

Xerochore Conference - "Ways to Support Drought Management Policy in Europe"
23-24 February 2010

Drought policy and participative management in the Júcar Basin, Spain.

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www.upv.es/aquatool/

www.chj.es



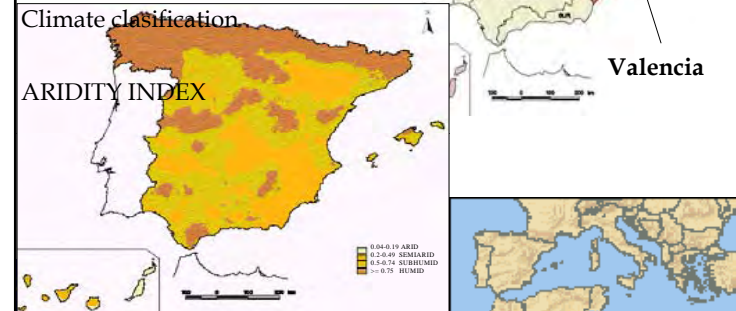
1

SPAIN

- Water adm. at basin scale since 1927: **Basin agencies**
- Users represented at the Agencies **Decision Boards: active participation**

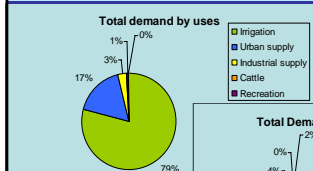
Climate classification

ARIDITY INDEX



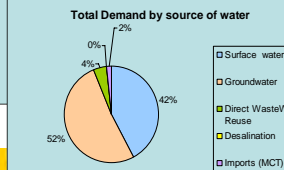
Júcar River Basin Authority (CHJ)

Surface (km ²)	43.000
Permanent population	4.792.528
Equivalent population due to tourism	367.322
Irrigation surface (ha)	347.275
Water demand (hm ³ /year)	3.172
(Hm ³ /year = Gigaliters/year)	



HALF OF THE AREA IS SEMIARID

+HIGHEST VARIABILITY IN EUROPE (IN SPACE AND TIME)



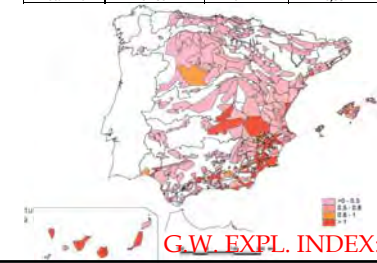
□ Surface water
□ Groundwater
□ Direct Waste/Wat Reuse
□ Desalination
□ Imports (MCT)

WATER SCARCITY INDEX (WEI)

AMBITO	DEMANDA	REC.RENOVABLE	D/RR
Galicia Costa	819	12.250	0,07
Norte I	617	12.689	0,05
Norte II	589	13.881	0,04
Norte III	486	5.337	0,09
Duero	3.860	13.660	0,28
Tajo	4.065	10.883	0,37
Guadiana I	2.312	4.414	0,52
Guadiana II	219	1.061	0,21
Guadalquivir	3.760	8.601	0,44
Sur	1.350	2.351	0,57
Segura	1.834	803	2,28
Júcar	2.962	3.432	0,86
Ebro	10.378	17.967	0,58
C.I. Cataluña	1.357	2.787	0,49
Baleares	288	661	0,44
Canarias	427	409	1,04
Total España	35.323	111.186	0,32

Sistema	Demanda 2015	Recurso en régimen natural	Demanda / Recurso régimen natural
Cenia-Maestrazgo	117	312	0,38
Miñares	300	531	0,56
Palancia	101	117	0,87
Turisa	666	496	1,34
Júcar	1.546	1.671	0,93
Serpis	125	190	0,66
Marina Alta	94	222	0,42
Marina Baja	75	74	1,01
Vinalopó - Alacantí	256	97	2,64
Total DHJ	3.280	3.711	0,88

In Spanish River Basin Plans for WFD **water licenses and ecological flows** are key issues



Drought monitoring: indicators used

Use of different types of indicators:

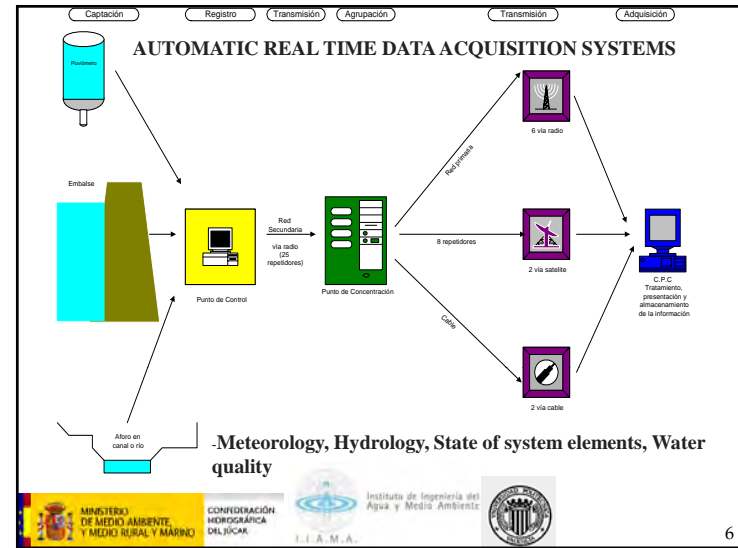
- 1) Meteorological drought (SPI)
- 2) Agricultural drought (Palmer)
- 3) Hydrological drought (historical position)
- 4)

And use of PRACTICAL institutional indicators for OPERATIONAL DROUGHT

CHJ Operational Drought Indicators



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CHJ-ODI Evaluation and Threshold Definition (Calibrated using simulation models)

Weighted combinations of standardized values of key variables related to water availability:

34 individual indicators:

- 9 reservoir volume
- 9 piezometric level
- 9 fluvial networks
- 7 pluviometers



Status Index	Status
0.75 – 1.00	NORMAL
0.50 – 0.75	PRE-ALERT
0.30 – 0.50	ALERT
0.00 – 0.15	EMERG.

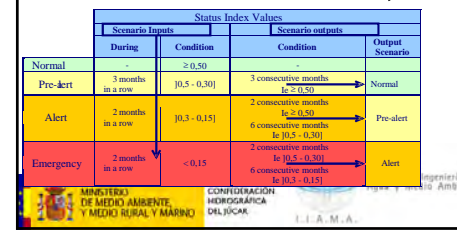
SISTEMA EXPLORACIÓN	Ind Estado 31.03.2008	INDICE SIST. EXPLORACIÓN
1	0.99	0.66
2	0.52	
3	0.74	
4	0.39	0.67
5	0.82	
6	0.66	
7	0.35	0.57
8	0.70	
9	0.61	
10	0.32	0.33
11	0.10	
12	0.04	
13	0.19	
14	0.39	
15	0.45	
16	0.53	
17	0.00	0.14
18	0.00	
19	0.35	
20	0.14	
21	0.20	
22	0.58	
23	0.16	
24	0.18	
25	0.73	
26	0.14	
27	0.58	
28	0.82	0.72
29	0.53	
30	0.80	0.82
31	0.82	
32	0.88	0.88
33	0.79	
34	0.70	0.73

Drought indicators JRBA (31 March 2008).

SCENARIOS

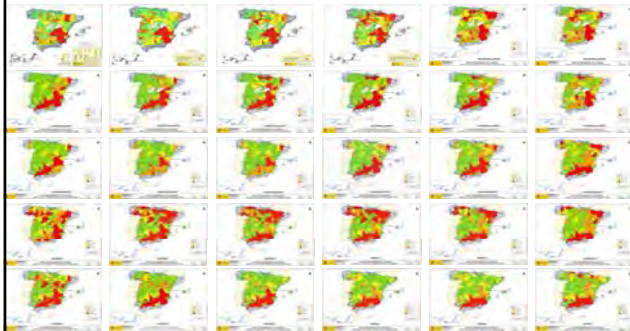
Sistema	Jun	Jul	Ago	Sep	Oct	Nov	Dic	Ene	Feb	Mar	System	Risk Value/05	Scenario
Cenia-Maestrazgo	0.87	0.63	0.61	0.64	0.77	0.79	0.74	0.69	0.66	0.66	Cenia-Maestrazgo	LOW	Normal
Mijares-Plana de Castellón	0.66	0.66	0.65	0.77	0.73	0.66	0.66	0.67	0.66	0.67	Mijares-Plana de Castellón	LOW	Normal
Palancia-Los Valles	0.68	0.61	0.55	0.64	0.67	0.40	0.68	0.61	0.58	0.57	Palancia-Los Valles	LOW	Normal
Turia	0.41	0.39	0.38	0.4	0.44	0.45	0.41	0.39	0.37	0.34	Turia	MEDIUM	PRE-ALERT
Júcar	0.58	0.56	0.28	0.23	0.22	0.19	0.18	0.14	0.14	0.14	Júcar	VERY HIGH	Emergency
Serpis	0.41	0.43	0.45	0.5	0.69	0.63	0.78	0.70	0.67	0.72	Serpis	LOW	Normal
Marina Alta	0.51	0.51	0.55	0.69	1.00	0.92	0.90	0.89	0.90	0.82	Marina Alta	VERY LOW	Normal
Marina Baja	0.80	0.80	0.80	0.85	1.00	1.00	1.00	0.92	0.92	0.88	Marina Baja	VERY LOW	Normal
Vinalopó-Alacantí	0.74	0.75	0.83	0.95	1.00	0.86	0.87	0.80	0.82	0.73	Vinalopó-Alacantí	VERY LOW	Normal

Drought status indicator per exploitation system

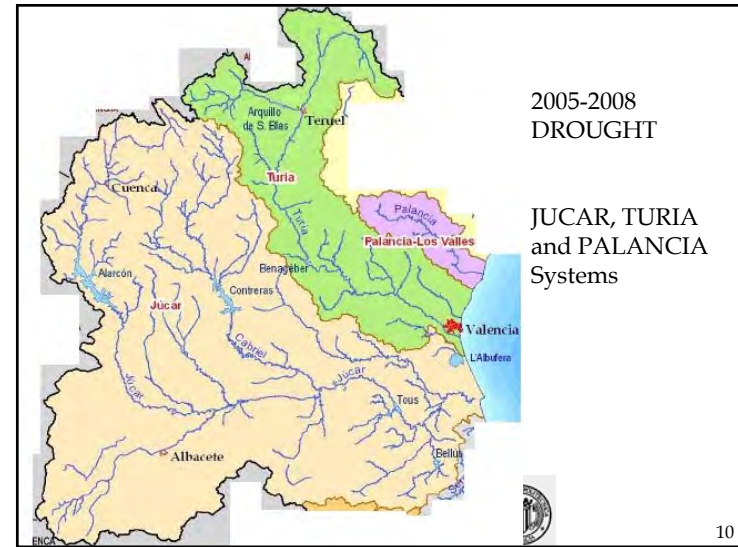


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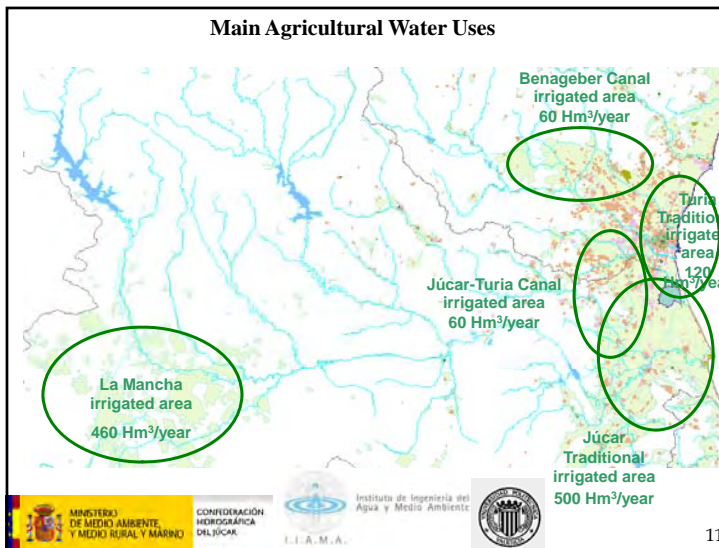
Spanish Global System of Operational Drought Indicators (monthly elaborated since Dec.2005 and published in the MMARM web page)



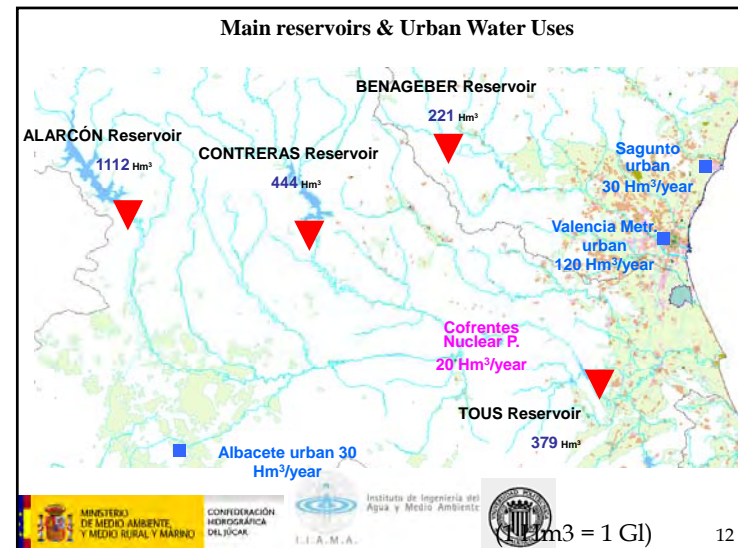
All basins in Spain have SPECIAL DROUGHT PLANS since 2007 Based on INDICATORS and SETS OF MEASURES for each scenario



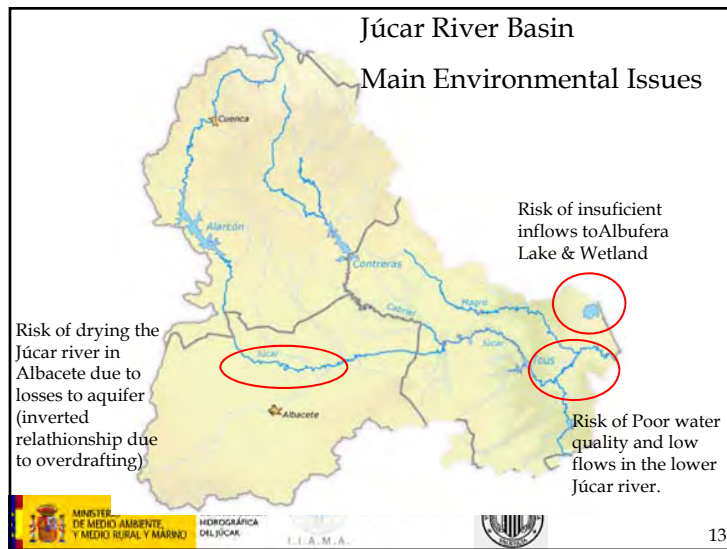
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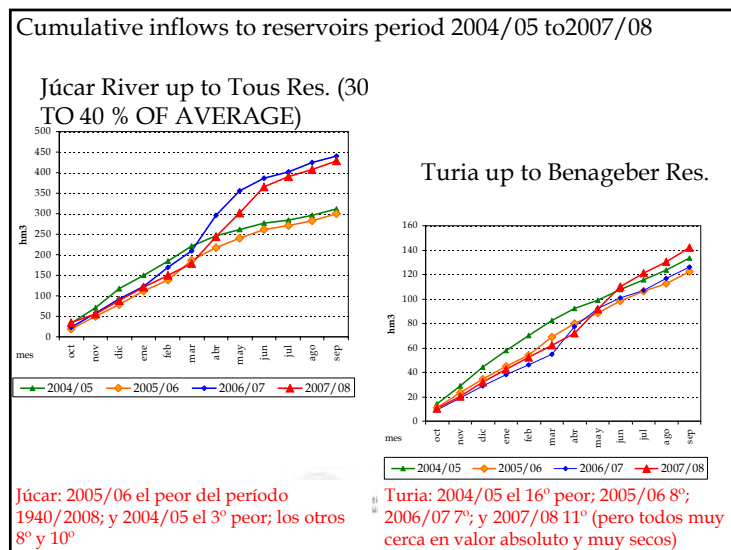
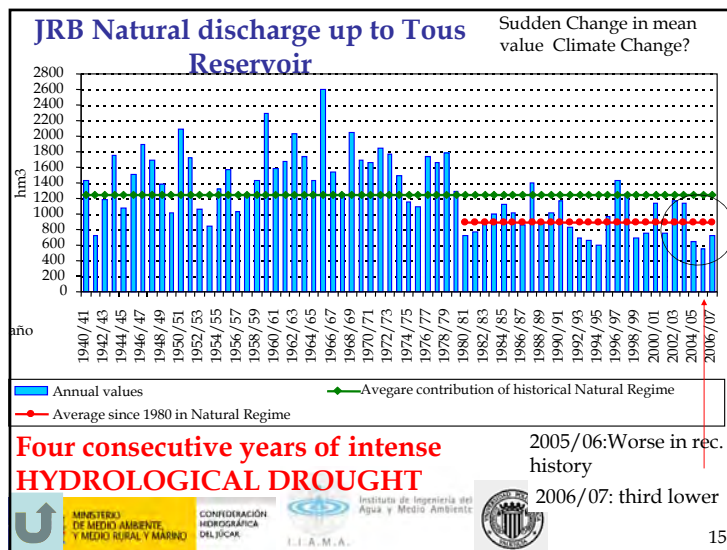


hydrologic year 2004/05

Latest natural hydrologic flows		Historical position (1= worst position)
	2004/05	
Alarcón	161,32	5
Contreras	134,90	6
Alarcón-Molinar *	213,44	4
Contreras-Molinar-Tous	174,35	26
Tous-Sueca	254,99	48
Total up to Tous	684,00	3
Total	939,00	6

Hydrologic year 2004/05 was the third year with lower flows to Tous dam in the historical data series (1940/41 - 2004/05)

The indicators pointed out a **severe meteorological drought** and increasing **risks of an operative drought**: first measures were applied and claimed, including the drought declaration



**Legal Framework:
OFFICIAL DROUGHT DECLARATION**

Royal Decree 1265/2005, of October 21st, by which exceptional administrative measures are adopted for the management of hydrological resources and for the correction of drought effects in the hydrological basins of rivers Júcar, Segura and Tajo, extended until 30th November 2008 by Royal Decree-Law 9/2007, of October 5th.

The **Permanent Drought Commission** (PDC) of the Governing Board, constituted on December 1st 2005, has developed a detailed follow-up of the drought evolution, meeting up monthly. Thanks to its constitution, public participation is made effective in drought management.



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Composition of the Commission: RD 1265/2005

Delegate board from the Governing Board of CHJ (JRBA)
Entitled to vote (13):

- President of JRBA
- JRBA (3) : Commissary, Technical Director, Head of Planning Office.
- Spanish Ministries (2): Industry (IGME) and Environment
- Autonomous Regional Governments (4)
 - Urban users representative (Valencia Metr. Area W. Supply)
 - Agricultural users representative (Real del Júcar Ditch).
 - Industrial users representative (Iberdrola, S.A.)

In advisory capacity (4)

- Environmental Interest Defence: Agró
- Entrepreneurial Representation: AVA
- Labor Unions representation: CCOO
- Local Entities representative: Albacete municipality

Numerous "guests"

SDC Meeting Calendar



- 1) 1st December 2005
- 2) 21st December 2005
- 3) 21st January 2006
- 4) 13th February 2006
- 5) 15th March 2006
- 6) 18th April 2006
- 7) 22nd May 2006
- 8) 27th June 2006
- 9) 19th July 2006
- 10) 24th August 2006
- 11) 12th September 2006
- 12) 28th September 2006
- 13) 15th November 2006
- 14) 15th December 2006
- 15) 15th February 2007
- 16) 20th April 2007
- 17) 18th July 2007
- 18) 17th September 2007
- 19) 31st October 2007
- 20) 12th December 2007
- 21) 15th February 2008
- 22) 14th March 2008
- 23) 18th April 2008
- 24) 12th June 2008
- 25) 16th September 2008
- 26) 17th October 2008
- 27) 22nd December 2008
- 28) 12th March 2009

SDC PROCEDURE:

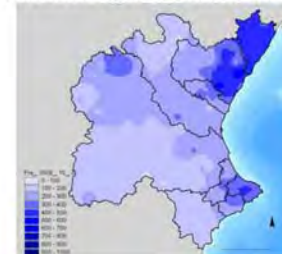
**METEO & HYDROLOGICAL INFORMATION
+DROUGHT INDEXES**

Allow to identify droughts and to compare situations (s-t)

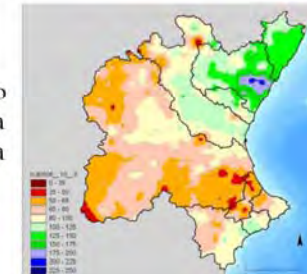
Percentage of normal cumulative rainfall

Available resource / normal (average) resource
Advantage: easy to understand

Octubre 2005 a marzo 2006



Respecto la media histórica



Continuous monitoring

Drought indicators CHJ
(31 January 2006)

Júcar => emergency
Marina Alta => alert



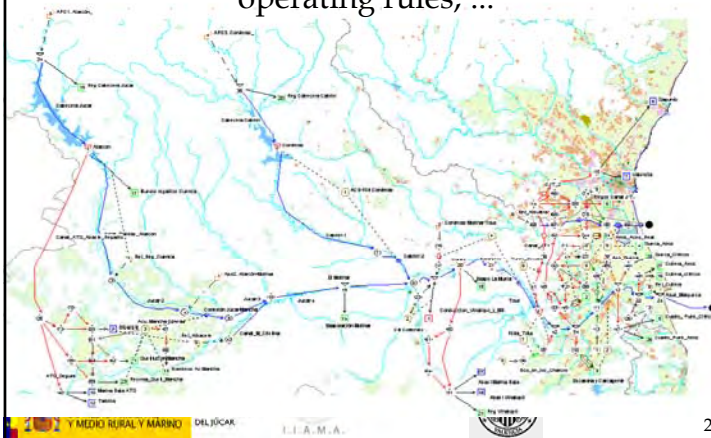
System	Valuation risk	State Index	State
Cenia-Maestrazgo	LOW	0.55	STABLE
Mijares-Plana de Castellón	LOW	0.51	STABLE
Palancia-Los Valles	LOW	0.52	STABLE
Turia	MEDIUM	0.38	INITIAL ALERT
Júcar	VERY HIGH	0.13	EMERGENCY
Serpis	MEDIUM	0.32	INITIAL ALERT
Marina Alta	HIGH	0.28	ALERT
Marina Baja	LOW	0.58	STABLE
Vinalopó-Alacantí	MEDIUM	0.49	INITIAL ALERT

DROUGHT RISKS ASSESSMENT



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Basin Scale Júcar management Simulation model
integrating all infrastructure, demands, priorities,
operating rules, ...



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AQUATOOL:

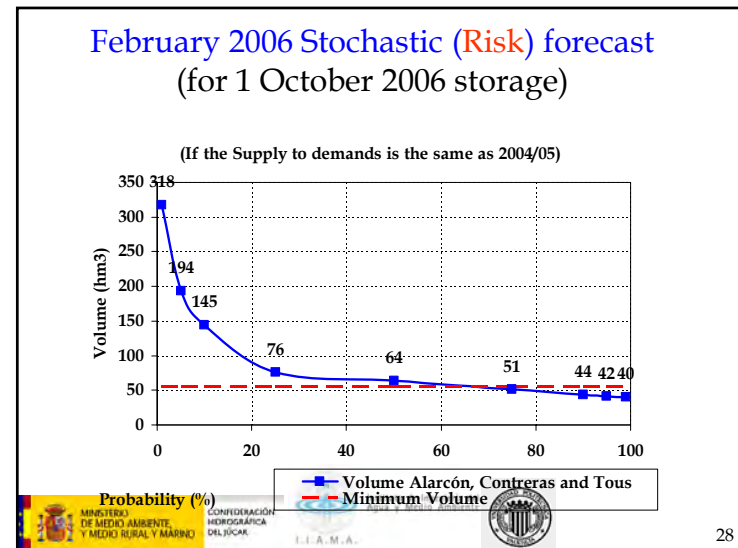
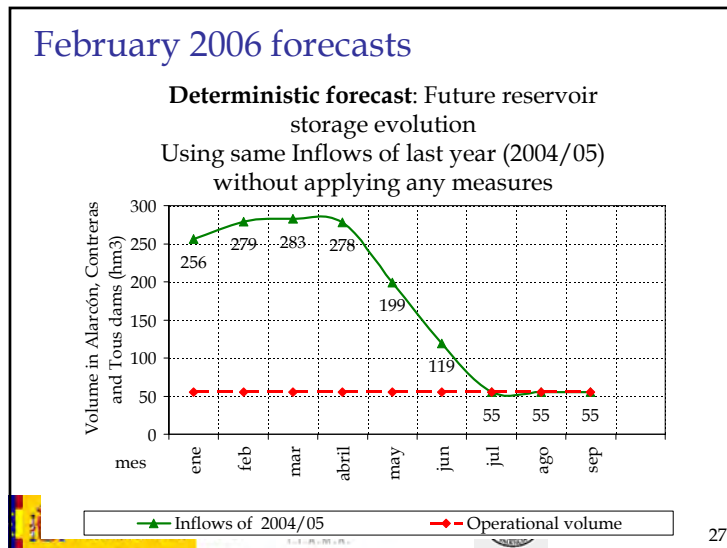
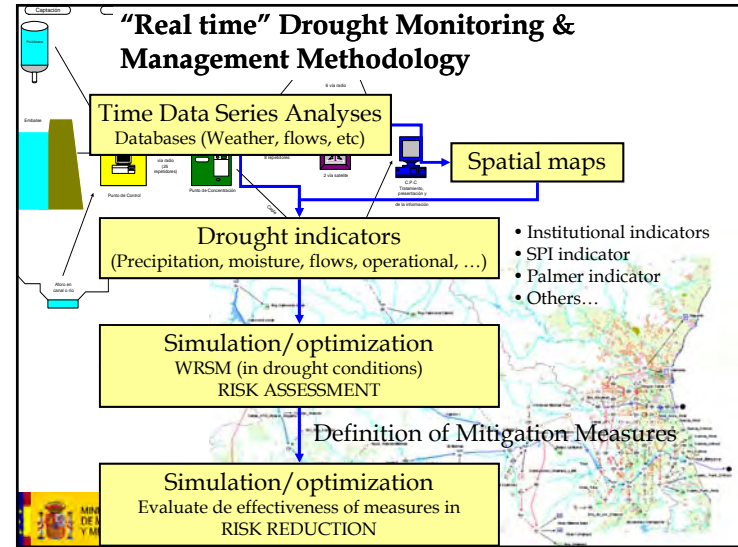
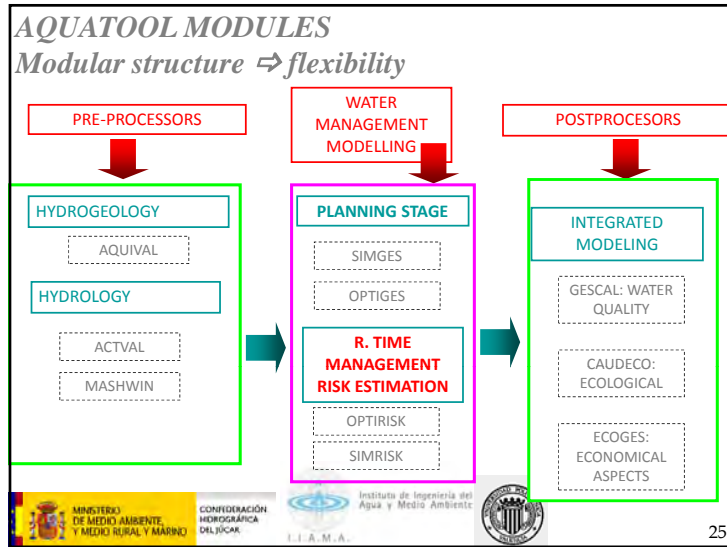


**DSS Shell designed for integrated
management of complex water
resource systems**

J. Andreu, J. Capilla, y E. Sanchis, "Generalized
decision support system for water resources
planning and management including conjunctive
water use", *Journal of Hydrology*, Vol. 177, pp.
269-291, 1996.

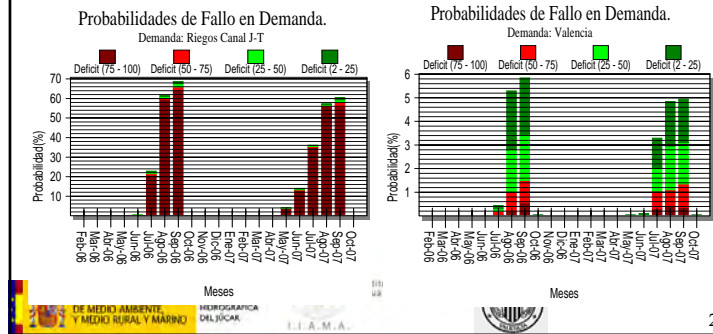


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Stochastic Risk estimation

Probability of failure in urban and agricultural areas



Measures 2005/06 (more detail later ...)

- Increase w. conveyance efficiency
- Increase Conjunctive surf&ground w. use + drought wells
- Increase Reuse of waste water
- Water rights purchase to preserve environmental flows
- Application of measures to save water: irrigation reduction, and alternative urban supply
- Conjunctive management of Turia and Júcar Basins
- Public education trough media (Newspapers, ...) in order to reduce urban consumption
- Intensive monitoring and surveillance., ...

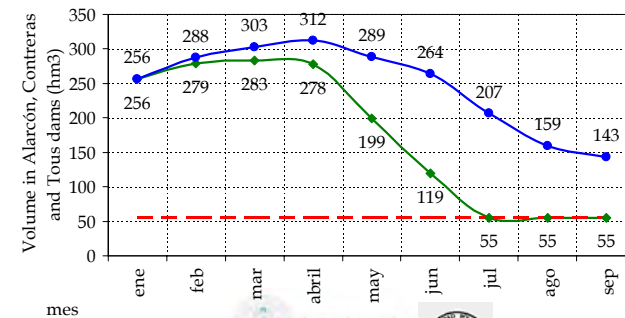
Surface Water Allocation Proposal for 2005/2006 (figures in Hm3=GL)

IRRIGATION	Supply	Supply	Proposal 2005/06	Reduction w.r. to 2004/05
	1994/95	2004/05		
Regadíos canal Júcar Turia	42	46	16,1	65 %
Sustitución de bombeos y consolidación de MO	0	21	7,35	65 %
Riegos tradicionales Júcar (Ribera Alta)	179	316	158	50 %
Riegos tradicionales Júcar (Ribera Baja)	204	305	183	40 %
URBAN SUPPLY	Supply	Proposal 2005/06		Reduction w.r. to 2004/05
	2005/06	From Júcar River	Other sources	
Abastecimiento Albacete	15	10	5	33 %
Abastecimiento Valencia	126	70	56	44 %
Abastecimiento Sagunto	7	4	3	43 %
INDUSTRIAL USE				Reduction w.r. to 2004/05
	2005/06	From Júcar River	Other sources	
Central N. Cofrentes	20	15	5	25 %

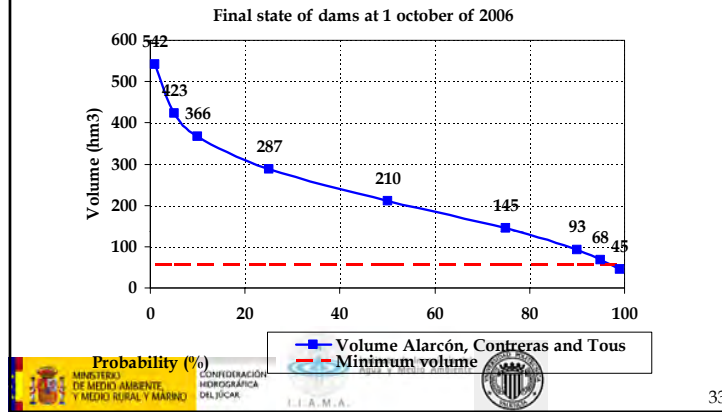
Effectiveness of the measures

February forecasts (if measures are applied)

Deterministic forecast: Future volume reservoir evolution Using same Inflows as last year (2004/05)



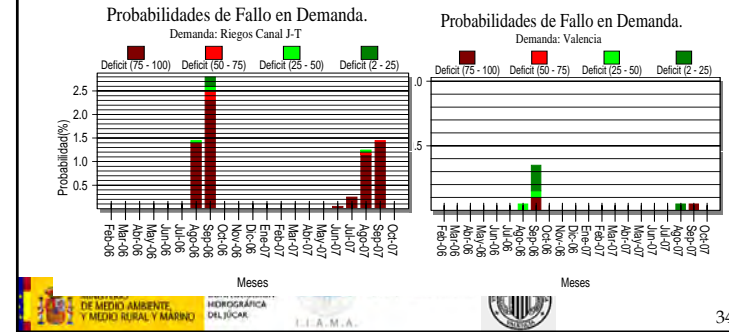
New February Stochastic forecast for 1 October 2006 (if measures are applied)



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New values for Risk of failures in demands

Probability of failure in urban and agricultural areas



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March 2006. Agreement for irrigation supply from SW

IRRIGATION	Supply		Reduction w.r. to 2004/05	Proposal 2005/06
	1994/95	2004/05		
Regadíos canal Júcar Turia	42	46	60 %	18,4
Asignación para sustitución de bombes y consolidación de MO	0	21	60 %	8,4
Riegos tradicionales Júcar (Albacete) (*)	8,7	8,7	45 %	4,8
Riegos tradicionales Júcar (Ribera Alta y Baixa)	383	621	43 %	354

REGADÍOS SUBTERRÁNEOS

Ahorro generalizado en las extracciones en el conjunto del acuífero de Mancha Oriental: 15% respecto a 406 hm³ (61 hm³). Posibilidad de materializar en tres años, con un mínimo del 5% en el primer año. **Aprobada la modificación del Plan de Explotación de la JCRMO en su Asamblea del 25 de marzo de 2006**

Ahorro en las extracciones en pozos con afección prácticamente inmediata al río similar a las tomas superficiales: 45%.

TRAMO MEDIO DEL JÚCAR

Posibilidad de indemnización económica por reducciones adicionales



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Action Plans 2005 to 2008 approved in March/April every year:

Find an equilibrium between environment, economic use of water, public safety, and sectors

Measures to minimise environmental impacts

Demand management and water saving

Measures to obtain additional resources

Management and control measures



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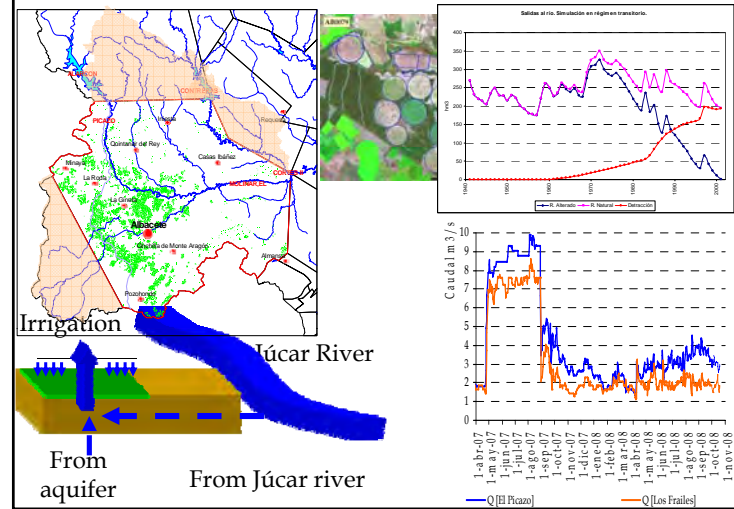
Environmental measures

- Flow maintenance
 - Midle Júcar (Mancha Oriental Aquifer)
 - Lower Júcar (after Tous Reservoir)
- Water Quality: new WW Treatment Plant set in operation in 2007 in the lower Júcar Basin.
- Wetland surveillance (flows and quality)



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Surveillance and maintenance of minimum flows



La Mancha Aquifer Use Reduction 2007-08

Public offer agreement for **water rights acquisition** in the middle section of the Júcar basin due to **environmental reasons**

Objective: Reducing extractions in the middle section of the Júcar river, both in surface water and in the area of the aquifer with a greater effect on the river flow.

2007 Rights acquisition and **adaptation** through **reduction of irrigated surface**.

2008 Rights acquisition and **adaptation** by using less water-consuming crops (spring crops) (**Changes in crop patterns**)



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Selection criteria (model based):

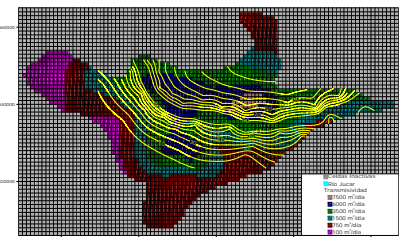
1. Effects on river (0-20 points)
2. Offered price (0-20 points)

Extension: 28.000 has

W.Rights volume: 148 hm³

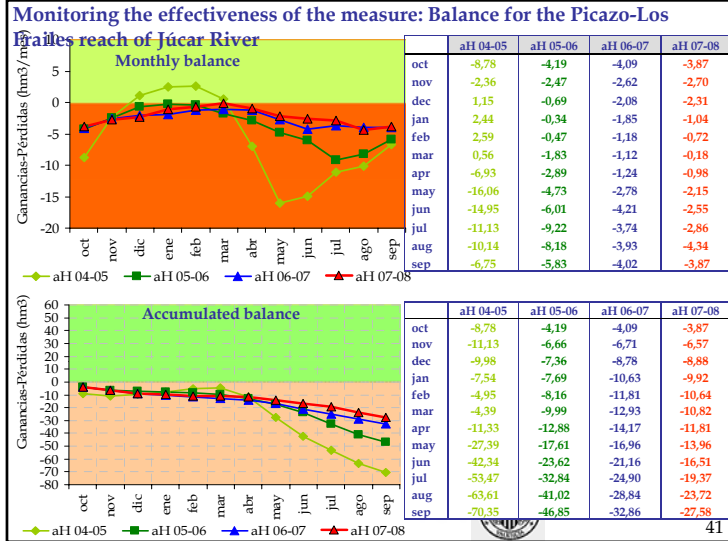
Time frame: seasons 2007-08

Uses reduction 2007&2008



	2007	2008
Maximum amount 07	0,1957 €/m ³	0,13 (€/m ³)
Minimum amount 07	0,13 (€/m ³)	0,25 €/m ³
Maximum amount 08	0,25 €/m ³	0,20 (€/m ³)
Minimum amount 08	0,20 (€/m ³)	
HGU Presented requests:	Total 119	Total 234
Right volume (hm³)	56,8	109,6
Renounced volume (no economic compensation) (hm ³)	22,9	12,5
Offered volume (hm ³)	27,3	50,6
Materialised budget (million€)	5,5	12,7
Reserved volume (hm ³)	6,6	46,5

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Surveillance middle section of Júcar river

Objective: flow maintenance downstream from Alarcón reservoir

Júcar river in summer 1995 Júcar river in summers 2006 and 2007

Strict control of water abstraction:

- Satelite & field control in MO aquifer
- Meters at main canals automatically meas.

Demand management and water savings:

- Turns in traditional irrigated farms (every 15 days)
- Improvement in trad. Conveyance system

Conveyance canal substituted by pressurised pipe

- Savings of 100 MCM/year
- Part of an ongoing modernization plan

Fases de la Acción:

- Red de agua: Instalación de tuberías de PVC de 1200 mm de diámetro en paralelo al canal. El canal original será desmantelado.
- Materiales más resistentes: Obras de saneamiento y saneamiento de las obras de saneamiento.
- Red de distribución y presión y canales de flujo: Instalación de tuberías de PVC de 1200 mm de diámetro en paralelo al canal.
- Obras de la red de distribución.
- Red de distribución hacia la parcela: Instalación de tuberías de PVC de 1200 mm de diámetro en paralelo al canal.
- Rehabilitación y red de flujo: Instalación de tuberías de PVC de 1200 mm de diámetro en paralelo al canal.

PLANTA GENERAL

Other water sources measures



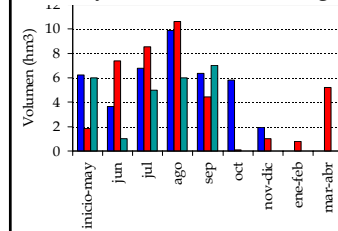
Conjunctive use of surface and groundwater + drought wells and pumping stations in irrigation networks (Re-use of irrigation drainages)

Farmers in the coastal plane, who are entitled to surface water, pumped from the aquifer and recycled sluce water, giving up an equal amount from their surface water allocation to be used by the upstream farmers and urban suppliers. The later paid for the costs of pumping (5 cents of euro/m3)

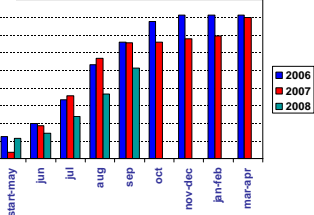


I.A.M.A.

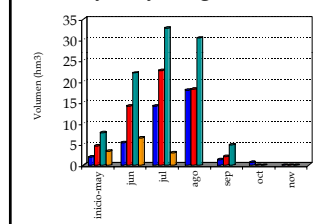
Monthly extractions in drought wells



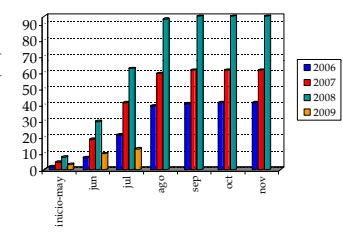
Accumulated extractions in drought wells



Monthly recycling of sluce waters



Cumulative recycling of sluce waters



Conjunctive management of Júcar and Turia Basins



Metropolitan area of Valencia:

-uses up to 90 MCM from Jucar Basin

-produces up to 120 MCM of treated wastewater

Trades with traditional irrigation areas: 47

TREATED WASTE WATER REUSE SCHEMES



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DIRECT REUSE OF RECLAIMED (TREATED) WASTEWATER

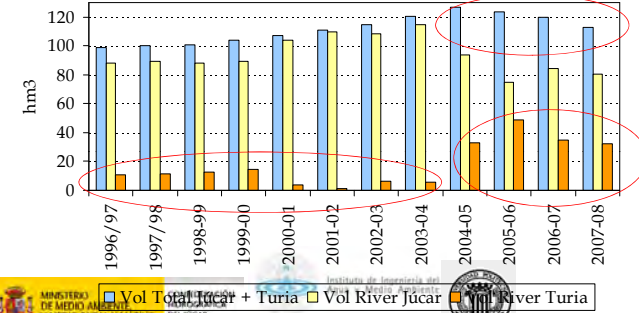


Volumes of Direct re-use of treated wastewater during drought

EDAR	Pinedo II. Extension		Quart-Benatger	Carraxset	Faterna-Fte. del Jarro		TOTAL
UDA	Tradit. I. Vega de Valencia. Rest of Ditches	Del Oro Ditch (G)	Tradit. I. Vega de Valencia. Rest of Ditches	Tradit. I. Vega de Valencia. Rest of Ditches	Tradit. I. Vega de Valencia. Rest of Ditches	Tradit. I. Vega de Valencia. Real Ac de Moncada	
User	Favara Ditch (B)	Del Oro Ditch (G)	Ditches of Andarella (B), Kirivella (B), Benager (B), Faltanar (B) y Favara (C)	Rascanya Ditch (B)	Formos Ditch (C)	Real de Moncada Ditch (B)	
	(Hm ³)	(Hm ³)	(Hm ³)	(Hm ³)	(Hm ³)	(Hm ³)	(Hm ³)
2005/06	6.015	22.156	0	0	0	0	28.171
2006/07	6.781	50.153	9.008	3.791	0.603	0.829	71.165
2007/08	9.946	66.857	12.782	3.444	0.214	0.913	94.157

URBAN DEMAND MANAGEMENT

Supply for the metropolitan area of Valencia with surface water from rivers Júcar and Turia



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Environmental measures Albufera Lake (Ramsar Wetland)

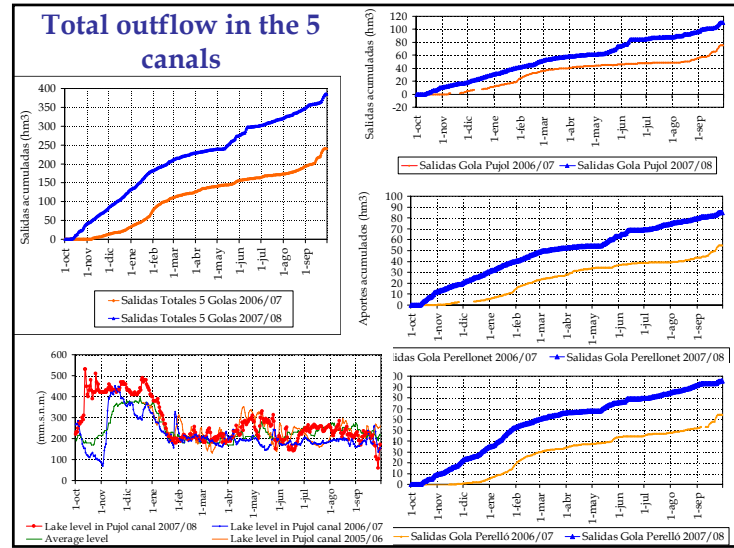


Monitoring network:

- Lake level
- Outflow in the 5 canals
- Inflows in some ditches



Total outflow in the 5 canals



Special control & monitoring of Aquifers, and Springs

Drought wells: flows, levels, and w.quality



W. Quality of Re-cycling in irrigation network



Basic Monitoring Network

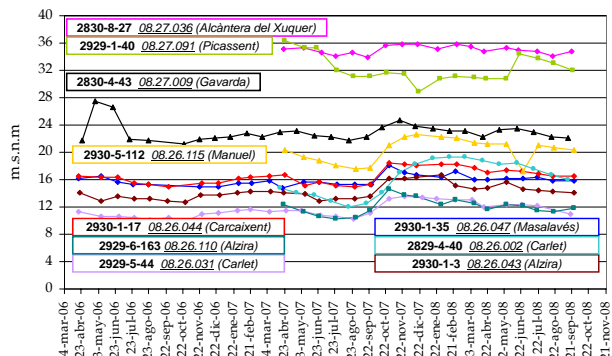
General Piezometry Albufera Piezometry Hydrometry

● Specific drought network



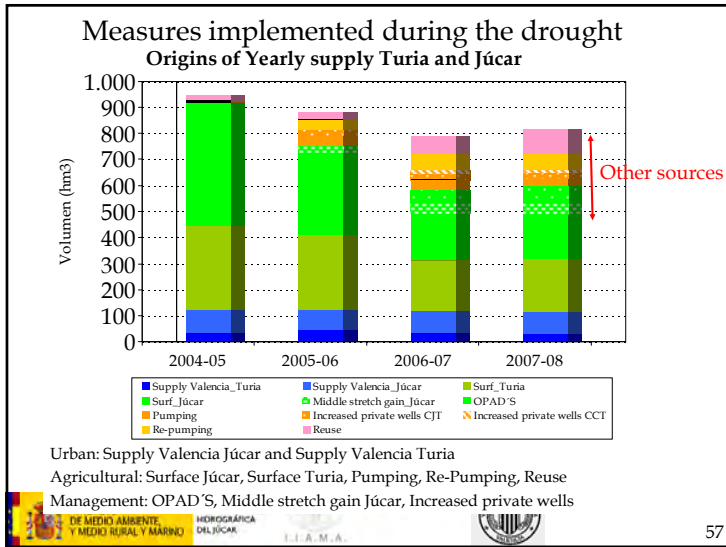
Piezometry	46	Piezometry = 72	Quality = 33
Piezometry and Quality	26		
Quality	7		
Hydrometry	4		Hiidrometry =4

GWB Valencia South Plane



Transparency: Public information on CHJ web page

WWW.CHJ.ES



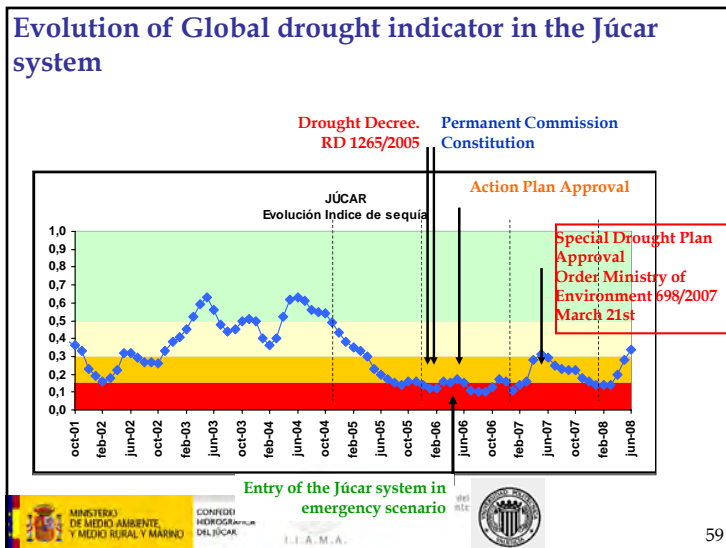
Emergency works

Main investments in:

- Improvement in the supply guarantee for urban areas and sources for alternative resource
- Improvement in drinking water treatment systems
- Improvement in the efficiency of irrigation systems

Emergency Works	Budget (thousand €)
Emergency Works 2005	19.285,0
Emergency Works 2006	35.286,0
Emergency Works 2007	15.350,0
Emergency Works 2008	4.940,0
Total	74.861,0

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	04-05			05-06			06-07			07-08			08-09							
	Oct	Ene	Abr	Jul	Oct	Ene	Abr	Jul	Oct	Ene	Abr	Jul	Oct	Ene	Abr	Jul				
CHJ Indicator	0,53	0,41	0,33	0,20	0,16	0,13	0,14	0,14	0,09	0,13	0,12	0,29	0,23	0,16	0,14	0,34	0,40	0,46	0,53	0,44
Scenario	Normalidad	Prealerta	Prealerta	Alerta	Alerta	Emergencia	Emergencia	Emergencia	Emergencia	Emergencia	Emergencia	Alerta	Alerta	Emergencia	Alerta	Prealerta	Prealerta	Prealerta		
Vol. stored in Alarcón Contreras & Tous (hm³)	577	578	600	424	218	236	309	221	107	160	260	282	159	207	268	365	266	398	649	610
Vol. Indicador	0,80	0,69	0,53	0,39	0,28	0,21	0,18	0,15	0,31	0,10	0,12	0,24	0,21	0,19	0,14	0,35	0,41	0,52	0,65	0,64
V. Alarcón (hm³)	373	346	343	219	129	117	129	113	44	65	110	127	71	66	67	119	98	131	242	246
V. Contreras (hm³)	141	163	177	81	42	51	63	54	22	33	45	66	44	52	60	108	113	144	210	234
V. Tous (hm³)	63	69	79	125	47	68	116	55	42	63	105	89	44	89	140	138	55	122	196	129
RESTRICCIONES Y SUMINISTROS																				
Riegos tradicional Albacete y subterráneo Zona Pólicia				8,7		45%		4,8		59%		3,6		59%		3,6				
Extracciones MO				406		15% (en dos años, materializado 5% (en un año))		358		20%		274		5%		297				294*
Sust. Bombos				21		60%		8,4		70%		6,3		81%		4,0				17
CJT				46				18,4				15,2				13,2				28,1
Superficiales Pozos Sequía				0		60%		7,0		70%		11,6		61%		12,8				0,08
Superficiales RT_Ribera_J				619				354				252				259				520
Pozos Sequía Rebombos				4,2		43%		31,8		57%		28,7		54%		19,8				0,23
Rebombos				3,7				39,7				62,3				62,4				15,9

*, en todo el accidente de la línea de transmisión de energía eléctrica, en la zona de la línea de transmisión de energía eléctrica, en la zona de la línea de transmisión de energía eléctrica. Parece que influyó mucho la subida del costo de energía eléctrica, en la zona de la línea de transmisión de energía eléctrica.

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Drought indicators JRBA
(30 September 2008).



Drought indicators JRBA
(28 February 2009).



- We never have 100% reliability.
- Permanently prepared for droughts.
- EFFICIENT WATER MANAGEMENT ORIENTED TO DROUGHT**
- Anticipation: **Indicators** must be **usefull** to anticipate, and to manage drought (not only statistical figures) at **basin or water resources system scale**:
 - CHJ-ODIndicators + Risk assessment (MODELS)**
- Permanent Conservation measures
- Special Plans for drought and Drought Manual**
- Drought = **CONFLICT**: **participation**, negotiation, transparency, tools and knowledge available to the stakeholders, ...
- Thrust atmosphere, cooperation, consensus
- Important role of DSS** as a tool for drought risk estimation, planning and management, efficiency of measures, and as a common shared vision among the **stakeholders**.

CONCLUSIONS

The most intensive drought in historical records was passed with:

- Low environmental damage (reversible)
- Low agricultural decrease in production (due to other circumstances, benefits were higher in some areas) (loses due to a simultaneous freezing in citric and fruits were higher)
- No restrictions on urban uses

Science and Policy can go together.

Every drought is different:

- SDP are guides
- But drought management must rely on adaptation to each drought

CONCLUSIONS

- Water **Scarce** Basins are usually also **drought** prone
- New drought management policy
 - Planning and proactive vs. Emergency and reactive
 - Special Drought Plans
- 2005-2008 Drought is the worst in recorded history in Jucar
- Permanent Drought Commission Plans of action:
 - Equilibrium
 - Environment protection measures
 - Control and management measures
 - Water conservation
 - Alternative resources generationMedidas de generación de recursos adicionales
 - EFFICIENT** resource allocation

Integrative DSS in Planning and Management provides many advantages, also in the negotiation phases:

- ◆ Development of **MODELS**, **SHARED** by the technicians, stakeholders, and policy makers: **SHARED VISION OF the SYSTEM + transparency + confidence in results and technicians.**
- ◆ **OBJECTIVE FRAMEWORK AND REFERENCE** that allows each group to evaluate the consequences of the alternatives that are proposed by them and by the others.
- ◆ **TOOL FOR the RATIONAL ANALYSIS OF MANAGEMENT AND OPERATION POLICIES** of resulting systems (**CRUCIAL FOR REACHING AGREEMENTS AND TO AVOID FUTURE CONFRONTATIONS**)
- ◆ **OBJETIVITY OF TECHNICAL ASPECTS** that allows negotiations to be developed **IN SOCIAL AND POLITICAL TERMS THAT ALLOW EQUITABLE AGREEMENTS** with a explicit knowledge of **trade-offs**

