

# THE NET OF AUTOMATIC METEOROLOGICAL STATIONS OF THE "DIRECÇÃO REGIONAL DE AGRICULTURA DO ALGARVE (DRAALG)"

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DRAALG  
Direcção Regional  
de Agricultura do  
Algarve  
Ministério da Agricultura,  
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## 1. INTRODUCTION

In the end of the seventies, through the initiative of the Agricultural Forecast and Warning Service, a sector of agricultural meteorology in the "Direcção Regional de Agricultura do Algarve (DRAALG) / Ministério da Agricultura, do Desenvolvimento Rural e das Pescas (MADRP)" (Agricultural Administration of the Algarve Region / Agricultural Ministry of Rural Development and Fishing) was created, which made use of conventional meteorological stations. With the technological evolution, on this type of equipment, it was possible to find in the market new alternatives, that they had come to give effective reply to an ample set of necessities. These sophisticated equipment allowed to give more data, with more precision and easy access, they also had a better adaptation in terms of application of forecast models. Conscientious of the necessity to modify the existing situation, the "DRAALG", through the area of the Plant Protection, initiated the converting process from the conventional stations to the automatic ones.

## 2. THE NET

Concerning the localization and taking care of to the attempt to effect the largest possible covering of the region of the Algarve in agronomical terms, we have 12 stations installed and working in zones: predominant of citrus (culture with great potential in the region); on the influence of the maritime coast – Atlantic Ocean and the Mediterranean Sea; clay land (horticulture and fruit trees in irrigated land); mountain range (trees and vegetation in dry land).

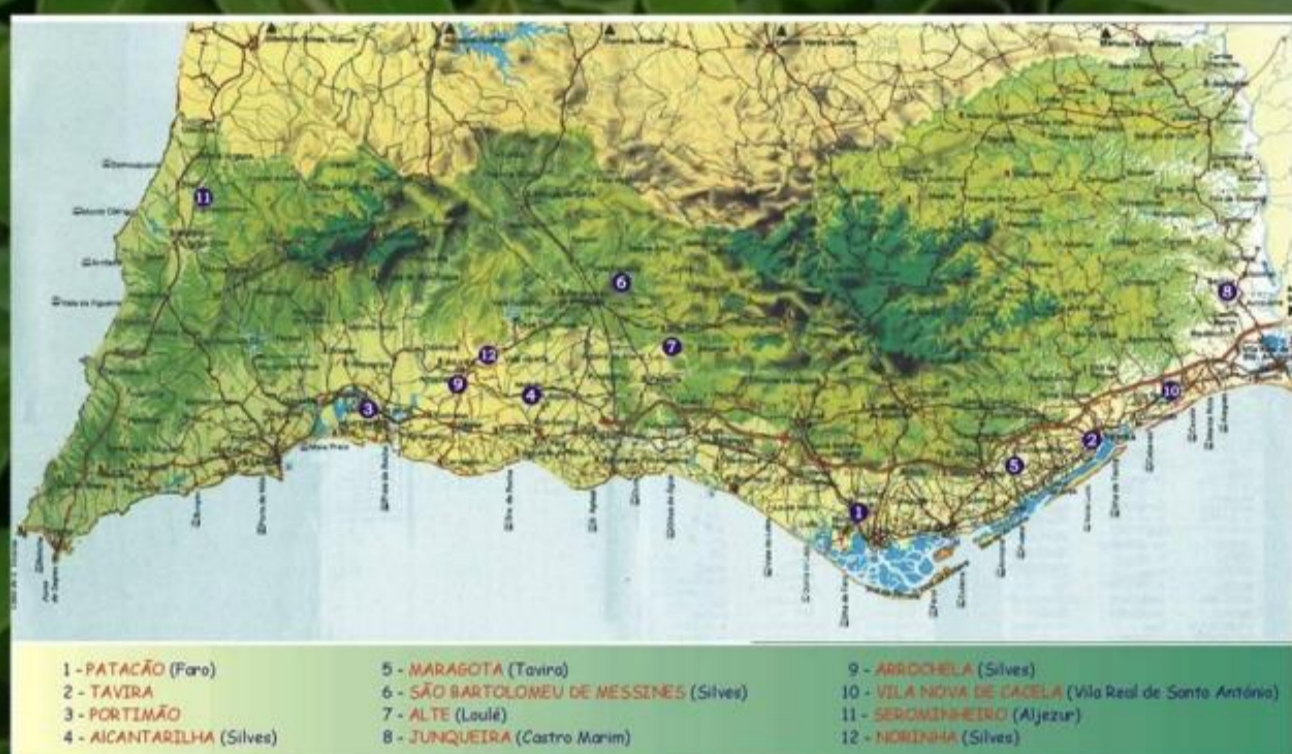


Fig.1 Geographic localization of the net of automatic meteorological stations in the Algarve region.

## 2.3 The meteorological station

Each station is mainly equipped with a mast, in which the environmental box is installed, this one lodges the equipment of command and storage (logger and memory card), the power circuit (battery and solar panel), the protection circuit (earth electrode and over-tension module) and the circuit of communication (modem GSM). On the mast we also have installed connecting rods for several sensors, nominated: combined temperature and relative humidity of air; precipitation; radiation; speed and wind direction; leaf humidity; and also the soil temperature.

The choice of the installation height of the sensors was made in accordance with the predominant vegetation in the Region of the Algarve, wind 2,00m and the remains at about 1,60m.



Fig.2 Meteorological station.

## 3. FUNCTIONING

### 3.1 Information processing

In each station, every 10 seconds all the sensors take readings, then the necessary statistical treatments are applied, these data is stored in hourly and daily reports. Beyond the common statistical processing of sums, averages, minimum and maximum values, we have algorithms of agrometeorological character as: the calculation of the insolation; potential evapotranspiration with the method of Penman-Monteith; number of cold hours; and very specific formulas or conditions that gives us, the occurrence of propitious conditions to the development of several pests and diseases (normally using the sensor of leaf humidity).

Daily, the collected data is automatically transferred via GSM from all the net to the central station (PC), where specific software of management of meteorological nets is installed, which allows: to collect the data automatically; visualize the readings in real time with the synoptic panel (fig.3), through analogical/digital counters and predefined functions; to program and to make the check-up of the stations.

The validation of the data is made by an automatic spreadsheet, that gives a monthly treatment for each station, making use of established intervals reliable in historical data. We also validate the treated data based in the comparison with other stations next to the analyzed one.



Fig.3 Visualization panel of the readings in real time.

## 3.2 Maintenance

Technician of the "DRAALG" execute regularly the usual: maintenance (cleanness, verification and check-up); repairing, with support from a complete set of equipment; periodically calibration in accordance with technical indications of the suppliers/manufacturers and reprogramming to modify the terms of gathering and processing data, or due to loss of power.

## 4. AVAILABILITY OF DATA

The requests for meteorological data have been many, from the most varied entities: companies of commerce of agricultural products, universities, institutions, ministries, farmers associations, golf courses, operative centers, entities in the area of harvests insurances and people in individual name. Normally we provide the daily reports (fig. 4), however sometimes, we also have requests of the hourly, mainly regarding the wind and precipitation, for characterization of a bad weather period.

ESTACIÃO METEOROLÓGICA AUTOMÁTICA DE VILA NOVA DE CAÇELA I VILA REAL DE SANTO ANTÓNIO																						
Data	Hora	T mid	T mx	T mn	HR md	HR mx	HR mn	RG int	DV md	VV md	VV mx	P	Ts md	Ts mx	Ts mn	ET0	EMA	Ins	HF>75	HF>75	T<7 ac	
(dd-mm-aaaa)	(hh:mm:ss)	(°C)	(°C)	(°C)	(%)	(%)	(%)	(K.J.m <sup>2</sup> )	(graus)	(m.s <sup>-1</sup> )	(m.s <sup>-1</sup> )	(mm)	(°C)	(°C)	(°C)	(mm)	(mm)	(h)	(h)	(h)	(h)	
01-01-2006	23:58:00	12.8	18.1	9.2	77	99	55	8890	326	1.2	6.9	0.0	11.4	13.7	9.9	2.0	1404	7.0	0.0	9.1	69.9	
02-01-2006	23:58:00	11.2	17.2	5.9	75	95	51	10342	354	1.2	6.6	0.0	10.2	12.8	8.0	2.2	1404	7.6	0.0	10.4	72.9	
03-01-2006	23:58:00	12.5	20.5	7.9	67	82	42	10275	8	1.1	4.2	0.0	10.2	13.6	8.0	2.5	1404	7.6	0.0	0.0	72.9	
04-01-2006	23:58:00	11.1	19.4	6.1	66	85	39	10414	360	0.5	3.4	0.0	9.7	13.0	7.3	2.3	1404	7.6	0.0	0.0	74.6	
05-01-2006	23:58:00	10.7	17.4	4.1	75	91	51	10136	304	0.4	3.4	0.0	9.4	12.5	6.5	2.1	1404	7.4	0.2	5.3	79.6	
06-01-2006	23:58:00	10.9	16.5	7.4	80	96	54	7294	304	1.3	5.7	4.6	10.6	12.9	8.9	1.6	1404	5.3	0.0	9.7	79.6	
07-01-2006	23:58:00	9.4	16.3	5.2	76	89	51	9719	358	0.9	4.7	0.0	9.1	12.2	6.8	2.0	1404	7.1	0.0	0.0	87.3	
08-01-2006	23:58:00	9.4	17.3	3.0	79	96	53	10393	23	0.3	3.3	0.0	8.7	12.4	5.9	2.0	1404	7.5	0.0	13.6	96.9	
09-01-2006	23:58:00	10.3	19.8	4.9	76	93	41	10560	14	0.1	3.4	0.0	8.9	12.9	6.1	2.1	1404	7.7	0.0	14.9	105.1	
10-01-2006	23:58:00	9.9	16.0	5.7	72	89	41	9754	1	0.9	4.7	0.0	8.7	11.6	6.4	2.0	1404	7.5	0.0	9.9	109.3	
11-01-2006	23:58:00	11.3	19.9	5.8	68	86	43	10578	33	0.8	3.8	0.0	8.9	12.7	6.3	2.4	1404	7.6	0.0	0.0	114.0	
12-01-2006	23:58:00	11.0	17.0	7.5	75	96	54	7590	33	0.8	4.3	0.0	9.4	12.1	7.2	1.6	1404	7.4	0.0	0.0	114.0	
13-01-2006	23:58:00	10.6	17.5	6.5	79	95	59	8910	24	0.6	3.9	0.0	9.9	12.7	7.9	1.5	1404	6.4	0.0	3.3	115.0	
14-01-2006	23:58:00	10.7	16.2	4.8	78	98	49	10497	336	0.8	5.9	2.2	9.6	12.7	7.8	2.1	1404	6.3	0.0	9.3	124.1	
15-01-2006	23:58:00	8.5	13.8	3.8	89	98	67	2073	323	0.9	7.8	12.8	8.5	10.7	6.4	0.7	1404	2.9	0.0	10.3	132.5	
16-01-2006	23:58:00	8.7	15.3	3.4	82	97	59	10943	350	1.0	5.2	0.2	8.9	12.2	6.2	2.1	1404	7.6	0.0	9.5	140.6	
17-01-2006	23:58:00	10.3	17.1	5.8	75	90	51	10771	2	1.3	4.4	0.0	8.9	12.6	6.2	2.2	1404	7.8	0.0	4.8	148.9	
18-01-2006	23:58:00	11.6	19.3	6.4	78	96	56	8649	345	0.5	3.6	0.0	10.1	13.6	7.4	1.8	1404	6.8	0.0	4.0	149.4	
19-01-2006	23:58:00	12.7	22.6	7.8	77	92	42	10863	338	0.6	3.3	0.0	10.6	14.5	7.9	2.4	1404	7.6	0.0	13.4	149.4	
20-01-2006	23:58:00	12.1	22.4	5.3	83	99	49	11396	352	0.2	2.9	0.0	10.6	14.9	7.4	2.4	1404	7.9	1.7	15.5	153.5	
21-01-2006	23:58:00	12.0	20.4	7.3	82	98	51	10153	11	0.1	2.1	0.2	10.8	14.7	7.9	2.1	1404	7.9	2.3	15.3	153.5	
22-01-2006	23:58:00	12.7	20.3	7.3	80	95	47	7894	6	0.4	3.0	0.0	11.5	14.7	9.4	1.5	1404	6.3	0.0	10.9	153.5	
23-01-2006	23:58:00	11.4	20.9	5.9	78	93	45	11173	22	0.3	3.4	0.0	10.6	14.5	7.7	2.3	1404	7.8	0.0	12.0	159.9	
24-01-2006	23:58:00	11.9	16.4	8.1	79	95	63	5894	58	1.1	5.8	0.0	10.8	12.6	9.1	1.3	1404	6.3	0.0	9.9	159.9	
25-01-2006	23:58:00	12.6	14.3	10.5	77	90	68	3215	96	2.4	6.8	0.4	11.2	12.1	10.7	1.2	1404	3.3	0.0	7.2	159.9	
26-01-2006	23:58:00	12.1	15.7	9.7	87	97	67	4056	63	1.0	4.8	6.4	11.8	13.3	10.3	1.0	1404	5.1	0.0	7.7	159.9	
27-01-2006	23:58:00	10.7	12.4	7.6	96	99	85	801	33	1.3	6.6	48.4	11.6	12.3	10.2	0.3	1404	0.2	0.0	15.1	159.9	
28-01-2006	23:58:00	7.1	11.4	2.8	57	85	36	13095	352	3.2	10.2	0.1	10.3	5.8	2.8	1404	0.4	0.0	0.0	170.0		
29-01-2006	23:58:00	7.0	13.4	3.6	82	96	49	15519	287	1.4	8.2	11.8	7.4	9.0	5.8	1.1	1404	4.2	0.0	12.4	183.9	
30-01-2006	23:58:00	7.1	13.0	2.4	72	95	51	13083	357	2.7	7.9	15.4	7.2	10.7	4.8	2.4	1404	8.3	0.0	1.1	194.1	
31-01-2006	23:58:00	8.0	18.3	0.6	63	86	32	13985	327	0.6	3.9	0.0	7.5	12.0	4.0	2.8	1404	8.4	0.0	0.0	207.8	
<b>MÉDIAS</b>		<b>11.6</b>	<b>17.3</b>	<b>5.9</b>	<b>77</b>	<b>93</b>	<b>51</b>	<b>8945</b>	<b>1</b>	<b>1.0</b>	<b>5.0</b>		<b>9.7</b>	<b>12.7</b>	<b>7.4</b>	<b>1.9</b>	<b>58.9</b>	<b>201.1</b>	<b>5.8</b>	<b>242.5</b>	<b>7.8</b>	
<b>SOMAS</b>								<b>277303</b>					<b>102.4</b>								<b>242.5</b>	
<b>MÁXIMOS</b>													<b>16.2</b>	<b>18.4</b>						<b>8.4</b>	<b>2.3</b>	<b>19.3</b>
<b>MÍNIMOS</b>																				<b>0.2</b>		<b>19.3</b>

Fig.4 Monthly spreadsheet data of a meteorological station.

Together, with the "Gabinete de Informação Geográfica (GIG)" (Geographic Information Cabinet) of the "DRAALG", using the Geomedia software (fig. 5), it is possible to interact with another kind of data as: the geographic characteristics, military maps, water areas, vegetation areas, etc.

In contribution with the "Centro Operativo e de Tecnologia de Regadio (COTR)" (Operative Center of Irrigation Technology) we have a protocol, for emission of acknowledgments of irrigation (calculated values of evapotranspiration in some cultures) (fig.6).

In development, the creation of a national database, with the "Direcção Geral de Protecção das Culturas (DGPC) / Serviço Nacional Avisos Agrícolas (SNAA)" (Main Administration of Culture Protection / National Agricultural Forecast and Warning Service).

Fig.5 Geomedia software, used in the GIG.

The information will be treated for application in forecast models of some enemies of the cultures (mildew of the grapevine, pear tree scab, etc.). With this important tool it will be possible to widen the models of forecast to other enemies, including pests (the fly of the olive, etc.), since for that the models should be tested (fig. 7).

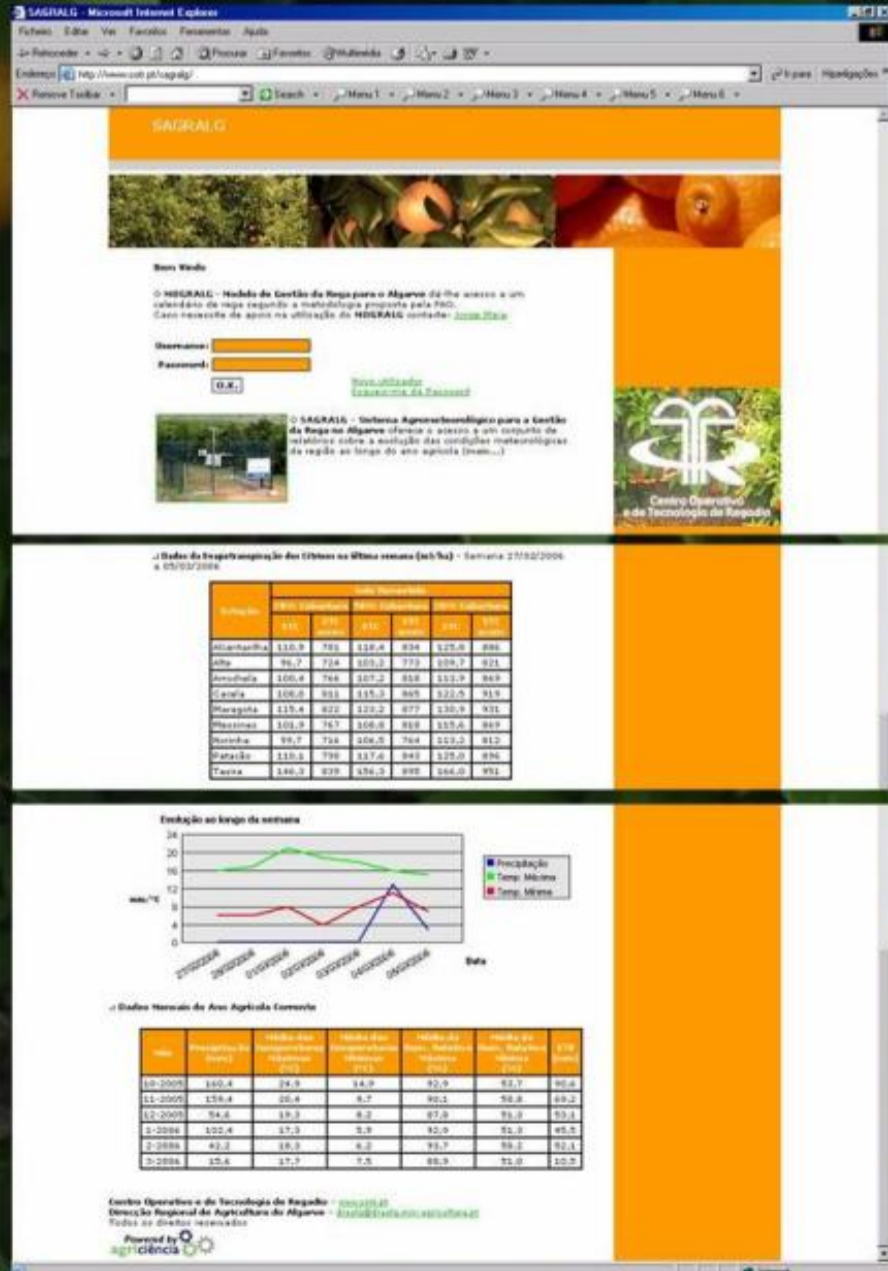


Fig.6 Partial view of the SAGRALG (Agrometeorological System for the Irrigation Management in Algarve). <http://www.cotr.pt/sagraig/>

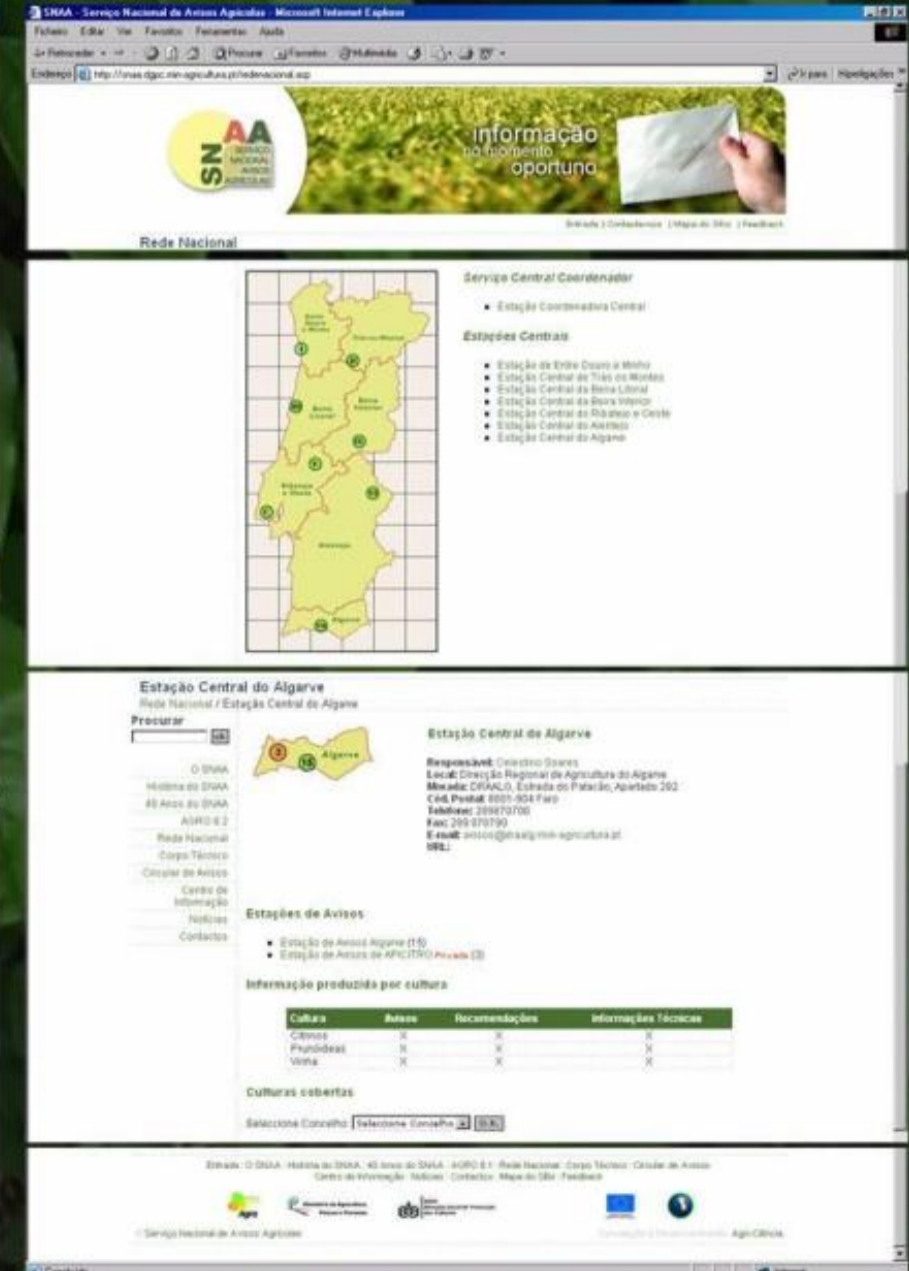


Fig.7 Partial view of the SNAA web page. <http://snaa.dgpc.min-agricultura.pt>