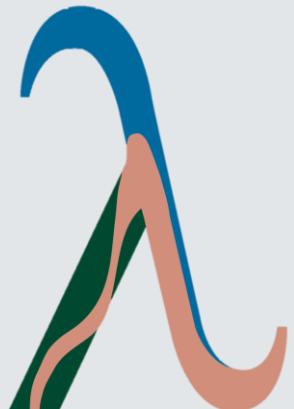
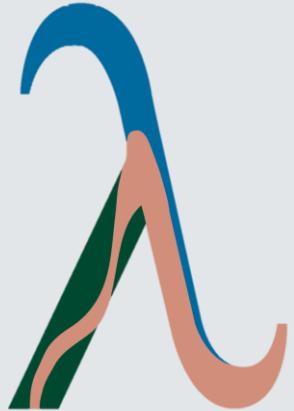


LAMBDA – MOHID Land Implementation



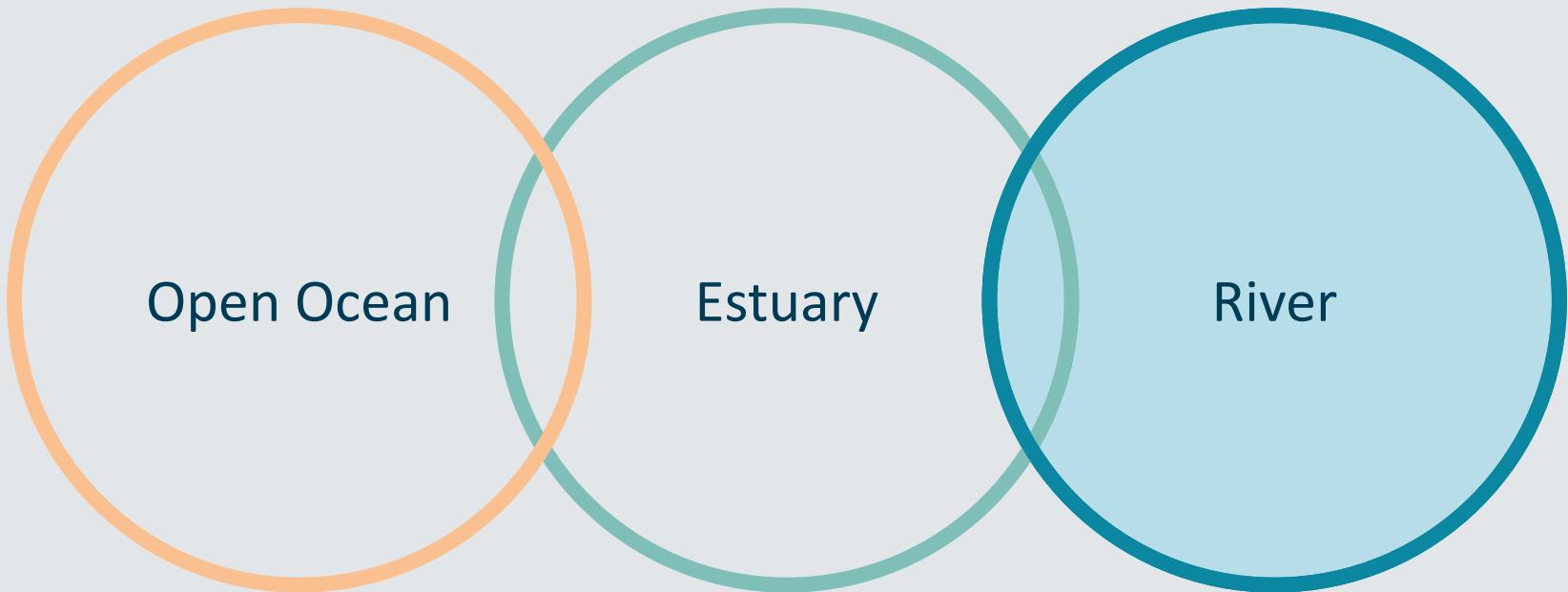
MOHIDING 2019
Flávio Santos

Main Objective:

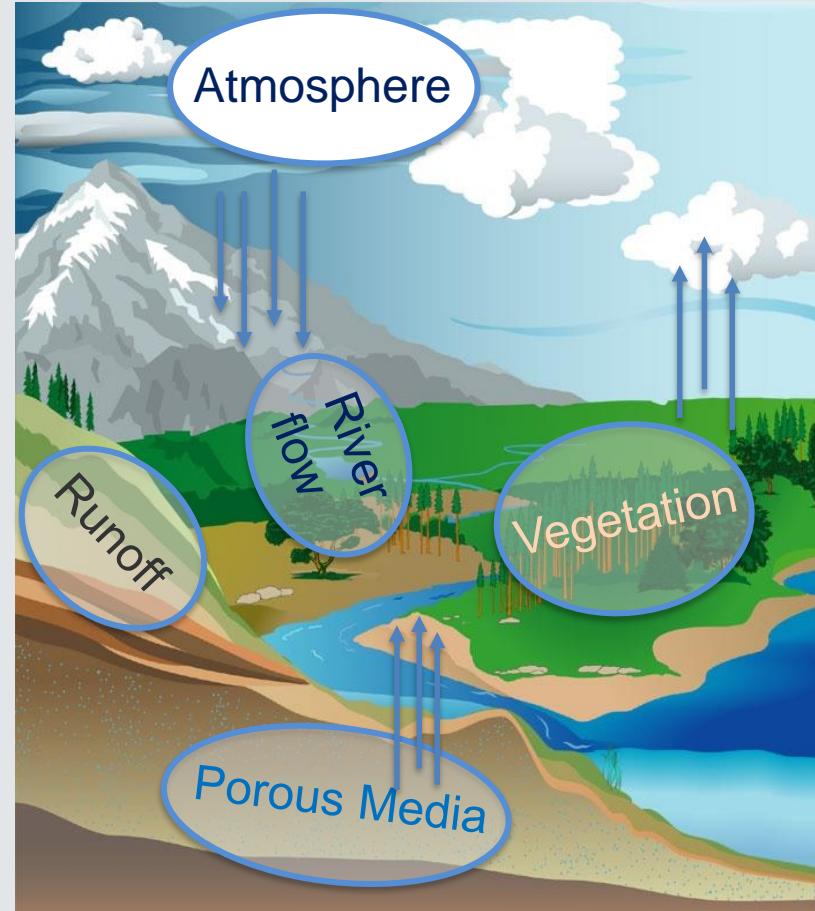


To improve the CMEMS MFCs thermohaline circulation in coastal areas by a better characterisation of the land-marine boundary conditions
CMEMS R&D priority 4.10 “Seamless interactions between CMEMS and coastal systems”

Conceptual Diagram:

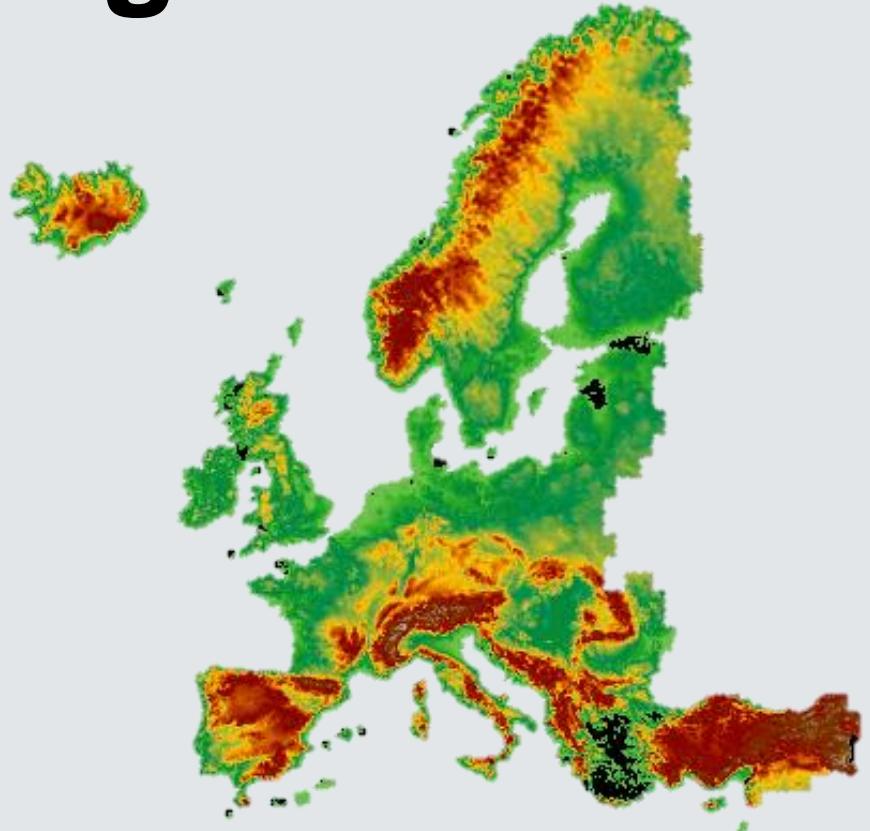


MOHID Land 101:



Watershed modelling details

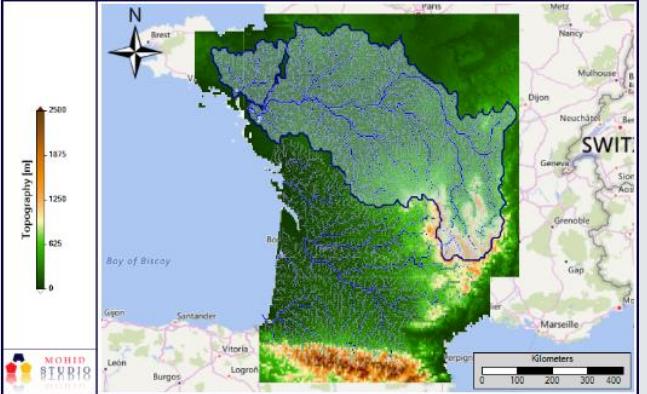
- 01/01/2008 – 01/01/2019
- 5 km x 5 km grid
- ERA5 or SAFRAN meteorological model
- EU-DEM (resolution: 30 m)
- Cross Sections from Andreadis et al., 2013
- 2012 Corine Land Cover
- 3D soil hydraulic database (resolution: 250 m) from Tóth et al. 2017



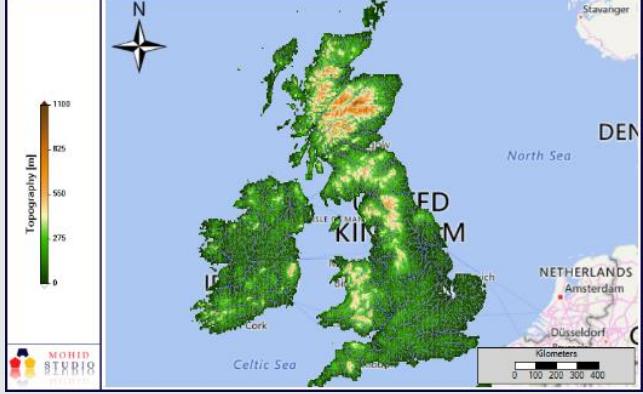
a) Western Iberian Peninsula



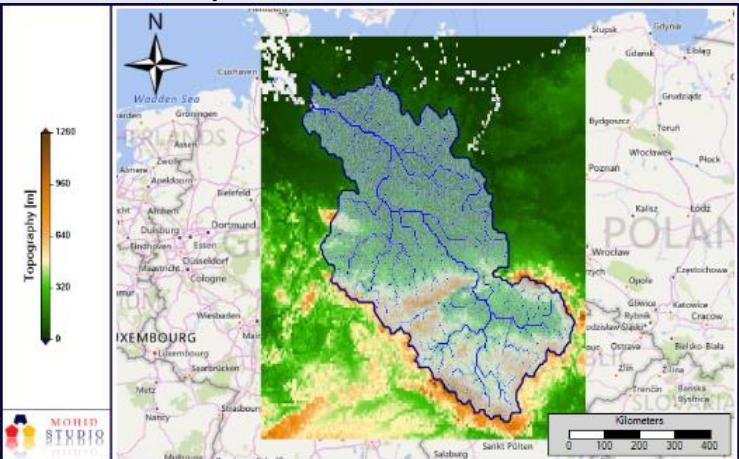
b) Western France



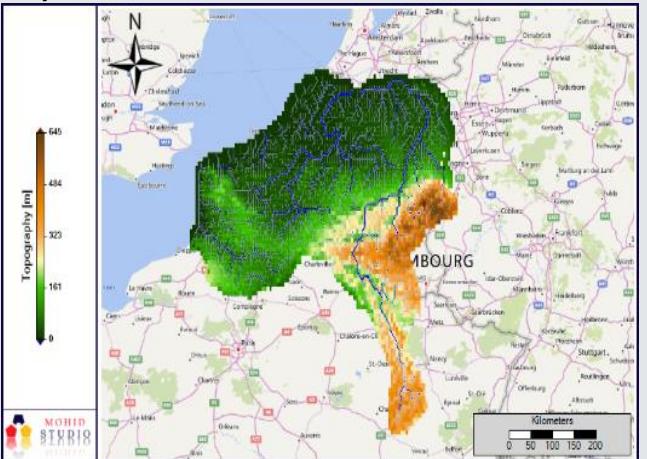
c) United Kingdom and Ireland



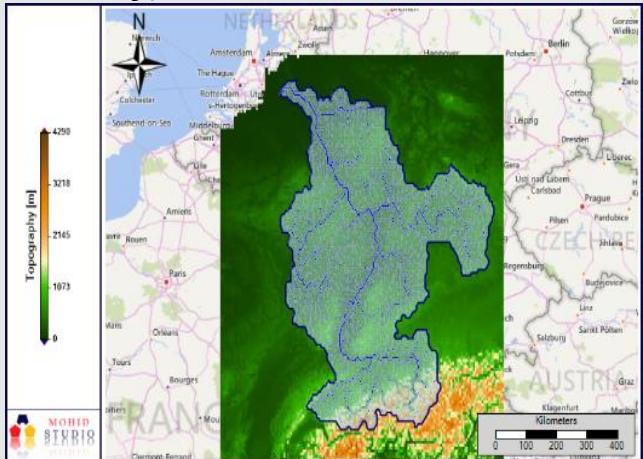
d) Elbe watershed



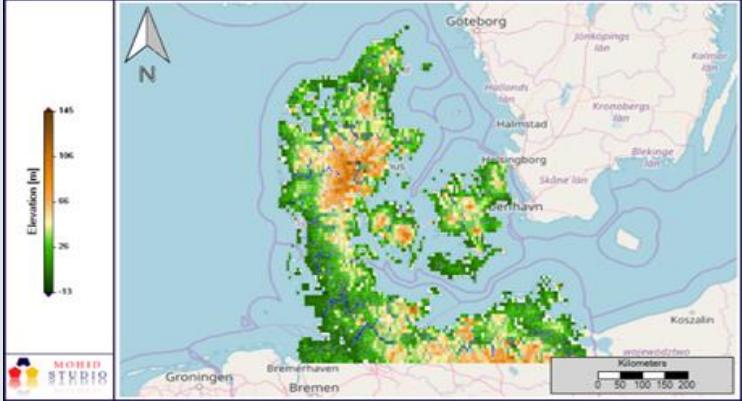
e) Somme, Escault and Meuse



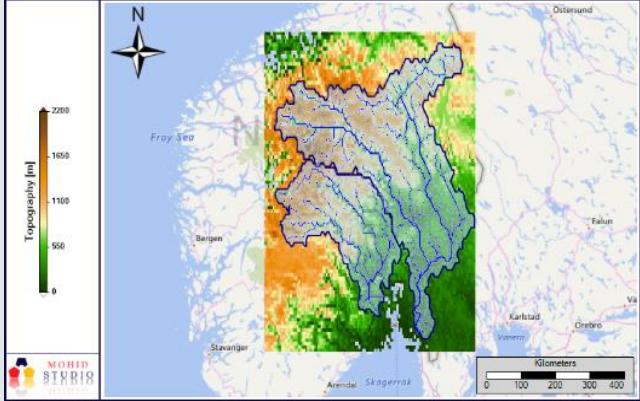
f) Rhine watershed



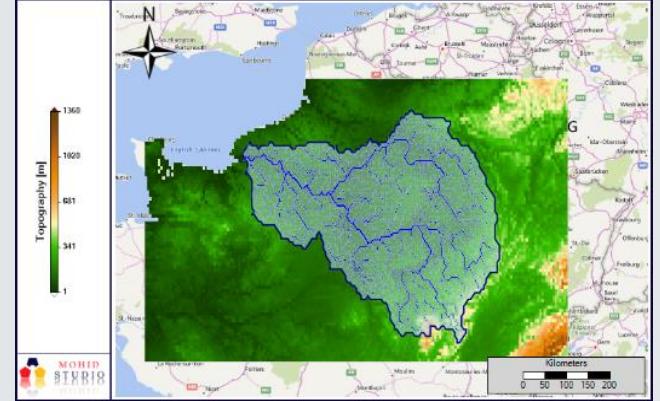
g) Denmark domain



h) Glomma and Drammen



i) Seine watershed



j) Ems and Weser watersheds



- 19 Basins
- UK + Ireland
- West Iberian Peninsula
- Denmark

Modelling results quality:

$$KGE = 1 - \sqrt{(r - 1)^2 + (\beta - 1)^2 + (\gamma - 1)^2}$$

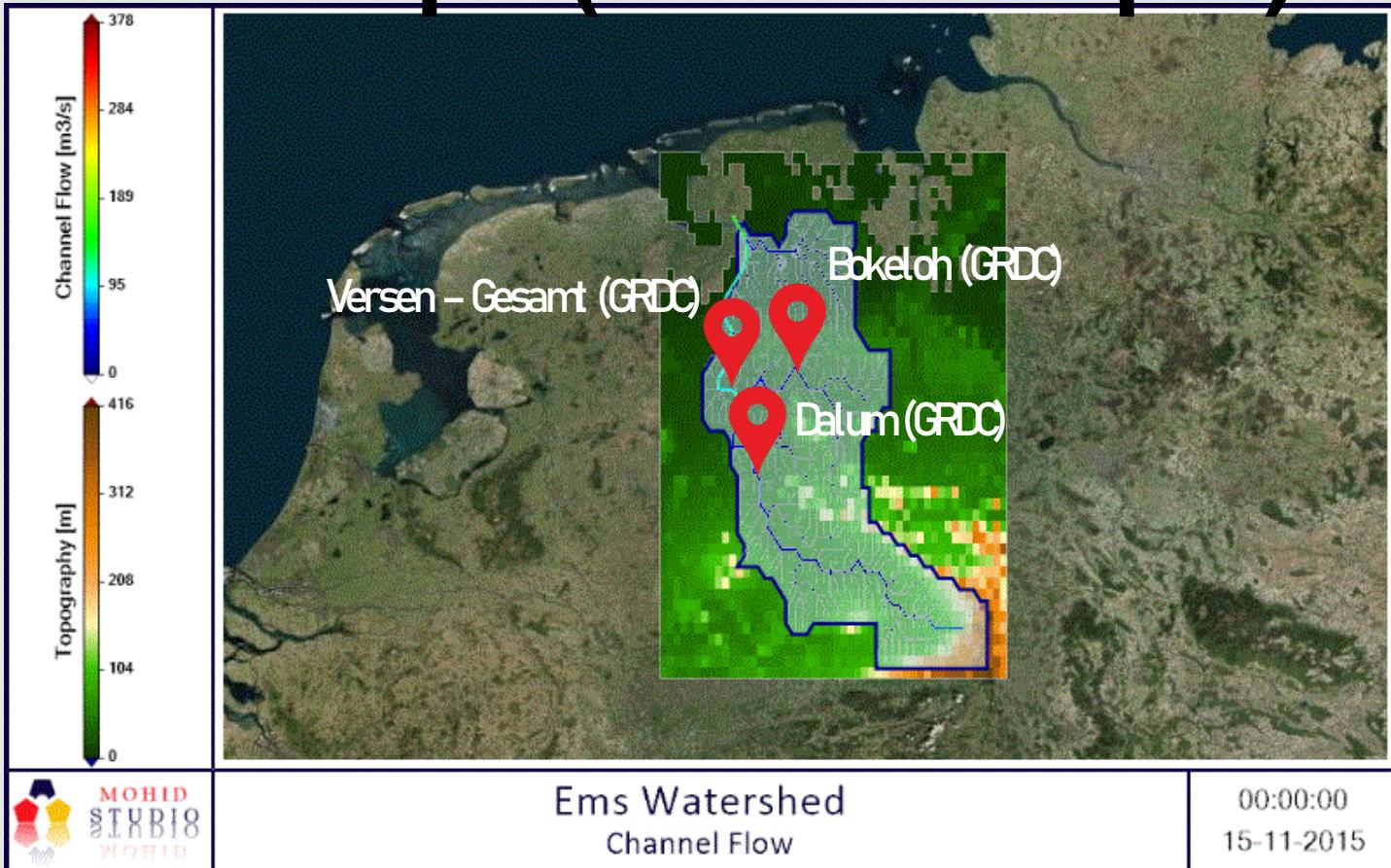
from $-\infty$ to 1

$$\beta = \frac{\mu_{sim}}{\mu_{obs}}$$

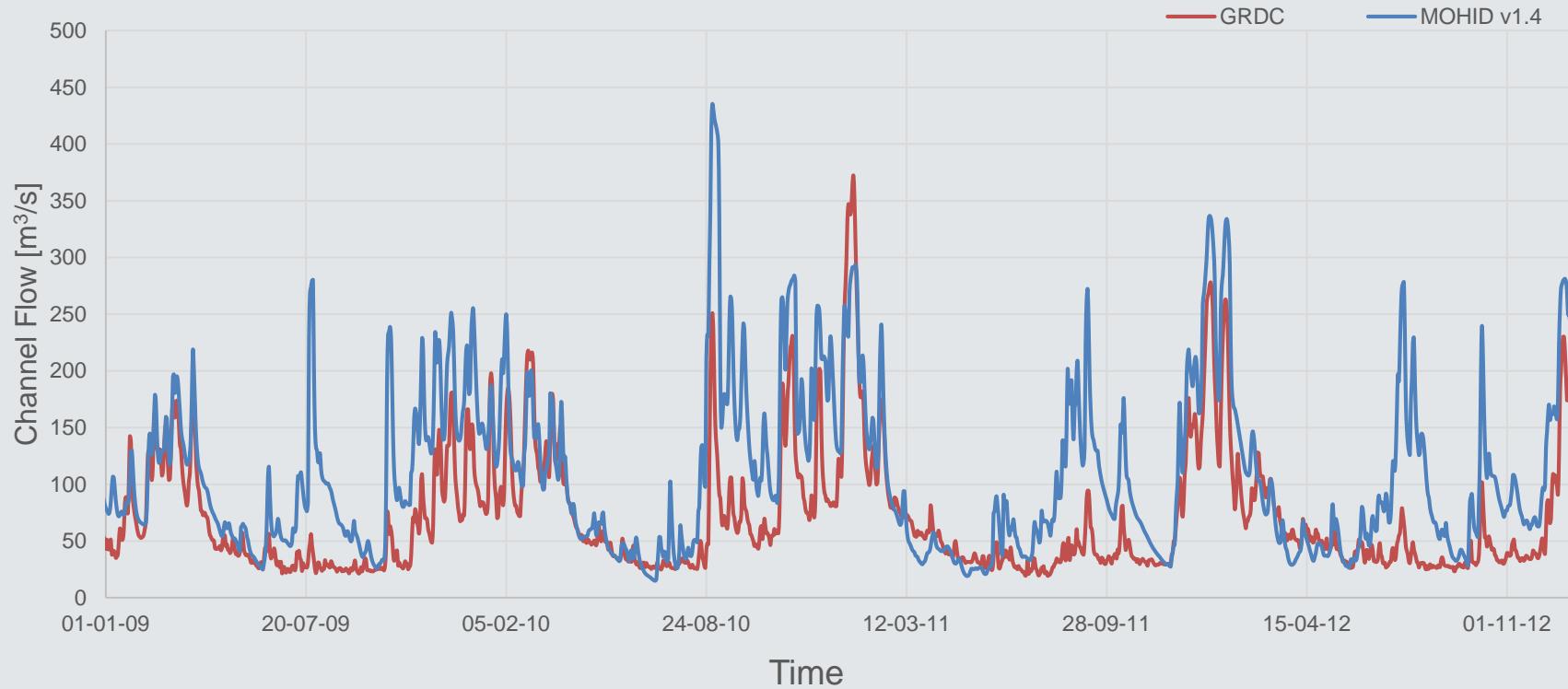
$$\gamma = \frac{Cv_{sim}}{Cv_{obs}} = \frac{\sigma_{sim}/\mu_{sim}}{\sigma_{obs}/\mu_{obs}}$$

(Also: R^2)

Calibration steps (Ems example)



Ems Calibration Process:

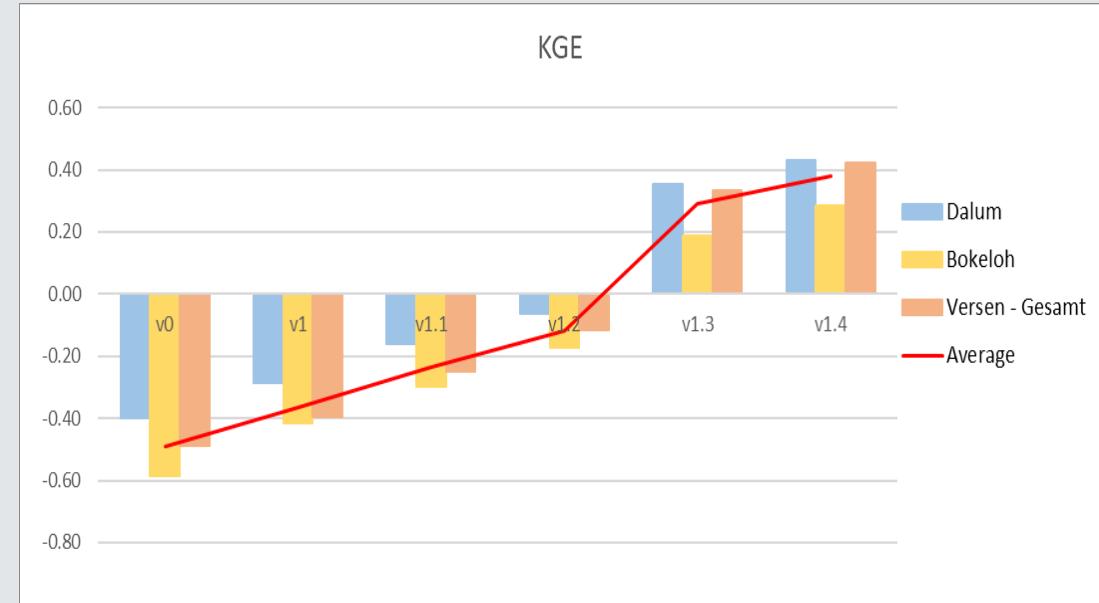
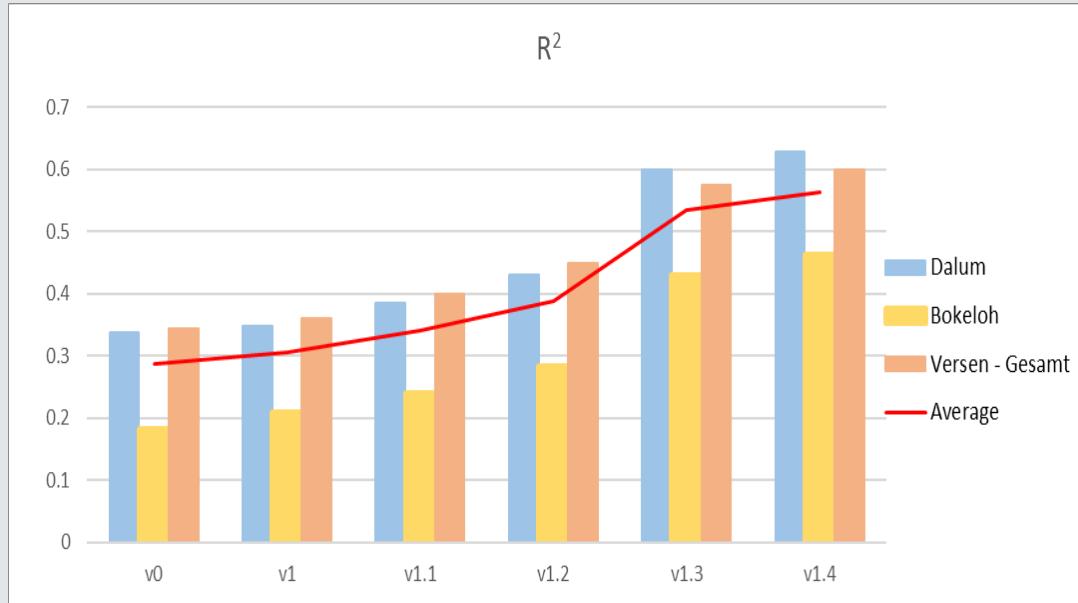


Simulated (MOHID) vs Observed (GRDC) channel flow in m^3/s between 1/1/2009 and 1/1/2013 in GRDC Station Versen – Gesamt.

	R ²	KGE
v0	0.3434	-0.487
v1	0.3589	-0.390
v1.1	0.3996	-0.250
v1.2	0.4480	-0.117
v1.3	0.5741	0.333
v1.4	0.5998	0.422

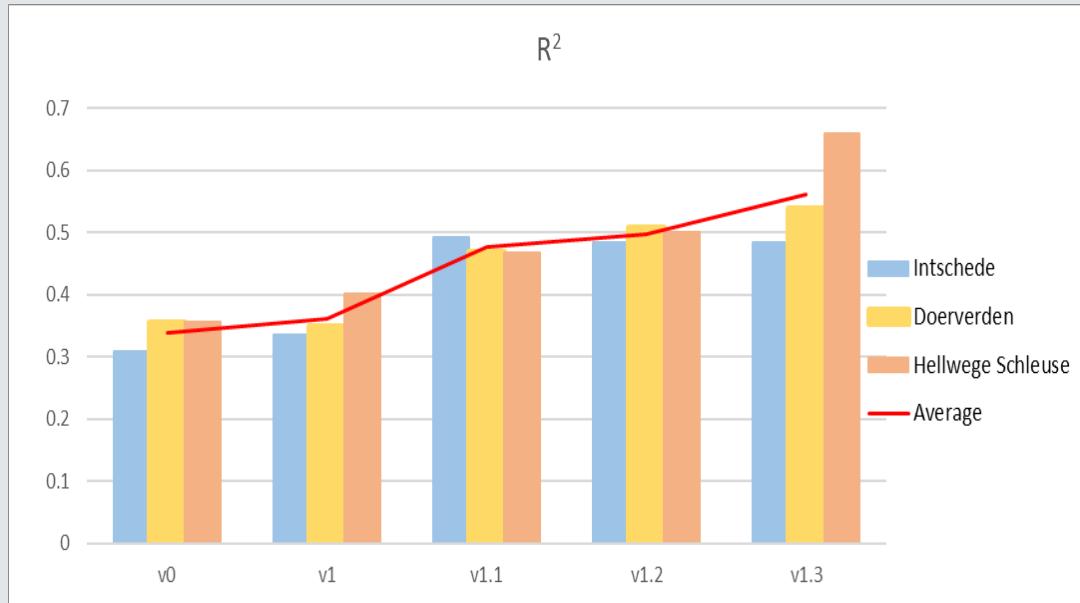
Additional
increase of Crop
Coefficient

Ems Calibration Process:



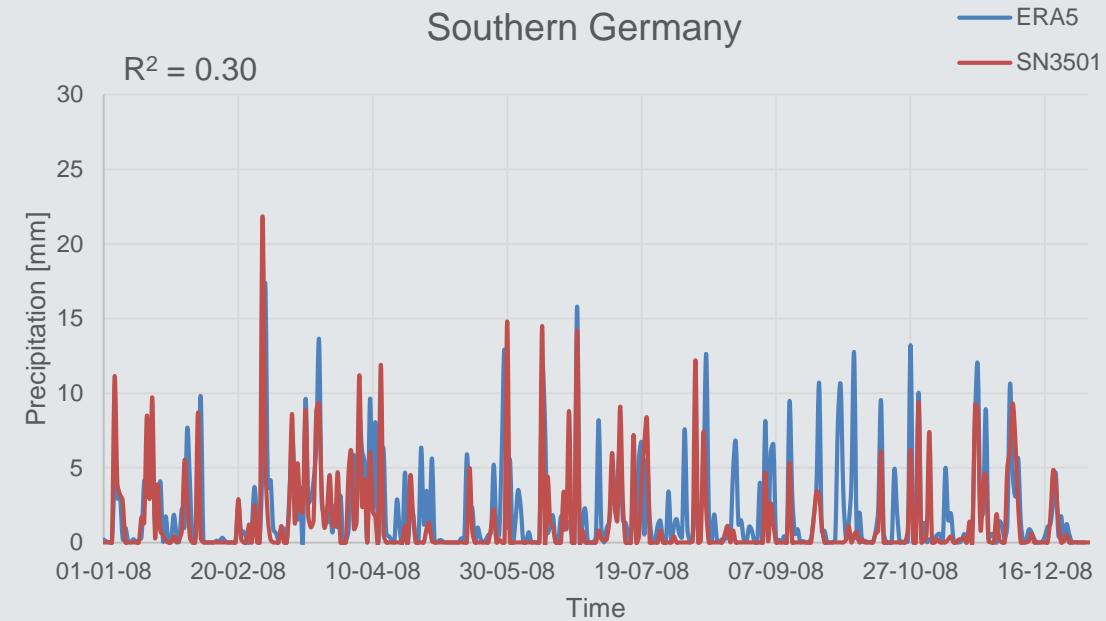
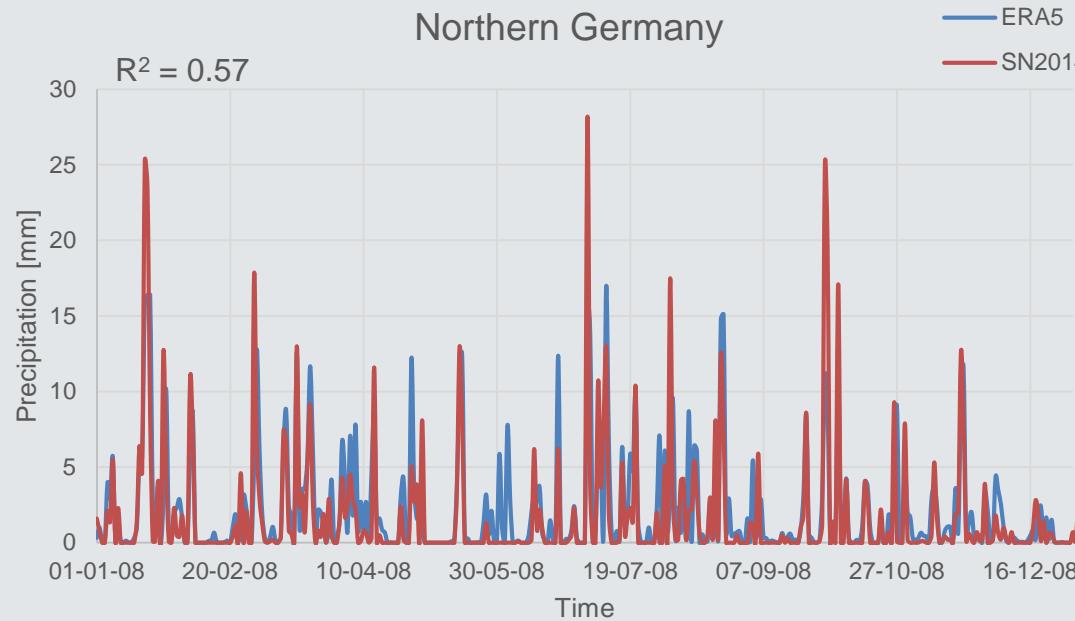
Statistical Indicators (R^2 in the left, KGE in the right) of Ems channel flow in the 3 chosen GRDC observed data stations: Dalum, Bokeloh and Versan-Gesamt. Red line represents the resulted average value of the three stations' indicators.

Weser Calibration Process:



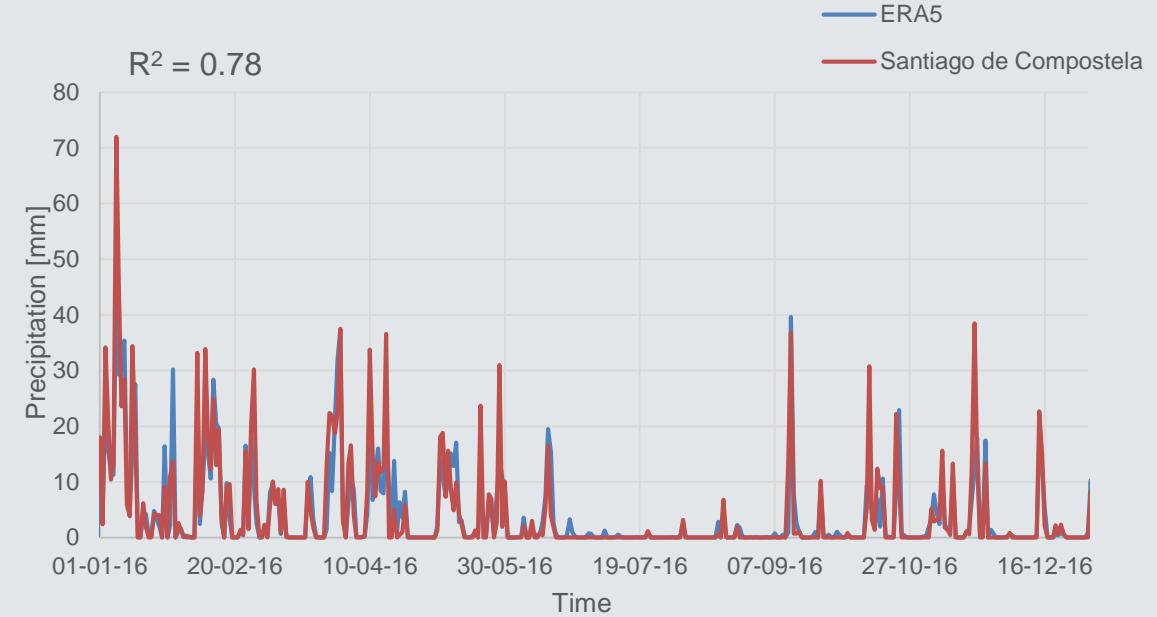
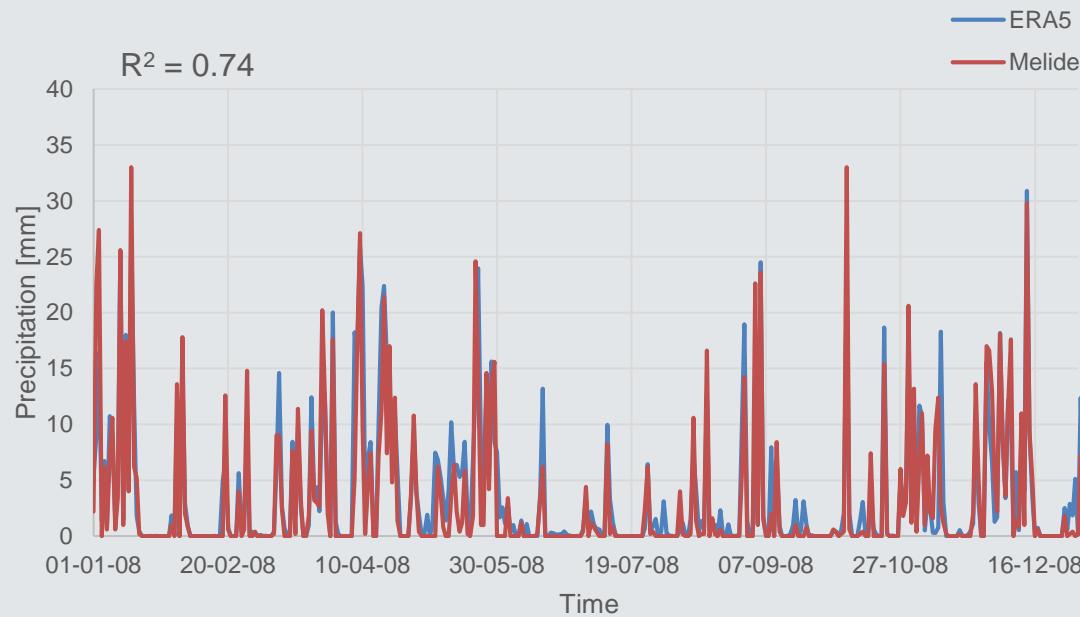
Statistical Indicators (R^2 in the left, KGE in the right) of Weser channel flow in the 3 chosen GRDC observed data stations: Intschede, Doerverden and Hellwege Schleuse. Red line represents the resulted average value of the three stations' indicators.

The Meteorological Problem:



Accumulated daily precipitation [mm] in the year 2008, compared between observed data in meteorological stations (SN2014 in the Northern Germany and SN3501 in the Southern Germany) and ERA5 meteorological model.

The Meteorological Problem:



Accumulated daily precipitation [mm], compared between observed data in meteorological stations (Melide on the left, data from 2008; and Santiago de Compostela, on the right, data from 2016, both stations in the Galiza region) and ERA5 meteorological model.

RIVER	STATION NAME	COUNTRY	R ²	KGE
GLOMMA	SOLBERGFOSS	NO	0.2632	0.0968
GLOMMA	ELVERUM	NO	0.0655	-0.0314
ROMUA	KAUSERUD	NO	0.1182	0.2692
GLOMMA	LANGNES	NO	0.1883	0.1995
LEIRET	KRAKFOSS	NO	0.1934	-0.101
LOSNA	LOSNA	NO	0.0058	-0.2274
LAGEN (NUMESDAL)	ROSTEN	NO	0.0054	-0.5737
DRAMSELV	DOVIKFOSS	NO	0.244	0.4257
SIMOA	EGGEDAL	NO	0.1249	-0.0022
FISKUM	FISKUM	NO	0.2062	-7.6244
WESER	INTSCHEDE	DE	0.484045	0.6162369
WUEMME	HELLWEGE SCHLEUSE	DE	0.659765	0.3395823
WESER	DOERVERDEN	DE	0.537708	0.6377819
EMS	DALUM	DE	0.628242	0.4310506
HASE	BOKELOH	DE	0.462481	0.284409
EMS	VERSEN - GESAMT	DE	0.59983	0.421625
SCHWARZE ELSTER	BAD LIEBENWERDA	DE	0.3044	0.2058
ELBE	TORGAU	DE	0.0821	0.0712
ELBE	WITTENBERG	DE	0.1421	-0.0296
ELBE	WITTENBERGE	DE	0.1649	0.0819
ELBE	MAGDEBURG-STROMBRUECKE	DE	0.2326	-0.0369
ELBE	NEU-DARCHAU	DE	0.2024	0.1304

RIVER	STATION NAME	COUNTRY	R ²	KGE
METUJE	HRONOV	CZ	0.0845	-0.0896
MEUSE	AMAY	BE	0.3648	0.3378
MEUSE	CHOOZ	BE	0.4586	0.3786
SENNE	TUBIZE	BE	0.1387	-0.0866
BOVENSCHELDE	HELKIJN	BE	0.1349	0.0623
MEUSE	VENLO	NL	0.4548	0.3868
RHINE	LOBITH	NL	0.7041	0.5286
RHINE	RHEINFELDEN	CH	0.5454	0.6516
RHINE	SPEYER	DE	0.6718	0.6994
RHINE	MAINZ	DE	0.7211	0.5964
RHINE	REES	DE	0.7205	0.5916
SEINE*	POSES	FR	0.5661	0.5321
AVON (CENTRAL ENGLAND)	EVESHAM	GB	0.74	0.3977
MERSEY	ASHTON WEIR	GB	0.4999	0.3788
TRENT (N. ENGLAND)	COLWICK	GB	0.5271	0.7212
THAMES	KINGSTON	GB	0.6257	0.631
SEVERN (CENTRAL ENGLAND)	BEWDLEY	GB	0.3358	-0.0104

Next Steps:

- Gathering of reliable flow data
- Completion of V1 calibration
- V1 Delivery

