



Institute of Meteorology and Water Management
National Research Institute

DWD, LfULG Saxony, JRC and NOAA
Collaboration Workshop
Sort-out Drought!

DROUGHT MONITORING IN POLAND

Tamara Tokarczyk

Flood and Drought Modelling Centre in Wrocław
Institute of Meteorology and Water Management
National Research Institute

Dresden-Pillnitz, 16 to 18 November 2016





PRESENTATION SCHEME

1. Role of IMWM NRI.
2. Drought – general approach.
3. POSUCH@ - drought assessment and forecasting system:
 - ✓ scheme,
 - ✓ data,
 - ✓ indices (meteorological and hydrological drought),
 - ✓ products.
3. Drought hazard prediction – current status.
4. Drought hazard prediction – development.



Institute of Meteorology and Water Management

National Research Institute

NATIONAL SERVICES

KZGW, RZGW, PIG, ...



*statutory tasks, legislative obligations,
agreements*

National Hydro-Meteorological Service

Operational Components

- ✓ Monitoring network
- ✓ **Operational forecasting**
- ✓ Telecommunication systems
- ✓ Data storage, processing and management
- ✓ ...

Products & Services

- ✓ Hazard Assessment
- ✓ Risk Analysis
- ✓ **Early Warning Systems**
- ✓ Sectoral and operational planning
- ✓ ...



*Products
and Services
delivery*

NATIONAL STAKEHOLDERS

- Government
- Non-governmental organizations
- Economic sectors
- Private business
- General public
- Media
- ...



*agreements and contracts,
cooperation*

INTERNATIONAL INSTITUTIONS, INTERREGIONAL AND INTERNATIONAL COMMISSIONS

WMO, GWP, IPCC, EDO, ...

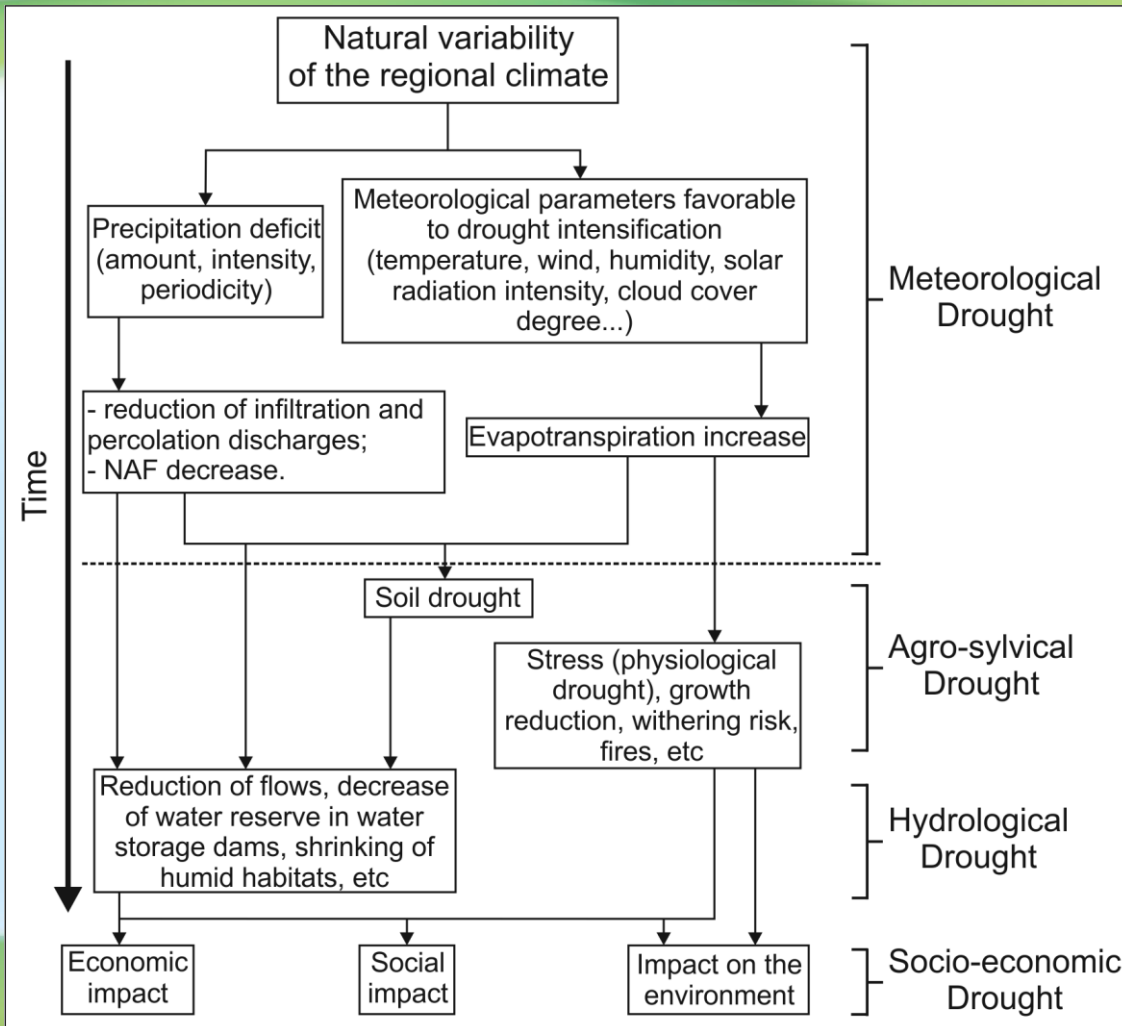


Role of IMWM NRI in Disaster Risk Reduction

Risk Assessment	Risk Reduction	Risk Transfer
<ul style="list-style-type: none">• Historical Hazard Database• Hazard statistics• Climate forecasting & trend analysis• Exposure & Vulnerability assessment• Risk decomposition	<ul style="list-style-type: none">• Preparedness:• Early warning Systems• Crisis management• Prevention &• Losses Reduction• Medium to long term sectoral planning (agriculture, water management, industry, etc.)	<ul style="list-style-type: none">• Government investment,• Investment funds,• Insurance instruments based on weather indexes
Information and knowledge sharing / Education and training		



DROUGHT EFFECTS



ENVIRONMENT

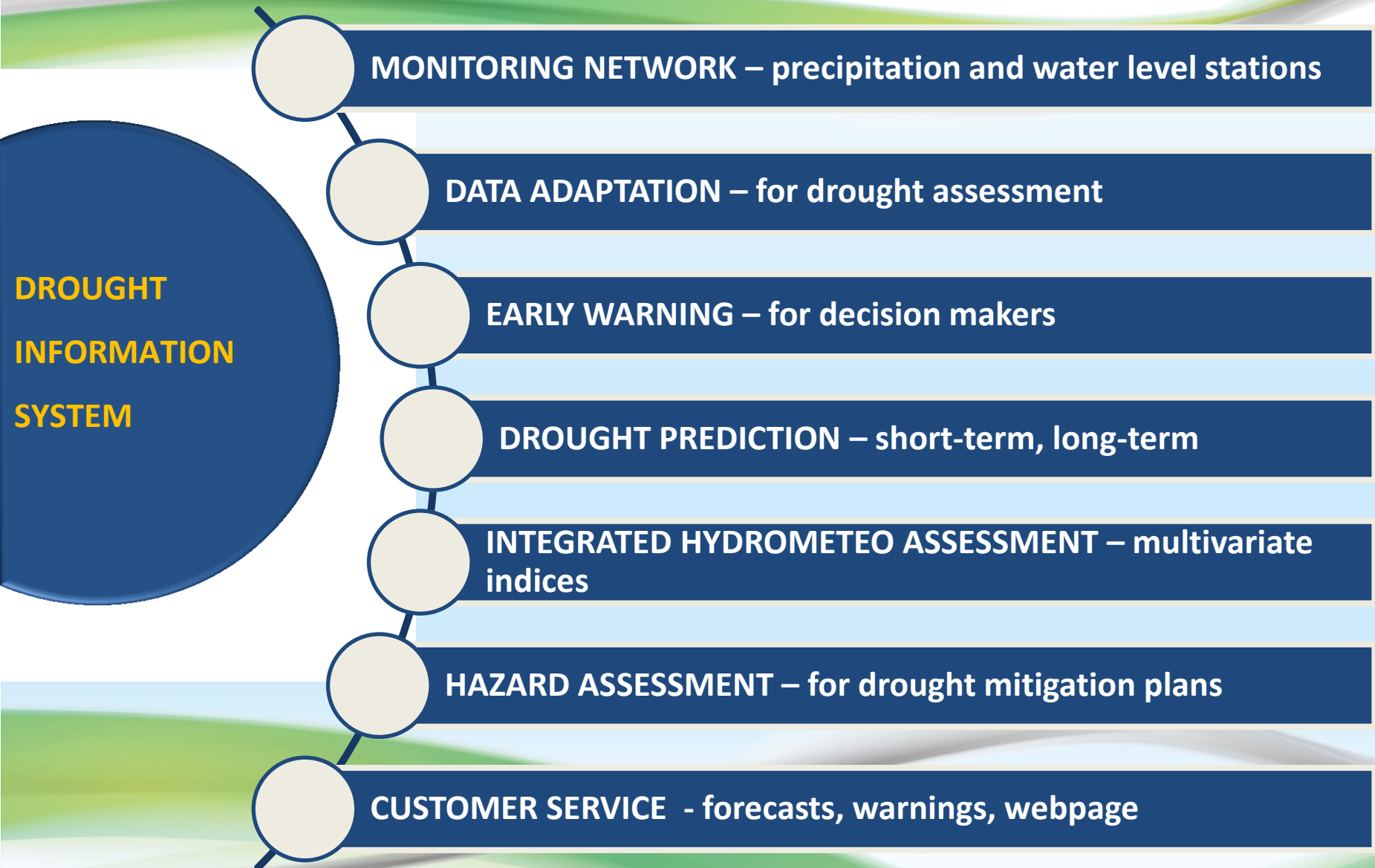
- ✓ low flow (surface water, groundwater),
- ✓ drying small rivers,
- ✓ impact on aquatic habitats, fauna and flora;

SOCIETY - ECONOMY

- ✓ water deficits,
- ✓ problems with water supply (people, industry, agriculture, fisheries...),
- ✓ economic losses (agriculture/industry production),
- ✓ restrictions of water usage,
- ✓ possible social conflicts.

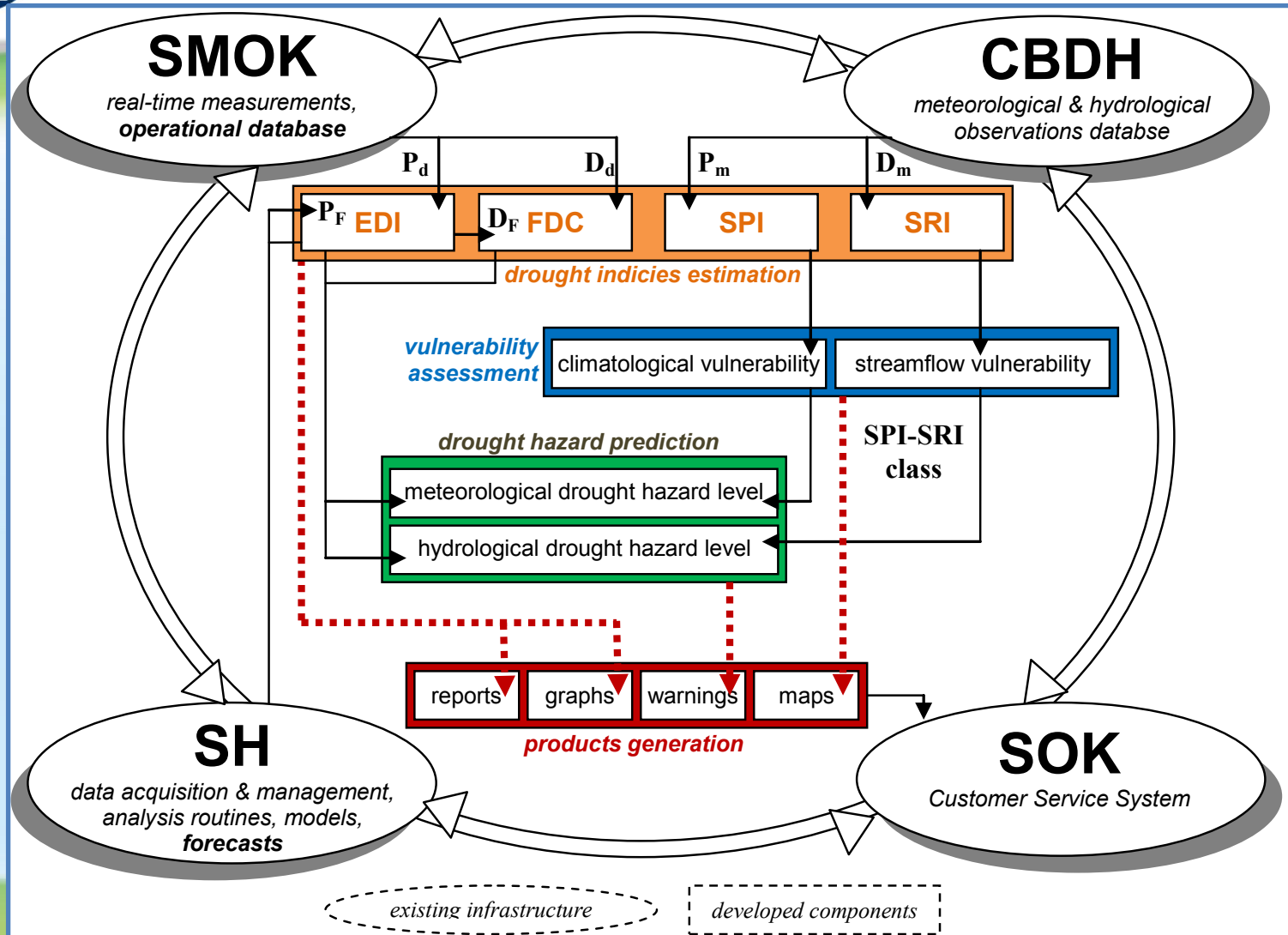


DROUGHT ASSESSMENT AND PREDICTION SYSTEM





DROUGHT HAZARD ASSESSMENT



P_d – daily precipitation, P_m – monthly precipitation, P_F – precipitation forecast
 D_d – daily discharges, D_m – monthly discharges, D_F – discharge forecast



DROUGHT INDICES ESTIMATION

- detection of various stages of drought including meteorological and hydrological drought identification,
- providing a standardized and dimensionless description of drought intensity,
- reveal temporal variability of drought up to daily time step,
- mapping drought spatial distribution.



DROUGHT HAZARD ASSESSMENT



DROUGHT HAZARD PREDICTION



POSUCH@ - WEBPAGE SCHEME

Strona intranetowa IMGW PIB | Witamy na stronie projektu Posucha

posucha.imgw.pl | wroclaw plan miasta

Często odwiedzane | Pierwsze kroki | Aktualności | EndNote - Output Styles | Zakładki

INNOWACYJNA GOSPODARKA NARODOWA STRATEGIA SPÓJNOŚCI | Instytut Meteorologii i Gospodarki Wodnej PIB | UNIA EUROPEJSKA EUROPEJSKI FUNDUSZ ROZWOJU REGIONALNEGO

reports on historical droughts | drought characteristics - current state | drought prediction

STRONA GŁÓWNA | O SERWISIE | SUSZE HISTORYCZNE | STAN AKTUALNY | PROGNOZA SUSZY | KONTAKT

PROGNOSTYCZNO-OPERACYJNY SYSTEM UDOSTĘPNIANIA CHARAKTERYSTYK SUSZY

POSUCH@

Strona POSUCH@ prowadzona jest przez Instytut Meteorologii i Gospodarki Wodnej Państwowego Instytutu Badawczego. Zrealizowana została w ramach Projektu „Wpływ zmian klimatu na środowisko, gospodarkę i społeczeństwo” akronim KLIMAT, podzadania „Doskonalenie metod prognoz hydrologicznych i ich wykorzystania do oceny zagrożeń w warunkach zmienności klimatu” (POIG.01.03.01-14-011/08).

Głównym celem serwisu jest udostępnianie informacji zawierających charakterystyki susz obejmujące identyfikacje suszy, ocenę jej intensywności oraz prognozę.

Serwis złożony jest z części prognostyczno-operacyjnej, którego bazę stanowi system oceny i prognozy rozwoju suszy oraz opisu susz historycznych.

project **KLIMAT**

CLIMATE CHANGE
IMPACT ON THE
ENVIRONMENT,
ECONOMY AND
SOCIETY

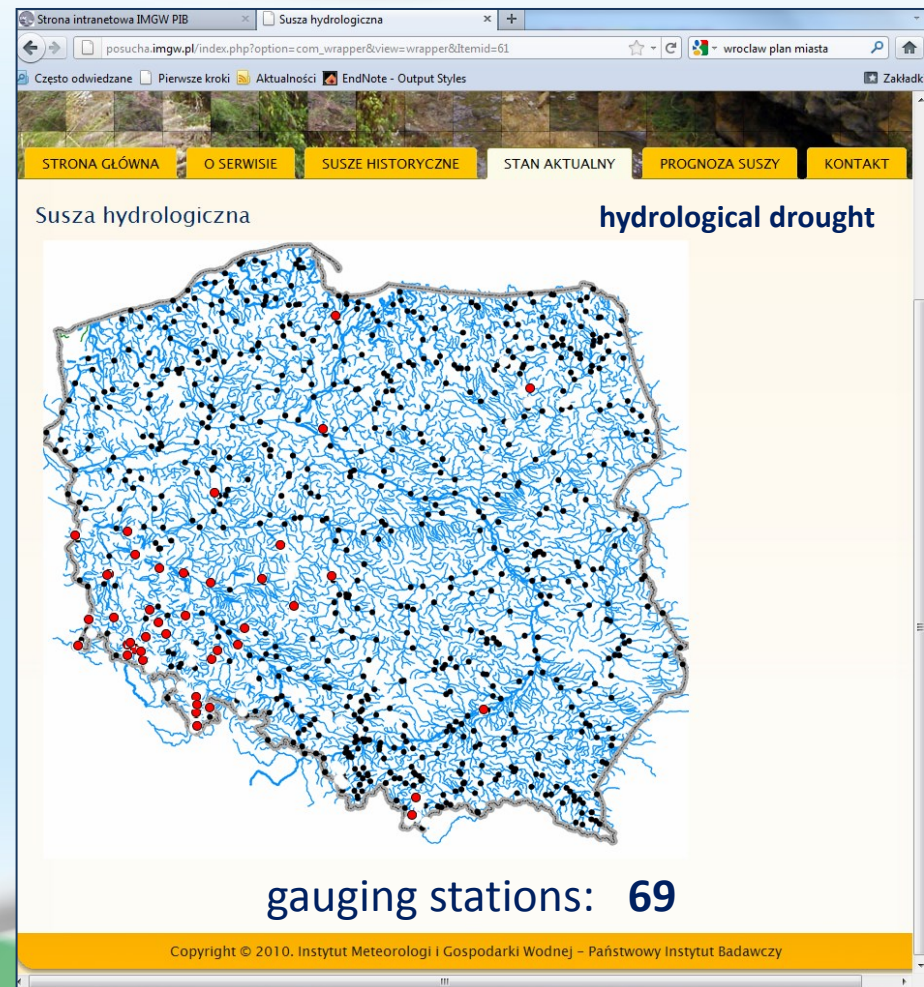
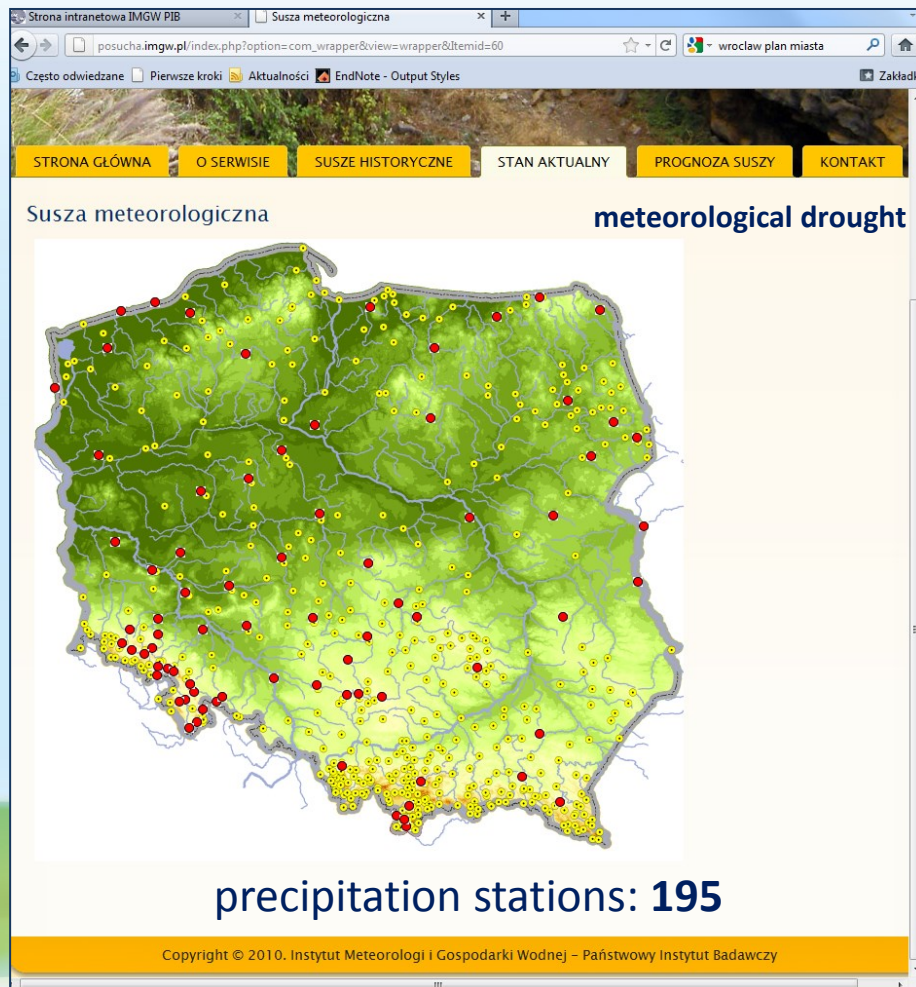
<http://posucha.imgw.pl>



POSUCH@ - MONITORING NETWORK

HISTORICAL DATABASE & OPERATIONAL DATABASE

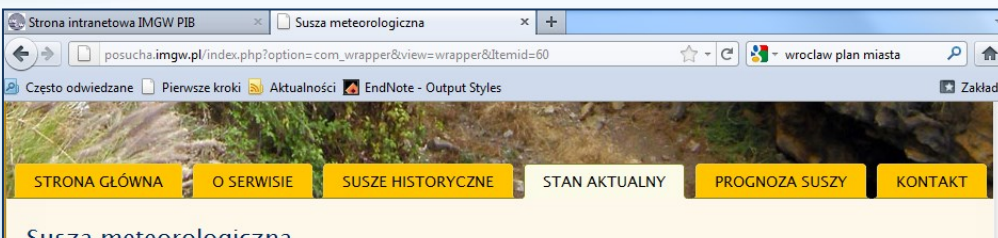
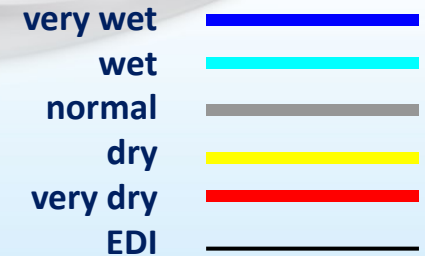
REFERENCE PERIOD: 1966-2010



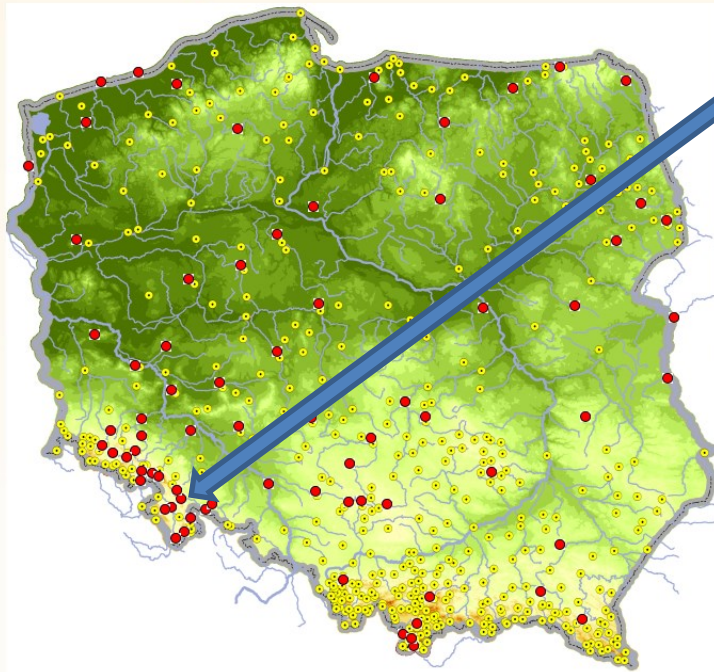


POSUCH@ - EFFECTIVE DROUGHT INDEX (EDI)

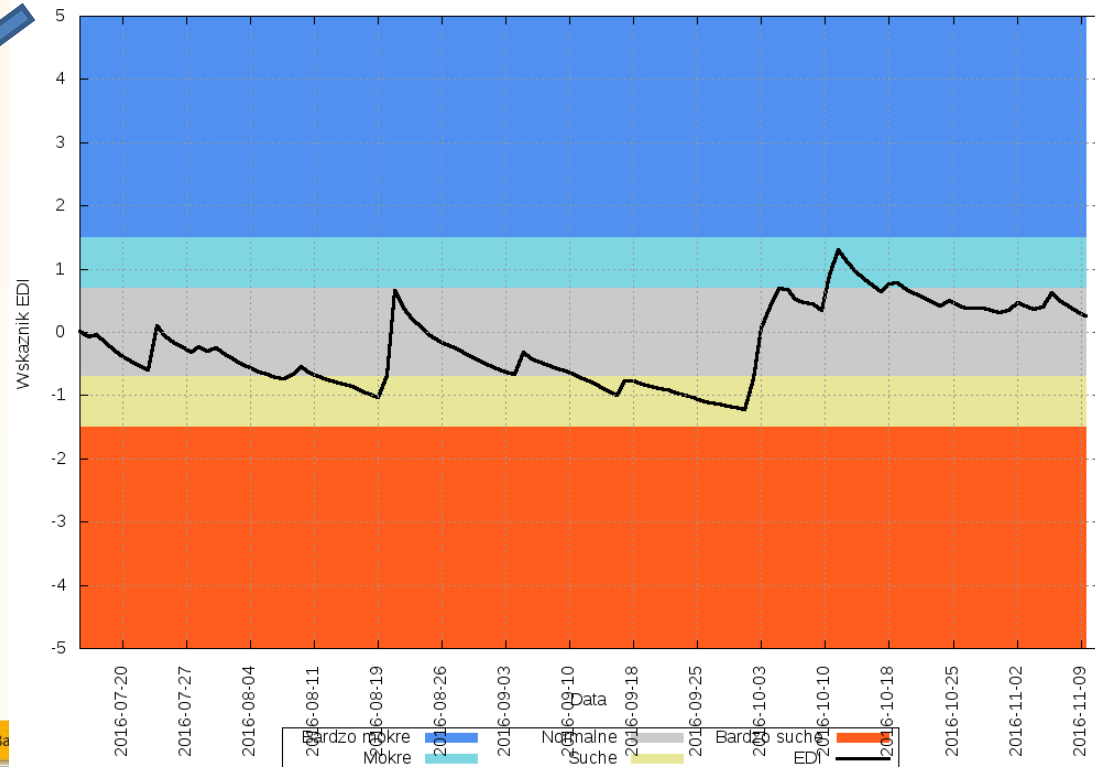
a measure of precipitation needed for a return to normal conditions; calculated with a daily time step



Susza meteorologiczna



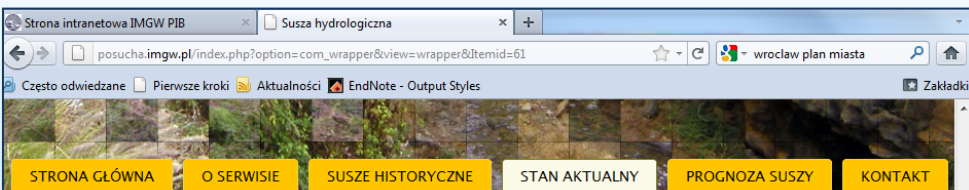
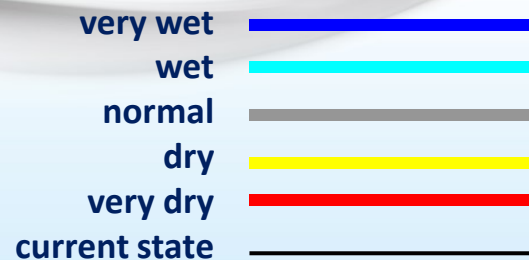
EDI: KŁODZKO (350160520)
Przedział Warunków Wilgotnościowych



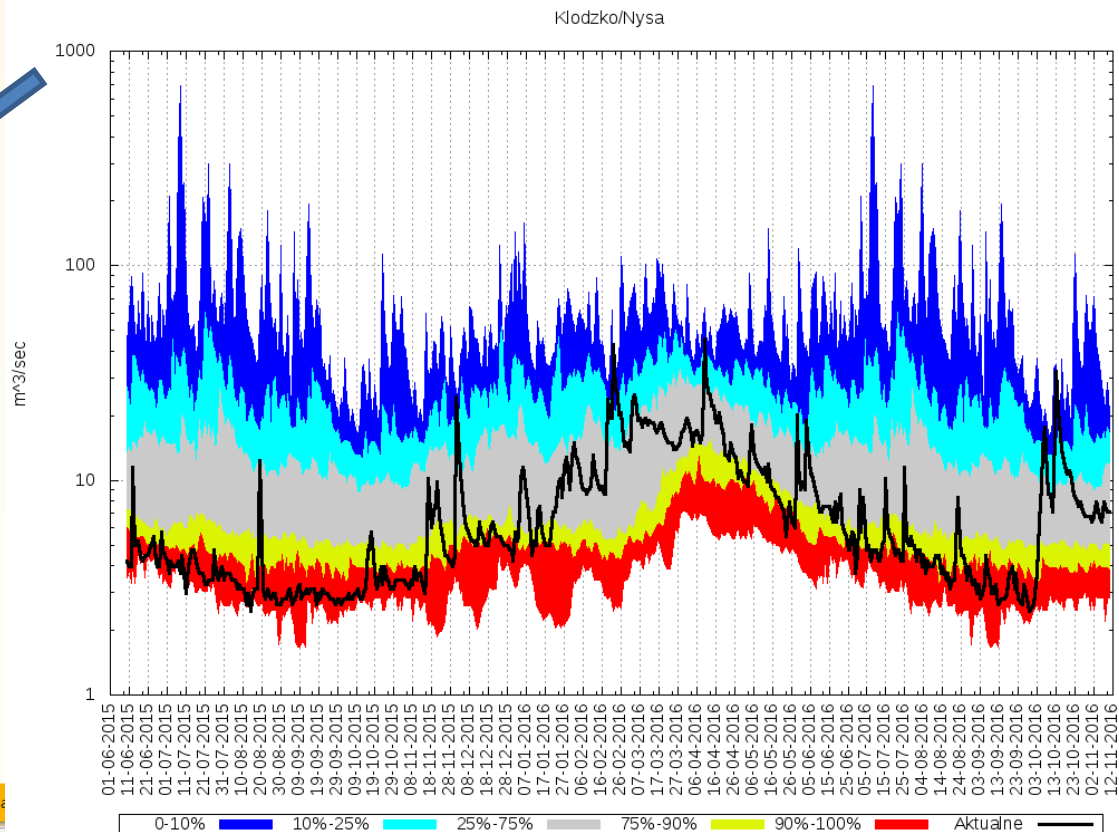
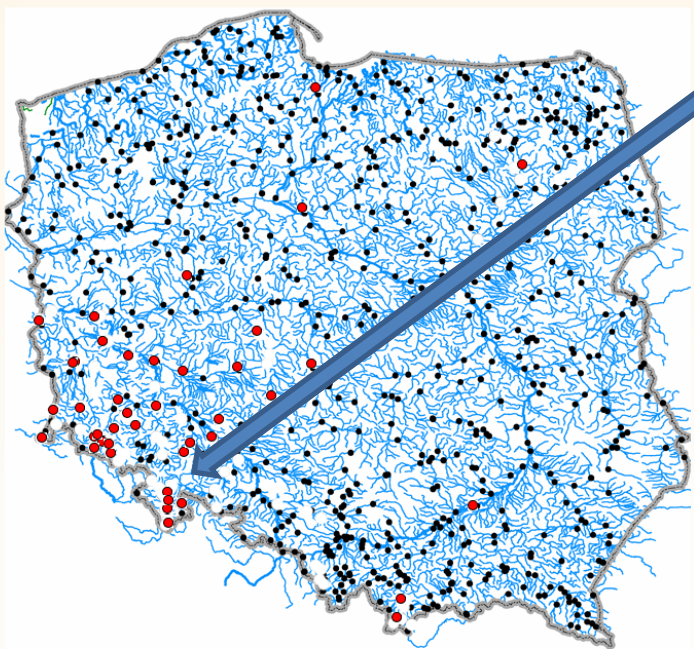


POSUCH@ - FLOW INDEX (FI_{FDC})

represents the empirical cumulative frequency of discharges as a function of the percentage of exceeded discharge time



Susza hydrologiczna

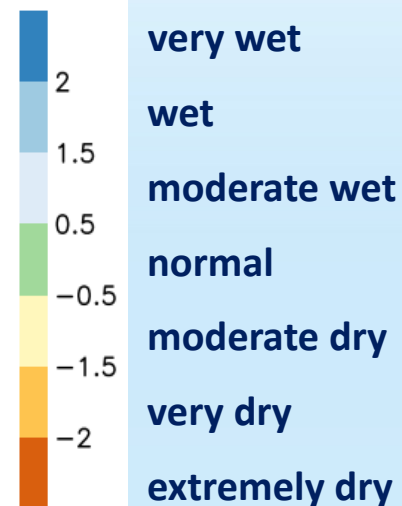
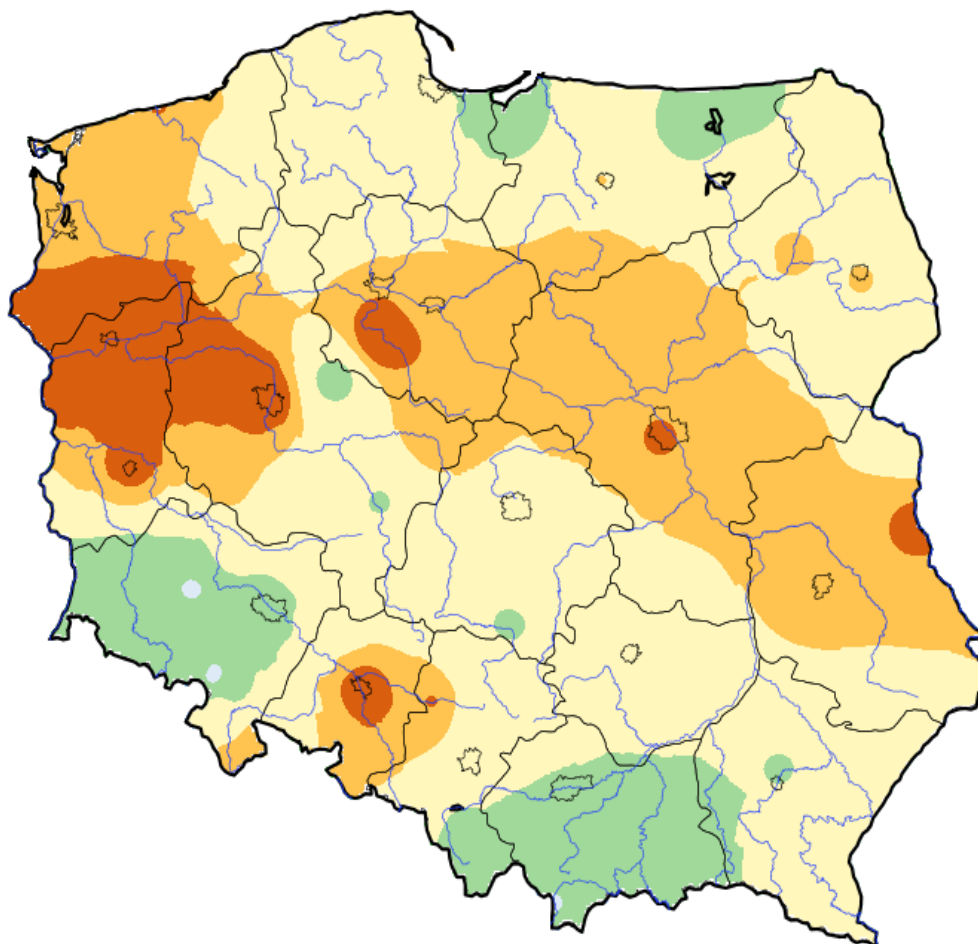




POSUCH@ - STANDARDIZED PRECIPITATION INDEX (SPI)

Wskaźnik SPI

Wrzesień 2016

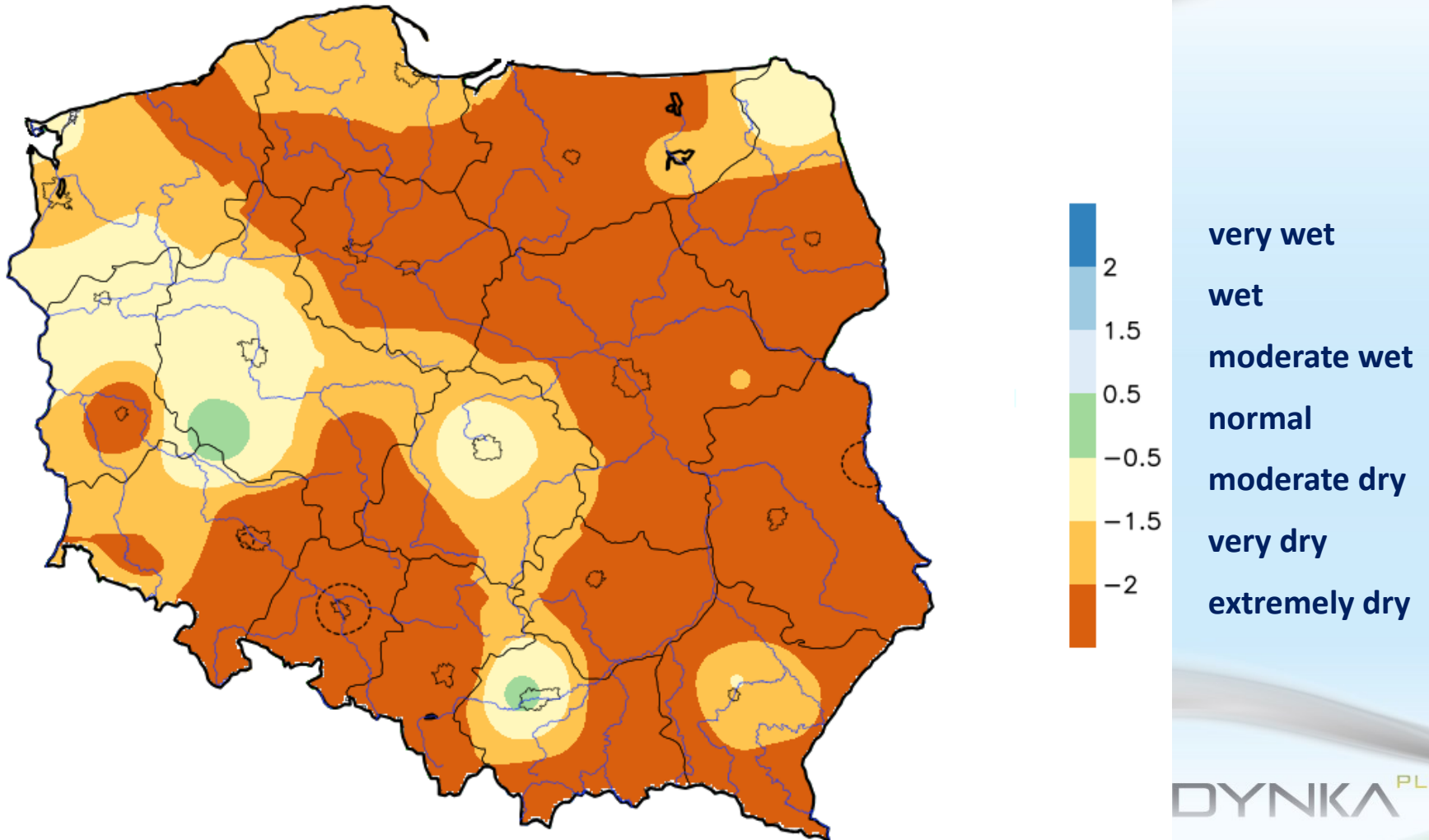




POSUCH@ - STANDARDIZED PRECIPITATION INDEX (SPI)

SPI_1month

August 2015





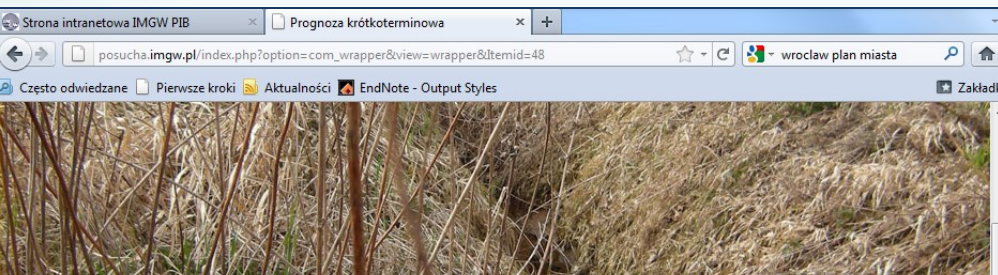
POSUCH@ – STANDARDIZED RUNOFF INDEX (SRI)

Rzeka	Wodowskaz	paź-14	lis-14	gru-14	sty-15	lut-15	mar-15	kwi-15	maj-15	cze-15	lip-15	sie-15	wrz-15	paź-15
Nysa Kłodzka	Międzylesie	0.15	-0.60	0.14	1.21	-0.32	-0.92	0.27	-1.35	-1.33	-0.83	-0.95	-0.97	-0.66
	Bystrzyca Kłodzka	-0.12	-0.62	-0.60	0.35	-0.41	-1.11	-0.53	-1.46	-1.19	-0.84	-0.93	-1.16	-0.71
	Kłodzko	-0.07	-0.18	-0.53	0.70	-0.17	-0.63	-0.09	-1.37	-1.33	-1.21	-1.38	-1.46	-1.47
	Bardo	0.02	-0.14	-0.82	0.04	-0.52	-1.20	-0.39	-1.45	-1.20	-1.38	-1.58	-1.49	-1.54
Biała Łądecka	Łądek Zdrój	0.27	0.64	-0.37	0.84	-0.22	-0.39	-0.37	-0.89	-0.87	-1.20	-2.37	-2.59	-2.82
	Żelazno	-0.28	-0.10	-0.71	0.14	-0.58	-0.93	-1.15	-0.88	-0.33	-0.90	-1.32	-1.35	-1.30
Bystrzyca Dusznicka	Szalejów Dolny	-0.77	-1.26	-1.45	-0.21	-1.03	-1.05	-0.83	-1.76	-1.63	-1.34	-1.48	-1.56	-1.56
Biała Glucholańska	Glucholazy	0.03	-0.27	-0.95	-0.71	-0.90	-0.77	-0.61	-1.11	-1.23	-1.04	-1.15	-1.13	-1.21
Prosna	Mirków	0.23	-0.55	-0.93	0.62	-0.06	-1.16	-0.82	-0.09	0.15	-0.05	-0.39	-0.18	0.02
	Piwonice	0.36	-0.04	-0.58	0.11	-0.39	-1.17	-1.08	-1.16	-1.10	-0.75	-1.40	-1.42	-1.52
	Bogusław	0.19	-0.15	-0.77	0.04	-0.46	-1.23	-1.11	-1.82	-1.34	-0.92	-1.34	-2.03	-1.93
Niesób	Kuźnica Skakawska	0.99	0.47	0.03	1.10	0.08	-0.89	-0.59	-0.42	0.12	0.50	0.67	0.28	0.05
Ołobok	Ołobok	-0.34	-0.34	-0.87	-0.30	-0.66	-1.33	-1.12	-0.99	-1.40	-0.45	-0.75	-0.63	-1.22
	Jelenia Góra	0.68	-0.27	-0.74	0.30	-0.85	-1.39	-0.96	-1.83	-1.57	-1.41	-1.31	-1.36	-1.55
	Pilchowice	0.84	0.07	-0.34	1.14	-0.64	-1.19	-0.88	-1.28	-0.99	-1.24	-1.76	-1.28	-1.45
	Dąbrowa Bolesławiecka	1.64	0.03	-0.45	1.10	-0.56	-1.22	-0.68	-0.82	-0.57	-1.03	-1.41	-1.41	-1.51
	Żagań	1.39	0.13	-0.56	0.74	-0.58	-1.30	-0.94	-1.40	-1.30	-1.24	-1.29	-1.91	-2.16
Wisła	Sandomierz	1.00	0.54	-0.31	0.31	0.36	0.47	0.21	-0.35	0.17	-0.81	-1.03	-1.21	-0.97
	Zawichost	0.61	-0.14	-0.62	0.86	0.04	0.14	-0.30	-0.37	-0.80	-1.23	-1.44	-1.31	-0.75
	Puławy-Azoty	0.72	0.18	-0.62	1.04	0.24	0.18	-0.10	-0.43	-0.87	-1.31	-1.56	-1.40	-0.73
Skawa	Wadowice	0.84	-0.23	-0.71	0.60	-0.18	0.91	0.40	0.23	-1.20	-1.96	-1.81	-1.71	-1.30
Raba	Stróża	0.81	-0.18	-0.75	0.61	-0.35	1.08	0.25	-0.06	-1.23	-1.53	-1.69	-1.42	-0.81
Dunajec	Czchów	1.38	0.48	-0.38	1.42	0.71	0.83	0.09	0.71	-0.85	-1.25	-0.93	-0.81	0.36
	Żabno	1.39	0.05	-0.49	1.02	0.44	0.83	-0.11	0.41	-0.92	-1.41	-1.19	-0.94	0.17
Biała Tarnowska	Koszyce Wielkie	1.18	0.17	-0.44	0.81	0.65	-0.11	-0.48	-0.52	-0.86	-1.05	-1.33	-1.42	-0.06
Wisłoka	Krajowice	1.14	0.01	-0.63	1.17	0.51	-0.31	-1.06	-0.67	-0.89	-1.01	-1.14	-1.31	-0.60
San	Jarosław	-0.61	-0.93	-1.30	0.24	0.27	-0.51	-0.47	-0.77	-0.79	-1.00	-1.22	-1.14	-0.94



POSUCH@ - SHORT TERM METEO CONDITIONS FORECAST

EDI + NUMERICAL WEATHER PREDICTION MODEL

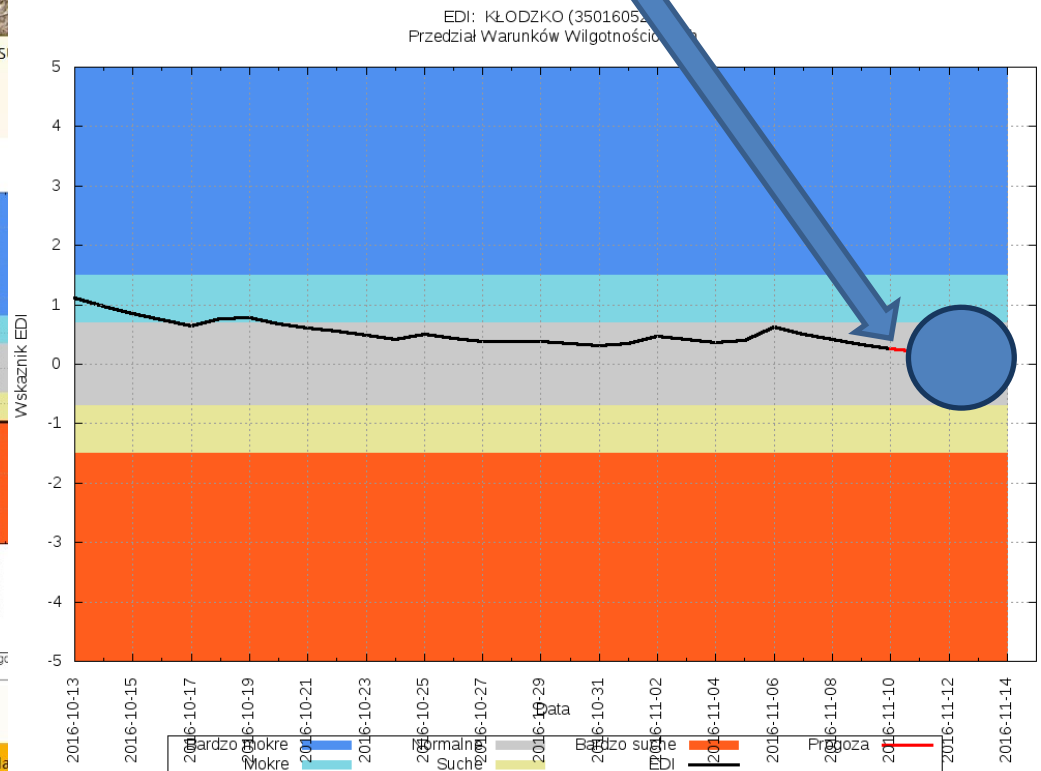
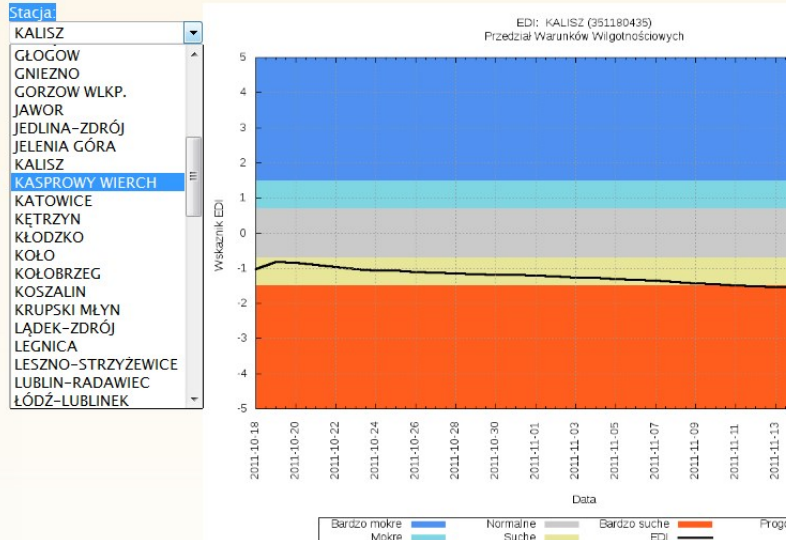


very wet
wet
normal
dry
very dry
EDI
forecast

STRONA GŁÓWNA O SERWISIE SUSZE HISTORYCZNE STAN AKTUALNY PROGNOZA

Prognoza krótkoterminowa

short term forecast





POSUCH@ - LONG TERM DROUGHT HAZARD PREDICTION

SPI + REGIONAL VULNERABILITY TO DROUGHT

Progniza zagrożenia suszą atmosferyczną...

posucha.imgw.pl/index.php?option=com_wrapper&view=wrapper&Itemid=63

posucha

Często odwiedzane Pierwsze kroki Aktualności EndNote - Output Styles Zakładki

INNOWACYJNA GOSPODARKA NARODOWA STRATEGIA SPÓJNOŚCI

Instytut Meteorologii i Gospodarki Wodnej PIB

UNIA EUROPEJSKA EUROPEJSKI FUNDUSZ ROZWOJU REGIONALNEGO

STRONA GŁÓWNA O SERWISIE SUSZE HISTORYCZNE STAN AKTUALNY PROGNOZA SUSZY KONTAKT

Progniza zagrożenia suszą atmosferyczną w półroczu ciepłym

Stacja: WROCLAW

--- Wybierz Stację ---
BANIE MAZURSKIE
BARDO ŚLĄSKIE
BIAŁYSTOK
BIERUTÓW
BOBRY
BOGUSZÓW-GÓRCE
BRAŃSK
BURZYŃ
CHEŁSTY
CHOJNICE
CHWAŁKOWICE
CIECHANOWICE
CZĘSTOCHOWA
DZIEWIĘTLICE
KŁODZKO
KOŁOBRZEG
POZNAŃ
WARSZAWA-OKECIE
WROCLAW

Nazwa stacji	Zlewnia	Warunki w poprzednim miesiącu Wrzesień 2016	Prawdopodobieństwo przejścia do warunków wilgotnych Październik 2016	Prawdopodobieństwo przejścia do warunków normalnych Październik 2016	Prawdopodobieństwo przejścia do warunków suchych Październik 2016
KŁODZKO	Nysa Kłodzka	suche	21%	29%	50%

drought hazard prediction for warm season

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gauging station

basin

conditions for the previous month

probability of moving to wet conditions

probability of moving to normal conditions

probability of moving to dry conditions

Nazwa stacji	Zlewnia	Warunki w poprzednim miesiącu Wrzesień 2016	Prawdopodobieństwo przejścia do warunków wilgotnych Październik 2016	Prawdopodobieństwo przejścia do warunków normalnych Październik 2016	Prawdopodobieństwo przejścia do warunków suchych Październik 2016
KŁODZKO	Nysa Kłodzka	suche	21%	29%	50%

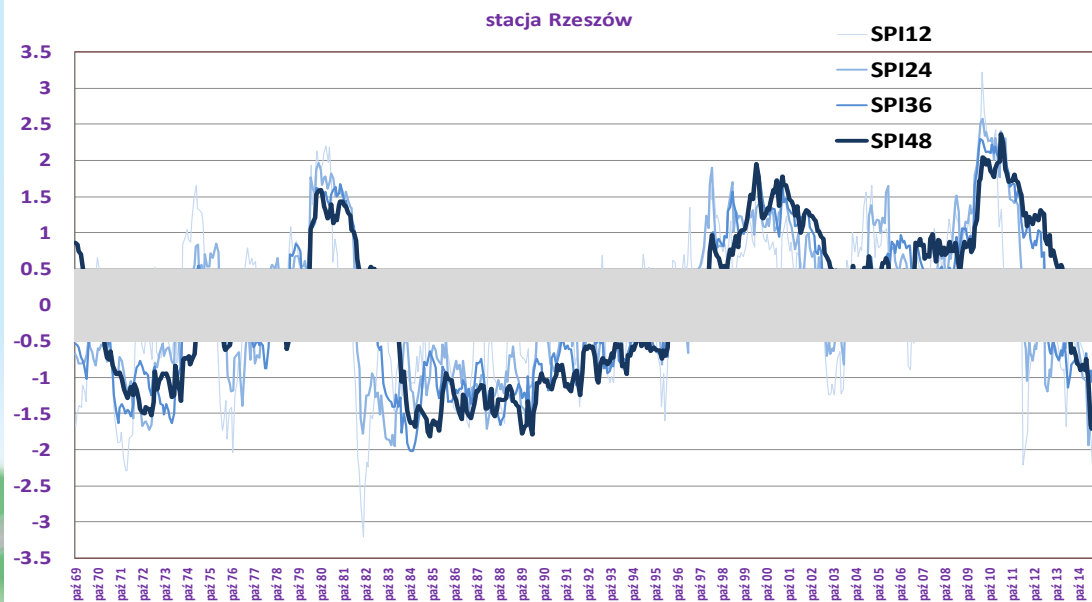
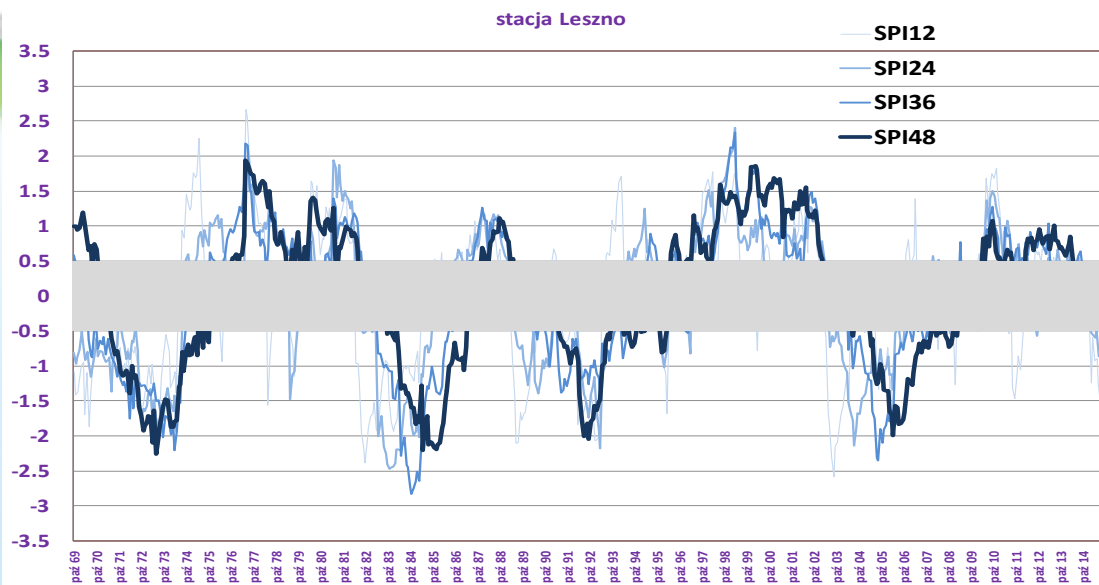


DROUGHT HAZARD PREDICTION – DEVELOPMENT

- 1. Frequency of drought intensity.**
- 2. Regional drought vulnerability.**
- 3. Long-term trends meteorological and hydrological conditions analyses.**
- 4. Integrated hydro-meteorological drought hazard assessment.**



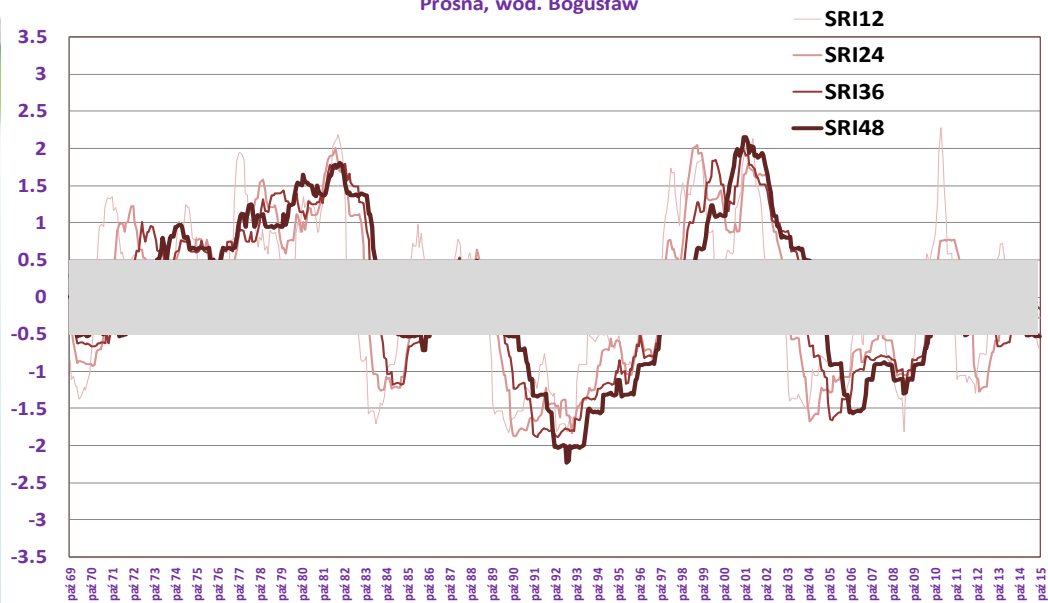
FREQUENCY OF METEOROLOGICAL DROUGHT INTENSITY



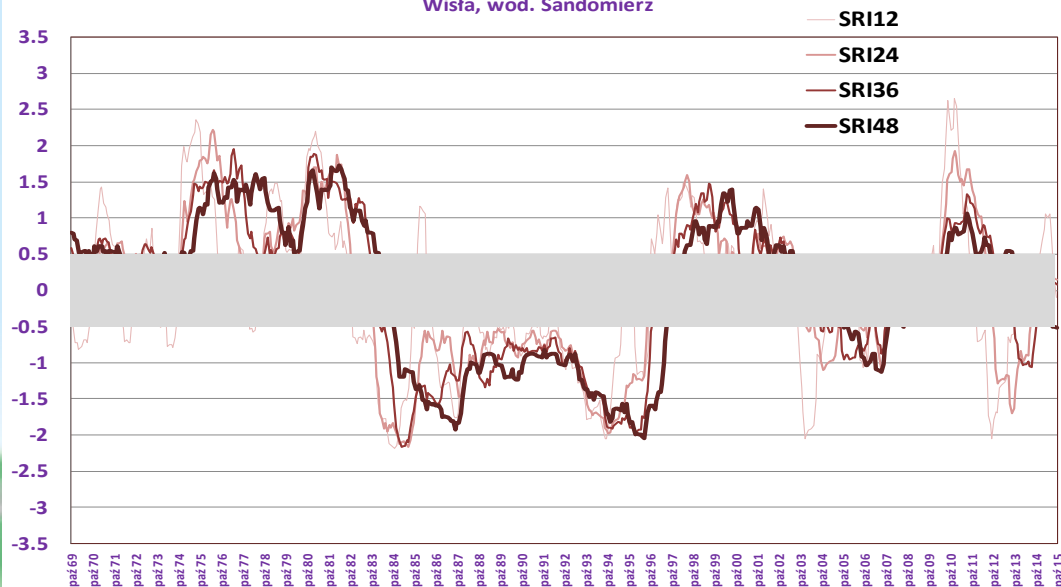


FREQUENCY OF HYDROLOGICAL DROUGHT INTENSITY

Prosna, wod. Bogusław



Wiśła, wod. Sandomierz

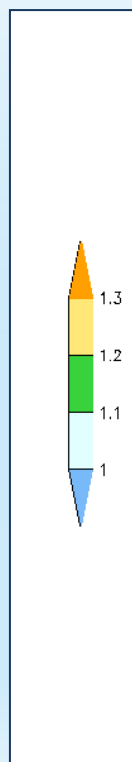
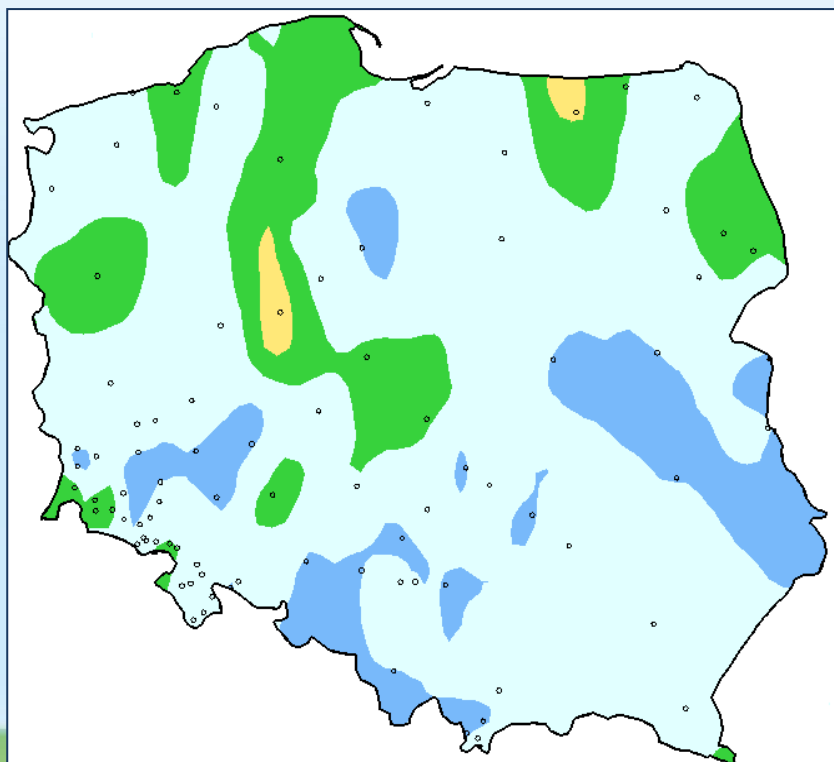




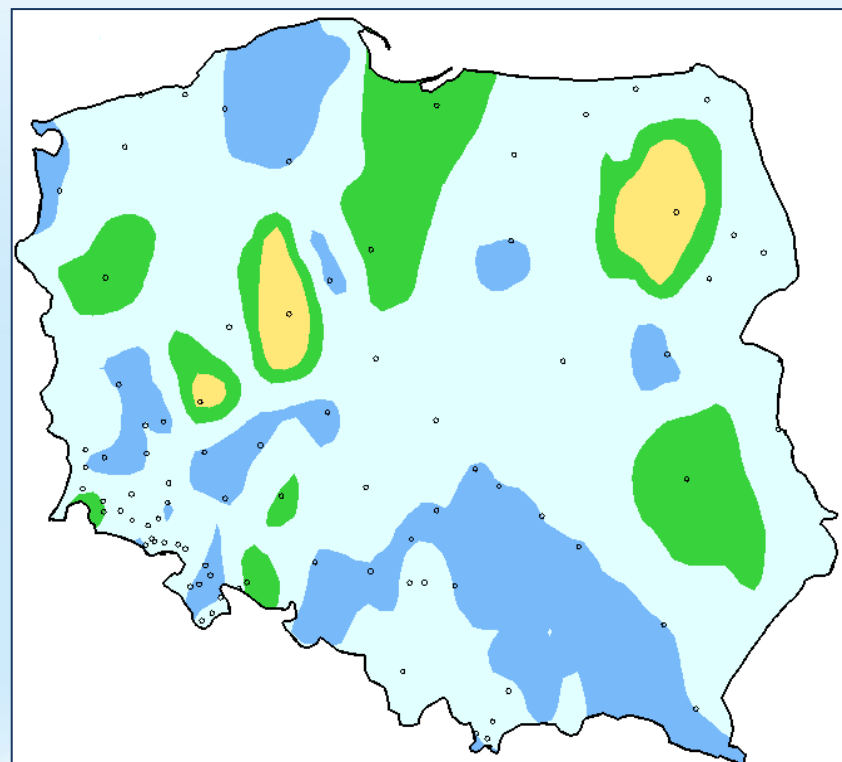
CLIMATOLOGICAL VULNERABILITY

EXPECTED RESIDENCE TIME

SEVERE DROUGHT



EXTREME DROUGHT

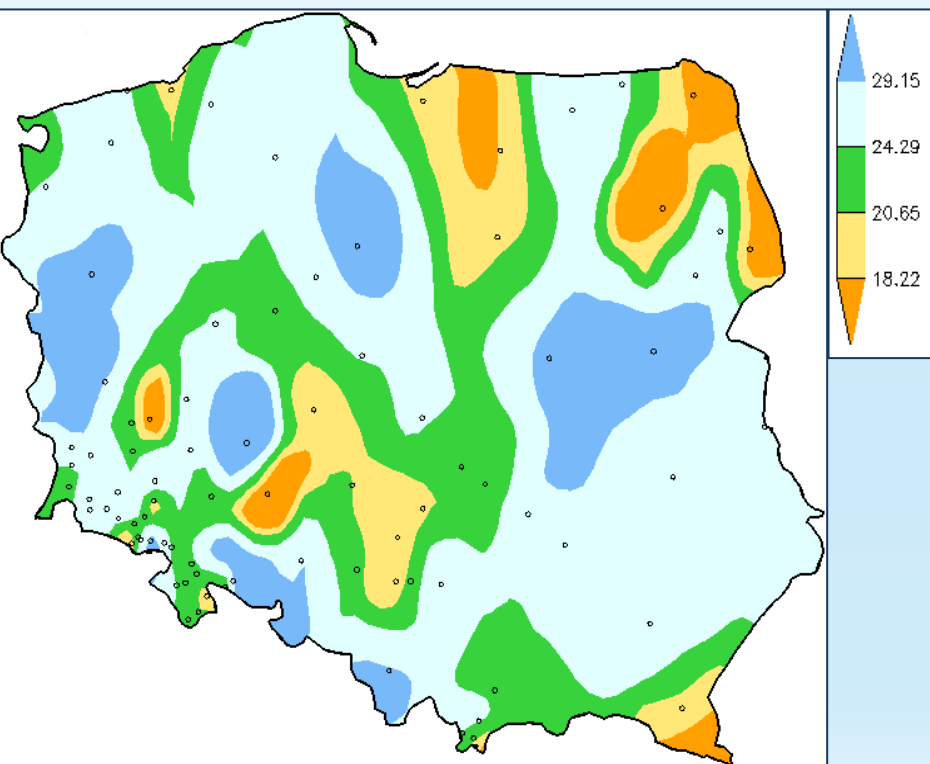




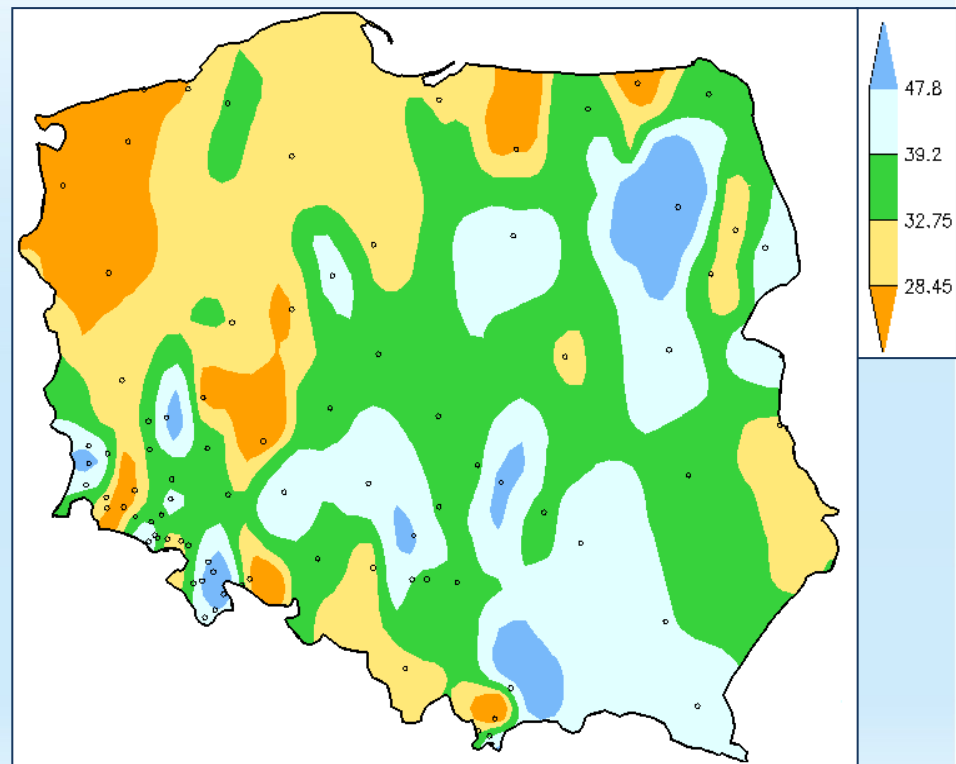
CLIMATOLOGICAL VULNERABILITY

EXPECTED RETURN PERIOD

SEVERE DROUGHT

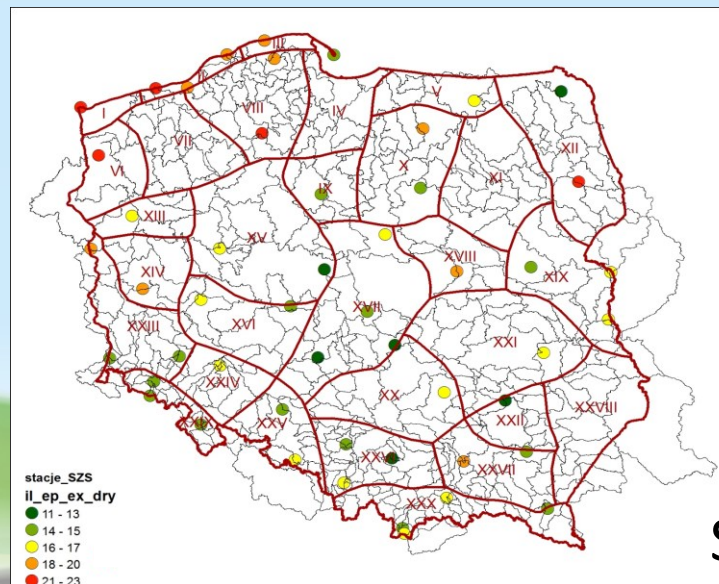
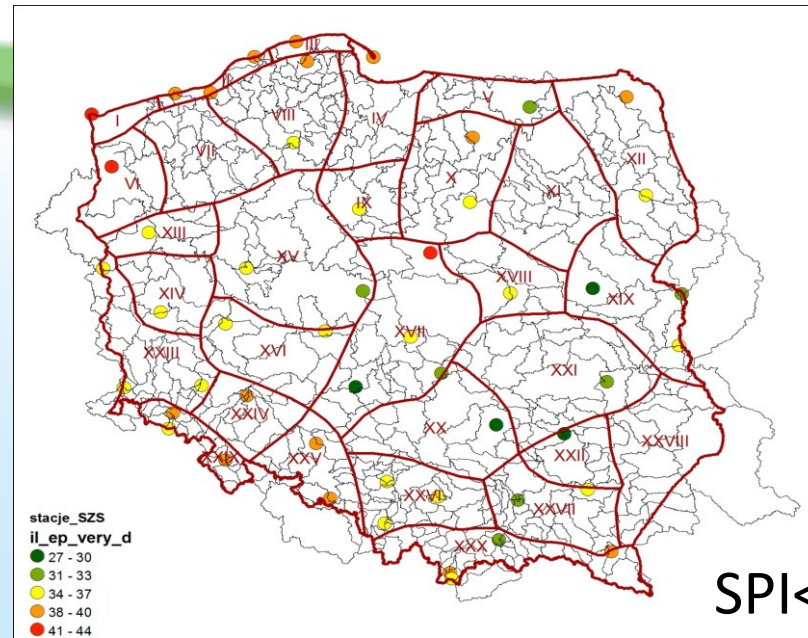
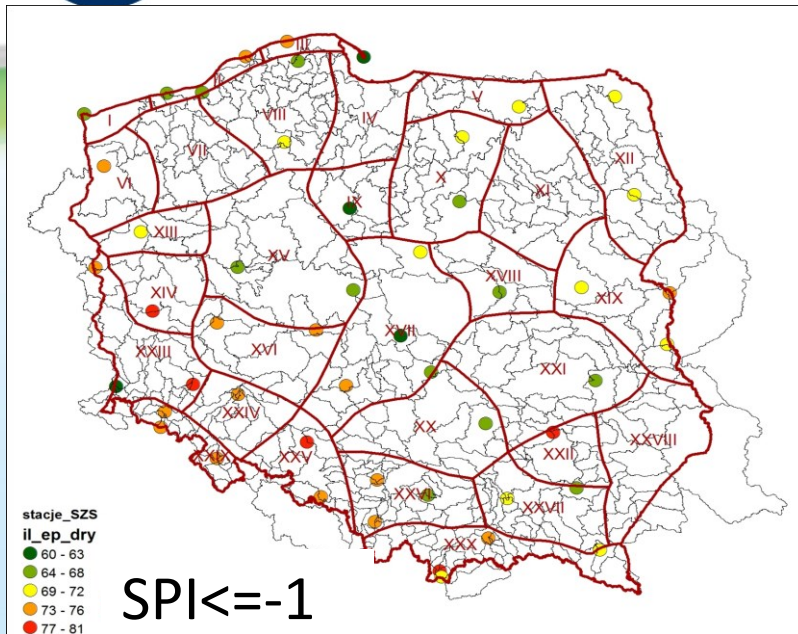


EXTREME DROUGHT





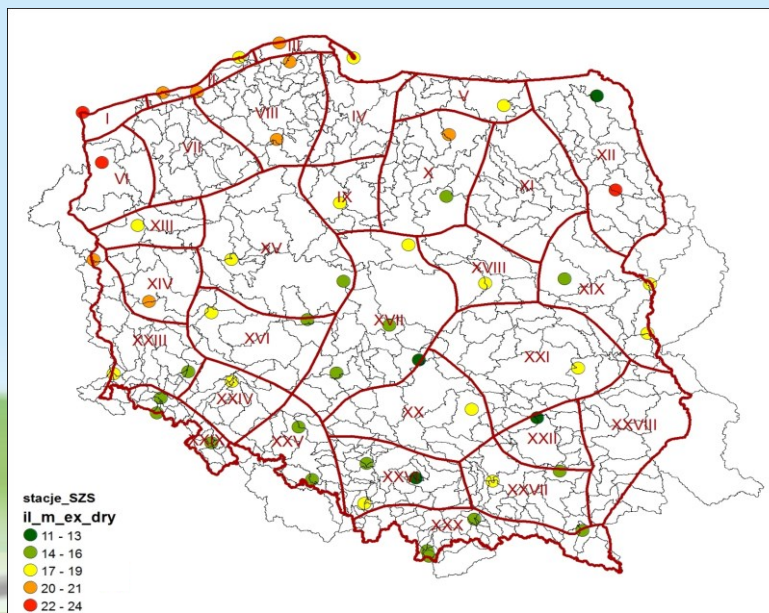
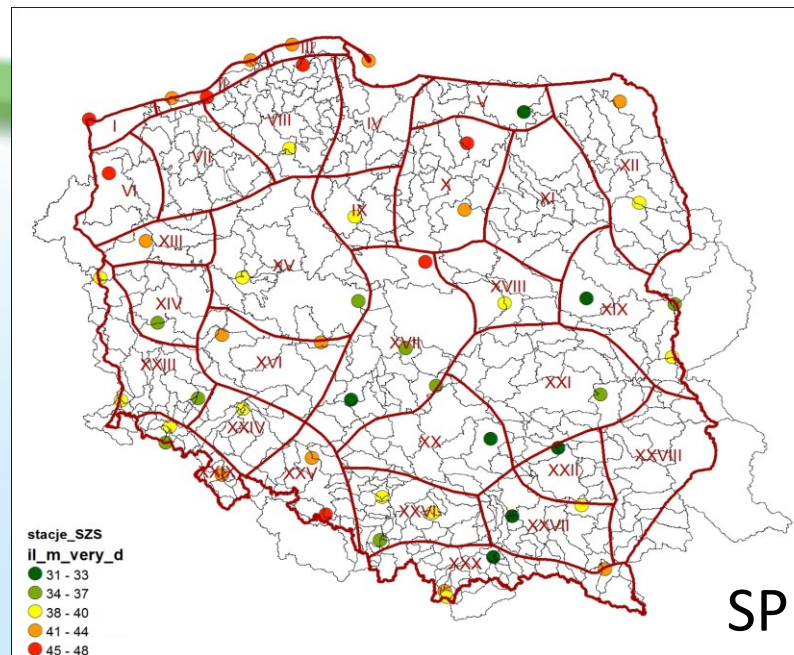
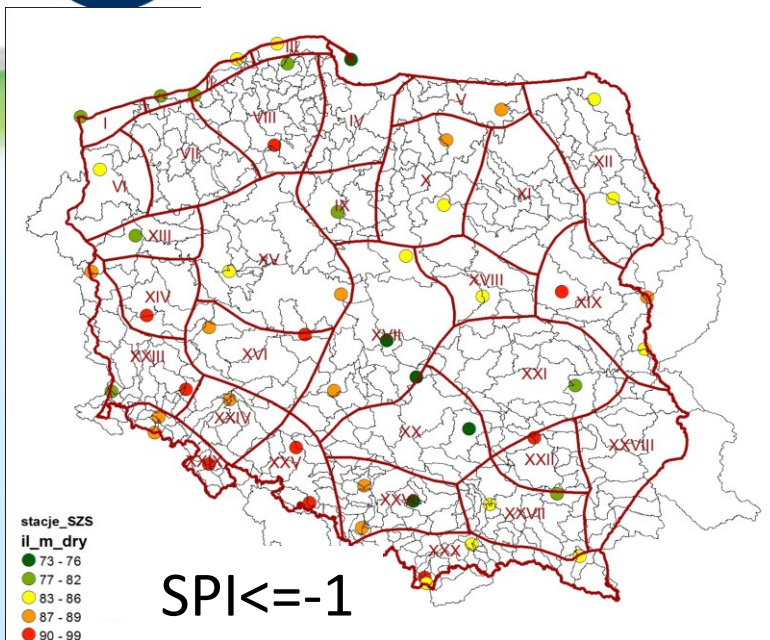
METEOROLOGICAL VULNERABILITY – no of episodes



(1969-2015)



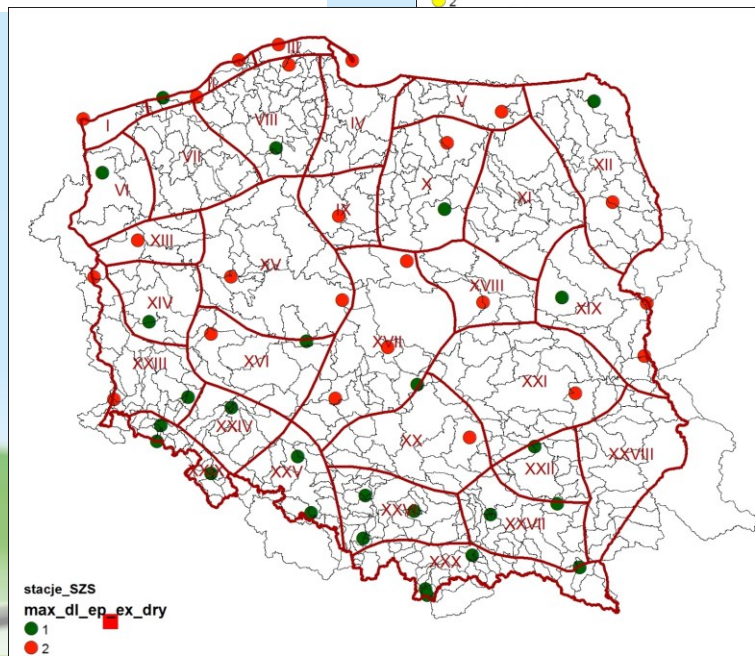
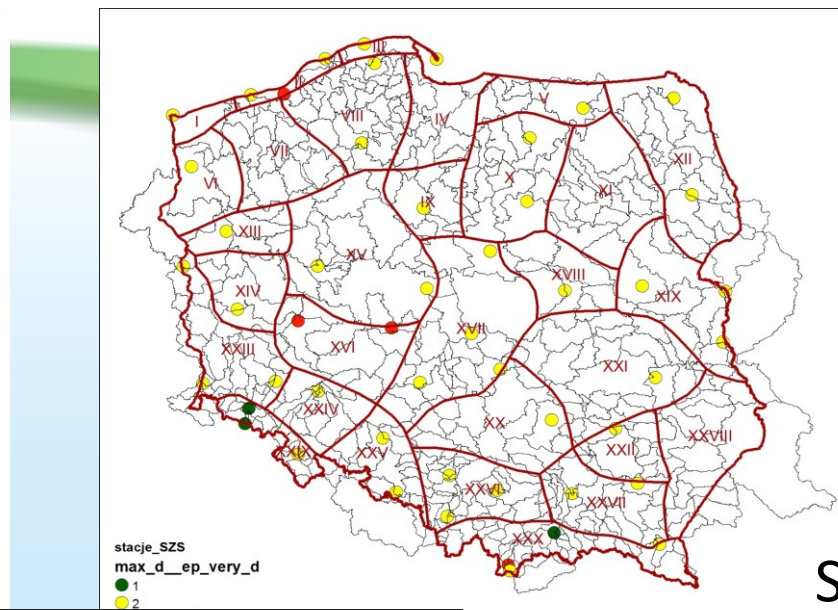
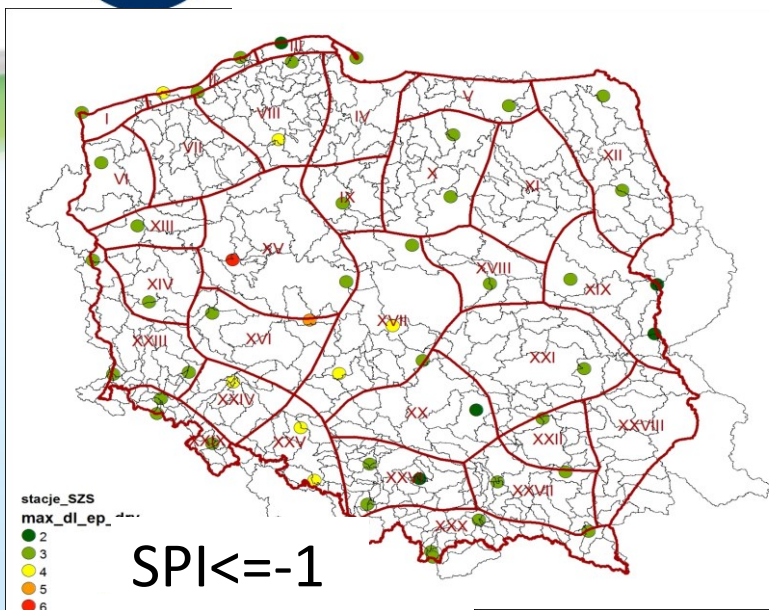
METEOROLOGICAL VULNERABILITY – no of months



(1969-2015)



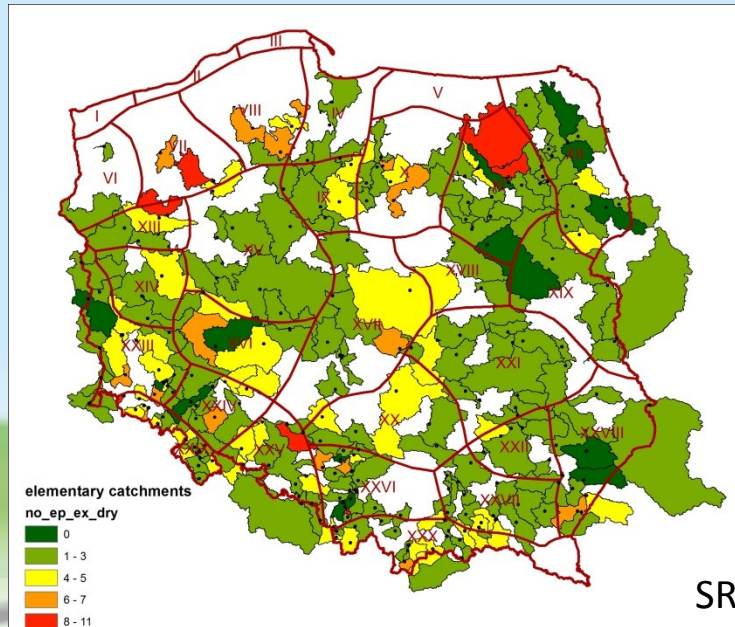
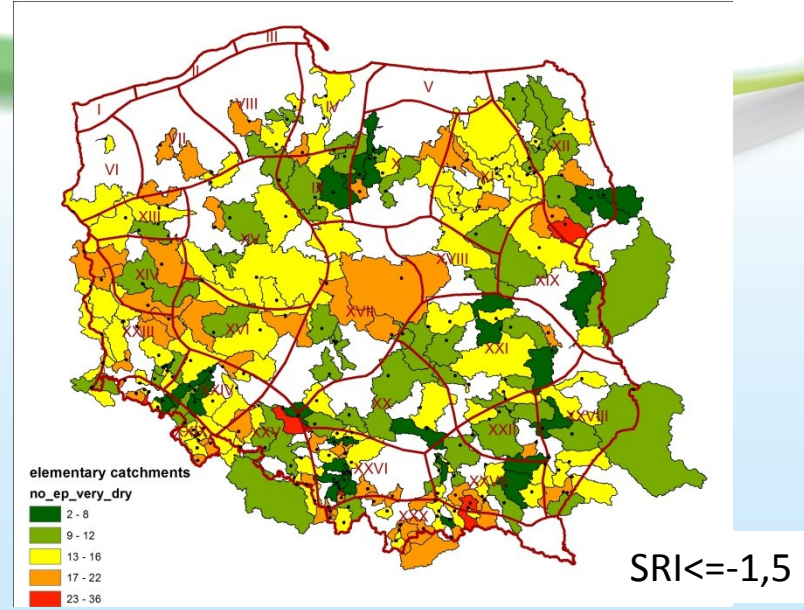
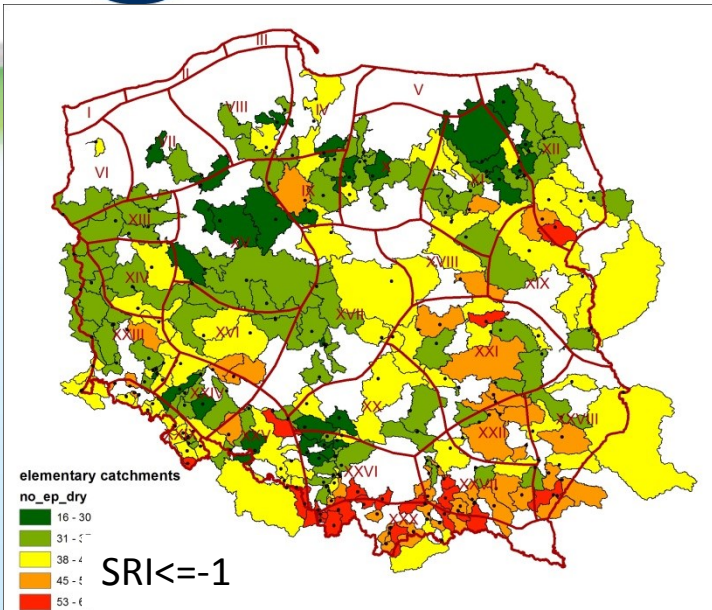
METEOROLOGICAL DROUGHT – max duration



(1969-2015)

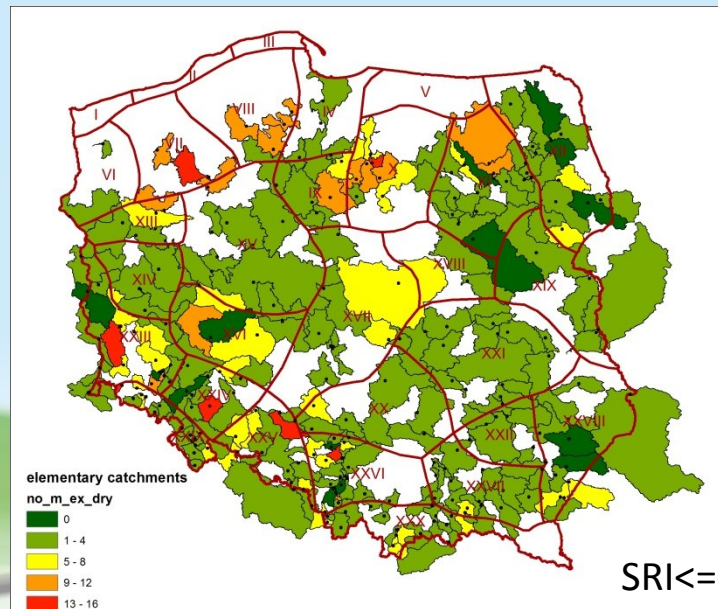
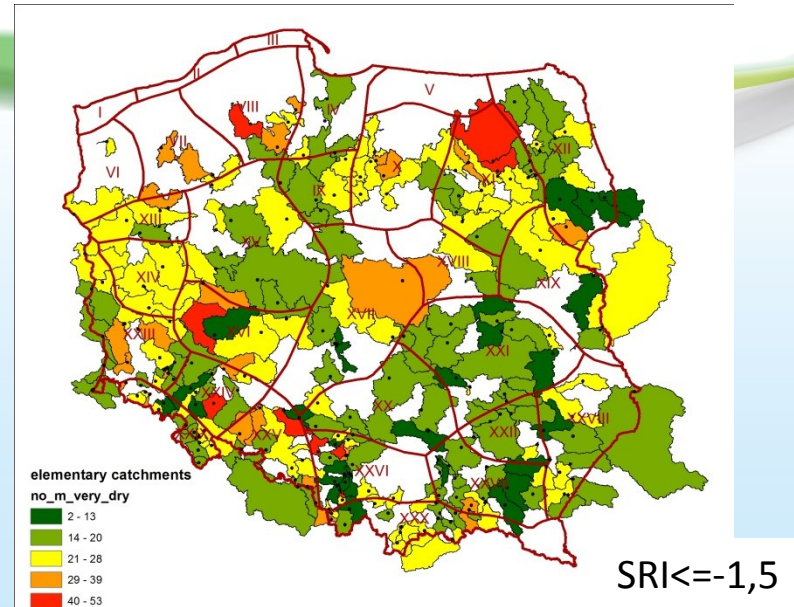
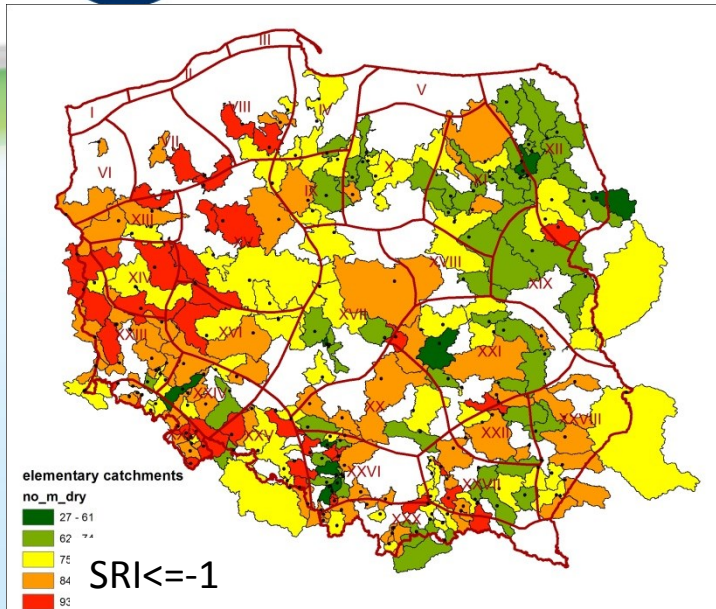


HYDROLOGICAL VULNERABILITY – no of episodes



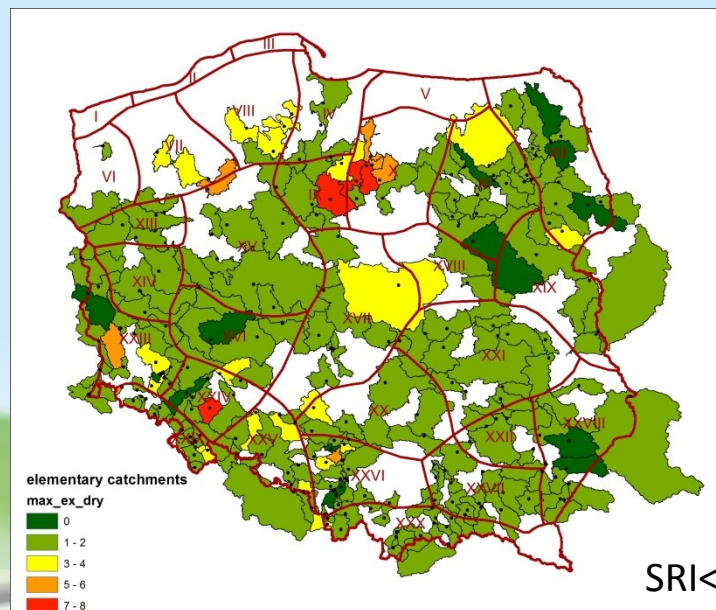
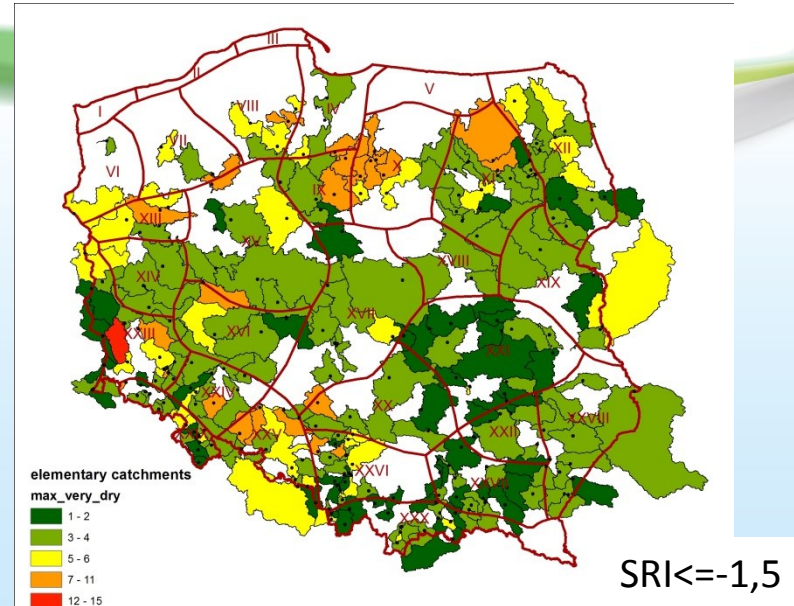
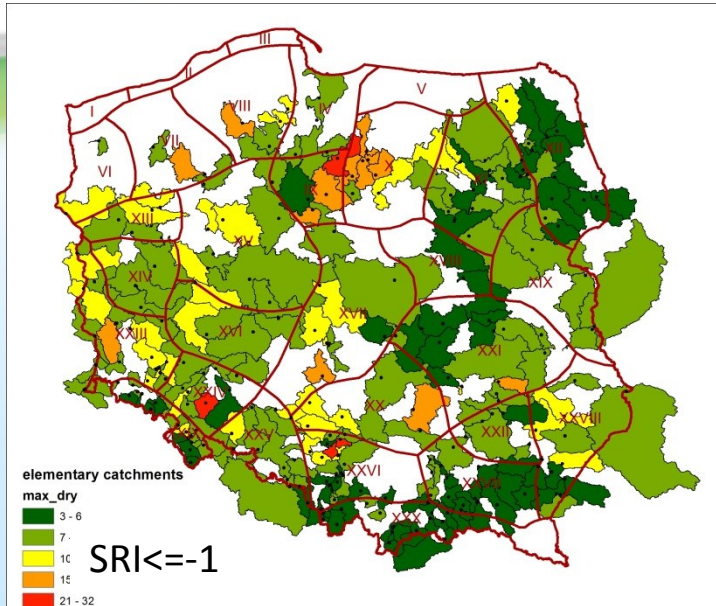


HYDROLOGICAL VULNERABILITY – no of months



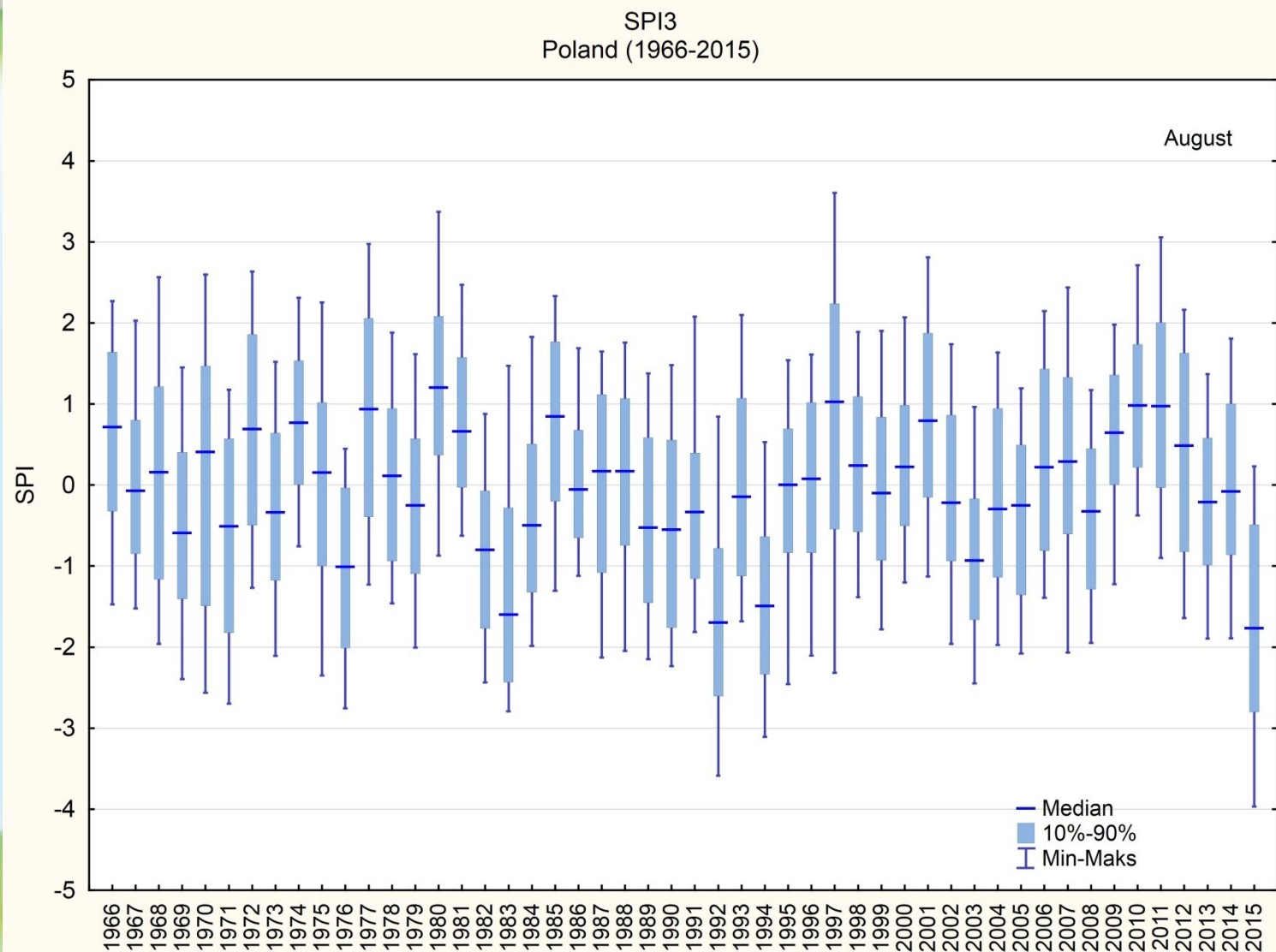


HYDROLOGICAL VULNERABILITY – max duration



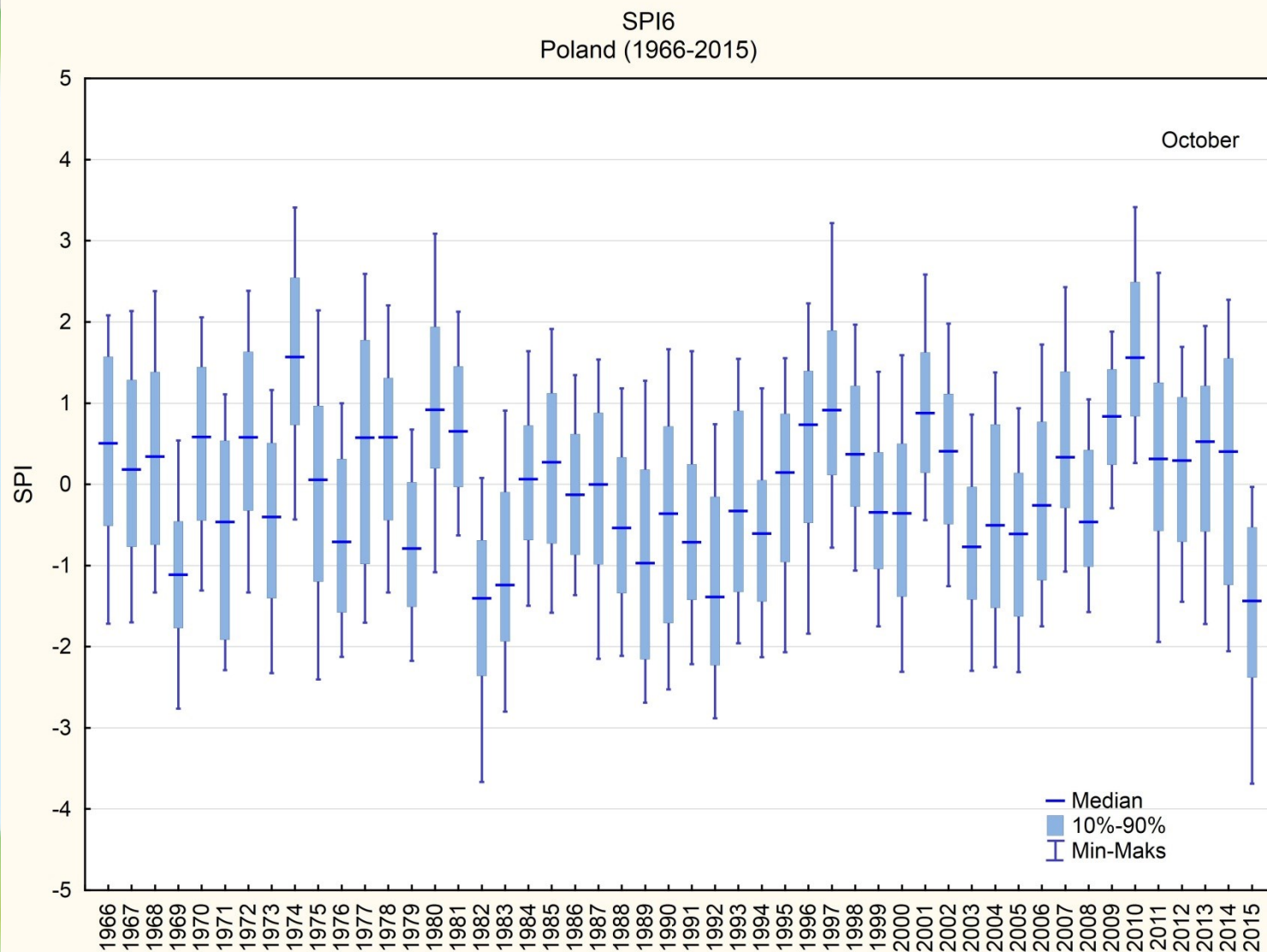


LONG-TERM TRENDS METEO CONDITIONS



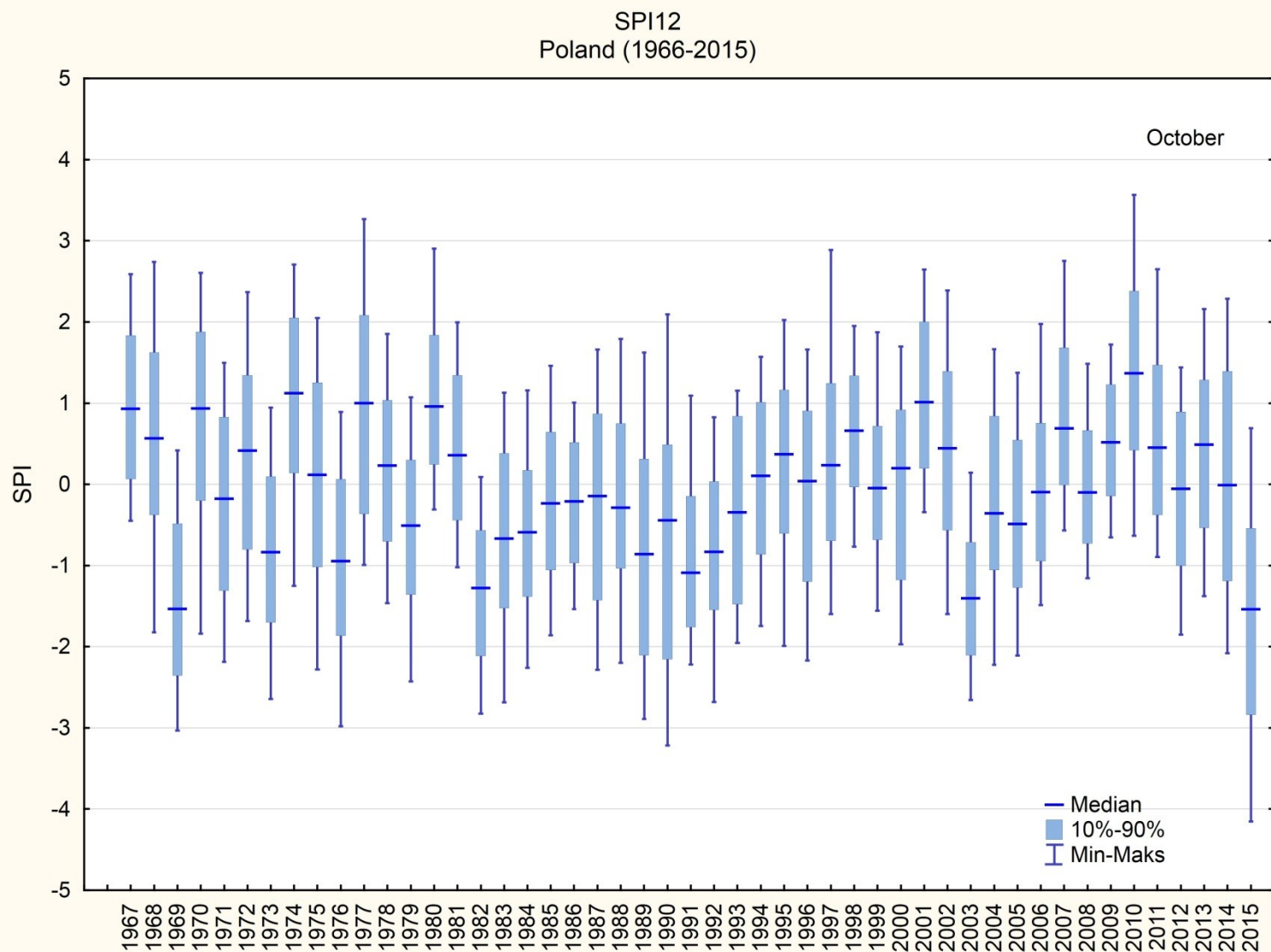


LONG-TERM TRENDS METEO CONDITIONS



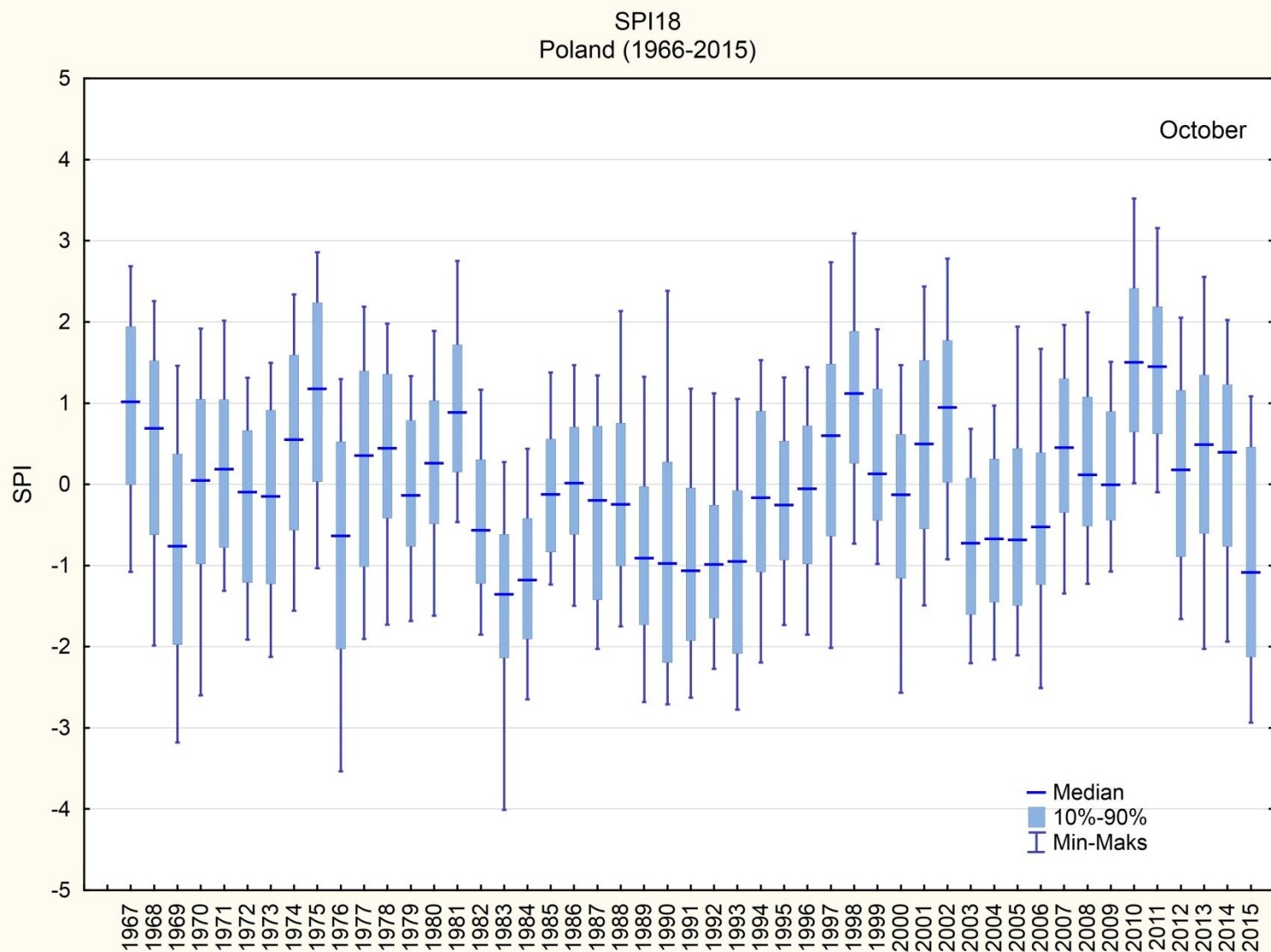


LONG-TERM TRENDS METEO CONDITIONS



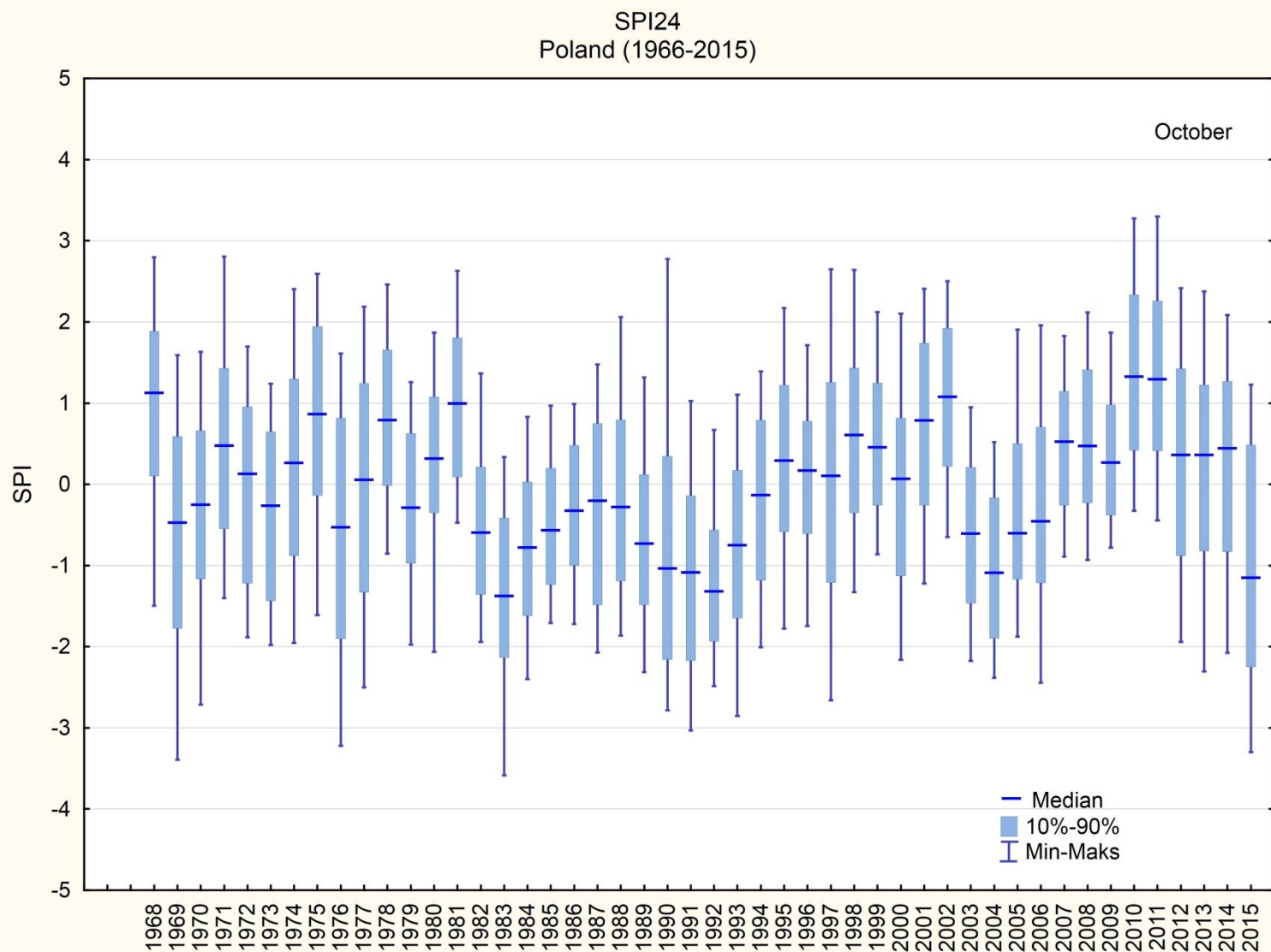


LONG-TERM TRENDS METEO CONDITIONS



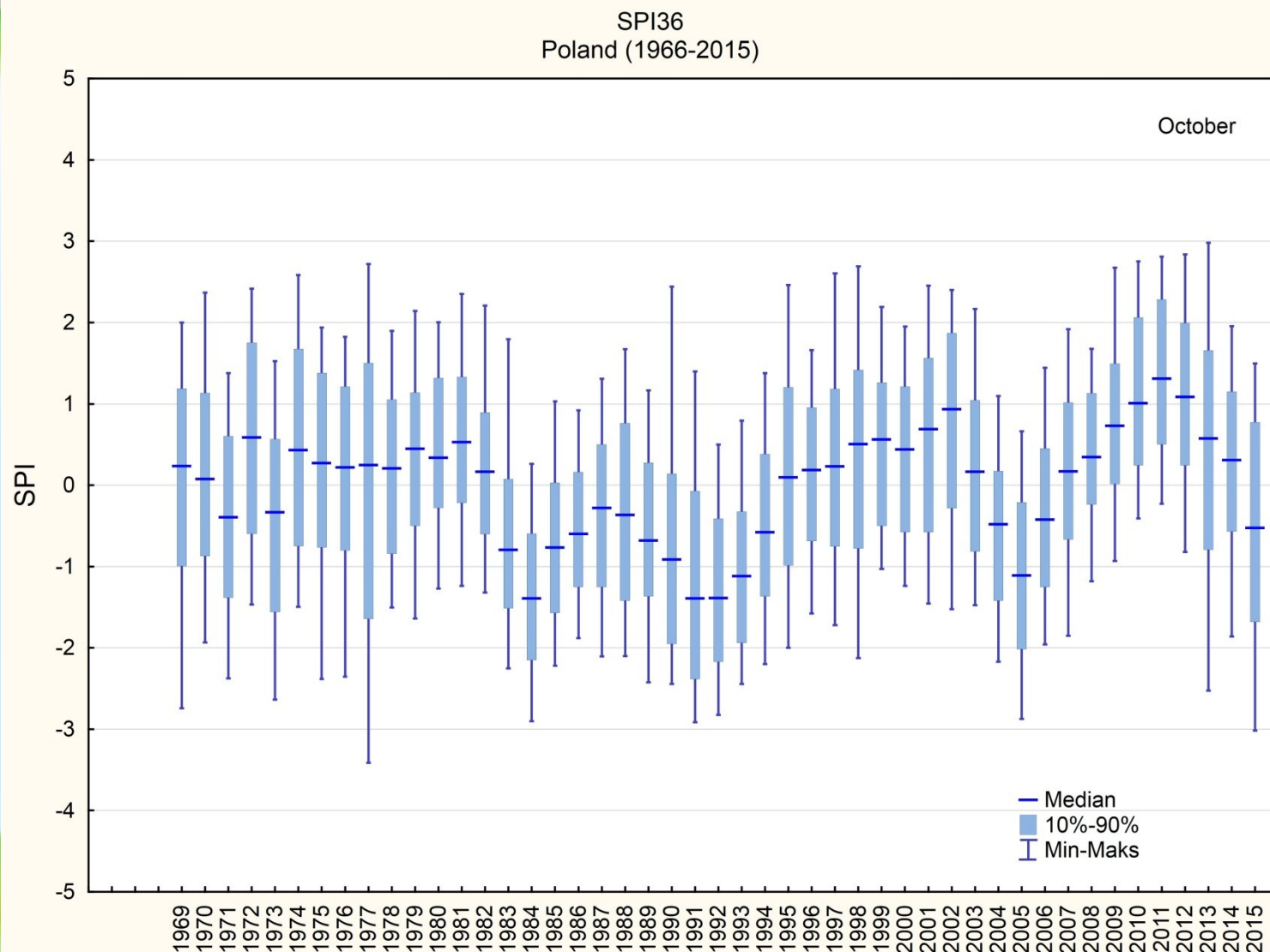


LONG-TERM TRENDS METEO CONDITIONS



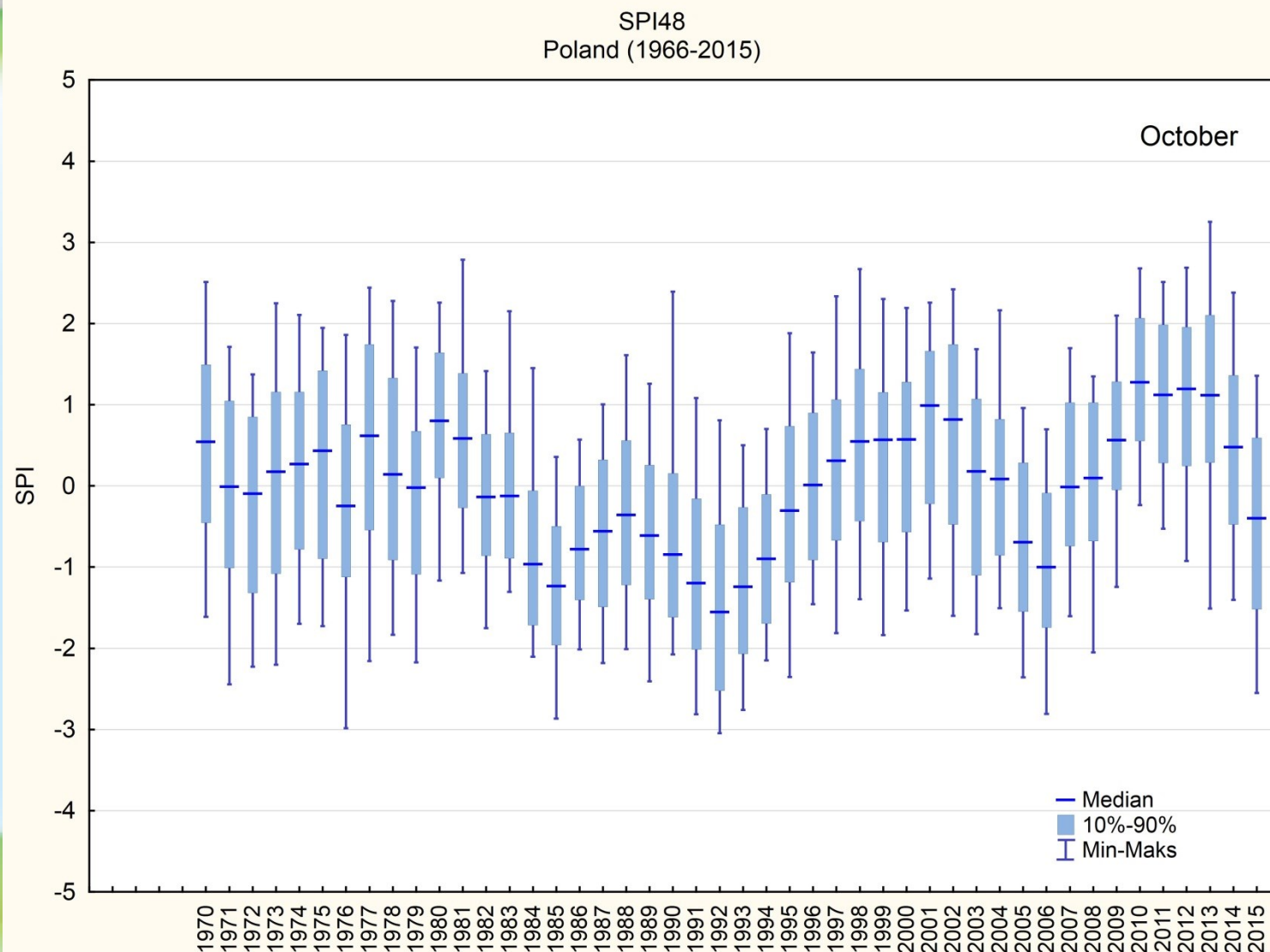


LONG-TERM TRENDS METEO CONDITIONS



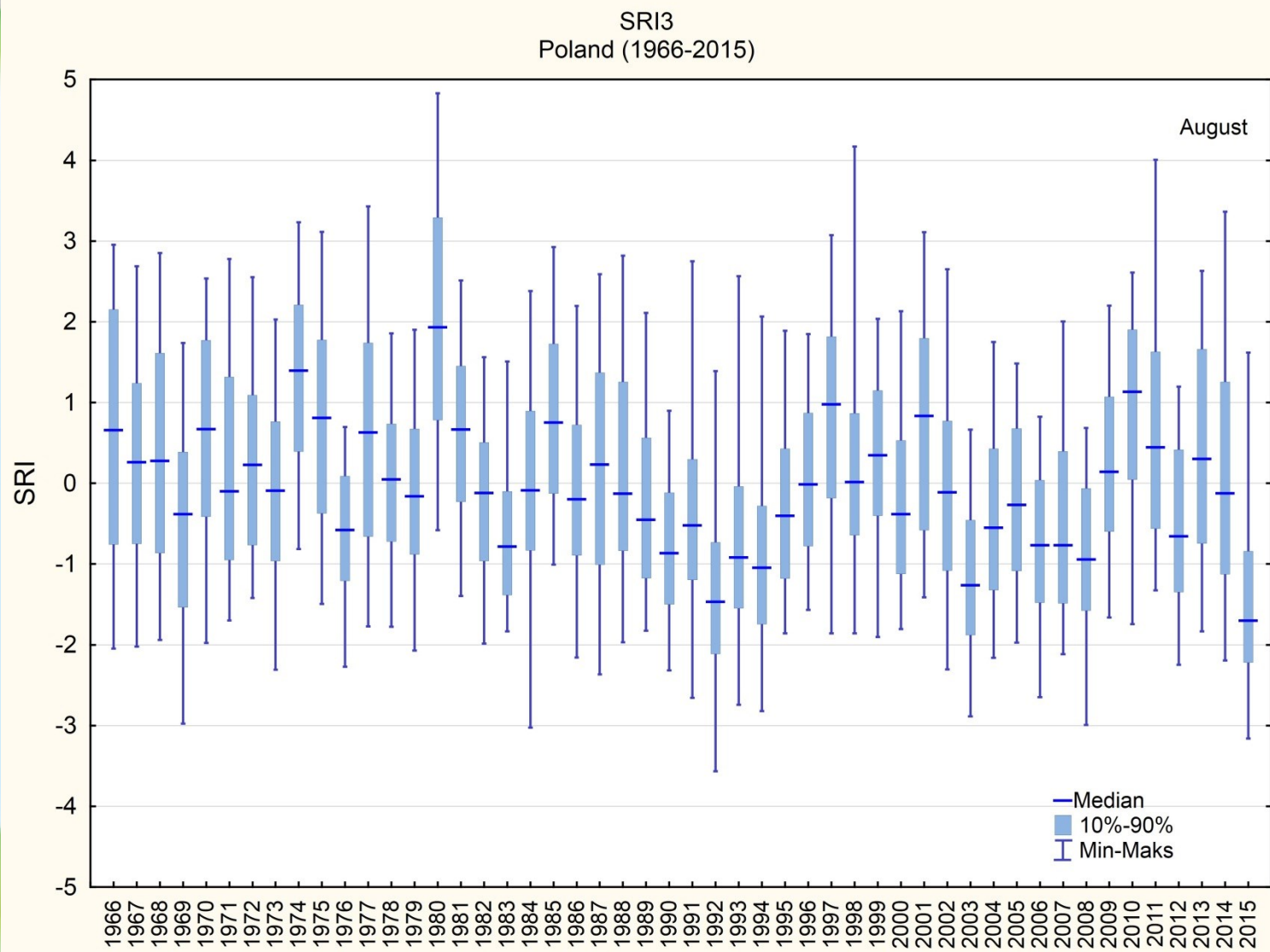


LONG-TERM TRENDS METEO CONDITIONS



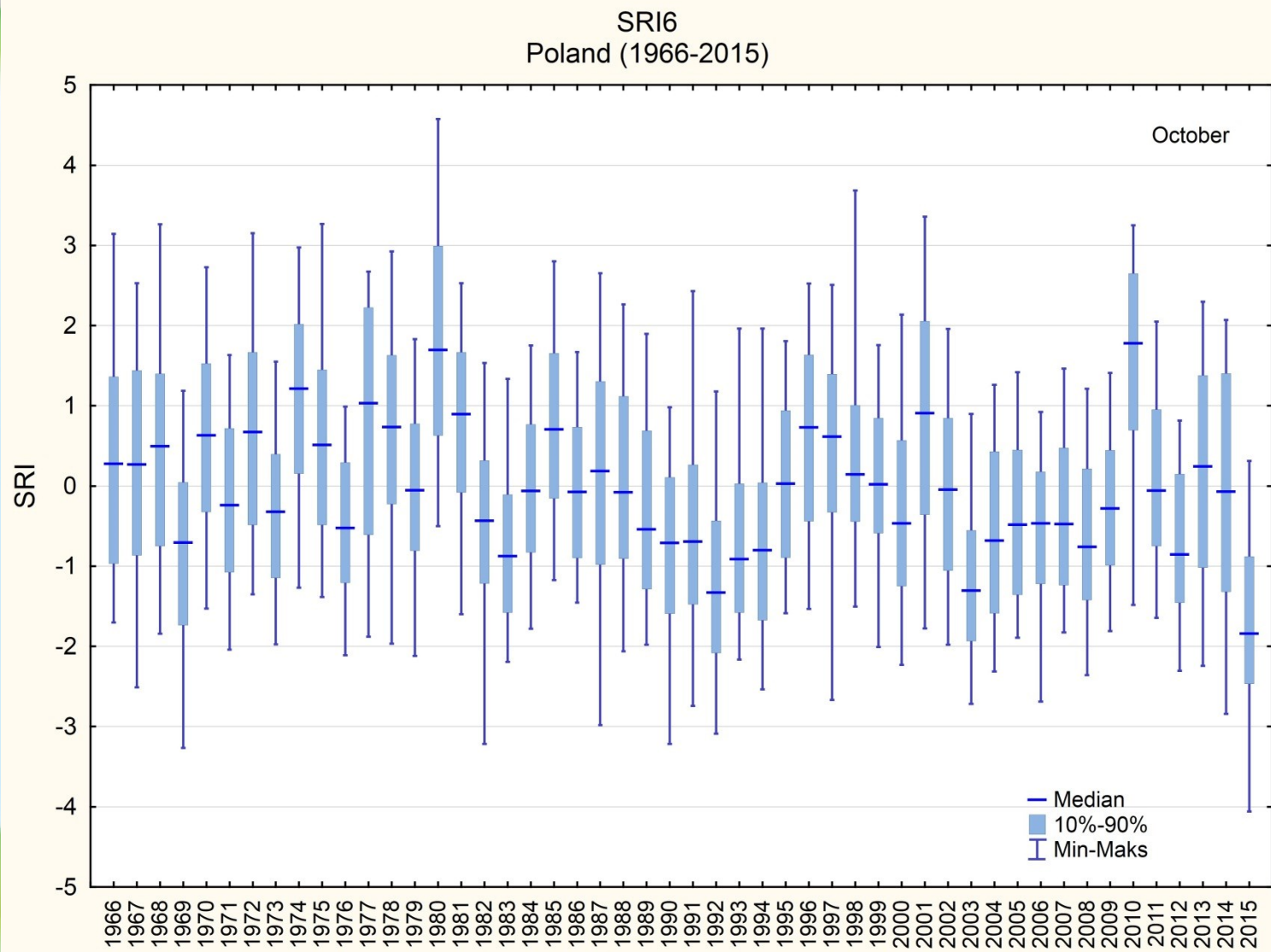


LONG-TERM TRENDS HYDRO CONDITIONS



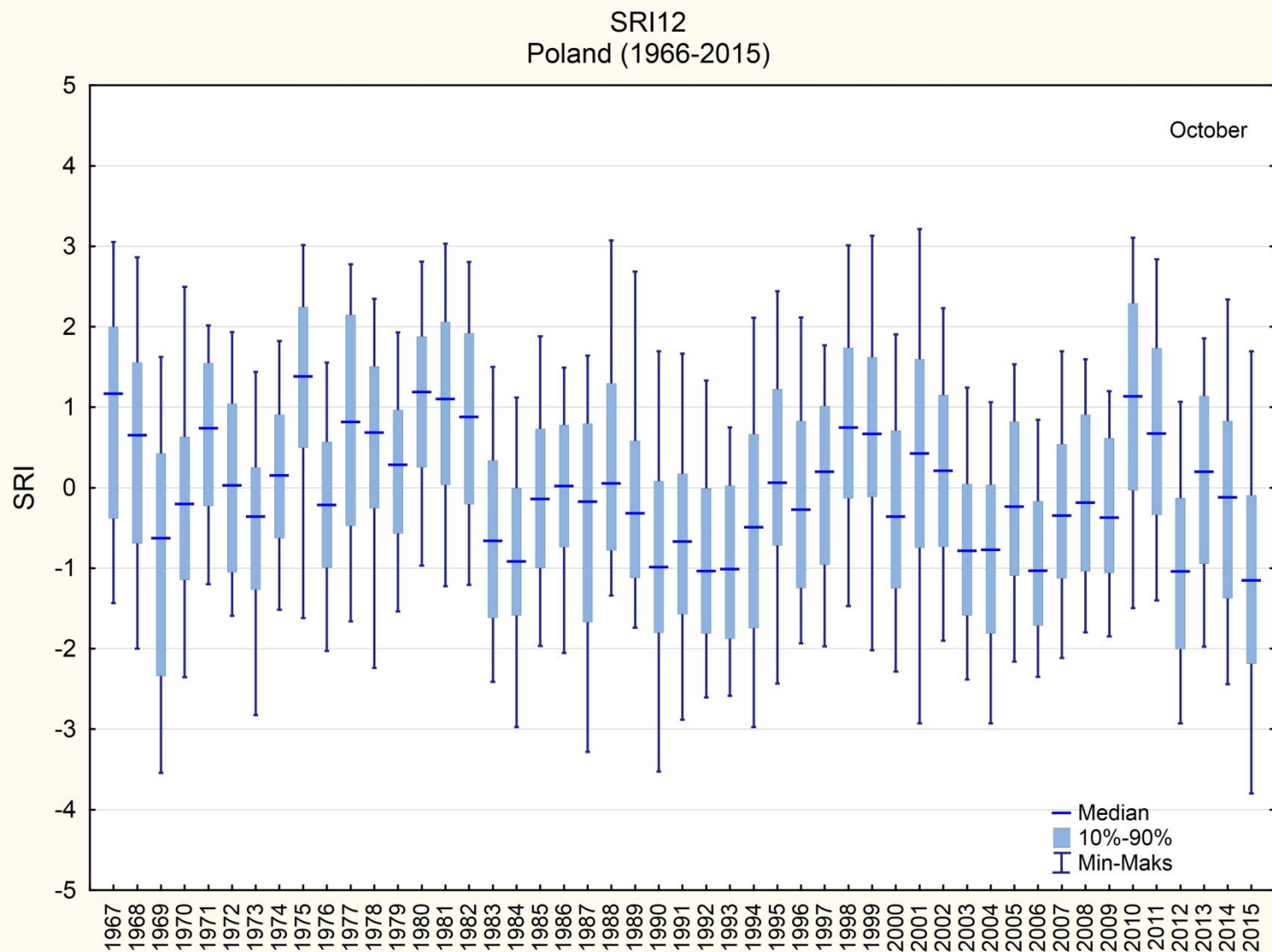


LONG-TERM TRENDS HYDRO CONDITIONS



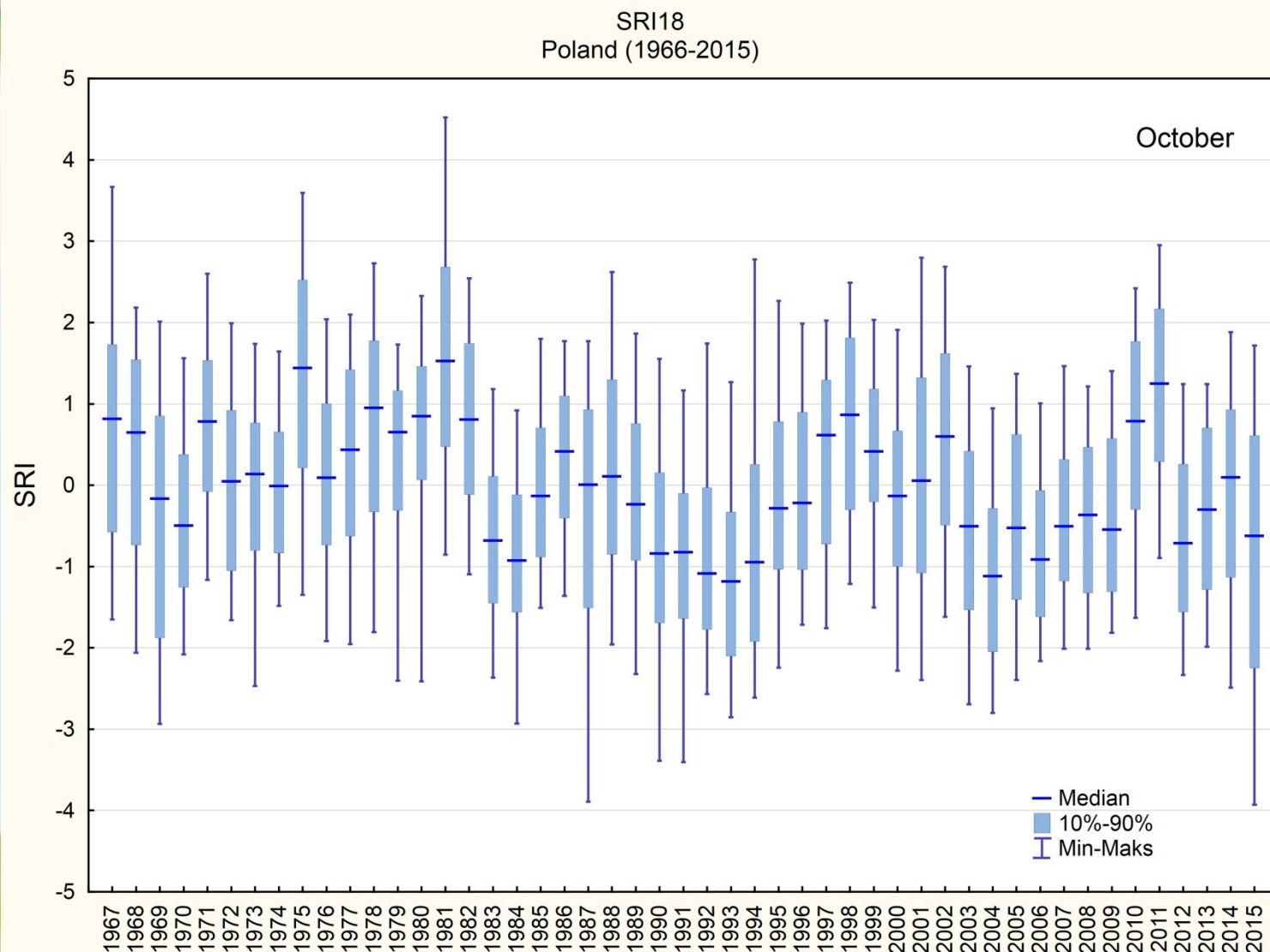


LONG-TERM TRENDS HYDRO CONDITIONS



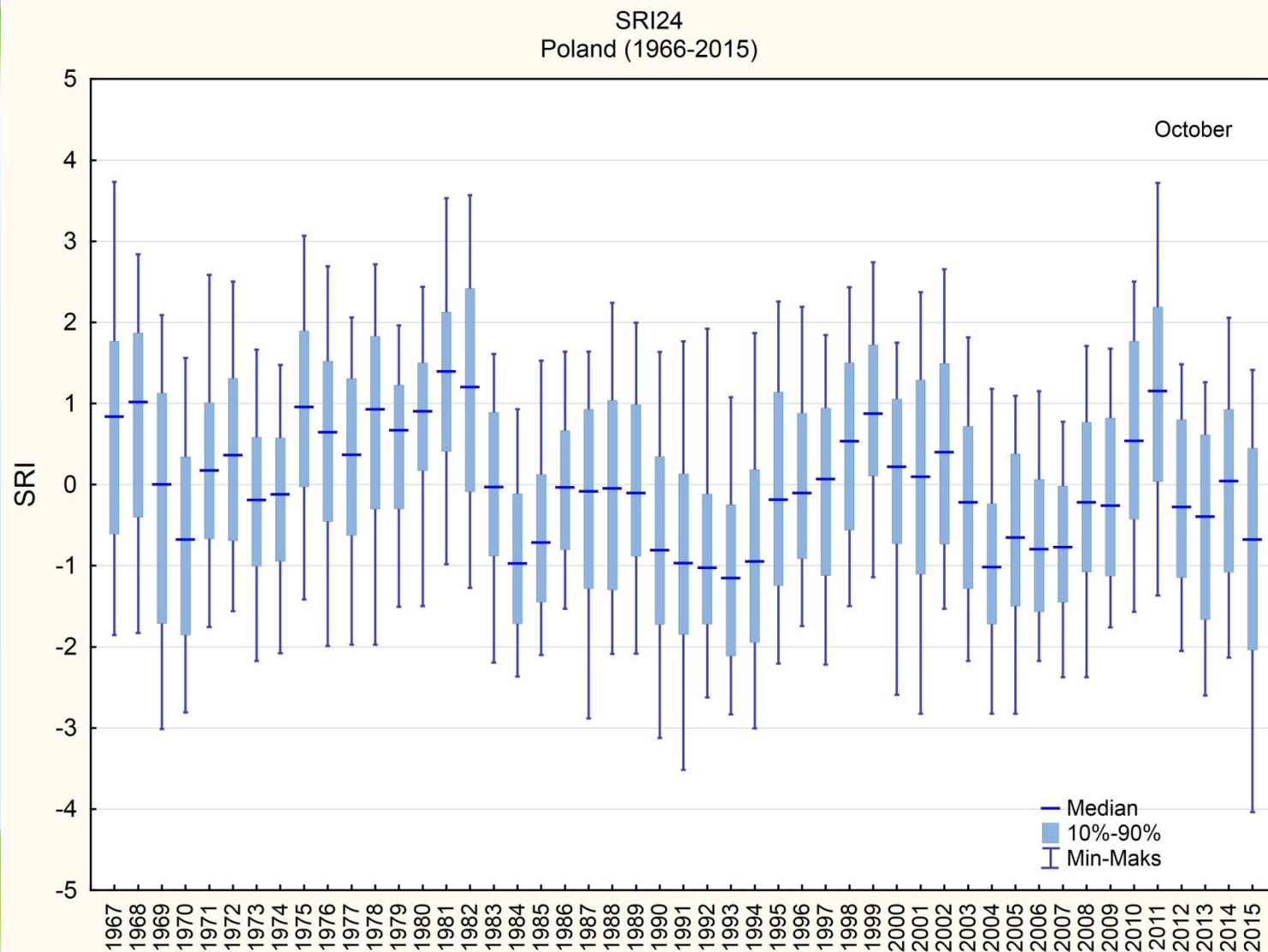


LONG-TERM TRENDS HYDRO CONDITIONS



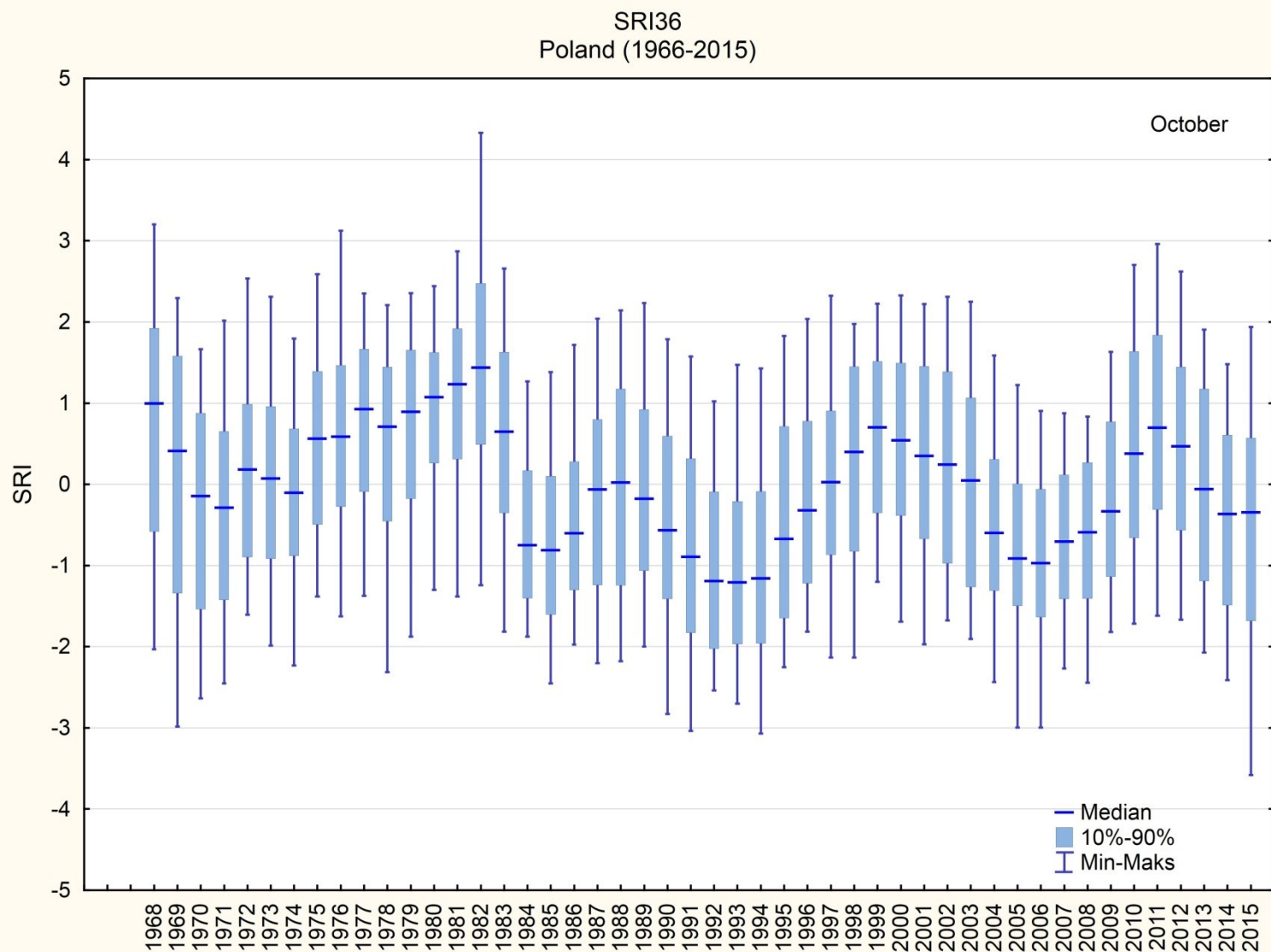


LONG-TERM TRENDS HYDRO CONDITIONS



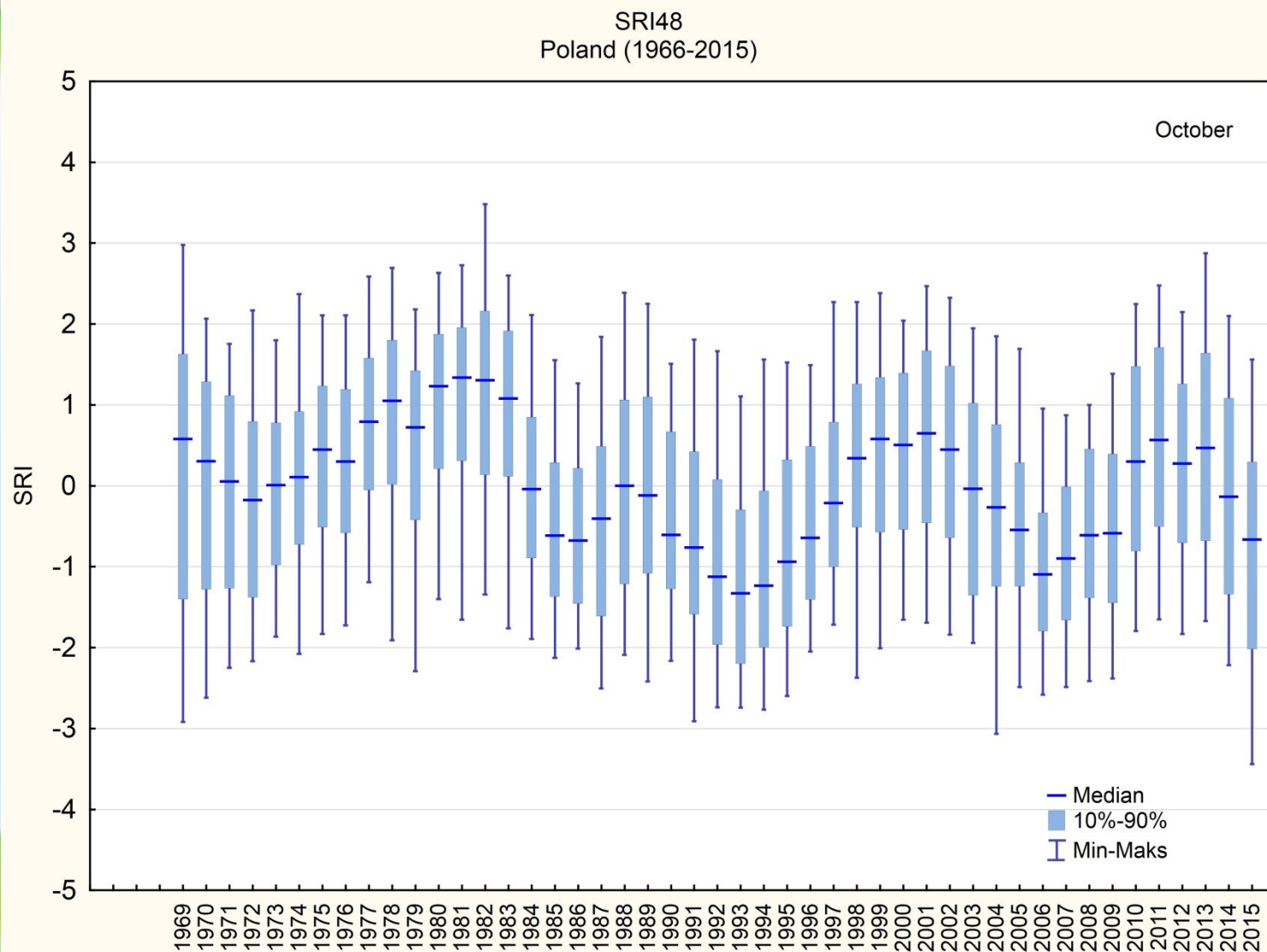


LONG-TERM TRENDS HYDRO CONDITIONS



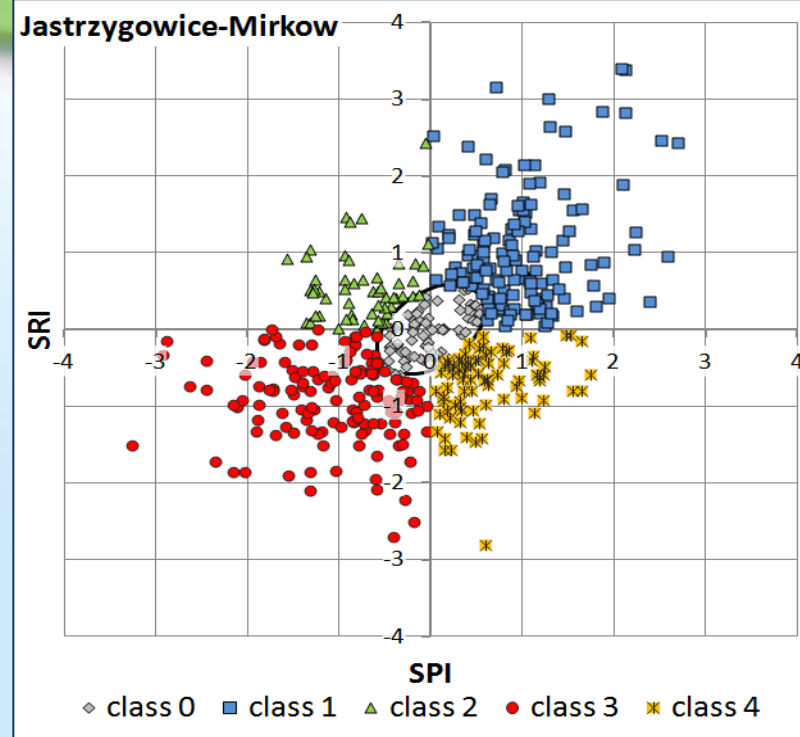
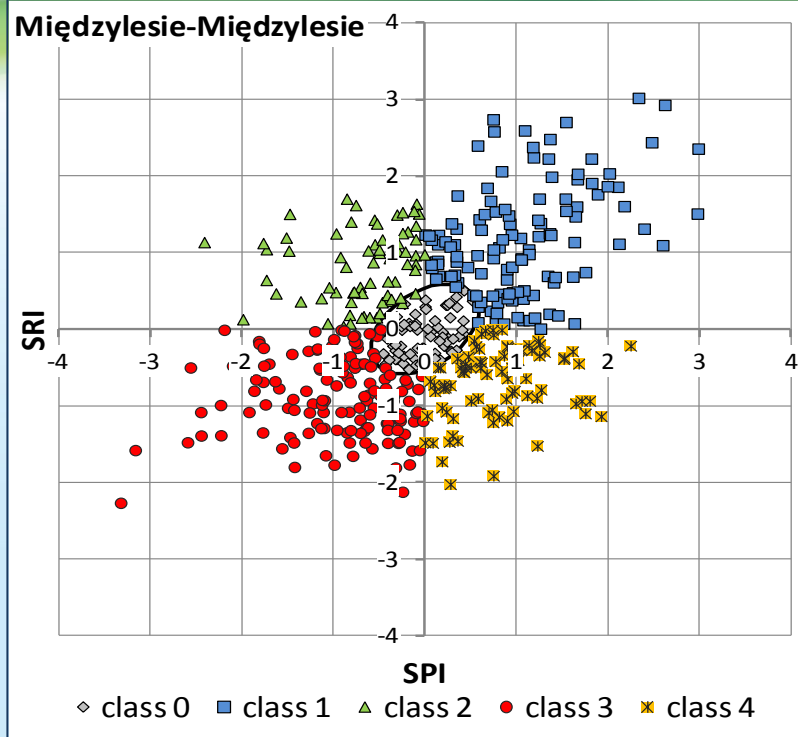


LONG-TERM TRENDS HYDRO CONDITIONS





DROUGHT HAZARD PREDICTION – DEVELOPMENT



CLASS	MOISTURE CONDITIONS	DROUGHT HAZARD
0	normal	none
1	wet meteorological and hydrological	none
2	dry meteorological wet hydrological	meteorological drought
3	dry meteorological and hydrological	meteorological and hydrological drought
4	wet meteorological dry hydrological	hydrological drought



PROJECTS

1. *Assessment of hydrological characteristics of Polish territory during different climatic conditions as within the project Hydrological Cycle of the CADSES Regions **HYDROCARE** (2006-2008).*
2. *Climate change impact on the environment, economy and society, acronym **KLIMAT** (POIG.01.03.01-14-011/08) (2008-2010):*
 - ✓ *Operational hydrological drought forecasting and its implementation **POSUCH@**,*
 - ✓ *Drought occurrence in Poland and the scale of threat,*
 - ✓ *Identification of areas especially threatened by water deficits, evaluation of water management rules in case of drought based on water balance models.*
3. *Drought Risk Management Scheme: a decision support system in: Integrated Drought Management Programme for Central and Eastern Europe (IDMP CEE) - a joint initiative of the World Meteorological Organization (WMO) and the Global Water Partnership (2012-2015).*



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National Research Institute

THANK YOU FOR ATTENTION

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