



University of Florence

Climate Change and quality of productions

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DiSAT

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Aims

**Assessment of climate change effects on
quality of productions**

**Set up of models for qualitative parameters
estimation for different crops cultivated in
European countries**





Work stages

- Collection of data and creation of databases
- Relations between quality parameters and agrometeorological/climatological variables/indices
- Evaluation of remote sensing and seasonal climatic forecast applications
- Analysis of the different spatial scales
- Set up of models
- Analysis of climate change impact

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Type of data

- Reanalysis
- Measured meteorological data
- Satellite images/climatic forecast
- Measured crop data





Our crop database

Durum wheat

- 10 yrs of quality data
- 1 site in Tuscany
- 1 yr of quality data
- 12 sites in Tuscany

Grapevine

- 8 yrs of quality data
- Mean value for Chianti area
- 55 yrs of annual rating
- Montalcino wine
- 33 yrs of annual rating
- 5 areas of central-north Italy

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Our meteo database

- 55 yrs of meteorological data
- 22 stations in Tuscany
- 8 yrs of satellite images
- Land use
- Seasonal weather forecasts (teleconnections)

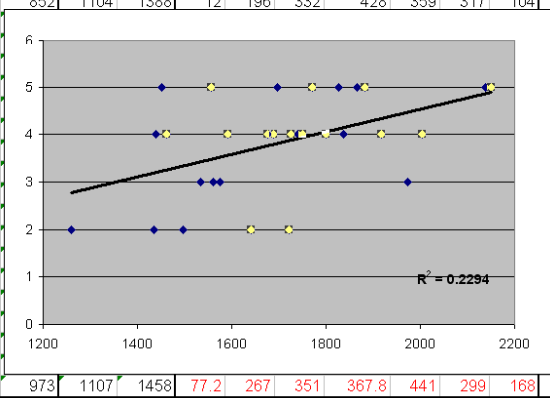




	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	
1	Empreiture del mare (mediterraneo occidentale)										Indici stagionali		STA mensili								IH mensili										
2	123	234	345	456	567	678	789	8	9	10	11	quality	STA	IH	8-9	8-9	789	789	STA a	STA r	STA g	STA lug	STA a	STA s	STA o	IH ap	IH ma	IH giu	IH lug	IH ag	IH se
3	1971	13.7	13.9	14.9	16.9	19.6	22.2	23.5	22.9	20.6	5	1556	2007	640	831	1008	1306	77	164	217	368	421	219	100	145	248	307	475	541	290	
4	1972	13.6	13.8	14.9	17.0	19.6	21.8	22.7	21.9	20.0	2	1260	1636	491	633	821	1048	25	114	242	330	321	170	64	81	193	314	415	418	215	
5	1973	13.7	13.8	15.0	17.4	20.4	22.9	24.0	23.1	20.8	3	1642	2049	707	890	1049	1335	19	175	294	342	410	296	115	59	268	386	445	524	365	
6	1974	13.8	14.0	15.0	17.1	19.7	22.1	23.2	22.2	19.8	3	1561	2122	677	852	1063	1340	49	159	279	386	416	261	21	133	273	376	488	519	332	
7	1975	13.9	14.1	15.0	16.9	19.7	22.3	23.6	22.9	20.5	4	1688	2116	675	835	1087	1357	78	184	245	412	367	308	104	146	278	336	522	455	379	

QUALITY - WI and HI

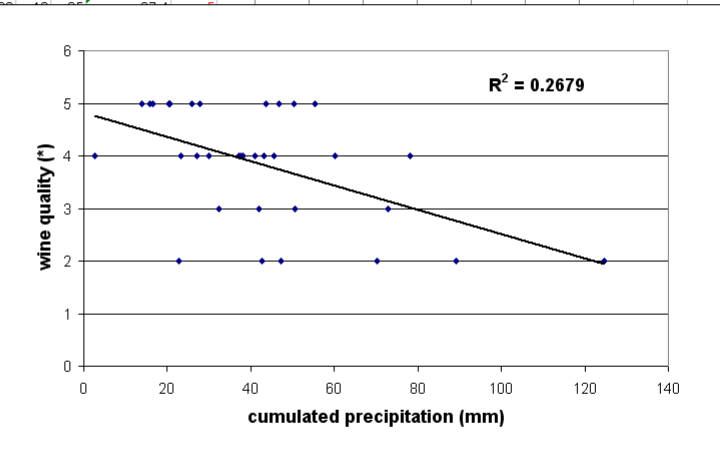
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17	1985	13.6	14.0	15.0	17.2	20.0	22.6	23.9	23.6	21.7	5	2139	2457	908	108	263	336	475	481	295	123	345	441	517	543	345	91	157	360	553	566	409
18	1986	13.6	13.6	15.0	17.1	20.1	22.6	24.0	23.6	21.4	4	2005	2297	765	139	350	327	499	569	384	143	332	432	491	591	352	112	292	392	588	622	374
19	1987	13.5	13.7	14.9	17.1	20.1	22.8	24.5	24.0	21.9	3	1973	2257	871	170	287	419	498	508	279	91	331	404	513	534	442	139	259	349	569	485	300
20	1988	14.3	14.4	15.5	17.7	20.4	23.0	24.0	23.4	21.4	5	2150	2389	826	170	287	419	498	508	279	123	345	441	517	543	345	91	157	360	553	566	409
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22	1990	14.9	14.9	16.0	18.1	21.0	23.4	24.5	24.0	21.7	5	1882	2315	677	170	287	419	498	508	279	91	331	404	513	534	442	139	259	349	569	485	300
23	1991	13.8	13.9	14.7	16.4	19.3	22.3	24.3	23.6	21.2	3	1576	2136	741	170	287	419	498	508	279	91	331	404	513	534	442	139	259	349	569	485	300
24	1992	13.7	13.8	15.1	16.9	19.7	22.4	23.9	23.2	20.6	2	1721	2268	723	170	287	419	498	508	279	91	331	404	513	534	442	139	259	349	569	485	300
25	1993	13.9	14.1	15.4	17.9	20.5	22.8	23.5	22.5	20.1	4	1837	2341	726	170	287	419	498	508	279	91	331	404	513	534	442	139	259	349	569	485	300
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27	1995	14.2	14.4	15.3	17.1	19.7	22.5	23.8	23.4	21.3	5	1697	2102	591	170	287	419	498	508	279	91	331	404	513	534	442	139	259	349	569	485	300
28	1996	14.3	14.2	15.2	17.5	19.9	22.5	23.1	22.3	20.1	4	1677	2160	597	170	287	419	498	508	279	91	331	404	513	534	442	139	259	349	569	485	300
29	1997	14.2	14.7	15.8	17.9	20.1	22.6	23.8	24.0	22.1	5	1866	2314	758	170	287	419	498	508	279	91	331	404	513	534	442	139	259	349	569	485	300
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31	1999	13.9	14.0	15.2	17.4	20.3	23.0	24.6	24.1	22.0	5	1826	2394	759	170	287	419	498	508	279	91	331	404	513	534	442	139	259	349	569	485	300
32	2000	14.0	14.4	15.7	18.0	20.7	22.9	24.0	23.5	21.4	4	1801	2386	740	973	1107	1458	77.2	267	351	367.8	441	299	168	153	374	468	486	580	393		



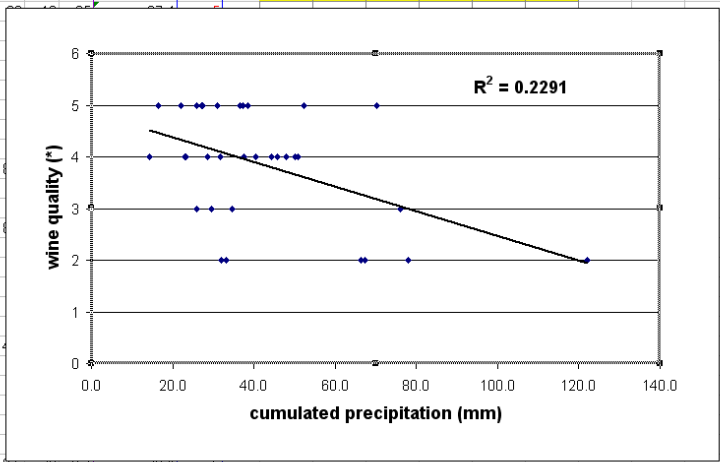
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1	Empreiture del mare (mediterraneo occidentale)										Indici stagionali		STA mensili								IH mensili											
2	123	234	345	456	567	678	789	8	9	10	11	quality	STA	IH	8-9	8-9	789	789	STA a	STA r	STA g	STA lug	STA a	STA s	STA o	IH ap	IH ma	IH giu	IH lug	IH ag	IH se	
3	1971	13.7	13.9	14.9	16.9	19.6	22.2	23.5	22.9	20.6	5	1556	2007	640	831	1008	1306	77	164	217	368	421	219	100	145	248	307	475	541	290		
4	1972	13.6	13.8	14.9	17.0	19.6	21.8	22.7	21.9	20.0	2	1260	1636	491	633	821	1048	25	114	242	330	321	170	64	81	193	314	415	418	215		
5	1973	13.7	13.8	15.0	17.4	20.4	22.9	24.0	23.1	20.8	3	1642	2049	707	890	1049	1335	19	175	294	342	410	296	115	59	268	386	445	524	365		
6	1974	13.8	14.0	15.0	17.1	19.7	22.1	23.2	22.2	19.8	3	1561	2122	677	852	1063	1340	49	159	279	386	416	261	21	133	273	376	488	519	332		
7	1975	13.9	14.1	15.0	16.9	19.7	22.3	23.6	22.9	20.5	4	1688	2116	675	835	1087	1357	78	184	245	412	367	308	104	146	278	336	522	455	379		
8	1976	13.6	13.8	14.9	17.2	20.3	22.8	23.4	22.1	19.7	3	1497	1862	479	643	844	1109	45	188	289	365	276	203	139	100	276	377	466	373	270		
9	1977	14.0	14.4	15.4	17.2	19.7	21.7	22.6	22.1	20.6	4	1461	1800	485	638	843	1097	64	165	245	358	302	183	154	131	246	327	459	390	248		
10	1978	13.8	13.8	14.7	16.6	19.3	21.8	23.0	22.4	20.3	6	1451	1759	608	780	930	1198	10	108	249	323	342	266	163	49	175	336	419	432	347		
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14	1982	14.2	14.3	15.3	17.7	20.9	23.5	24.2	23.0	20.7	4	1740	2163	676	852	1104	1388	12	196	332	428	359	317	104	55	287	432	537	457	395		
15	1983	13.7	13.9	15.1	17.2	20.0	22.7	24.1	23.5	21.5	5	1771	2132	665	107	240	365	595	456	370	83	138	317	488	437	296	123	246	382	601	579	526
16	1984	13.7	13.8	14.6	16.4	19.1	21.6	22.9	22.1	20.2	2	1435	1760	583	153	363	359	479	545	399	113	195	351	545	548	504	137	305	371	582	594	401
17	1985	13.6	14.0	15.0	17.2	20.0	22.6	23.9	23.6	21.7	5	2139	2457	908	108	263	336	475	481	295	123	345	441	517	543	345	91	157	360	553	566	409
18	1986	13.6	13.6	15.0	17.1	20.1	22.6	24.0	23.6	21.4	4	2005	2297	765	139	350	327	499	569	384	143	332	432	491	591	352	112	292	392	588	622	374
19	1987	13.5	13.7	14.9	17.1	20.1	22.8	24.5	24.0	21.9	3	1973	2257	871	170	287	419	498	508	279	91	331	404	513	534	442	139	259	349	569	485	

Annual rating and cumulated rainfall

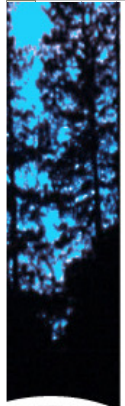
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	Barra della formula	Y	Z	AA
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2	1970	32	34	33	20	53	61	29	38	26	10	27	31	31.0	5								0.181	0.062	0.267	
3	1971	39	24	57	41	52	38	17	14	50	14	56	12	27.2	5		jan-feb	jan-mar	jan-apr	jan-may	jan-jun	jan-jul	jan-aug	jan-sep	jan-oct	
4	1972	38	44	33	80	37	4.7	94	51	89	28	15	19	78.1	2											
5	1973	37	25	41	47	6.1	61	68	64	70	51	9.6	24	67.4	2		feb-mar	feb-apr	feb-may	feb-jun	feb-jul	feb-aug	feb-sep	feb-oct		
6	1974	19	47	38	84	53	41	15	31	32	37	25	3.9	26.0	3											
7	1975	9.5	25	53	32	61	22	23	82	27	52	40	22	44.3	4		mar-apr	mar-may	mar-jun	mar-jul	mar-aug	mar-sep	mar-oct			
8	1976	12	33	40	54	23	78	76	80	43	41	40	29	66.3	2											
9	1977	27	41	29	24	44	37	23	27	46	26	15	18	31.7	4		apr-may	apr-jun	apr-jul	apr-aug	apr-sep	apr-oct				
10	1978	44	38	29	78	62	45	17	49	16																
11	1979	32	33	40	73	8	60	52	42	43																
12	1980	34	6.3	51	41	104	35	19	22	2.7																
13	1981	14	24	20	34	34	57	54	36	60																
14	1982	9.4	11	26	21	9.9	13	54	35	23																
15	1983	3.7	31	24	19	13	52	31	62	17																
16	1984	12	24	37	42	57	28	5.3	47	47																
17	1985	34	19	55	31	39	14	24	11	14																
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19	1987	41	36	17	24	28	21	46	7.1	51																
20	1988	24	21	19	54	78	89	15	31	20																
21	1989	1.2	16	20	74	58	99	87	68	73																
22	1990	11	7.7	36	61	74	21	39	46	28																
23	1991	9.9	25	23	58	73	13	11	36	42																
24	1992	12	4.8	19	54	46	77	52	22	23																
25	1993	1.7	8.1	21	42	51	28	29	11	30																
26	1994	26	22	0.4	53	17	44	81	2.3	38																
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28	1996	14	34	24	35	38	37	36	30	78																
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33	2001	26	22	36	36	57	31	17	51	47	9.5	29	9.7	38.4	5											
34	2002	4	23	12	57	73	63	100	141	125	42	48	37	122.1	2											



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1	anno	gen	feb	mar	apr	mag	giu	lug	ago	set	ott	nov	dic	multi mesi	qualità		jan	feb	mar	apr	may	jun	jul	aug	sep
2	1970	32	34	33	20	53	61	29	38	26	10	27	31	31.0	5								0.181	0.062	0.267
3	1971	39	24	57	41	52	38	17	14	50	14	56	12	27.2	5		jan-feb	jan-mar	jan-apr	jan-may	jan-jun	jan-jul	jan-aug	jan-sep	jan-oct
4	1972	38	44	33	80	37	4.7	94	51	89	28	15	19	78.1	2										
5	1973	37	25	41	47	6.1	61	68	64	70	51	9.6	24	67.4	2		feb-mar	feb-apr	feb-may	feb-jun	feb-jul	feb-aug	feb-sep	feb-oct	
6	1974	19	47	38	84	53	41	15	31	32	37	25	3.9	26.0	3										
7	1975	9.5	25	53	32	61	22	23	82	27	52	40	22	44.3	4		mar-apr	mar-may	mar-jun	mar-jul	mar-aug	mar-sep	mar-oct		
8	1976	12	33	40	54	23	78	76	80	43	41	40	29	66.3	2										
9	1977	27	41	29	24	44	37	23	27	46	26	15	18	31.7	4		apr-may	apr-jun	apr-jul	apr-aug	apr-sep	apr-oct			
10	1978	44	38	29	78	62	45	17	49	16															
11	1979	32	33	40	73	8	60	52	42	43															
12	1980	34	6.3	51	41	104	35	19	22	2.7															
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14	1982	9.4	11	26	21	9.9	13	54	35	23															
15	1983	3.7	31	24	19	13	52	31	62	17															
16	1984	12	24	37	42	57	28	5.3	47	47															
17	1985	34	19	55	31	39	14	24	11	14															
18	1986	34	56	41	51	43	80	84	31	38															
19	1987	41	36	17	24	28	21	46	7.1	51															
20	1988	24	21	19	54	78	89	15	31	20															
21	1989	1.2	16	20	74	58	99	87	68	73															
22	1990	11	7.7	36	61	74	21	39	46	28															
23	1991	9.9	25	23	58	73	13	11	36	42															
24	1992	12	4.8	19	54	46	77	52	22	23															
25	1993	1.7	8.1	21	42	51	28	29	11	30															
26	1994	26	22	0.4	53	17	44	81	2.3	38															
27	1995	8.5	16	17	32	43	45	51	104	55															
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31	1999	8.8	8.4	29	45	33	57	74	40	44															
32	2000	5.7	4.9	30	43	22	35	21	27	37															
33	2001	26	22	36	36	57	31	17	51	47	9.5	29	9.7	38.4	5										
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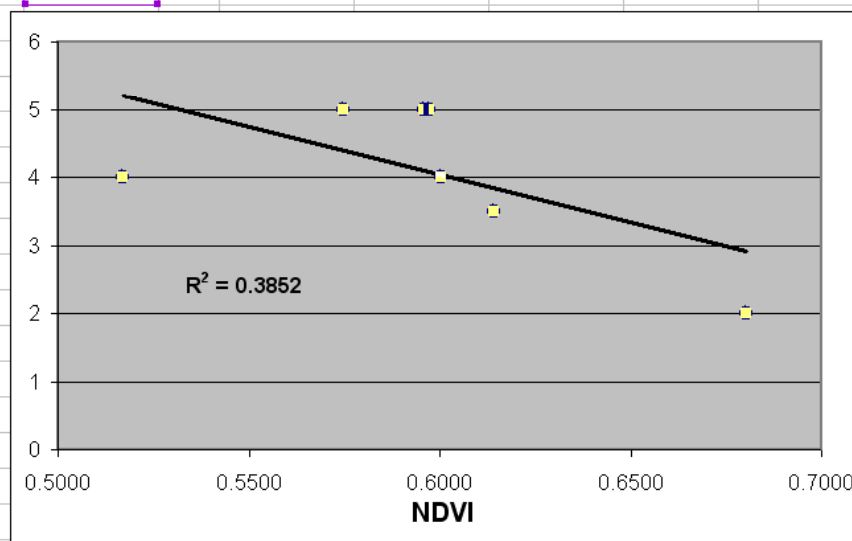
September
July-September





NDVI and annual rating

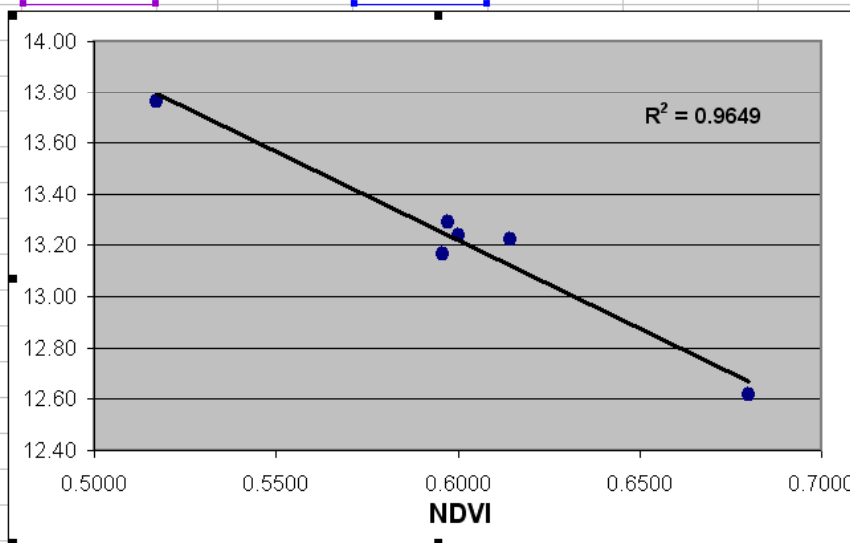
	A	B	C	D	E	F	G	H	I	J	K	L	M	N
	Annata	Qualità		NDVI 241		Acidità totale (g/l)	Alcol (%/Vol)	Densità Relativa	Densità ottica a 420 nm	Densità ottica a 520 nm	Estratto secco senza zuccheri (g/l)	IPT (DO 280)	Intensità colorante (420+520)	pH (a 20 °C)
1														
2	2000	4		0.6004		5.64	13.24	0.99521	3.40	4.82	28.24	52	8.22	3.48
3	2001	5		0.5959		5.23	13.17	0.99440	3.89	5.65	27.74	62	9.53	3.53
4	2002	2		0.6801		6.02	12.62	0.99456	3.01	4.17	25.27	46	7.18	3.32
5	2003	4		0.5171		5.23	13.76	0.99423	4.04	5.46	28.89	67	9.51	3.43
6	2004	5		0.5974		5.33	13.29	0.99392	3.81	4.64	27.93	59	8.42	3.40
7	2005	3.5		0.6142		5.48	13.22	0.99415	3.56	4.30	27.42	57	7.83	3.45
8	2006	5		0.5746										
9														
10														
11														
12														
13														
14														
15														
16														
17														
18														
19														
20														
21														
22														
23														
24														





NDVI and alcohol

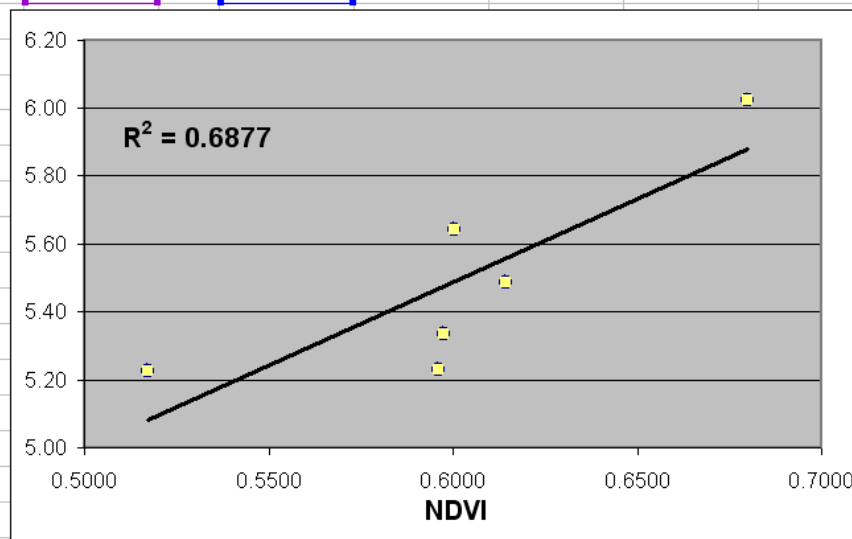
	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Annata	Qualità		NDVI 241		Acidità totale (g/l)	Alcol (%/Vol)	Densità Relativa	Densità ottica a 420 nm	Densità ottica a 520 nm	Estratto secco senza zuccheri (g/l)	IPT (DO 280)	Intensità colorante (420+520)	pH (a 20 °C)
2	2000	4		0.6004		5.64	13.24	0.99521	3.40	4.82	28.24	52	8.22	3.48
3	2001	5		0.5959		5.23	13.17	0.99440	3.89	5.65	27.74	62	9.53	3.53
4	2002	2		0.6801		6.02	12.62	0.99456	3.01	4.17	25.27	46	7.18	3.32
5	2003	4		0.5171		5.23	13.76	0.99423	4.04	5.46	28.89	67	9.51	3.43
6	2004	5		0.5974		5.33	13.29	0.99392	3.81	4.64	27.93	59	8.42	3.40
7	2005	3.5		0.6142		5.48	13.22	0.99415	3.56	4.30	27.42	57	7.83	3.45
8	2006	5		0.5746										





NDVI and total acidity

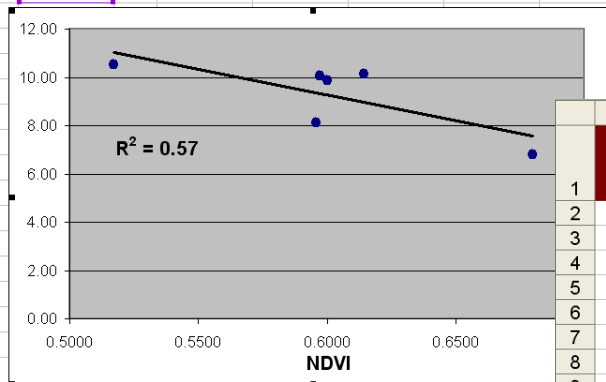
	A	B	C	D	E	F	G	H	I	J	K	L	M	N
	Annata	Qualità		NDVI 241		Acidità totale (g/l)	Alcol (%/Vol)	Densità Relativa	Densità ottica a 420 nm	Densità ottica a 520 nm	Estratto secco senza zuccheri (g/l)	IPT (DO 280)	Intensità colorante (420+520)	pH (a 20 °C)
1														
2	2000	4		0.6004		5.64	13.24	0.99521	3.40	4.82	28.24	52	8.22	3.48
3	2001	5		0.5959		5.23	13.17	0.99440	3.89	5.65	27.74	62	9.53	3.53
4	2002	2		0.6801		6.02	12.62	0.99456	3.01	4.17	25.27	46	7.18	3.32
5	2003	4		0.5171		5.23	13.76	0.99423	4.04	5.46	28.89	67	9.51	3.43
6	2004	5		0.5974		5.33	13.29	0.99392	3.81	4.64	27.93	59	8.42	3.40
7	2005	3.5		0.6142		5.48	13.22	0.99415	3.56	4.30	27.42	57	7.83	3.45
8	2006	5		0.5746										



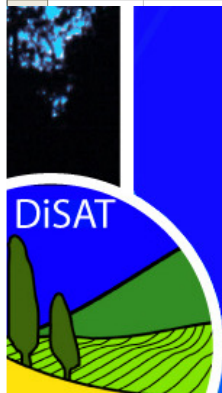
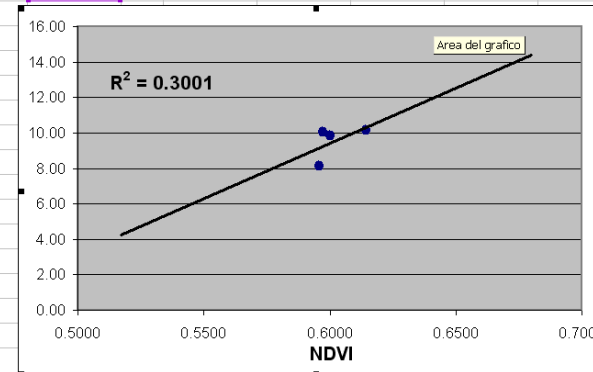


NDVI and glycerol

	A	B	C	D	E	F	G	H	I	J	K	L
	Annata	Qualità		NDVI 241		Acidità totale (g/l)	Alcol (%/Vol)	Densità Relativa	Densità ottica a 420 nm	Densità ottica a 520 nm		Glicerolo
1												
2	2000	4		0.6004		5.64	13.24	0.99521	3.40	4.82		9.85
3	2001	5		0.5959		5.23	13.17	0.99440	3.89	5.65		8.12
4	2002	2		0.6801		6.02	12.62	0.99456	3.01	4.17		6.79
5	2003	4		0.5171		5.23	13.76	0.99423	4.04	5.46		10.53
6	2004	5		0.5974		5.33	13.29	0.99392	3.81	4.64		10.04
7	2005	3.5		0.6142		5.48	13.22	0.99415	3.56	4.30		10.13
8	2006	5		0.5746								

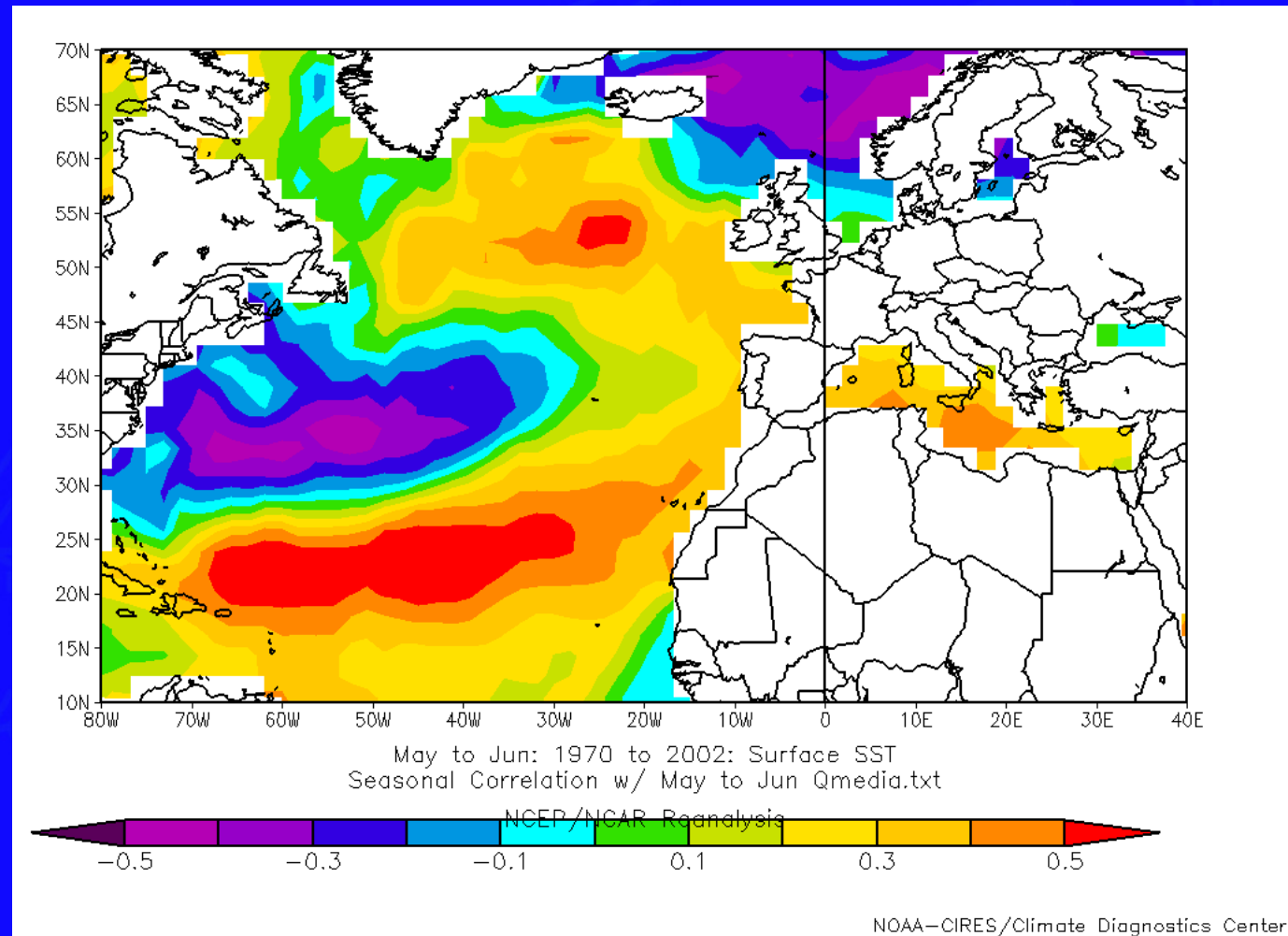


	A	B	C	D	E	F	G	H	I	J	K	L
	Annata	Qualità		NDVI 241		Acidità totale (g/l)	Alcol (%/Vol)	Densità Relativa	Densità ottica a 420 nm	Densità ottica a 520 nm		Glicerolo
1												
2	2000	4		0.6004		5.64	13.24	0.99521	3.40	4.82		9.85
3	2001	5		0.5959		5.23	13.17	0.99440	3.89	5.65		8.12
4	2002	2		0.6801		6.02	12.62	0.99456	3.01	4.17		6.79
5	2003	4		0.5171		5.23	13.76	0.99423	4.04	5.46		10.53
6	2004	5		0.5974		5.33	13.29	0.99392	3.81	4.64		10.04
7	2005	3.5		0.6142		5.48	13.22	0.99415	3.56	4.30		10.13
8	2006	5		0.5746								





Teleconnections between annual rating (Italian wine) and Atlantic SST





SST anomalies for the period 1970-2002

