SIGRAS App: climate, vegetation and soil information for support systems for decision making in agricultural production through smart devices.

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Abstract

One of the most important adaptation measure to Climate Change and Variability is the development of tools and systems to support agricultural activities management and preservation of natural resources. The GRAS Unit of the National Institute of Agricultural Research (INIA Uruguay), elaborate and make available tools and products to contribute to these goals (www.inia.uy/gras). In this regard, "SIGRAS App" was developed, with up-to-date information (estimates of soil water balance variables, NDVI) and historical data (NDVI, soil features, water balance, climate and basic cartography) as well as Tools and Alerts. Information developed with MGAP, INUMET, IRI. Available: Android, iOS and WPhone,

1. Introduction

Among the most important measures to adapt to Climate Change and Variability, is the development of tools and information systems to help farmers, researchers and governments to generate capacities for prevention, adaptation and risk management, and for general management related to agricultural production activities and preservation of natural resources [1] [2]. In this regard and in order to contribute, the Agro-climate and Information System Unit (GRAS) of the National Institute of Agricultural Research (INIA Uruguay) develops, elaborates and makes available to every user and in real time, products, tools and different information [3] [4] [5].

Within the most recently developed products, there is an application for smart devices (cellphones, tablet, etc.) call “SIGRAS App” (Figure 1).

Figure 1. SIGRAS App.

2. Materials and methods

SIGRAS App is mostly based on an on-line web information system “SIGRAS” [6] [7] [8] available since 2013. It access the geographic information database of "SIGRAS" and get the information to be displayed on the mobile device. Through a consultancy, a PHP script was developed that connects to the INIA database and generate a downloadable XML that returns the requested information to the mobile device. The framework PhoneGap (Apache Software Foundation) was used in order to develop the application in HTML5, CSS and JavaScript, and to be able to run it natively on Android and iOS platforms; Offering a unique JavaScript API to access native services. This application needs to access the device's GPS to obtain the current geographical coordinates, for which an HTML5 page was created, making a Javascript call to allow the use of GPS of any device independent of its platform.

This new App provides real time information:

- Estimations of different output variables of a national water balance model with a spatial resolution of 30 km x 30 km, estimated by INIA and methodology describe in [9] (accumulated precipitation, real evapotranspiration, soil available water, well-being water index, potential evapotranspiration, non-retained water)
- Normalized Difference Vegetation Index (NDVI). This index, that uses the visible and near-infrared bands of the electromagnetic spectrum, provides information of the vegetation health as assess chlorophyll activity. We extract the information from the MOD13Q1 MODIS product of LP DAAC, NASA [10]. This product is a composite image, provided every 16 days at 250-meter spatial resolution, with the maximum NDVI value for each pixel in that period.

We also include historical information:

- NDVI statistics based on 11 years information (2000-2011) from 16 days composite images [10]. Average, maximum and minimum values are available for each one of the 23 dates, calculated by INIA.
- Soil characteristics with a spatial resolution of 1:40,000, estimated by a private consultant of INIA, using basic data from de Ministry of Livestock, Agriculture and Fishery of Uruguay (CONEAT index [11], Texture, Depth, Water storage capacity, etc.)
- Water balance statistics based on 25 years (1985-2009) with a spatial resolution of 30 km. x 30 km. Values of the 10, 50 and 90 percentiles are available for each month and each variable (mm - % of soil water, effective precipitation, well-being water index, etc.) estimated by INIA [12].
- Climate statistics based on 30 years (1980-2009) with a spatial resolution of 60 km. x 60 km. Values of the 10, 33, 50, 66 and 90 percentiles are available for each month and each variable: precipitation based on 53 stations and temperature, heliophany, frosty days and relative humidity based on 24 stations, done by INIA and IRI [12]
- Basic cartography (administrative divisions, hydrographic basins, etc), from AGESIC [13].

SIGRAS app also have available a “Tools and Alerts” section were the user can find:

- Six days precipitation forecast and a five days frost forecast elaborated by the Center for weather forecasting and climate studies [14] of Brazil
- Forecast for favorable conditions for fusariosis develop and Deoxynivalenol (DON) mycotoxin in wheat grain, estimated by INIA
- A personalize soil water estimation tool “CuantAgua”, developed by INIA, [15].

Every data is on line all the time, and users can access to the information related to a specific location of interest, choosing from their actual position, the number of the property or just selecting from the map. In the “Marker” item, the user can save the locations they need in order to have them available any time.

1. Results and Discussion

SIGRAS App "packages" integrates data and information from very different sources as remote sensors, historical and real-time databases, model outputs and statistical analyzes. It is one of the first applications, created for smart devices, which allows farmers, researchers and any other users to access to a large amount of information in a very simple and "usable" way in order to contribute to planning and decision-making.

SIGRAS App is free and available to download in on-line Android, iOS and Windows Phone stores for any user.

2. Acknowledgements

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