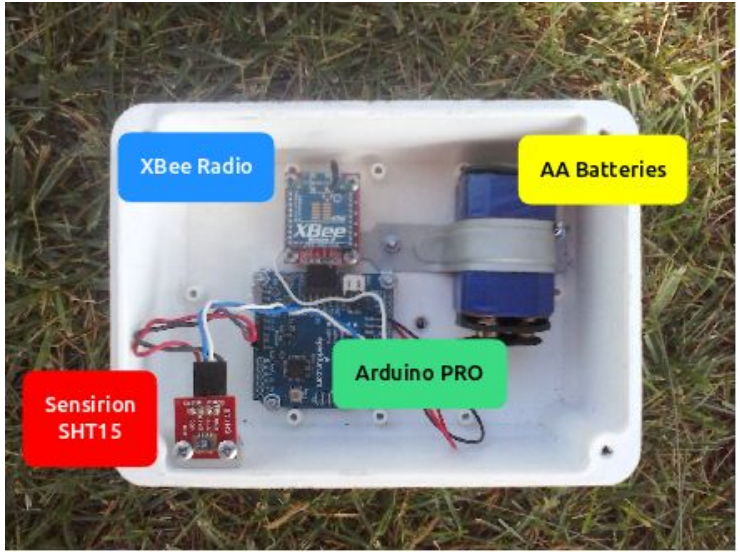
Data required for its execution:

- Fifty days where radiation frosts have occurred, extracted from a historical dataset of ten years and belonging to the same month, from the day in which the prediction will be made.

- The temperature (T0) and the dew point (D0) acquired two hours after sunset the day before to the night to predict

[1] Snyder, R. L., & Melo-Abreu, J. D. (2005). Frost protection: fundamentals, practice and economics. Volume 1. *Frost protection: fundamentals, practice and economics*, *1*, 1-240.

[2] Iacono L., Vázquez-Poletti J.L., García Garino C., Llorente I.M. (2014) A Model to Calculate Amazon EC2 Instance Performance in Frost Prediction Applications. In: Hernández G. et al. (eds) High Performance Computing. CARLA 2014. Communications in Computer and Information Science, vol 485. Springer, Berlin, Heidelberg

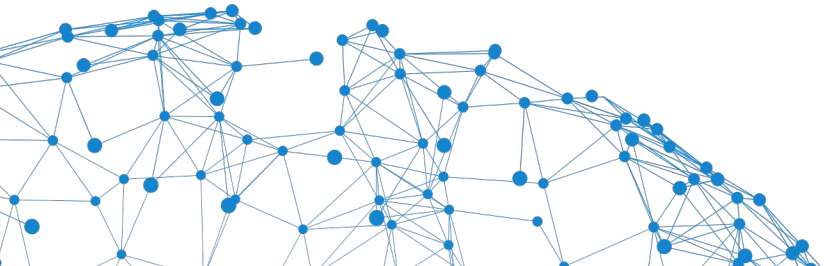

XBee Radio
AA Batteries
Arduino PRO
Sensirion
SHT15


Sensor Cirrus
Environmental Monitoring


amazon web services™
EC2
GPRS/ EDGE /3G
WSN Base Station
ZigBee Coordinator
ZigBee
Sensor Nodes & Routers

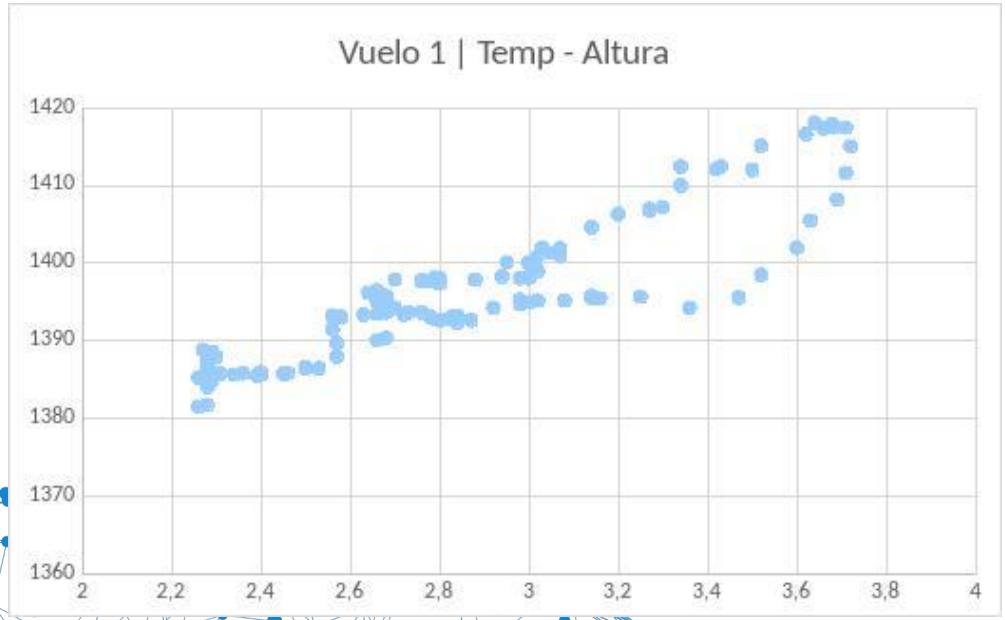
Method and Technologies Validation

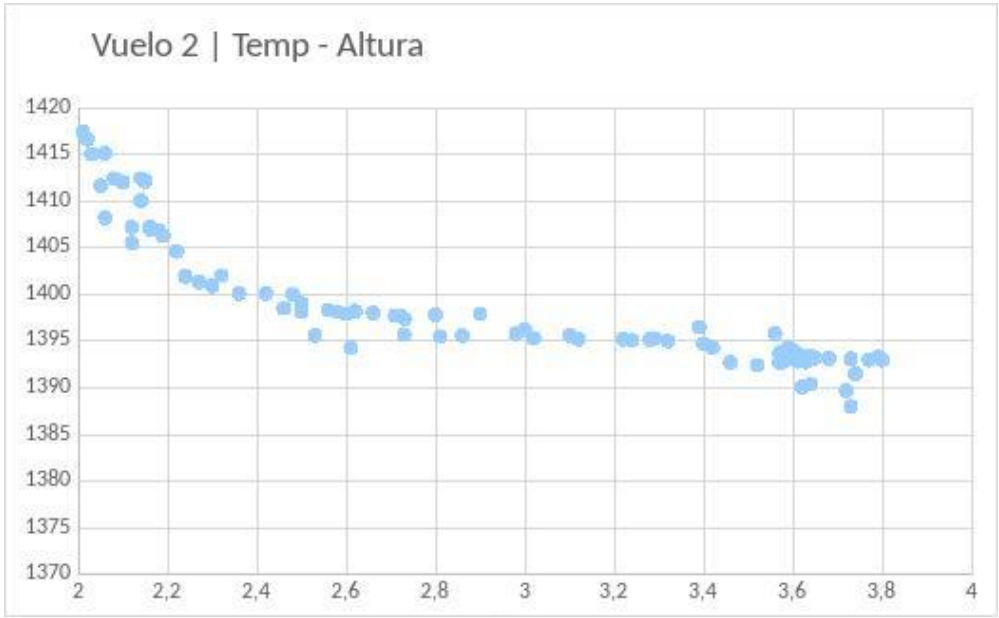
- Gualtallary, Mendoza, Argentina
- Catena Zapata
- Adrianna Vineyard
- Alt: 1450 m



- Frost night
- 8 sensor nodes already deployed
- 1 Drone Phantom 3 w/ Temp and Hum sensor
- 2 base stations.
- Kind of frost (Advection or Radiation).
- Validation of Temperature prediction.

- Time Series Drone (Temp vs Altitude) show how temperature behaviour is different according frost even:





Which kind of frost occur most frequently on my farm?

Why?

Because I need to invest on a frost protection system (wind machines, sprinklers)

- Advection frost: wind machines will not help to much
- Radiation frost: wind machines are the potential best solution [3]

How I can determine the kind of frost:

Using historical time series from the data collection system of the region in which the farm is placed or flying my drone each frost night.

[3] Ribeiro, António C., J. Paulo De Melo-Abreu, and Richard L. Snyder. "Apple orchard frost protection with wind machine operation." *Agricultural and Forest Meteorology* 141.2-4 (2006): 71-81.

Study for Wind Machines leasing

Which are the parameters to use in order to classify the frost?:

Temperature and wind gust speed

Criteria:

- Advection frost: temperature less than 0 degrees, wind speed is equal to or greater than 7 km/h and wind direction is from a sector between 160 and 200º (cold fronts in Argentina), which is typical of advection frosts.

- Radiation frost: temperature is less than 0 degrees Celsius and wind speed is less than 7 km/h

Data:

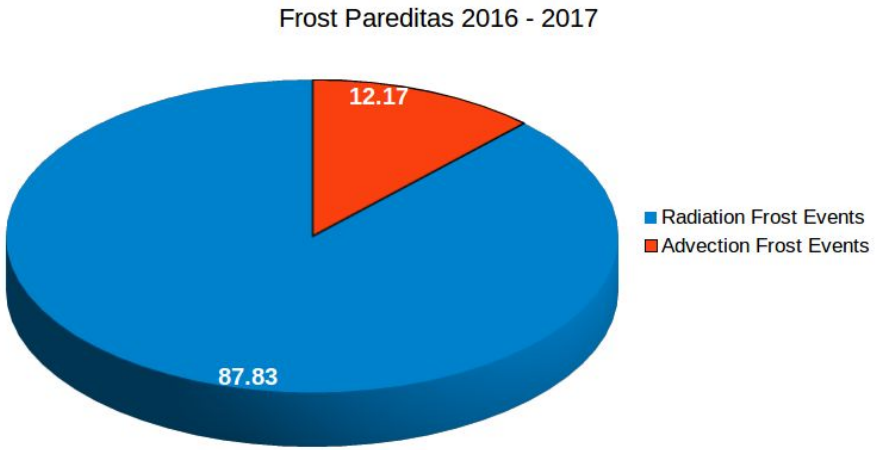
- Temperature and wind during frost season in 2016 and 2017.

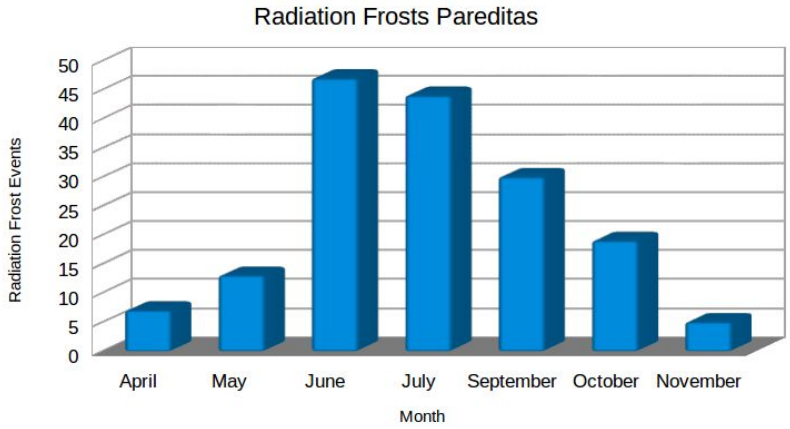
- Data collected each 15 minutes by two Davis weather stations.

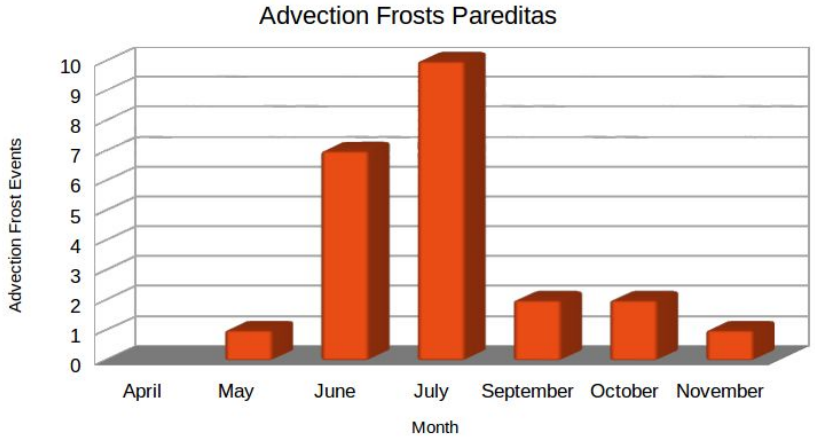
Study for Wind Machines leasing

Results:

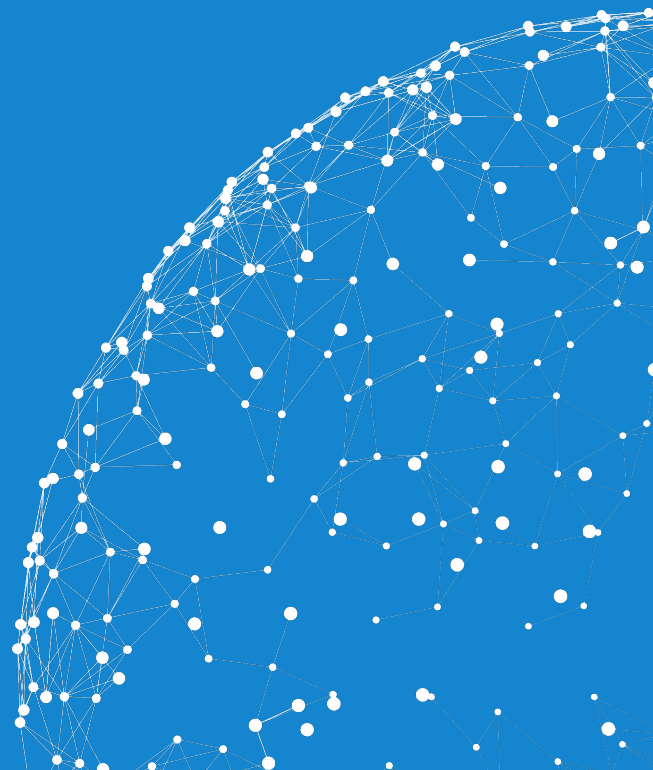
Much more radiation frosts than advection frosts





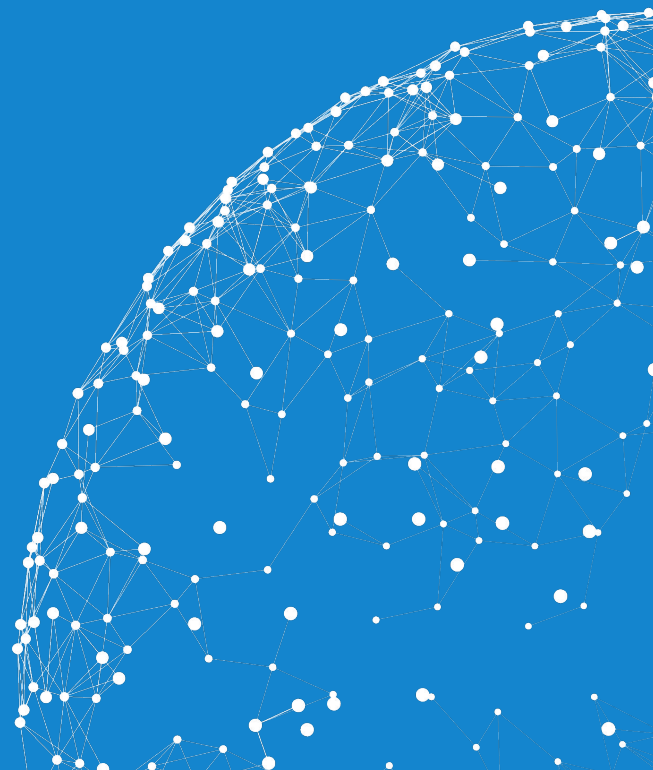


Other questions to answer



- When to plant?
- When to harvest?
- Irrigation is correct?
- Weather (frosts, storms) events affecting crops?
- What will be the crop yield?

Technologies Involved



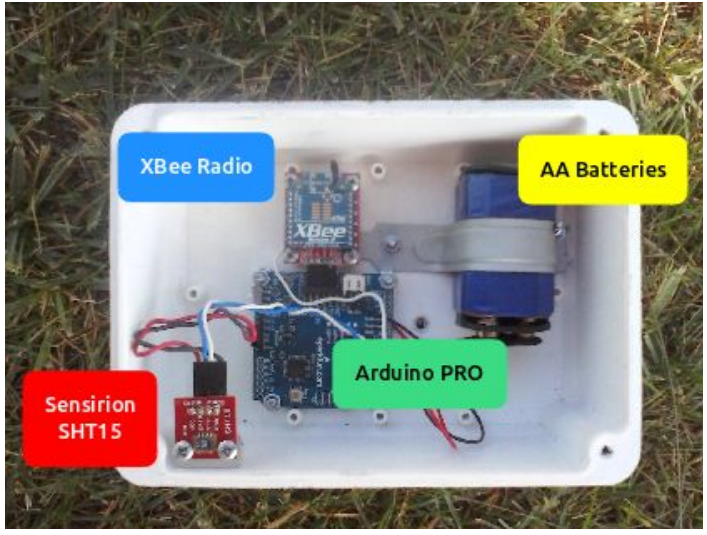
Internet of Things (IoT)

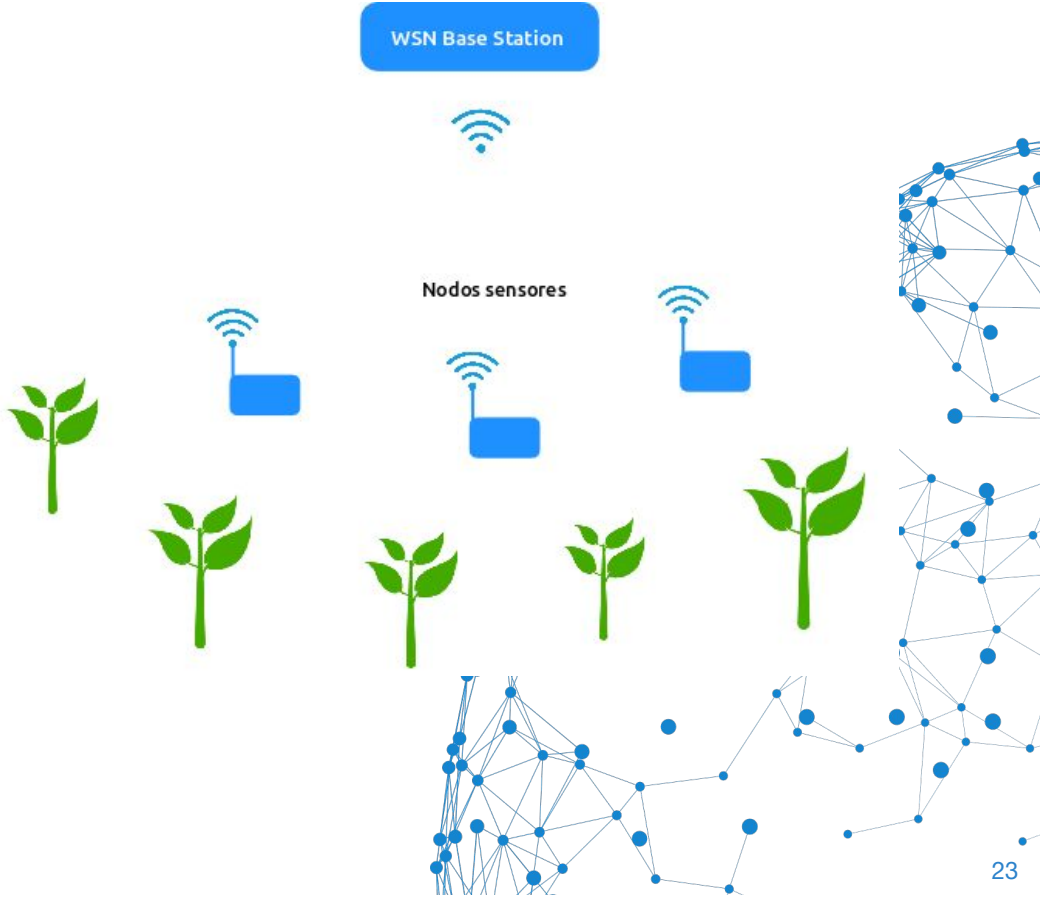
The Internet communicates a wide diversity of devices, hence emerges the term Internet of Things (IoT) to refer to this global network of interconnected objects [1].

[1] Gubbi et al. Internet of Things (IoT): A vision, architectural elements, and future directions. Future generation computer systems, 29(7), 1645-1660, 2013.

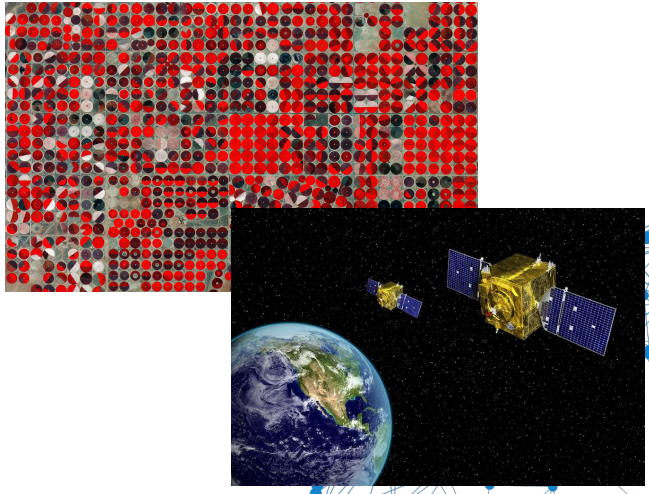
Things for agriculture…

Wireless Sensor Networks





Weather Radar



Things data storing and processing

Traditional IT Resources

- Servers

HPC Resources

- Clusters
- Grid Computing
- Cloud Computing
  - High Availability
  - Resources provided on demand and available 24 x 7

Conclusions

Conclusions

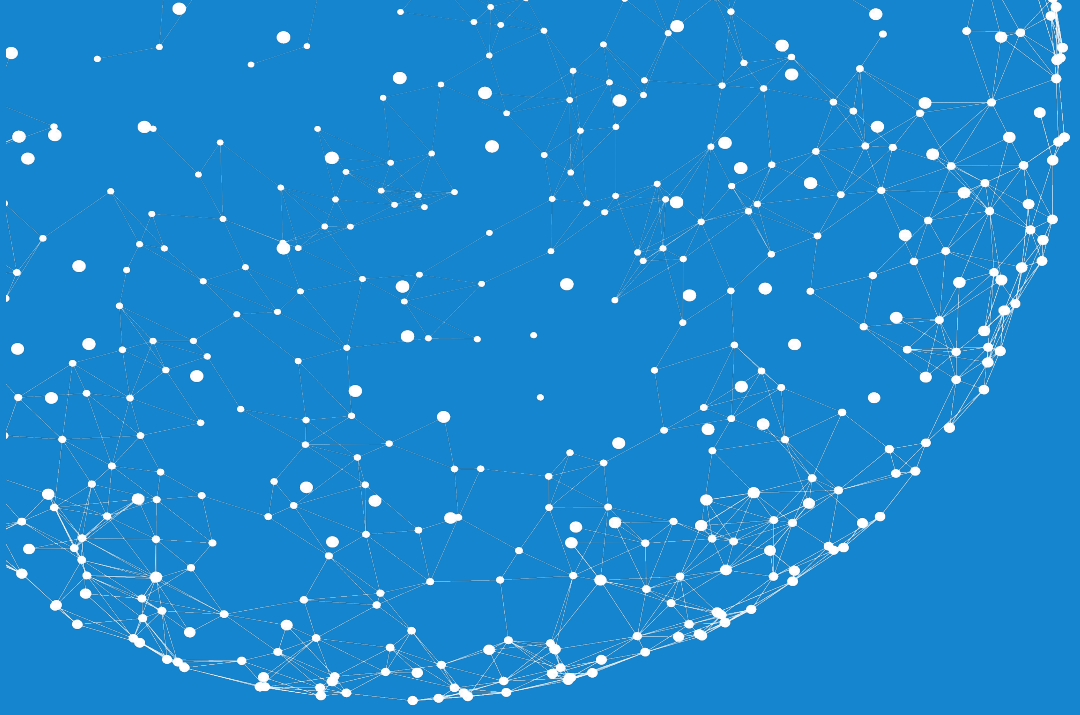
Every day there are more devices that generate time series in precision agriculture.

The analysis of these data allows to improve crops and yields.

Computer infrastructures should be prepared to store and process large data volumes acquired from heterogeneous devices.

Data and models (frost prediction, weather forecast) must be available online and 24x7.

Finally, all these technologies allow us to contribute to the growth of farmers in the region.



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QUESTIONS

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