SWAT 2015

PULA / SARDINIA / ITALY

MARINA BOLADO PENAGOS

A METHODOLOGY TO ASSESS THE ROLE OF THE RIVER DISCHARGES TO THE GULF OF CADIZ ON THE NUTRIENT SUPPLY TO THE ALBORAN SEA

- ✓ **INTRODUCTION**
  - General – MEGAN Project
  - Case Study – Guadalquivir River
- ✓ **CATCHMENT MODEL**
  - Set up
  - Calibration and Validation
- ✓ **SATELLITE IMAGES**
- ✓ **CONCLUSIONS**

INTRODUCTION

- MEGAN Project -

INTRODUCTION

- Guadalquivir River-

INTRODUCTION

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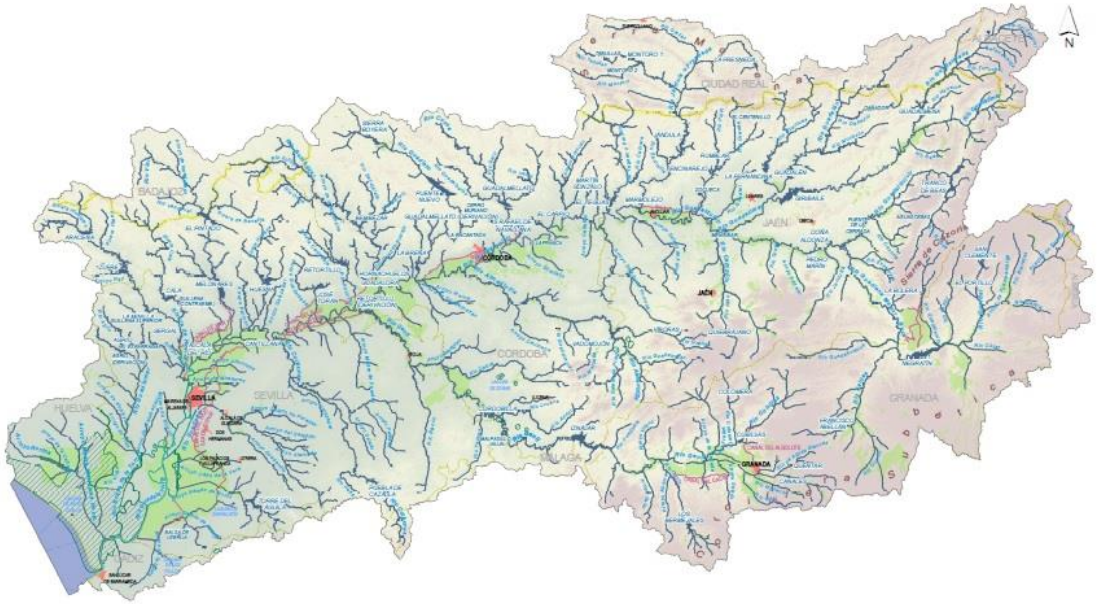
INTRODUCTION

- Guadalquivir River-



Around 656 km

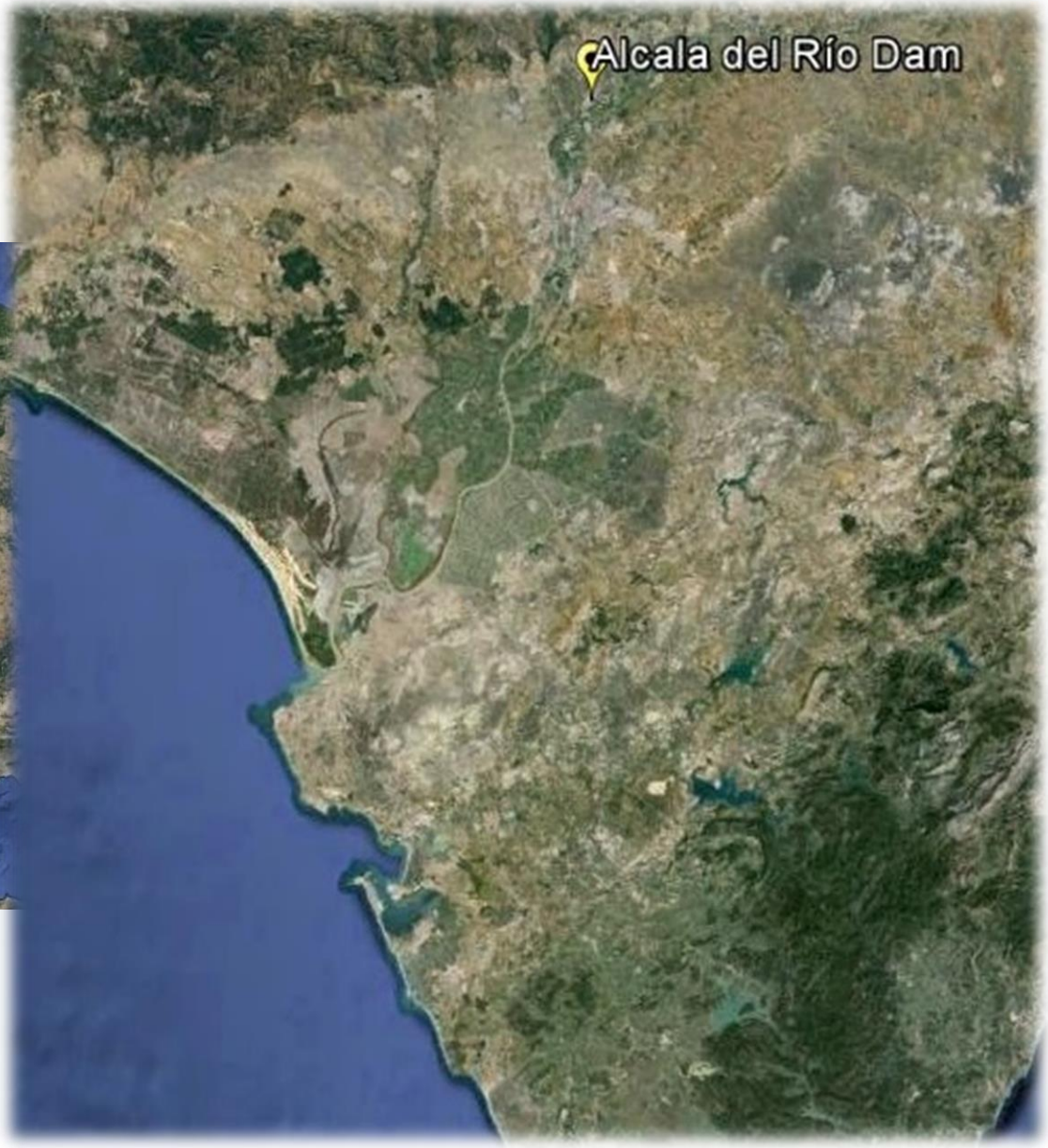
Drains a watershed area which has an extension higher than 50.000 km^2.

Involves different Autonomus Communities.

Andalucía around 90%.

INTRODUCTION

- Guadalquivir Estuary-



INTRODUCTION

- Guadalquivir Estuary-

Quasi-permanent tidal dominance

Loss of freshwater inputs

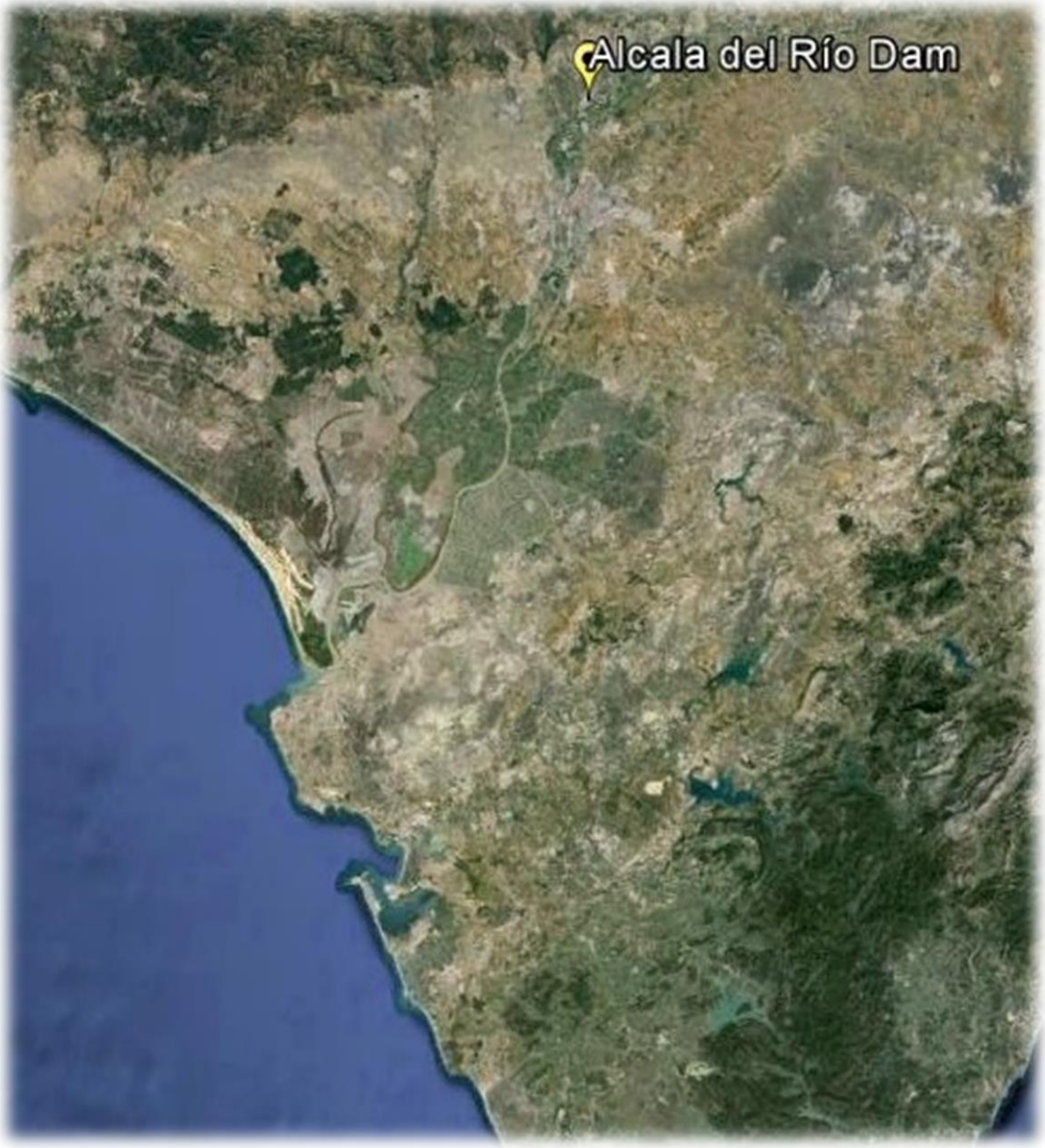
o 100 km.

First 85 km are navigable.

Freshwater discharge controlled by a dam

Well-mixed

Small vertical salinity and temperature gradients.



CATCHMENT MODEL

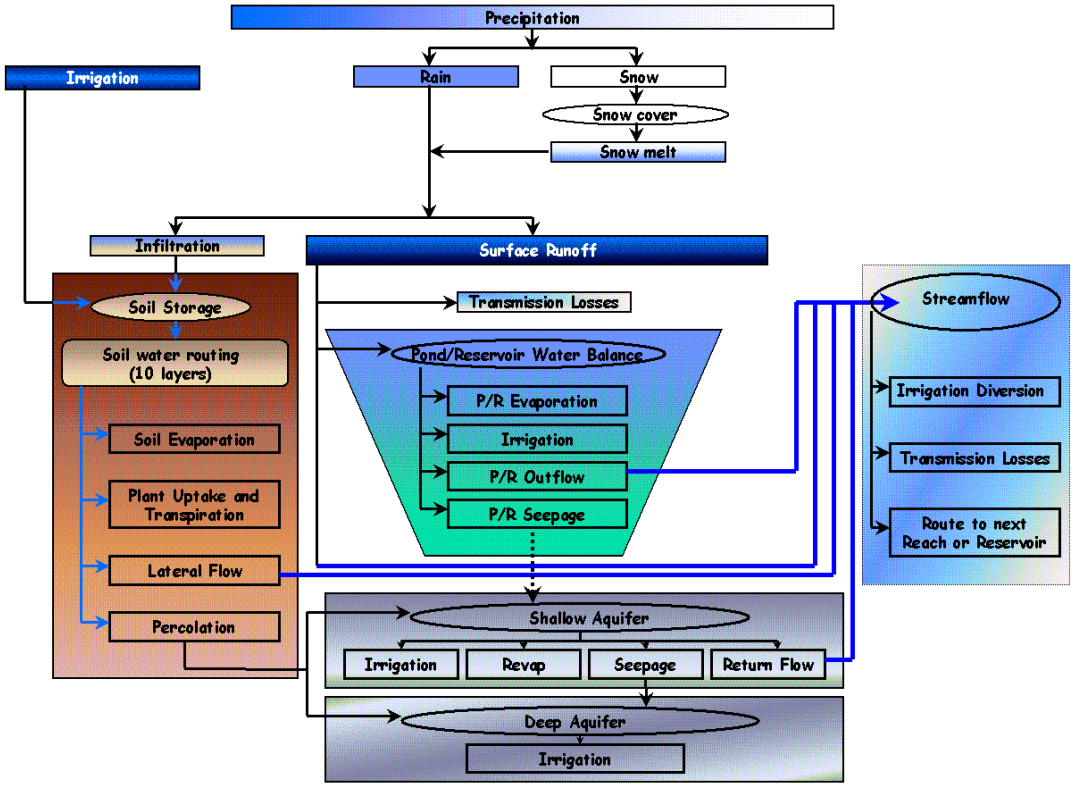
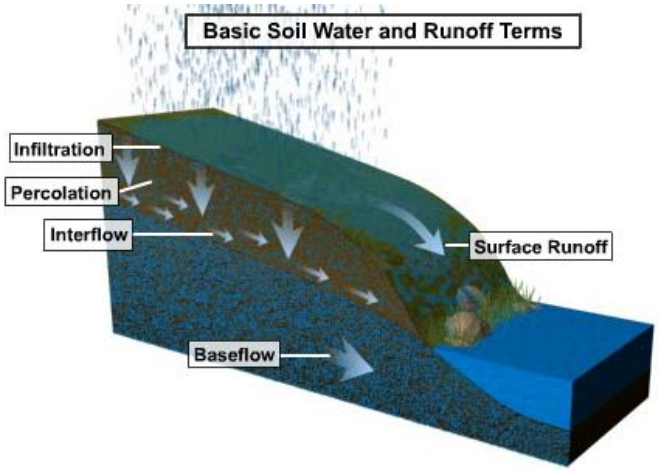
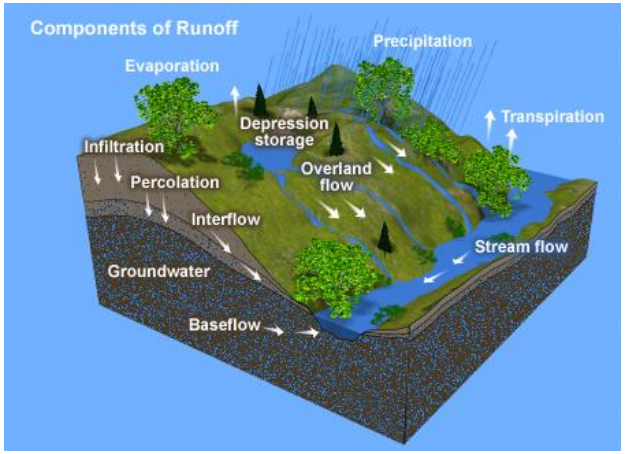


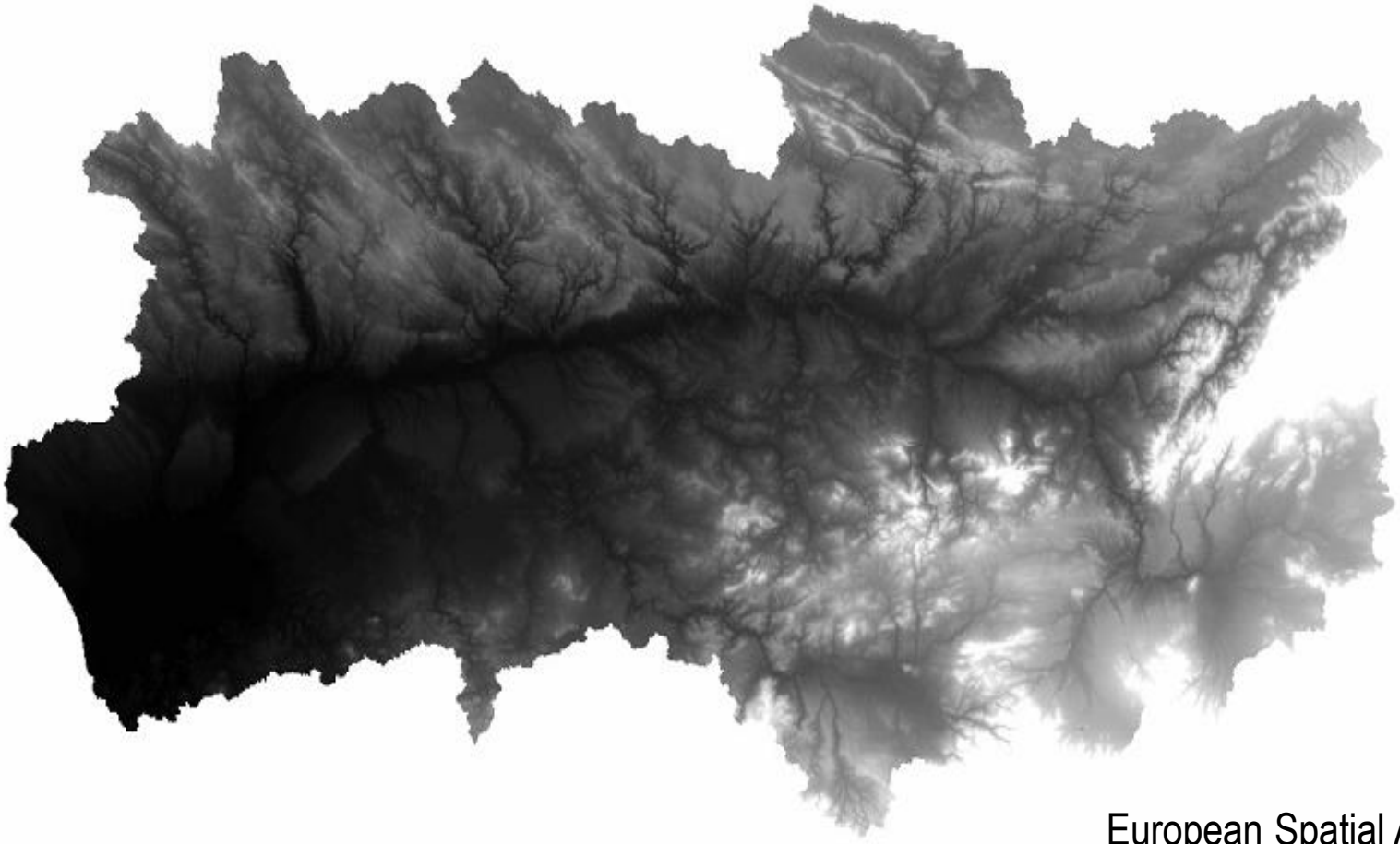
Figure 1.5: Schematic of pathways available for water movement in SWAT





CATCHMENT MODEL

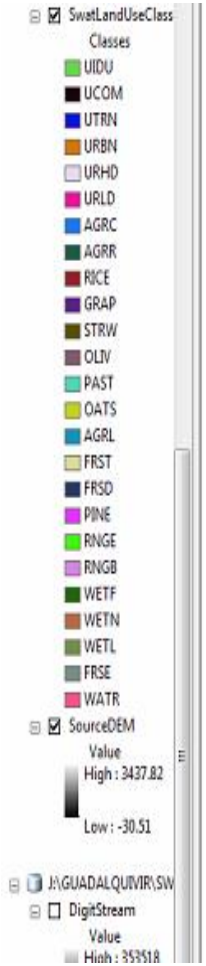
-Set up: DIGITAL ELEVATION MODEL-

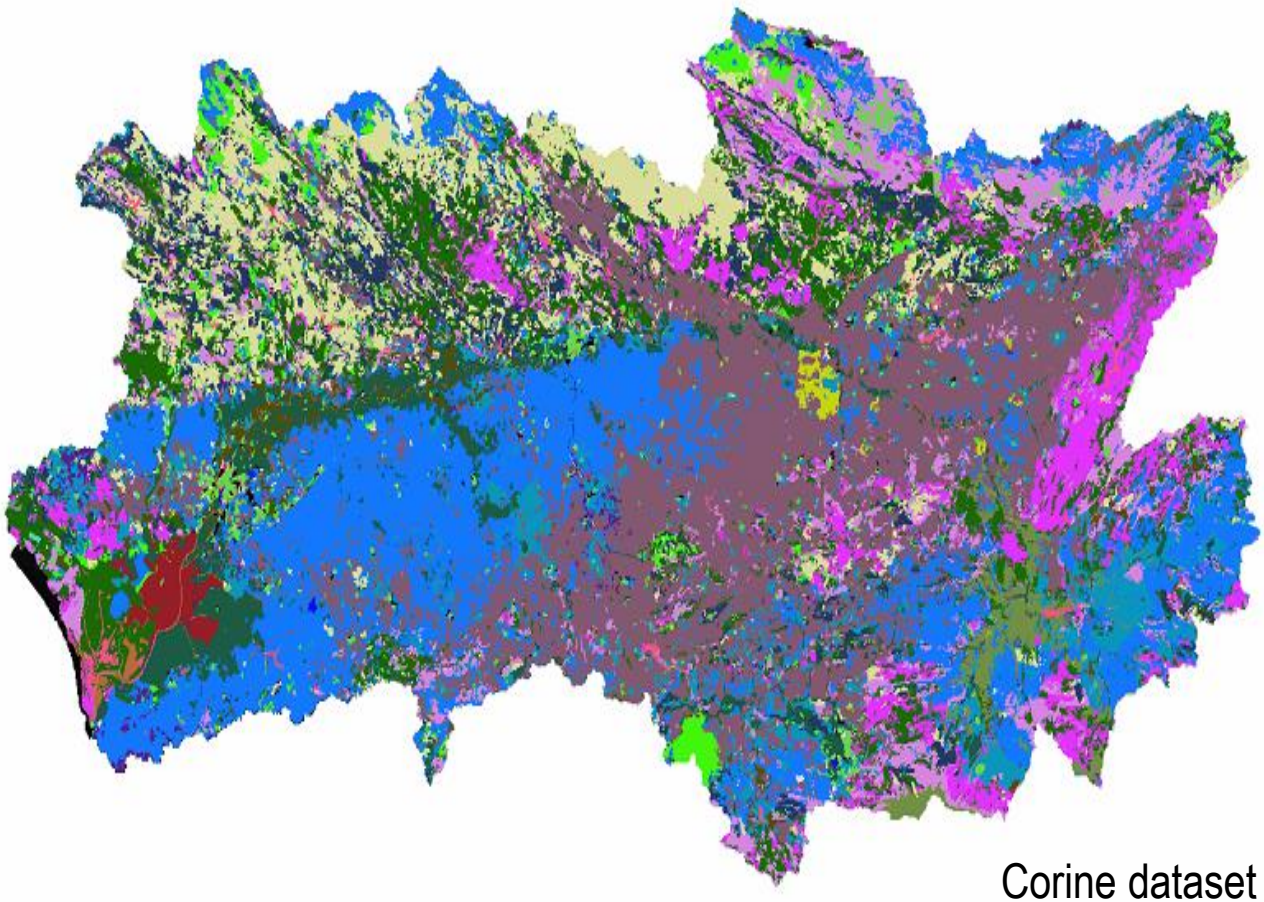


European Spatial Agency.

CATCHMENT MODEL

- Set up: LAND USE-





Corine dataset v 1.3.

CATCHMENT MODEL

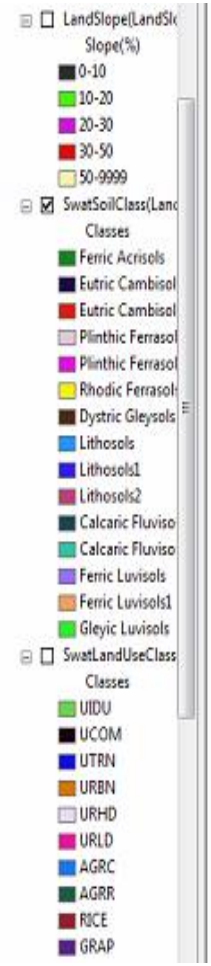
- Set up: SOIL DATA BASE-

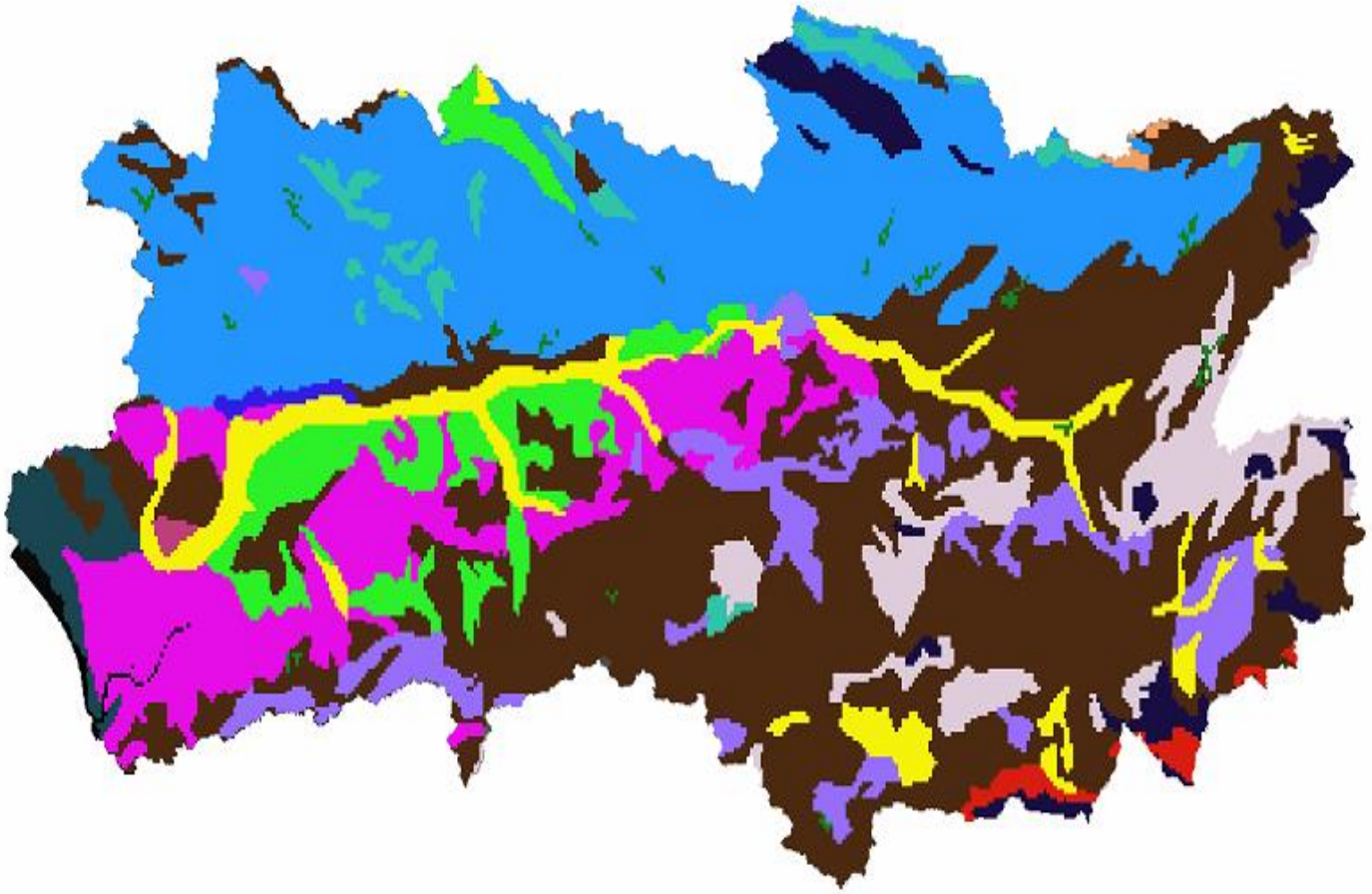
OBJECTID	MUID	SEQN	SNAM	S5ID	CMPPCT	NLAYERS	HYDGRP	SOL_ZMX	ANION_EXCL	SOL_CRK	TEXTURE	SOL_Z1	SOL_BD1	SOL_AWC1	SOL_K1	SOL_CBN1	CLAY1	SILT1	SAND1	ROCK1	SOL_ALB1	USLE_K1	SOL_EC1	SOL_Z2	SOL_BD2
2	Af17-1/2ab	FA	Ferric Acrisols	3 33		4	A	218	0.25	0.5	Af-Lg-G-I	109	1.7	0.11	47	0.35	10.2	8.7	81.1	0	0.01	0.116106	4.4	174.4	1.4
15	Be45-2a	EC	Eutric Cambisols	LPq		2	A	1508	0	0.7	Be-Th	1055.6	1.4	0.13	88	1.26	22.4	41.1	36.4	0.1	0.01	0.174092	19.3	1508	0.4
26	Be9-3c	EC1	Eutric Cambisols1	Cme		3	B	369	0	0.25	Be-Lc-Up	221.4	1	0.19	91	0.68	45.4	35.7	18.8	0.1	0.01	0.166515	25.2	332.1	1.5
45	Fp7-2ab	PF	Plinthic Ferrasols	LPm		3	A	2940	0	0.4	Fp-Af-Lf	1764	1.5	0.12	16	1.04	16	42	42	0	0.01	0.180406	6.1	2352	1.7
49	Fp9-3a	PF1	Plinthic Ferrasols1	URe		4	A	5480	0	0.6	Fp-I-Ne	2740	1.3	0.15	15	1.69	36.5	5.8	57.7	0	0.01	0.10729	8.9	4384	1.3
51	Fr8-2/3b	RF	Rhodic Ferrasols	FLc		4	A	2906	0	0	Fr-Ne-Rd-	1453	1.4	0.12	49	0.81	22.5	7.7	69.8	0	0.01	0.125756	2.7	2034.2	1.5
52	Gd6-2a	DG	Dystric Gleysols	CLL		4	A	20300	0	0.8	Gd-Fo-Jd-	10150	1.3	0.13	50	2.59	20.7	28.1	51.3	-0.1	0.01	0.164994	12	14210	1.5
60	I	L	Lithosols	LTh		1	A	15208	0	0	I	15208	1.2	0.12	69	0.97	24.9	16.2	58.9	0	0.01	0.14927	10.4	0	0
61	I	L1	Lithosols1	RGu		2	A	160	0	0	I-RK	80	1.2	0.12	69	0.97	24.9	16.2	58.9	0	0.01	0.14927	10.4	160	1.4
69	I-E-bc	L2	Lithosols2	LUj		2	A	79	0	0	I-E	39.5	1.2	0.12	69	0.97	24.9	16.2	58.9	0	0.01	0.14927	10.4	79	1.4
102	Jc21-3a	CF	Calcaric Fluvisols	ARI		4	A	987	0	0.7	Jc-R-Yy-Z	493.5	1.4	0.15	-1	-1	40	50	10	0	0.01	0.237602	-1	690.9	1.4
115	Jc32-2a	CF1	Calcaric Fluvisols1	LUx		2	A	972	0	1	Jc-Zo	680.4	1.4	0.12	100	0.84	25.2	54	20.9	-0.1	0.01	0.200107	23.8	972	1.7
135	Lf32-1/2ab	FL	Ferric Luvisols	GYh		2	A	3094	0.45	0.45	Lf-I	2784.6	1.6	0.09	69	0.37	10.5	7.3	82.2	0	0.01	0.107198	4.6	3094	1.3
136	Lf4-1/2ab	FL1	Ferric Luvisols1	CLp		3	A	73	0.3	0.4	Lf-I-Lg	43.8	1.6	0.09	69	0.37	10.5	7.3	82.2	0	0.01	0.107198	4.6	58.4	1.3
139	Lg2-1/2a	GL	Gleyic Luvisols	ACg		2	A	2830	0.35	0.85	Lg-Lf	1981	1.4	0.09	80	0.45	12.3	6	81.7	0	0.01	0.102313	9.5	2830	1.6

		Williams1995																							
		fcsand		fcl-silt	forgc	fhisand		Kusle																	
			0.200000002	0.79235	0.999404	0.733102		0.116106		VH	0.25		Af17-1/2ab	Af50	Lg30	G10	I10							Williams1995	
			0.201240166	0.877648	0.985746	0.999948		0.174092		VL	0.05		Be45-2a	Be70	Th30									fcsand	
			0.213587525	0.781797	0.997206	0.999999		0.166515		VL	0.05		Be9-3c	Be60	Lc30	Vp10									0.2
			0.200587207	0.907708	0.991004	0.999829		0.180406		H	0.18		Fp7-2ab	Fp60	Af20	Lf20										0.2
			0.200000272	0.550968	0.978062	0.995484		0.10729		M	0.13		Fp9-3a	Fp50	I30	Ne10	Vp10									0.2
			0.200000021	0.663659	0.995485	0.951744		0.125756		L	0.1		Fr8-2/3b	Fr50	Ne20	Rd20	I10									0.2
			0.200023785	0.847395	0.974595	0.998794		0.164994		H	0.18		Gd6-2a	Gd50	Fo20	Jd20	Af10									0.2
			0.200000976	0.756314	0.992542	0.994235		0.14927		L	0.1		I	I100												0.2
			0.200000976	0.756314	0.992542	0.994235		0.14927		H	0.17		I	I50	RK50											0.2
			0.200000976	0.756314	0.992542	0.994235		0.14927		H	0.18		I-E-bc	I50	E50											0
			0.28341119	0.838336	1.000033	1		0.237602		H	0.17		Jc21-3a	Jc50	R20	Yy20	Z10									0.2
			0.225600157	0.891457	0.995002	0.999998		0.200107		Vh/H	0.2		Jc32-2a	Jc70	Zo30											0.2
			0.200000001	0.765369	0.999334	0.700769		0.107198		H/M	0.15		Lf32-1/2ab	Lf90	I10											0.2
			0.200000001	0.765369	0.999334	0.700769		0.107198					Lf4-1/2ab	Lf60	I20	Lg20										0.2
			0.200000001	0.715665	0.998989	0.715537		0.102313					Lg2-1/2a	Lg70	Lf30											0.2

CATCHMENT MODEL

- Set up: SOIL DATA BASE-





FAO Database v 3.6

CATCHMENT MODEL

- Set up → Q, RAINFALL and TEMPERATURE VALUES -

Q (m^3/ s) – monthly values
01/2005 → 12/2014
S.A.I.H GUADALQUIVIR
(http://www.chguadalquivir.es/saih

CATCHMENT MODEL

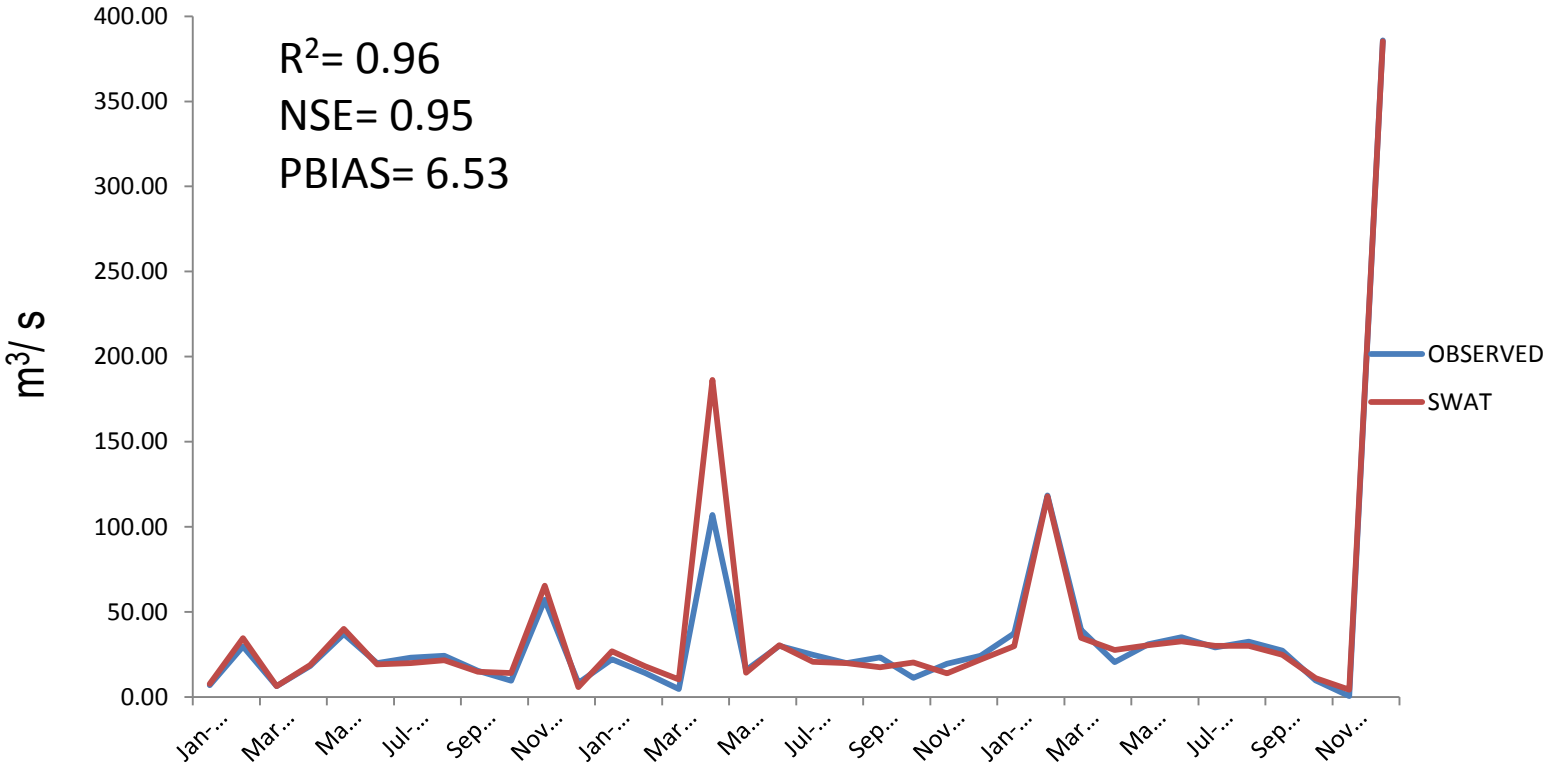
- Set up → Q, RAINFALL and TEMPERATURE VALUES -

RAINFALL and TEMPERATURE – daily values
01/2005 → 12/2014
AGROCLIMATIC STATIONS – Junta de Andalucía
(http://www.juntadeandalucia.es/agriculturaypesca/ifapa/ria)

CATCHMENT MODEL

- Calibration -

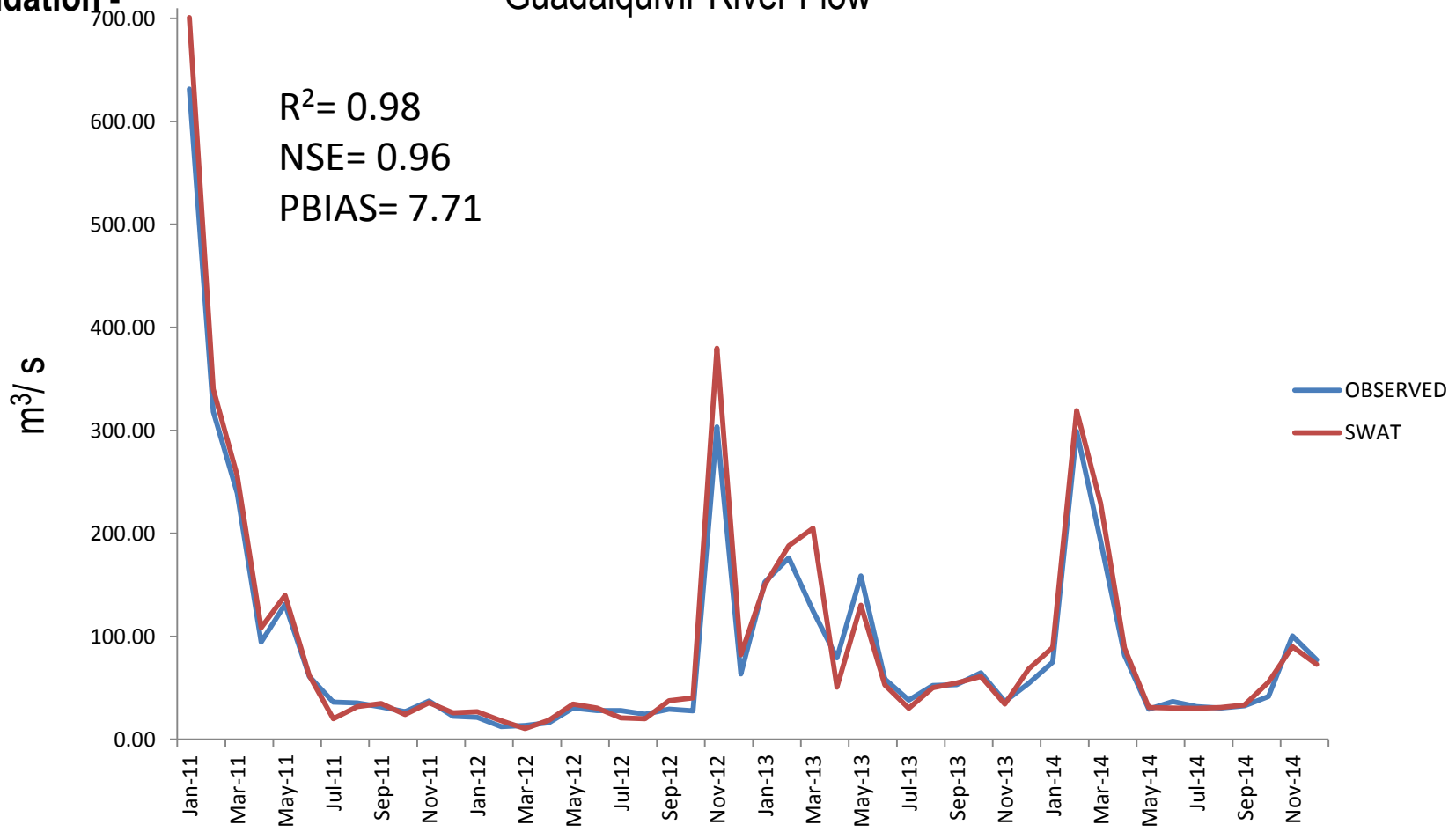
Guadalquivir River Flow



$$NSE = 1 - \frac{\sum_{t=1}^{T} (Q_{m,t} - Q_{s,t})^2}{\sum_{t=1}^{T} (Q_{m,t} - \overline{Q}_m)^2} \qquad PBIAS = \left[\frac{\sum_{t=1}^{T} (Q_{s,t} - Q_{m,t})}{\sum_{t=1}^{T} Q_{m,t}} \right] \times 100 \qquad R^2 = \left[\frac{\sum_{t=1}^{T} (Q_{m,t} - \overline{Q}_m)(Q_{s,t} - \overline{Q}_s)}{\sum_{t=1}^{T} \left[(Q_{m,t} - \overline{Q}_m)^2 \right]^{0.5} \sum_{t=1}^{T} \left[(Q_{s,t} - \overline{Q}_s)^2 \right]^{0.5}} \right]^2$$

CATCHMENT MODEL

- Validation -



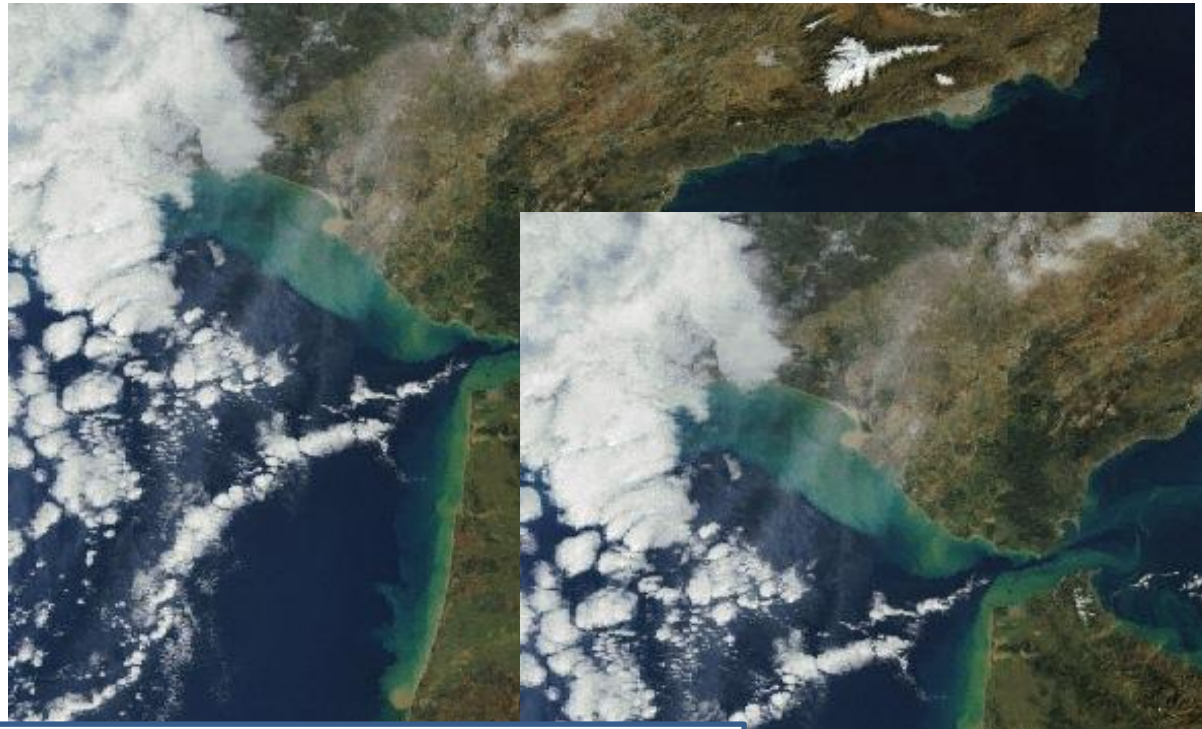
$$NSE = 1 - \frac{\sum_{t=1}^{T} (Q_{m,t} - Q_{s,t})^2}{\sum_{t=1}^{T} (Q_{m,t} - \overline{Q}_m)^2}$$

$$PBIAS = \left[\frac{\sum_{t=1}^{T} (Q_{s,t} - Q_{m,t})}{\sum_{t=1}^{T} Q_{m,t}} \right] \times 100$$

$$R^2 = \left[\frac{\sum_{t=1}^{T} (Q_{m,t} - \overline{Q}_m)(Q_{s,t} - \overline{Q}_s)}{\sum_{t=1}^{T} \left[(Q_{m,t} - \overline{Q}_m)^2 \right]^{0.5} \sum_{t=1}^{T} \left[(Q_{s,t} - \overline{Q}_s)^2 \right]^{0.5}} \right]^2$$

SATELLITE IMAGES.

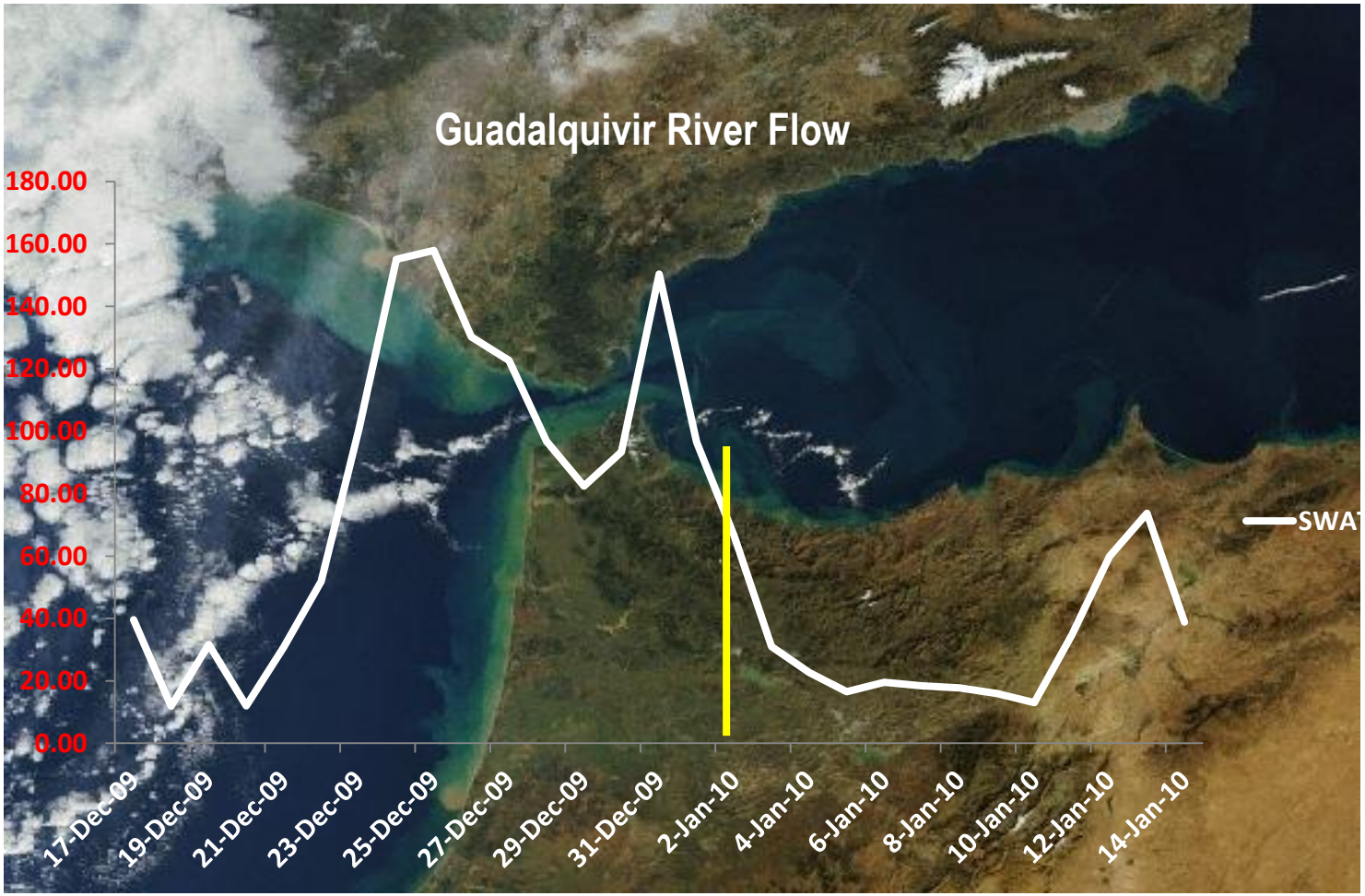
- 01 / 02 / 2010 -



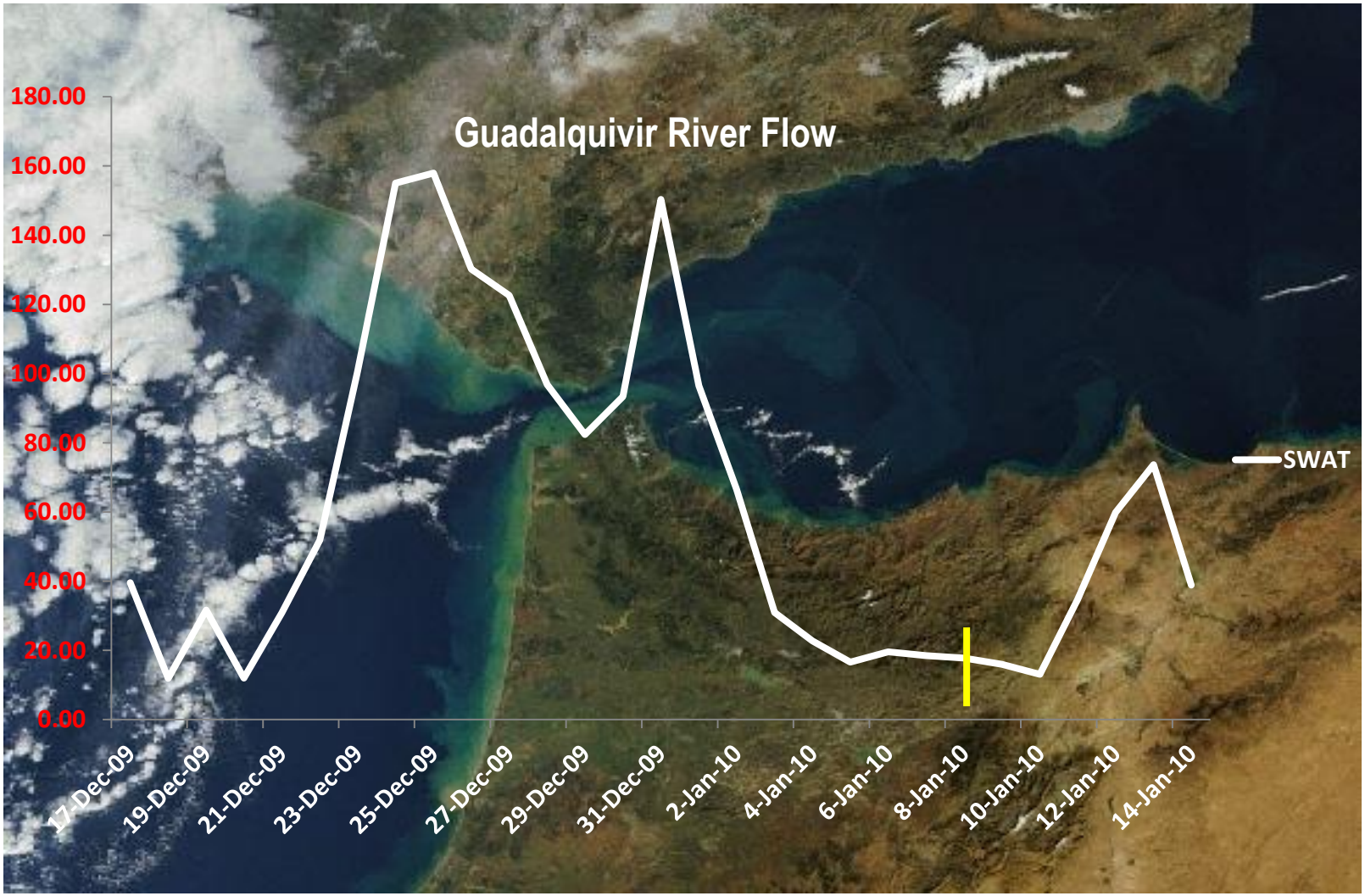
- 01 / 08 / 2010 -

Extreme conditions
FLUVIALLY DOMINATED REGIME
(Díez-Minguito et al., 2012)

SATELLITE IMAGES
- 01 / 02 / 2010 -



DICUSSION: SATELLITE IMAGES
- 01 / 08 / 2010 -



CONCLUSIONS

The initial hypothesis could be right aiming to extent the study adding nutrients and coupling SWAT with the hydrological 3d baroclinic model UCA3D developed by Cádiz University and calibrate and validate for the system Gulf of Cádiz-Strait of Gibraltar-Alboran Sea.

To calibrate and validate the new couple model inside the MEGAN project is contemplated the release of **drifts buoys**, tracers and genetic analysis of the nutrients.

CONCLUSIONS

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The results obtained have allowed a first evaluation of the contribution of the river discharges to the nutrient input to the Gulf of Cadiz.

Further extension of the methodology to the other relevant river basin discharging to the Gulf of Cádiz and the Alboran Sea, along with the evaluation of the other involved processes, will allow assessing the relative importance of the river discharges to the Gulf of Cadiz in the nutrient supply to the Alboran Sea through the Strait of Gibraltar.

THANKS!

marina.bolado@uca.es