

Observations

Climate Teleconnection	Decade	Observations
AO Index	2008-2018	Maize: EXO Increases the correlation Wheat: EXO Increases the correlation Soy: EXO not significant
SAM Index	2008-2018	Maize: EXO Increases the correlation Wheat: EXO not significant Soy: EXO not significant
IOD Index	2008-2018	Maize: EXO not significant Wheat: EXO not significant Soy: EXO not significant
nhtele_index_1	2008-2018	Maize: EXO not significant Wheat: EXO Increases the correlation Soy: EXO not significant
nhtele_index_2	2008-2018	Maize: EXO Increases the correlation Wheat: EXO Increases the correlation Soy: EXO not significant
nhtele_index_3	2008-2018	Maize: EXO Increases the correlation Wheat: EXO Increases the correlation Soy: EXO not significant
nhtele_index_4	2008-2018	Maize: EXO Increases the correlation Wheat: EXO Increases the correlation Soy: EXO not significant
pna_index	2008-2018	Maize: EXO Increases the correlation Wheat: EXO Increases the correlation Soy: EXO not significant
psa_index_1	2008-2018	Maize: EXO not significant Wheat: EXO not significant Soy: EXO not significant
psa_index_2	2008-2018	Maize: EXO not significant Wheat: EXO not significant Soy: EXO not significant

1. **AO Index** - The Arctic Oscillation Index measures the atmospheric pressure patterns in the Arctic region, influencing weather and climate in mid-latitudes.
2. **SAM Index** - The Southern Annular Mode Index characterizes the north-south movement of westerly winds in the Southern Hemisphere, affecting weather and climate patterns.
3. **IOD Index** - The Indian Ocean Dipole Index gauges sea surface temperature differences in the Indian Ocean, impacting monsoons and climate in surrounding regions.
4. **nhtele_index_1** - Northern Hemisphere Teleconnection Index 1 represents a specific teleconnection pattern in the Northern Hemisphere affecting weather.
5. **nhtele_index_2** - Northern Hemisphere Teleconnection Index 2 denotes another teleconnection pattern in the Northern Hemisphere influencing climate variability.
6. **nhtele_index_3** - Northern Hemisphere Teleconnection Index 3 signifies an additional teleconnection pattern in the Northern Hemisphere linked to atmospheric circulation.
7. **nhtele_index_4** - Northern Hemisphere Teleconnection Index 4 corresponds to yet another teleconnection pattern in the Northern Hemisphere impacting weather and climate.
8. **PNA Index** - The Pacific/North American (PNA) Pattern Index describes the atmospheric circulation pattern over the Pacific and North America, influencing weather in those regions.
9. **psa_index_1** - Pacific South America Teleconnection Index 1 relates to a teleconnection pattern affecting weather and climate in the Pacific and South America.
10. **psa_index_2** - Pacific South America Teleconnection Index 2 represents an additional teleconnection pattern in the Pacific and South America region, influencing climate variability.

Different indexes for the same teleconnection is possibly because of the different quantification methods used.

Artic Oscillations

date_range = {"start": "2008-12-01", "end": "2018-12-01"}

Maize

Type of Data		Best ENDO lag	Best EXO Lag	Correlation	RMSE
Seasoned Data	Without EXO	1	-	0.17	0.06
	With EXO	1	6	0.19	0.06
	Infl. Adjusted – W/o EXO	1	-	0.17	0.06
	Infl. Adjusted – with EXO	1	6	0.20	0.06
Deseasoned Data	Without EXO	1	-	0.15	0.05
	With EXO	1	7	0.24	0.05
	Infl. Adjusted – W/o EXO	1	-	0.14	0.05
	Infl. Adjusted – with EXO	1	7	0.23	0.05

Artic Oscillations

date_range = {"start": "2008-12-01", "end": "2018-12-01"}

Wheat

Type of Data		Best ENDO lag	Best EXO Lag	Correlation	RMSE
Seasoned Data	Without EXO	2	-	0.16	0.04
	With EXO	2	7	0.25	0.04
	Infl. Adjusted – W/o EXO	2	-	0.14	0.04
	Infl. Adjusted – with EXO	2	7	0.23	0.04
Deseasoned Data	Without EXO	2	-	0.19	0.04
	With EXO	2	7	0.25	0.04
	Infl. Adjusted – W/o EXO	2	-	0.16	0.04
	Infl. Adjusted – with EXO	2	7	0.23	0.04

Artic Oscillations

date_range = {"start": "2008-12-01", "end": "2018-12-01"}

Soyabean

Type of Data		Best ENDO lag	Best EXO Lag	Correlation	RMSE
Seasoned Data	Without EXO	1	-	-0.05	0.05
	With EXO	1	2	-0.04	0.05
	Infl. Adjusted – W/o EXO	1	-	-0.07	0.05
	Infl. Adjusted – with EXO	1	2	-0.04	0.05
Deseasoned Data	Without EXO	1	-	-0.03	0.05
	With EXO	1	8	0	0.05
	Infl. Adjusted – W/o EXO	1	-	-0.04	0.05
	Infl. Adjusted – with EXO	1	8	0.01	0.05

SAM Index

date_range = {"start": "2008-12-01", "end": "2018-12-01"}

Maize

Type of Data		Best ENDO lag	Best EXO Lag	Correlation	RMSE
Seasoned Data	Without EXO	1	-	0.17	0.06
	With EXO	1	3	0.21	0.06
	Infl. Adjusted – W/o EXO	1	-	0.17	0.06
	Infl. Adjusted – with EXO	1	3	0.21	0.04
Deseasoned Data	Without EXO	1	-	0.15	0.05
	With EXO	1	3	0.22	0.04
	Infl. Adjusted – W/o EXO	1	-	0.14	0.05
	Infl. Adjusted – with EXO	1	3	0.20	0.05

SAM Index

date_range = {"start": "2008-12-01", "end": "2018-12-01"}

Wheat

Type of Data		Best ENDO lag	Best EXO Lag	Correlation	RMSE
Seasoned Data	Without EXO	2	-	0.16	0.04
	With EXO	2	6	0.17	0.04
	Infl. Adjusted – W/o EXO	2	-	0.14	0.04
	Infl. Adjusted – with EXO	2	8	0.15	0.04
Deseasoned Data	Without EXO	2	-	0.19	0.04
	With EXO	2	6	0.21	0.04
	Infl. Adjusted – W/o EXO	2	-	0.16	0.04
	Infl. Adjusted – with EXO	2	6	0.18	0.04

SAM Index

date_range = {"start": "2008-12-01", "end": "2018-12-01"}

Soyabean

Type of Data		Best ENDO lag	Best EXO Lag	Correlation	RMSE
Seasoned Data	Without EXO	1	-	-0.05	0.05
	With EXO	1	8	0.01	0.05
	Infl. Adjusted – W/o EXO	1	-	-0.07	0.05
	Infl. Adjusted – with EXO	1	8	0.02	0.05
Deseasoned Data	Without EXO	1	-	-0.03	0.05
	With EXO	1	8	0.02	0.05
	Infl. Adjusted – W/o EXO	1	-	-0.04	0.05
	Infl. Adjusted – with EXO	1	8	0.02	0.05

nhtele_index_4

date_range = {"start": "2008-12-01", "end": "2018-12-01"}

Maize

Type of Data		Best ENDO lag	Best EXO Lag	Correlation	RMSE
Seasoned Data	Without EXO	1	-	0.17	0.06
	With EXO	1	11	0.20	0.06
	Infl. Adjusted – W/o EXO	1	-	0.17	0.06
	Infl. Adjusted – with EXO	1	11	0.21	0.06
Deseasoned Data	Without EXO	1	-	0.15	0.05
	With EXO	1	4	0.19	0.05
	Infl. Adjusted – W/o EXO	1	-	0.14	0.05
	Infl. Adjusted – with EXO	1	11	0.16	0.05

nhtele_index_4

date_range = {"start": "2008-12-01", "end": "2018-12-01"}

Wheat

Type of Data		Best ENDO lag	Best EXO Lag	Correlation	RMSE
Seasoned Data	Without EXO	2	-	0.16	0.07
	With EXO	2	5	0.25	0.07
	Infl. Adjusted – W/o EXO	2	-	0.14	0.07
	Infl. Adjusted – with EXO	2	5	0.23	0.07
Deseasoned Data	Without EXO	2	-	0.19	0.07
	With EXO	2	5	0.27	0.07
	Infl. Adjusted – W/o EXO	2	-	0.16	0.07
	Infl. Adjusted – with EXO	2	5	0.24	0.07

nhtele_index_4

date_range = {"start": "2008-12-01", "end": "2018-12-01"}

Soyabean

Type of Data		Best ENDO lag	Best EXO Lag	Correlation	RMSE
Seasoned Data	Without EXO	1	-	-0.05	0.05
	With EXO	1	4	0.02	0.05
	Infl. Adjusted – W/o EXO	1	-	-0.07	0.05
	Infl. Adjusted – with EXO	1	6	-0.06	0.05
Deseasoned Data	Without EXO	1	-	-0.03	0.05
	With EXO	1	9	-0.03	0.05
	Infl. Adjusted – W/o EXO	1	-	-0.04	0.05
	Infl. Adjusted – with EXO	1	9	-0.03	0.05

pna_index

date_range = {"start": "2008-12-01", "end": "2018-12-01"}

Maize

Type of Data		Best ENDO lag	Best EXO Lag	Correlation	RMSE
Seasoned Data	Without EXO	1	-	0.17	0.06
	With EXO	1	7	0.24	0.06
	Infl. Adjusted – W/o EXO	1	-	0.17	0.06
	Infl. Adjusted – with EXO	1	7	0.24	0.06
Deseasoned Data	Without EXO	1	-	0.15	0.05
	With EXO	1	7	0.23	0.05
	Infl. Adjusted – W/o EXO	1	-	0.14	0.05
	Infl. Adjusted – with EXO	1	7	0.22	0.05

pna_index

date_range = {"start": "2008-12-01", "end": "2018-12-01"}

Wheat

Type of Data		Best ENDO lag	Best EXO Lag	Correlation	RMSE
Seasoned Data	Without EXO	2	-	0.16	0.07
	With EXO	2	7	0.29	0.06
	Infl. Adjusted – W/o EXO	2	-	0.14	0.07
	Infl. Adjusted – with EXO	2	7	0.27	0.06
Deseasoned Data	Without EXO	2	-	0.19	0.07
	With EXO	2	7	0.3	0.07
	Infl. Adjusted – W/o EXO	2	-	0.16	0.07
	Infl. Adjusted – with EXO	2	7	0.28	0.06

pna_index

date_range = {"start": "2008-12-01", "end": "2018-12-01"}

Soyabean

Type of Data		Best ENDO lag	Best EXO Lag	Correlation	RMSE
Seasoned Data	Without EXO	1	-	-0.05	0.05
	With EXO	1	10	0.01	0.05
	Infl. Adjusted – W/o EXO	1	-	-0.07	0.05
	Infl. Adjusted – with EXO	1	9	0.06	0.05
Deseasoned Data	Without EXO	1	-	-0.03	0.05
	With EXO	1	10	0.02	0.05
	Infl. Adjusted – W/o EXO	1	-	-0.04	0.05
	Infl. Adjusted – with EXO	1	10	0.02	0.05

psa_index_1

date_range = {"start": "2008-12-01", "end": "2018-12-01"}

Maize

Type of Data		Best ENDO lag	Best EXO Lag	Correlation	RMSE
Seasoned Data	Without EXO	1	-	0.17	0.06
	With EXO	1	5	0.17	0.06
	Infl. Adjusted – W/o EXO	1	-	0.17	0.06
	Infl. Adjusted – with EXO	1	6	0.19	0.06
Deseasoned Data	Without EXO	1	-	0.15	0.05
	With EXO	1	5	0.16	0.05
	Infl. Adjusted – W/o EXO	1	-	0.14	0.05
	Infl. Adjusted – with EXO	1	6	0.17	0.05

psa_index_1

date_range = {"start": "2008-12-01", "end": "2018-12-01"}

Wheat

Type of Data		Best ENDO lag	Best EXO Lag	Correlation	RMSE
Seasoned Data	Without EXO	2	-	0.16	0.07
	With EXO	2	11	0.20	0.07
	Infl. Adjusted – W/o EXO	2	-	0.14	0.07
	Infl. Adjusted – with EXO	2	11	0.16	0.07
Deseasoned Data	Without EXO	2	-	0.19	0.07
	With EXO	2	11	0.21	0.07
	Infl. Adjusted – W/o EXO	2	-	0.16	0.07
	Infl. Adjusted – with EXO	2	11	0.17	0.07

psa_index_1

date_range = {"start": "2008-12-01", "end": "2018-12-01"}

Soyabean

Type of Data		Best ENDO lag	Best EXO Lag	Correlation	RMSE
Seasoned Data	Without EXO	1	-	-0.05	0.05
	With EXO	1	3	-0.01	0.05
	Infl. Adjusted – W/o EXO	1	-	-0.07	0.05
	Infl. Adjusted – with EXO	1	3	-0.01	0.05
Deseasoned Data	Without EXO	1	-	-0.03	0.05
	With EXO	1	3	-0.01	0.05
	Infl. Adjusted – W/o EXO	1	-	-0.04	0.05
	Infl. Adjusted – with EXO	1	3	-0.01	0.05

psa_index_2

date_range = {"start": "2008-12-01", "end": "2018-12-01"}

Maize

Type of Data		Best ENDO lag	Best EXO Lag	Correlation	RMSE
Seasoned Data	Without EXO	1	-	0.17	0.06
	With EXO	1	3	0.22	0.06
	Infl. Adjusted – W/o EXO	1	-	0.17	0.06
	Infl. Adjusted – with EXO	1	10	0.16	0.06
Deseasoned Data	Without EXO	1	-	0.15	0.05
	With EXO	1	3	0.20	0.06
	Infl. Adjusted – W/o EXO	1	-	0.14	0.05
	Infl. Adjusted – with EXO	1	10	0.12	0.05

psa_index_2

date_range = {"start": "2008-12-01", "end": "2018-12-01"}

Wheat

Type of Data		Best ENDO lag	Best EXO Lag	Correlation	RMSE
Seasoned Data	Without EXO	2	-	0.16	0.07
	With EXO	2	4	0.20	0.07
	Infl. Adjusted – W/o EXO	2	-	0.14	0.07
	Infl. Adjusted – with EXO	2	4	0.18	0.07
Deseasoned Data	Without EXO	2	-	0.19	0.07
	With EXO	2	4	0.20	0.07
	Infl. Adjusted – W/o EXO	2	-	0.16	0.07
	Infl. Adjusted – with EXO	2	8	0.17	0.07

psa_index_2

date_range = {"start": "2008-12-01", "end": "2018-12-01"}

Soyabean

Type of Data		Best ENDO lag	Best EXO Lag	Correlation	RMSE
Seasoned Data	Without EXO	1	-	-0.05	0.05
	With EXO	1	10	-0.03	0.05
	Infl. Adjusted – W/o EXO	1	-	-0.07	0.05
	Infl. Adjusted – with EXO	1	10	-0.02	0.05
Deseasoned Data	Without EXO	1	-	-0.03	0.05
	With EXO	1	10	-0.01	0.05
	Infl. Adjusted – W/o EXO	1	-	-0.04	0.05
	Infl. Adjusted – with EXO	1	10	-0.01	0.05

nhtele_3 index

date_range = {"start": "2008-12-01", "end": "2018-12-01"}

Maize

Type of Data		Best ENDO lag	Best EXO Lag	Correlation	RMSE
Seasoned Data	Without EXO	1	-	0.17	0.06
	With EXO	1	1	0.23	0.06
	Infl. Adjusted – W/o EXO	1	-	0.17	0.06
	Infl. Adjusted – with EXO	1	1	0.24	0.06
Deseasoned Data	Without EXO	1	-	0.15	0.05
	With EXO	1	3	0.20	0.05
	Infl. Adjusted – W/o EXO	1	-	0.14	0.05
	Infl. Adjusted – with EXO	1	3	0.18	0.05

nhtele_3 index

date_range = {"start": "2008-12-01", "end": "2018-12-01"}

Wheat

Type of Data		Best ENDO lag	Best EXO Lag	Correlation	RMSE
Seasoned Data	Without EXO	2	-	0.16	0.07
	With EXO	2	5	0.21	0.07
	Infl. Adjusted – W/o EXO	2	-	0.14	0.07
	Infl. Adjusted – with EXO	2	5	0.19	0.07
Deseasoned Data	Without EXO	2	-	0.19	0.07
	With EXO	2	5	0.24	0.07
	Infl. Adjusted – W/o EXO	2	-	0.16	0.07
	Infl. Adjusted – with EXO	2	5	0.22	0.07

nhtele_3 index

date_range = {"start": "2008-12-01", "end": "2018-12-01"}

Soyabean

Type of Data		Best ENDO lag	Best EXO Lag	Correlation	RMSE
Seasoned Data	Without EXO	1	-	-0.05	0.05
	With EXO	1	6	0.04	0.05
	Infl. Adjusted – W/o EXO	1	-	-0.07	0.05
	Infl. Adjusted – with EXO	1	6	0.06	0.05
Deseasoned Data	Without EXO	1	-	-0.03	0.05
	With EXO	1	6	0.05	0.05
	Infl. Adjusted – W/o EXO	1	-	-0.04	0.05
	Infl. Adjusted – with EXO	1	6	0.07	0.05

IOD_INDEX

date_range = {"start": "2008-12-01", "end": "2018-12-01"}

Maize

Type of Data		Best ENDO lag	Best EXO Lag	Correlation	RMSE
Seasoned Data	Without EXO	1	-	0.17	0.06
	With EXO	1	4	0.15	0.06
	Infl. Adjusted – W/o EXO	1	-	0.17	0.06
	Infl. Adjusted – with EXO	1	4	0.15	0.06
Deseasoned Data	Without EXO	1	-	0.15	0.05
	With EXO	1	11	0.16	0.06
	Infl. Adjusted – W/o EXO	1	-	0.14	0.05
	Infl. Adjusted – with EXO	1	4	0.12	0.05

IOD_INDEX

date_range = {"start": "2008-12-01", "end": "2018-12-01"}

Wheat

Type of Data		Best ENDO lag	Best EXO Lag	Correlation	RMSE
Seasoned Data	Without EXO	2	-	0.16	0.07
	With EXO	2	8	0.18	0.07
	Infl. Adjusted – W/o EXO	2	-	0.14	0.07
	Infl. Adjusted – with EXO	2	8	0.15	0.07
Deseasoned Data	Without EXO	2	-	0.19	0.07
	With EXO	2	8	0.20	0.07
	Infl. Adjusted – W/o EXO	2	-	0.16	0.07
	Infl. Adjusted – with EXO	2	1	0.13	0.07

IOD_INDEX

date_range = {"start": "2008-12-01", "end": "2018-12-01"}

Soyabean

Type of Data		Best ENDO lag	Best EXO Lag	Correlation	RMSE
Seasoned Data	Without EXO	1	-	-0.05	0.05
	With EXO	1	9	0.02	0.05
	Infl. Adjusted – W/o EXO	1	-	-0.07	0.05
	Infl. Adjusted – with EXO	1	1	-0.04	0.05
Deseasoned Data	Without EXO	1	-	-0.03	0.05
	With EXO	1	9	0.05	0.05
	Infl. Adjusted – W/o EXO	1	-	-0.04	0.05
	Infl. Adjusted – with EXO	1	1	-0.02	0.05

nhtele_index_1

date_range = {"start": "2008-12-01", "end": "2018-12-01"}

Maize

Type of Data		Best ENDO lag	Best EXO Lag	Correlation	RMSE
Seasoned Data	Without EXO	1	-	0.17	0.06
	With EXO	1	6	0.18	0.06
	Infl. Adjusted – W/o EXO	1	-	0.17	0.06
	Infl. Adjusted – with EXO	1	6	0.19	0.06
Deseasoned Data	Without EXO	1	-	0.15	0.05
	With EXO	1	6	0.17	0.05
	Infl. Adjusted – W/o EXO	1	-	0.14	0.05
	Infl. Adjusted – with EXO	1	6	0.17	0.05

nhtele_index_1

date_range = {"start": "2008-12-01", "end": "2018-12-01"}

Wheat

Type of Data		Best ENDO lag	Best EXO Lag	Correlation	RMSE
Seasoned Data	Without EXO	2	-	0.16	0.07
	With EXO	2	4	0.20	0.07
	Infl. Adjusted – W/o EXO	2	-	0.14	0.07
	Infl. Adjusted – with EXO	2	4	0.18	0.07
Deseasoned Data	Without EXO	2	-	0.19	0.07
	With EXO	2	4	0.22	0.07
	Infl. Adjusted – W/o EXO	2	-	0.16	0.07
	Infl. Adjusted – with EXO	2	4	0.20	0.07

nhtele_index_1

date_range = {"start": "2008-12-01", "end": "2018-12-01"}

Soyabean

Type of Data		Best ENDO lag	Best EXO Lag	Correlation	RMSE
Seasoned Data	Without EXO	1	-	-0.05	0.05
	With EXO	1	8	-0.00	0.05
	Infl. Adjusted – W/o EXO	1	-	-0.07	0.05
	Infl. Adjusted – with EXO	1	2	0.09	0.05
Deseasoned Data	Without EXO	1	-	-0.03	0.05
	With EXO	1	8	0.01	0.05
	Infl. Adjusted – W/o EXO	1	-	-0.04	0.05
	Infl. Adjusted – with EXO	1	8	0.01	0.05

nhtele_index_2

date_range = {"start": "2008-12-01", "end": "2018-12-01"}

Maize

Type of Data		Best ENDO lag	Best EXO Lag	Correlation	RMSE
Seasoned Data	Without EXO	1	-	0.17	0.06
	With EXO	1	4	0.21	0.06
	Infl. Adjusted – W/o EXO	1	-	0.17	0.06
	Infl. Adjusted – with EXO	1	4	0.22	0.06
Deseasoned Data	Without EXO	1	-	0.15	0.05
	With EXO	1	4	0.19	0.05
	Infl. Adjusted – W/o EXO	1	-	0.14	0.05
	Infl. Adjusted – with EXO	1	4	0.19	0.05

nhtele_index_2

date_range = {"start": "2008-12-01", "end": "2018-12-01"}

Wheat

Type of Data		Best ENDO lag	Best EXO Lag	Correlation	RMSE
Seasoned Data	Without EXO	2	-	0.16	0.07
	With EXO	2	4	0.22	0.07
	Infl. Adjusted – W/o EXO	2	-	0.14	0.07
	Infl. Adjusted – with EXO	2	4	0.21	0.07
Deseasoned Data	Without EXO	2	-	0.19	0.07
	With EXO	2	4	0.24	0.07
	Infl. Adjusted – W/o EXO	2	-	0.16	0.07
	Infl. Adjusted – with EXO	2	4	0.22	0.07

nhtele_index_2

date_range = {"start": "2008-12-01", "end": "2018-12-01"}

Soyabean

Type of Data		Best ENDO lag	Best EXO Lag	Correlation	RMSE
Seasoned Data	Without EXO	1	-	-0.05	0.05
	With EXO	1	6	-0.03	0.05
	Infl. Adjusted – W/o EXO	1	-	-0.07	0.05
	Infl. Adjusted – with EXO	1	6	-0.03	0.05
Deseasoned Data	Without EXO	1	-	-0.03	0.05
	With EXO	1	6	-0.00	0.05
	Infl. Adjusted – W/o EXO	1	-	-0.04	0.05
	Infl. Adjusted – with EXO	1	6	0.00	0.05