EGSIEM

European Gravity Service for Improved Emergency Management

Title: WP6 (Hydrological Service)

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EGSIEM Meeting

GFZ Potsdam

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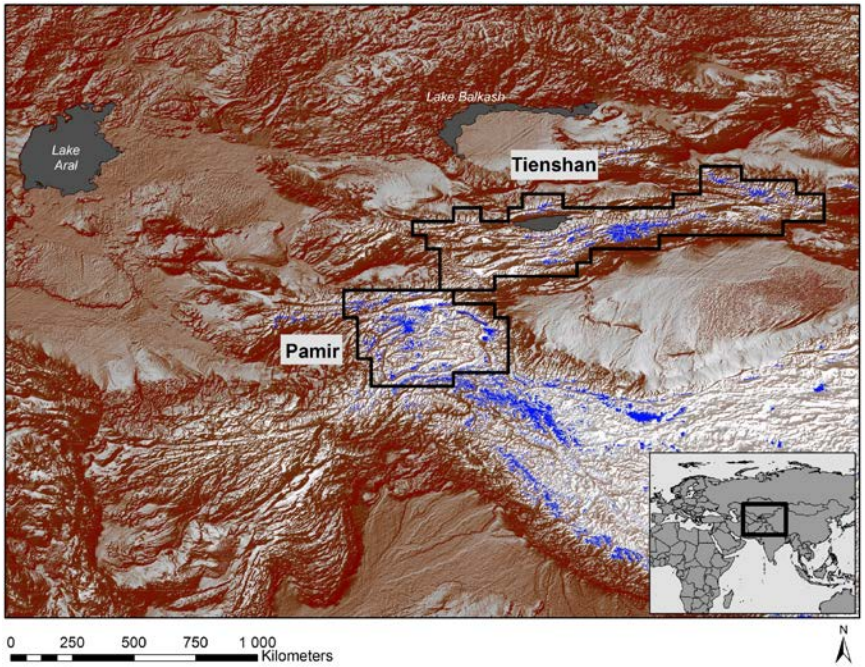
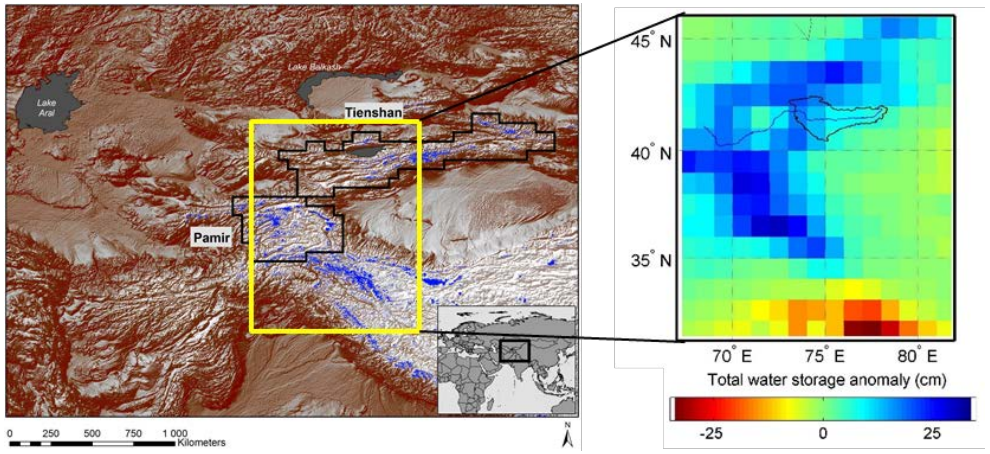
HORIZON 2020

Seasonal forecasting of summer streamflow in Central Asia



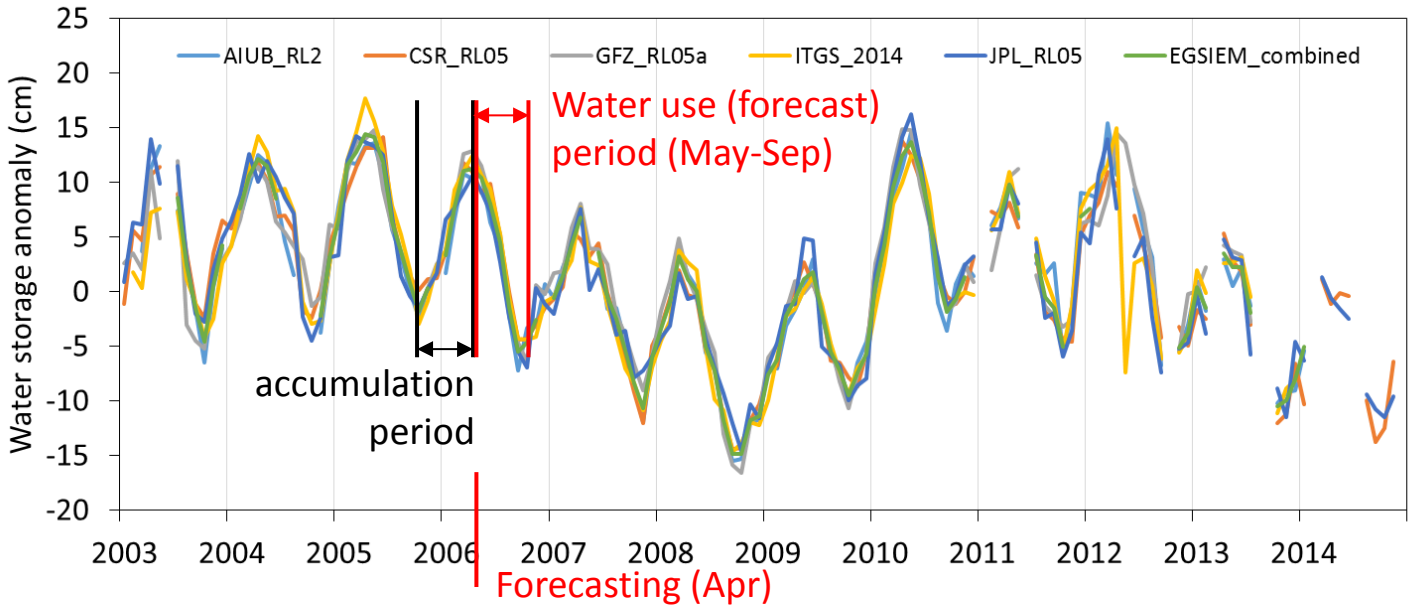
Water resources in Central Asia depend on snowmelt and glacier melt from mountain ranges such as Pamir and Tien Shan

Seasonal forecasting of summer streamflow in Central Asia



Naryn river basin
River gauging station Uchterek
Basin size ~50000km²

April 2010 total water storage (TWS) anomaly



Seasonal forecasting of summer streamflow in Central Asia

Linear forecast models

Forecast variable:

- Summer streamflow (May-Sep)

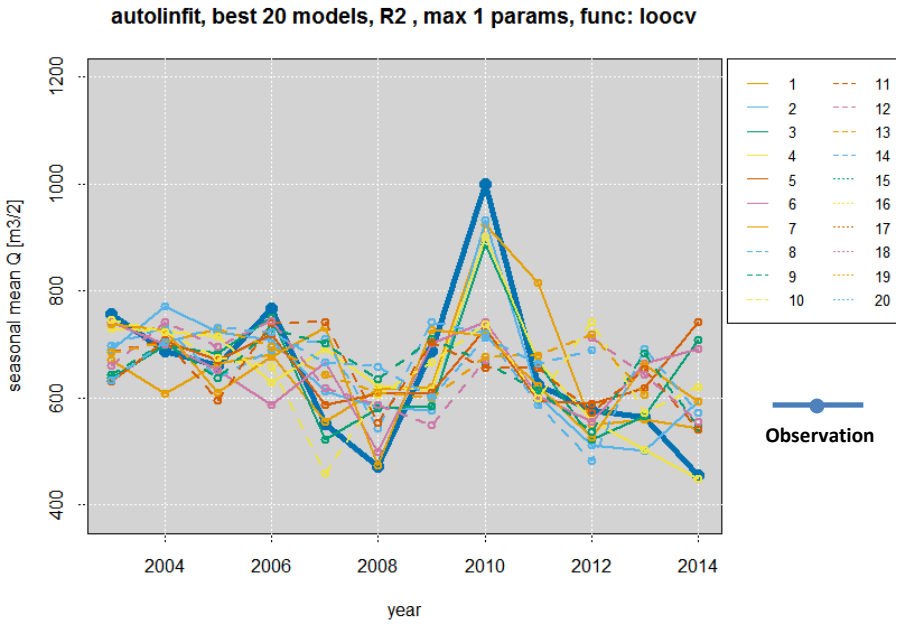
Predictors (winter conditions):

- Precipitation
- Standardized Precipitation Index (SPI)
- Air temperature
- River discharge
- Snow cover
- GRACE TWS anomaly

Seasonal forecasting of summer streamflow in Central Asia

Linear forecast model (1 predictor) (2003-2014)

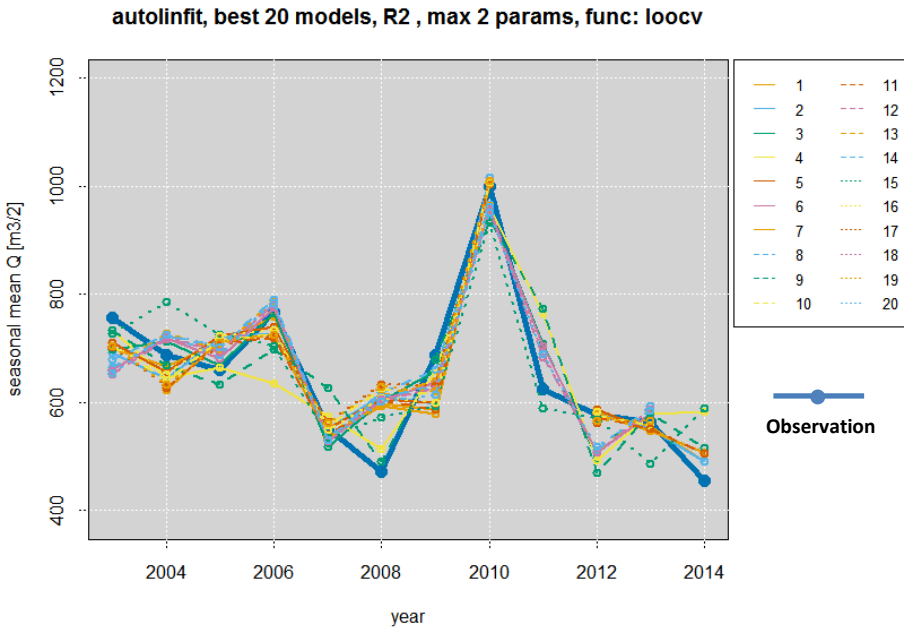
	Predictor	R^2 cross-validation
1	precip_feb	0.655
2	precip_janmar	0.645
3	precip_janfeb	0.602
4	precip_febmar	0.493
5	precip_jan	0.311
6	temp_jan	0.286
7	temp_janfeb	0.274
8	temp_janmar	0.202
9	temp_febmar	0.152
10	snowcov_mar	0.086
11	temp_feb	0.083
12	JPL_RL05_1_DDK2s_grav_jan	0.034
13	JPL_RL05_1_DDK2s_grav_feb	0.025
14	GFZ_RL05a_DDK2s_grav_mar	0.011



Seasonal forecasting of summer streamflow in Central Asia

Linear forecast model (2 predictors) (2003-2014)

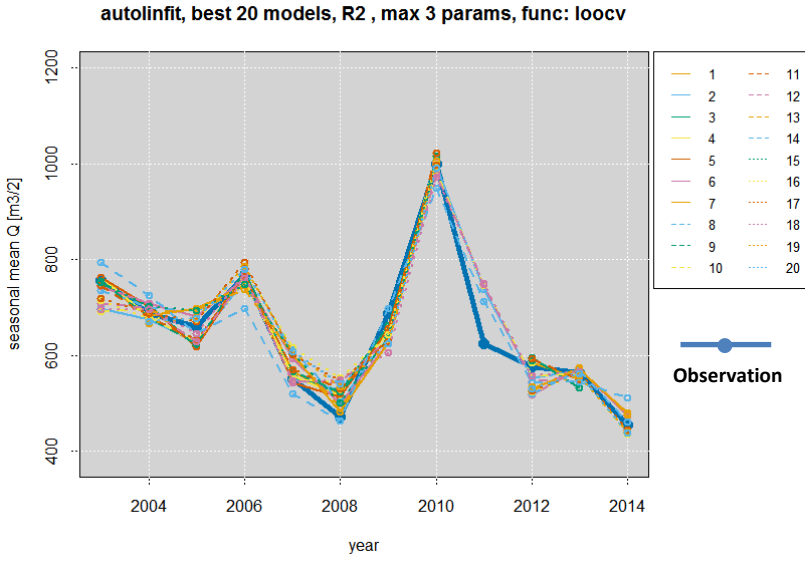
	Predictor	R^2 cross-val
1	JPL_RL05_1_DDK2s_grav_jan + precip_feb	0.773
2	CSR_RL05_DDK2s_grav_jan + precip_feb	0.756
3	GFZ_RL05a_DDK2s_grav_mar + precip_janfeb	0.752
4	temp_jan + precip_feb	0.747
5	JPL_RL05_1_DDK2s_grav_janfeb + precip_feb	0.742
6	GFZ_RL05a_DDK2s_grav_feb + precip_janfeb	0.732
7	EGSIEM2_DDK3s_grav_jan + precip_feb	0.732
8	GFZ_RL05a_DDK2s_grav_janmar + precip_janfeb	0.725
9	temp_janfeb + precip_feb	0.722
10	CSR_RL05_DDK2s_grav_janfeb + precip_feb	0.721
11	EGSIEM2_DDK2s_grav_jan + precip_feb	0.719
12	CSR_RL05_DDK2s_grav_feb + precip_janfeb	0.698
13	GFZ_RL05a_DDK2s_grav_janfeb + precip_janfeb	0.696
14	CSR_RL05_DDK2s_grav_janfeb + precip_janfeb	0.689
15	snowcov_mar + precip_janmar	0.682
16	JPL_RL05_1_DDK2s_grav_janmar + precip_feb	0.675
17	GFZ_RL05a_DDK2s_grav_janmar + precip_feb	0.674
18	EGSIEM2_DDK2s_grav_feb + precip_janfeb	0.673
19	GFZ_RL05a_DDK2s_grav_janfeb + precip_feb	0.671
20	EGSIEM2_DDK3s_grav_feb + precip_janfeb	0.663



Seasonal forecasting of summer streamflow in Central Asia

Linear forecast model (3 predictors) (2003-2014)

	Predictor	R^2 cross-val
1	CSR_RL05_DDK2s_grav_janfeb + temp_mar + precip_janfeb	0.928
2	CSR_RL05_DDK2s_grav_feb + temp_mar + precip_janfeb	0.918
3	GFZ_RL05a_DDK2s_grav_janfeb + temp_mar + precip_janfeb	0.915
4	CSR_RL05_DDK2s_grav_janmar + temp_mar + precip_janfeb	0.908
5	GFZ_RL05a_DDK2s_grav_janmar + temp_mar + precip_janfeb	0.904
6	JPL_RL05_1_DDK2s_grav_jan + temp_janfeb + precip_feb	0.871
7	EGSIEM2_DDK3s_grav_jan + temp_janfeb + precip_feb	0.867
8	CSR_RL05_DDK2s_grav_jan + temp_janfeb + precip_feb	0.861
9	JPL_RL05_1_DDK2s_grav_janmar + temp_mar + precip_janfeb	0.861
10	EGSIEM2_DDK3s_grav_feb + temp_mar + precip_janfeb	0.861
11	JPL_RL05_1_DDK2s_grav_janfeb + temp_mar + precip_janfeb	0.860
12	EGSIEM2_DDK2s_grav_feb + temp_mar + precip_janfeb	0.848
13	EGSIEM2_DDK2s_grav_jan + temp_janfeb + precip_feb	0.847
14	snowcov_mar + temp_janfeb + precip_feb	0.845
15	JPL_RL05_1_DDK2s_grav_janfeb + temp_janfeb + precip_feb	0.844
16	CSR_RL05_DDK2s_grav_jan + temp_feb + precip_feb	0.839
17	JPL_RL05_1_DDK2s_grav_jan + temp_feb + precip_feb	0.833
18	JPL_RL05_1_DDK2s_grav_feb + temp_mar + precip_janfeb	0.829
19	EGSIEM2_DDK3s_grav_jan + temp_feb + precip_feb	0.821
20	EGSIEM2_DDK2s_grav_jan + temp_feb + precip_feb	0.815



Seasonal forecasting of summer streamflow in Central Asia

Summary

- GRACE TWS alone is not a good predictor for summer streamflow
- But forecasts can be improved by GRACE TWS as additional predictor (in addition to, e.g., precipitation, temperature)
- EGSIEM combined monthly solution performs similar or slightly worse than individual solutions