

Federal hydrometeorological institute of Bosnia and Herzegovina
www.fhmzbih.gov.ba

Sabina Hodžić, Head of the Sector for applied meteorology
Nedžad Voljević, Head of the Agrometeorology department



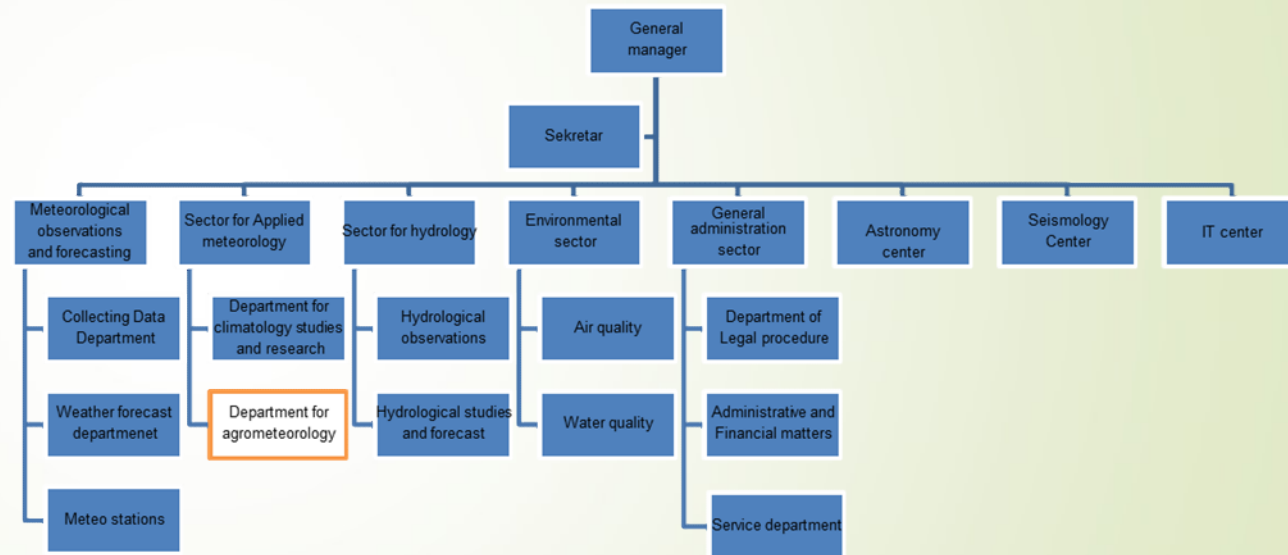
Agricultural meteorology – current state,
on-going projects, future activities

Department of agrometeorology, within the Sector for applied meteorology

Roles and responsibilities

- systematic observation and monitoring of hydrometeorological parameters;
- processing and analysis of agrometeorological data, providing and publishing information, forecasts, products and services related to the weather, climate and water,
- the derivation of drought-relevant parameters, indices and indicators,
- permanent monitoring and analysing of actual meteorological conditions and making of: seven-day, decade and monthly agrometeorological bulletins and annual analyses, agrometeorological information, analyses and warnings.

Federal Hydrometeorological Institute (organization chart)



Agrometeorological and phenological stations in Federation of Bosnia and Herzegovina (network)

All these stations and phenological gardens are located on or very close to the main meteorological stations



Agrometeorological products

➤ SEVEN - DAYS AGROMETEOROLOGICAL BULLETIN AND FORECAST

- The assessment of the influence of expected weather according to the short medium range weather forecast in the forthcoming period on the crop performance and field work operations
- www.fhmzbih.gov.ba/agrometeorology.php

➤ TEN-DAYS PRODUCT INCLUDE:

- Climatological summary of temperature, rainfall, vegetation conditions for 11 station
- Weekly and on demand agrometeorological forecasts

➤ MONTHLY BULLETIN

- Analysis and assessment of growth and development conditions and agriculture crop
- Performance during the month on the basis of the value of agrometeorological parameters and crop needs in given development phases

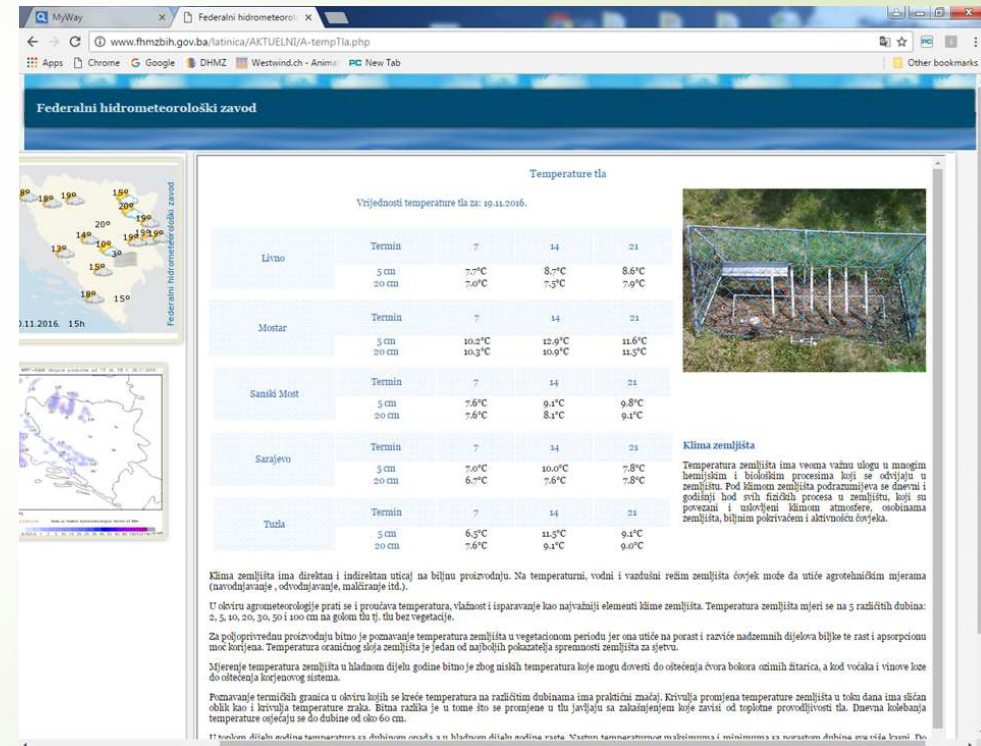
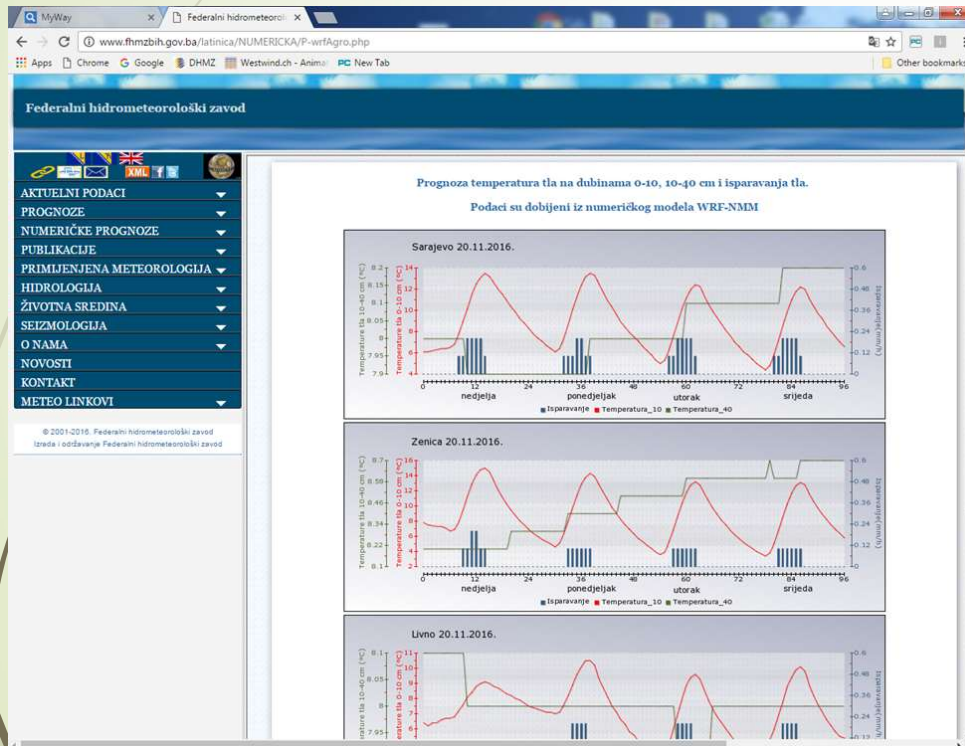
➤ WARNING OF SEVERE AGROMETEOROLOGICAL PHENOMENA

➤ IMPACT STUDIES AND APPLIED RESEARCHES

Products from agrometeorological department

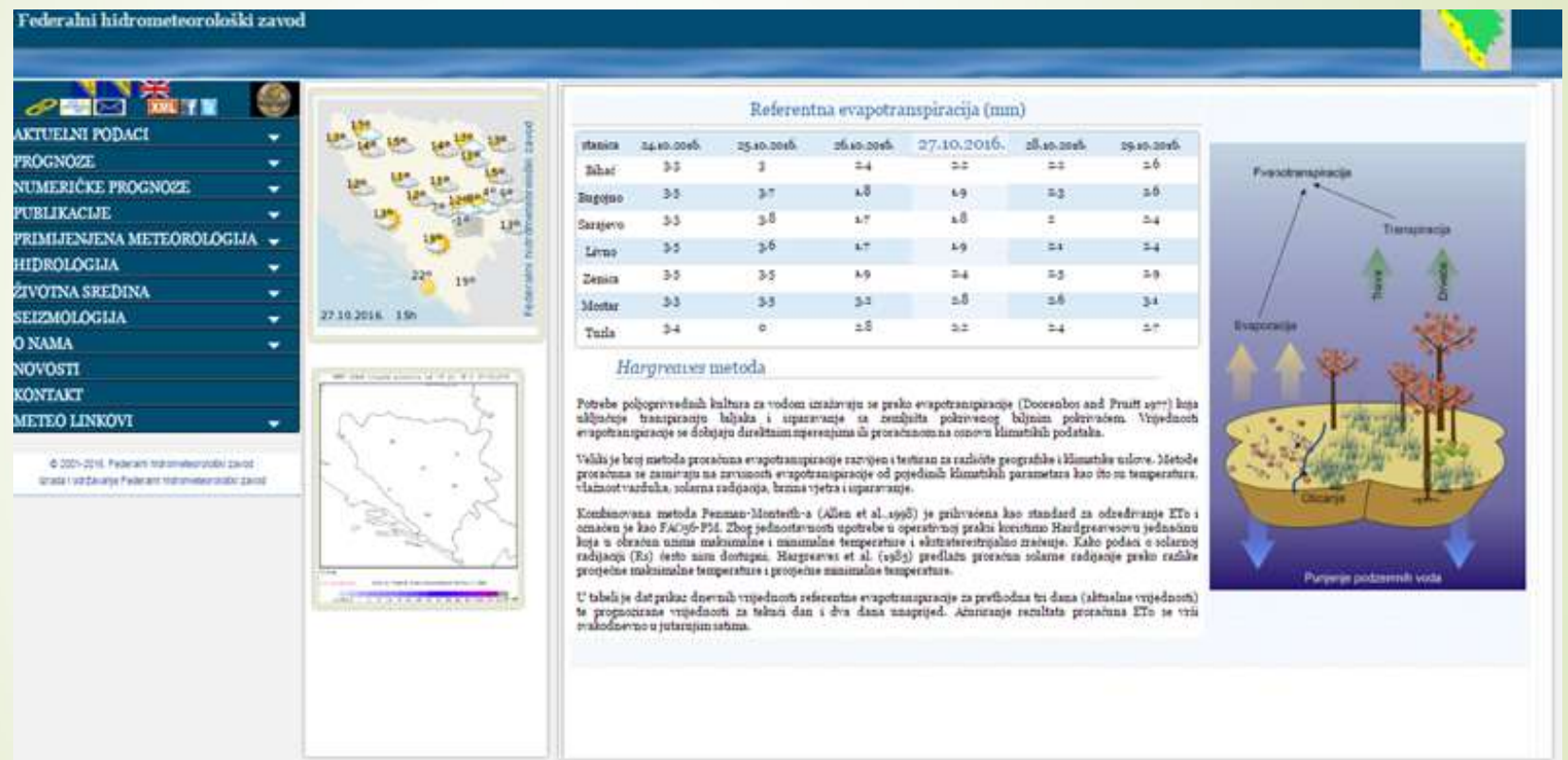
Soil temperature measurements

Soil monitoring and forecast



Evapotranspiration, values for past three days, current day and forecast for next two days, also presented on the official website.

Update of Eto is on daily base.



Due to simplicity and easy calculation, we use Hardgreaves equation.

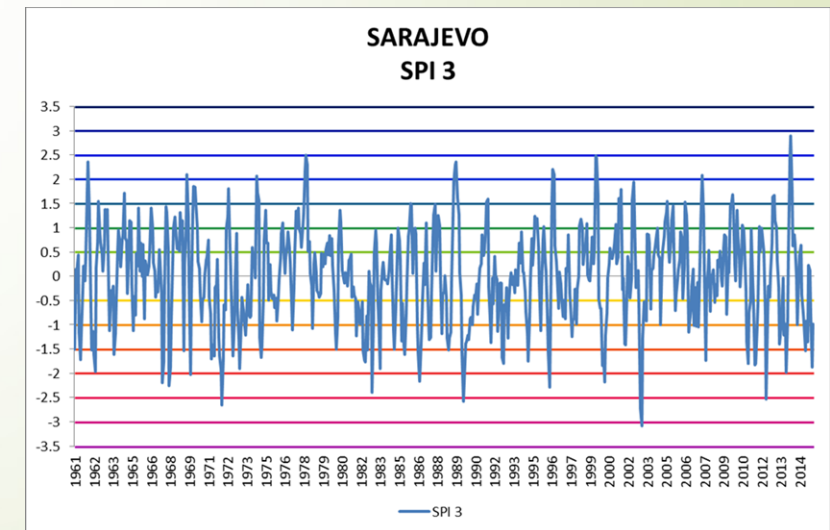
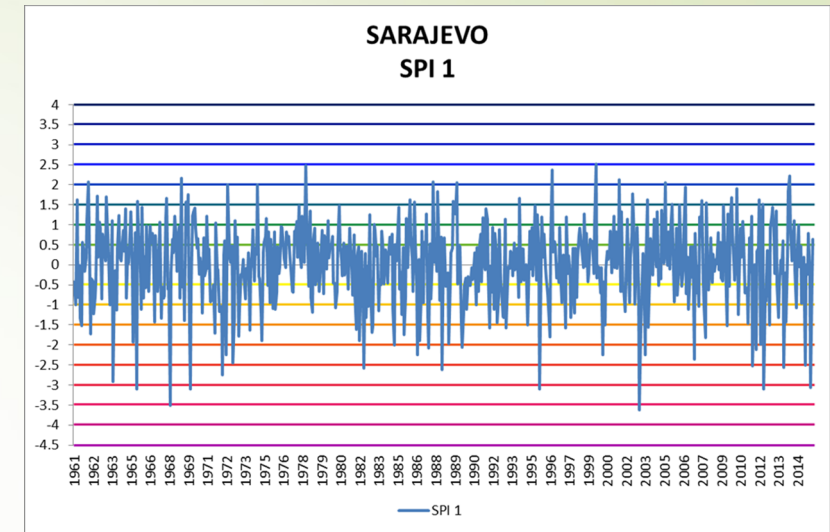
Drought monitoring by the SPI - Standardized Precipitation Index

“Rainfall indices”

SPI - Standardized Precipitation Index -
Moisture conditions estimated on the basis of
SPI for 1,2,3,6, and 12 months
(base period 1961-2005)

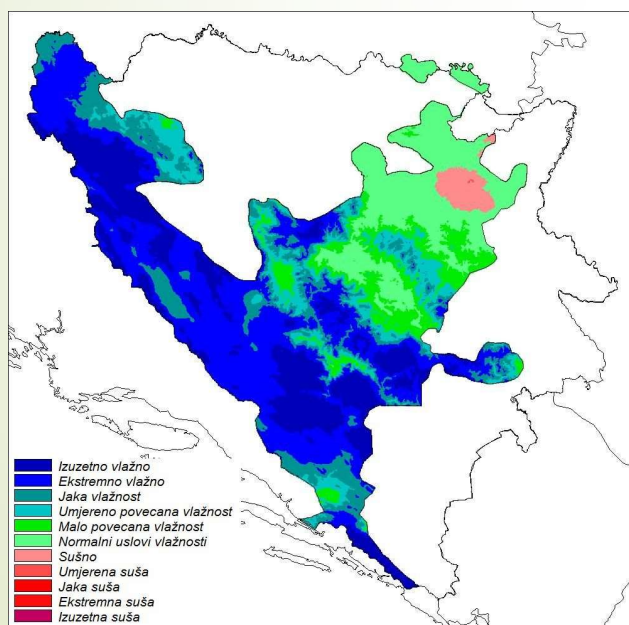
1-month SPI reflects short - term conditions, its
application can be related closely to
meteorological types of drought along with short
- term soil moisture and crop stress, especially
during the growing season

3-month SPI reflects short and medium-term
moisture conditions and provides a seasonal
estimation of precipitation.

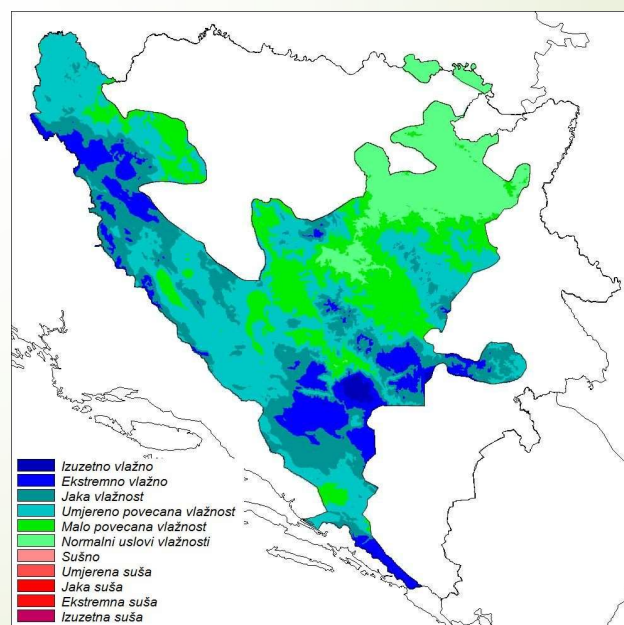


One of the products on our website:
Drought monitoring (SPI 60) and forecast (SPI 30) – (based on products of WRF-NMM model and weather forecasts from FHMI B&H),
prepared with the help of colleagues from RHMS of Serbia

Uslovi vlažnosti u Federaciji Bosne i Hercegovine, procjenjeni prema SPI 2, Standardizovanom padavinskom indeksu, vrijednosti za vremenski period od 60 dana (31.10.-02.09.2016. godine). U centralnim i sjevernim dijelovima Federacije Bosne i Hercegovine preovladavali su normalni uslovi vlažnosti, uz manju epizodu sušnog tla na sjeveroistoku. U dijelu Hercegovine i na zapadu registrovane su kategorije ekstremnog do izuzetno vlažnog tla.

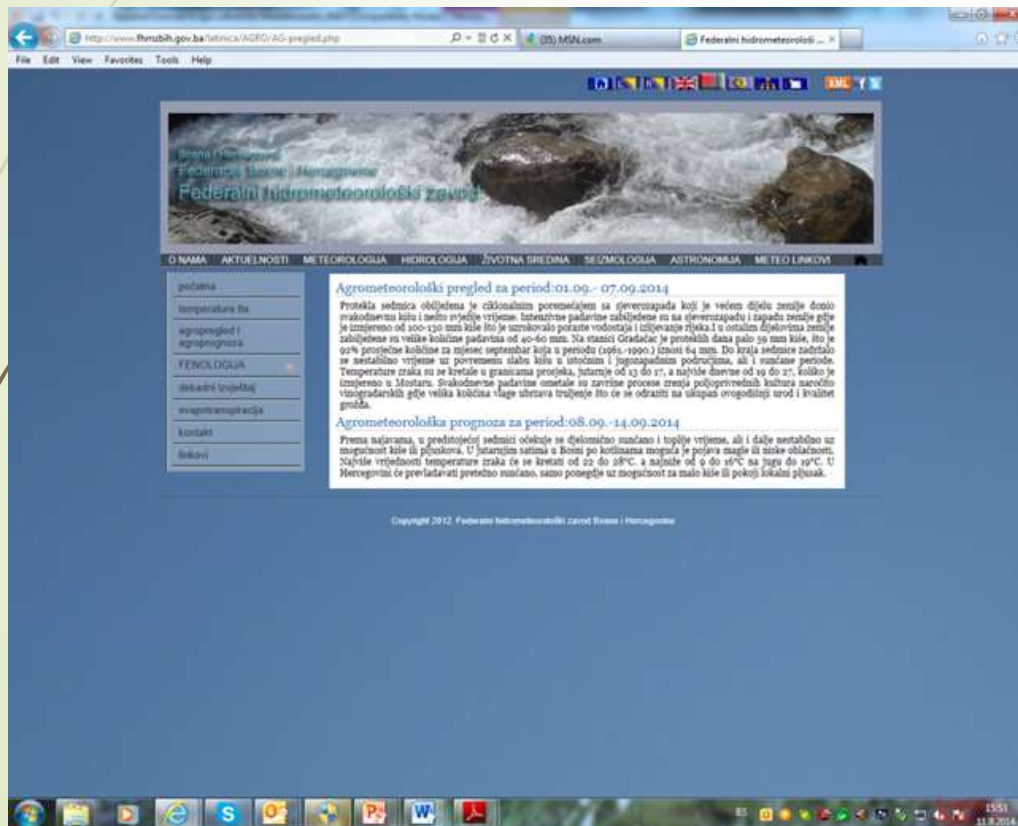


Prognoza SPI 1, Standardizovanog padavinskog indeksa za period od 30 dana, izvedena na osnovu osmotrenih i prognoziranih petodnevni padavina (01.10.-31.10.2016. godine), U narednom prognostičkom periodu, najvećim dijelom Federacije Bosne i Hercegovine preovladavaće kategorije normalne do umjereno povećane vlažnosti tla, sa izuzetkom manjih područja Hercegovine i Krajine gdje će tlo biti u kategoriji jako do izuzetno vlažno.



Agrometeorological review and 7-days agrometeorological forecast are very interesting for farmers

- **AGROMETEOROLOGICAL ASSESMENT OF THE INFLUENCE OF EXPECTED WEATHER CONDITION ON THE AGRICULTURAL PRODUCTION AND FIELD WORKS**



- **7-days agrometeorological forecast FOR PERIOD 31.10.2016 – 06.11.2016 godine**
- Prema kartama prognostičkih modela, u većem dijelu sedmice pred nama očekuje se stabilno vrijeme, sa svježim jutrima i porastom temperatura tokom dana. Jutarnje vrijednosti kretaće se od 3 do 8 u unutrašnjosti, u Hercegovini od 6 do 11, a dnevne će dostizati do 14 °C u Bosni, u Hercegovini između 15 i 18 °C. Mjestimično su mogući kratkotrajni slabiji mrazevi, pretežno u prvom dijelu sedmice. Sa približavanjem vikenda, izgledno je pogoršanje vremenskih prilika praćeno padavinama. Ovakvo vrijeme pogodovaće provođenju aktualnih poljskih radova, a povoljno stanje vlage zemljišta omogućava nesmetano nicanje i razvoj posijanih ozimina.
- Prognozu pripremio: Nedžad Voljevica

This 7-days agrometeorological forecast, (every Sunday at BH Radio 1, public broadcaster) is one of the most popular products from our service

www.bhrt.ba/bhrt1/pregled-programa/nedjelja/

VIJESTI SPORT KULTURA EKONOMIJA ŽIVOTNI STIL BHRT BHT1 BHR1

MPBHRT

05,03 – Muzika raspoloženja
— Jutarnji muzički program. Urednici BH radija 1 biraju muziku različitih žanrova čiji je zajednički nazivnik – jutro. Muzika je namijenjena svima koji rano počinju novi dan.

06,00 – Vijesti
06,03 – Dobro jutro
06,30 – Vijesti
06,33 – Etno muzika
07,00 – Jutarnje vijesti
07,10 – Dobro selo
08,00 – Vijesti
08,05 – Kompozitor sedmice
09,00 – Vijesti
09,03 – Sedmica
— Magazin Informativnog programa BH radija 1.

10,00 – Vijesti
10,03 – Razglednica/To sam ja
11,00 – Vijesti
11,03 – Cosmopolit
12,00 – Podnevne vijesti
12,05 – Svijet na dlanu (r)
13,00 – Vijesti
13,03 – Muzika dana (r)
14,00 – Vijesti
14,03 – Album sedmice

RADIO TV ZVUK BOSNE I HERCEGOVINE
RADIO-TELEVIZIJSKA KUĆA I NEKRETNOSNE
RADIO AND TELEVISION OF BOSNIA AND HERZEGOVINA

RADIO PRIČE

Obavještajne službe na Balkanu
Posted on: 28.10.2016.

Milo Đukanović se povlači iz politike
Posted on: 28.10.2016.

Intervju – Željko Ivanković, dobitnik nagrade „Đalski“
Posted on: 28.10.2016.

POZITIVNA BIH

www.bhrt.ba/bhrt1-emisije/dobro_selo/dobro-selo-30-10-2016/

MENU

DOBRO SELO [30.10.2016.]
28.10.2016. By K.H. 👁 4

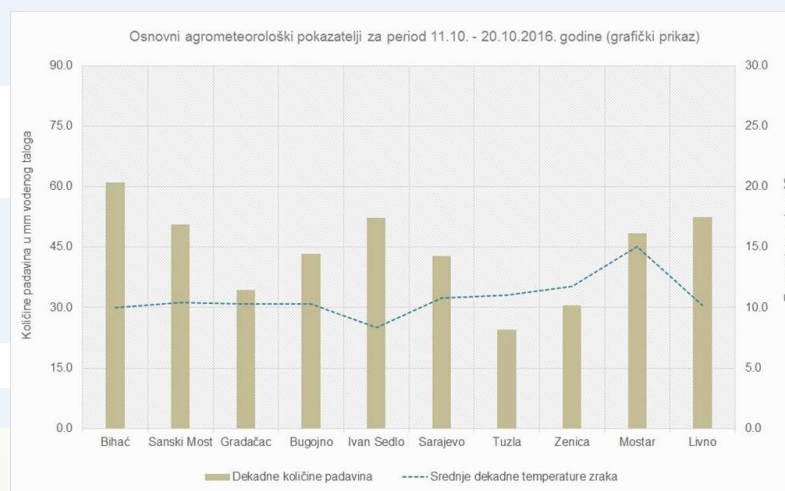
DOBRO SELO
RADIO BOSNE I HERCEGOVINE

Nedjeljom u 07:10h

as well as 10-days report - basic agrometeorological parameters presented in a form of table

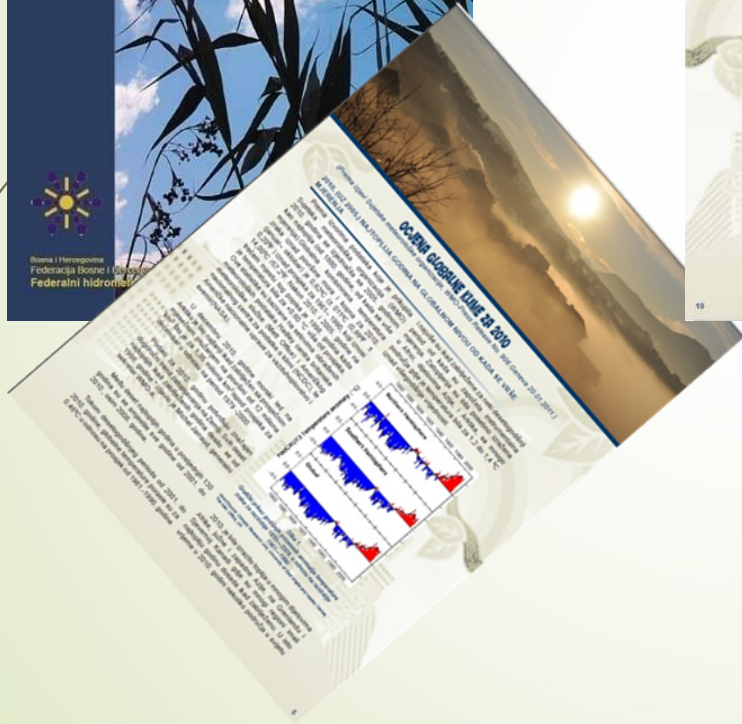
Osnovni agrometeorološki pokazatelji za period 11.10. - 20.10.2016. godine (tabelarni prikaz)

Stanica	Bihać	Sanski Most	Bugojno	Gradačac	Jajce	Livno	Mostar	Ivan Sedlo	Sarajevo	Zenica	Tuzla
Srednja temperatura zraka	10,0	10,4	10,3	10,3	-	10,2	15,0	8,4	10,8	11,7	11,0
Apsolutna max temp. zraka	19,5	19,9	24,1	18,0						25,2	22,0
Apsolutna min temp. zraka	1,0	-0,6	-0,4	4,4						10,7	3,6
Apsolutna min temp. zraka na 5cm	0,2	-1,4	-1,4	2,1						10,8	2,0
Padavine	61,1	50,7	43,4	34,4						20,5	24,5



Climatological summary of temperature, rainfall, vegetation conditions for 11 stations and 10 days report (graphical overview)

Monthly meteorological bulettin and yearbook.

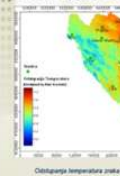


KLIMATOLOŠKA ANALIZA U 2010.

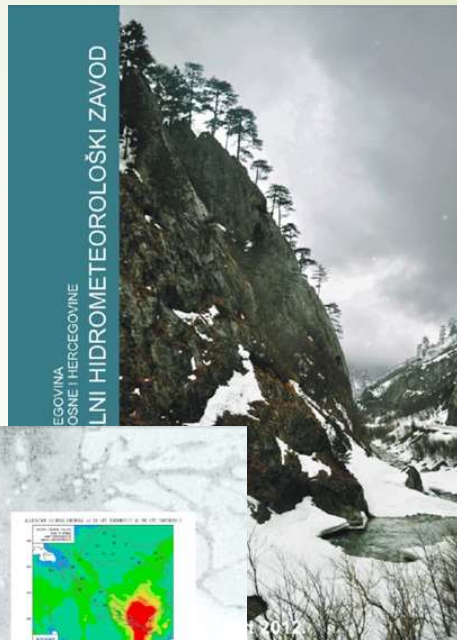
Srednje temperature u 2010. godini bile su više od standardne normalne vrijednosti (period 1961.-1990) na čitavom promatranom prostoru i kretale su se u rasponu od 1.4 °C na Bjelašnici i 7.9 °C na Ivan Selahu do 14.3 °C u Šibici i 15.2 °C u Mostaru. Temperaturna odstupanja kretale su se od 8.2 °C na Bjelašnici do 1.3 °C u Bugojnu. Temperature

STANICE	TEMPERATURA		STANICE	TEMPERATURA	
	odstupanje (°C)	percentil		odstupanje (°C)	percentil
Bihac	0.6	85	Livno	0.8	97
Bjelašnica	0.2	71	Mostar	0.6	93
Bugojno	1.3	100	Sarajevo	1.1	100
Dvuar	0.6	94	Sanski Most	0.7	92
Gradac as	0.9	90	Šibic	0.8	94
Ivan Selah	0.6	93	Tuzla	0.8	98
Apce	0.7	94	Zenica	1.0	100

Tabela 1 - Odstupanje godišnjih temperaturnih prosjeka od vjetroloških niza (1961. - 1990)



Odstupanje temperature prosjeka od 1961.-1990.



EGOVINA
OSNE I HERCEGOVINE
LNI HIDROMETEOROLOŠKI ZAVOD

Čistilan snijeg, snježni nanosi podarna hladnoća paritali su čitavu zemlju i doveli do prelaska u normalnom funkcionisanju. Stanje elementarne nepogode proglašeno je u više općina u Bosni i Hercegovini. Najteže je bilo ornašično na jugu zemlje gdje su zabilježene rekordne visine snijega.

Maksimalne visine snijega u gradovima Bosne i Hercegovine od 1961. godine do februara 2012. godine kretale su se od 37 cm u Mostaru izmjerene 1971. godine do 112 cm u Gradac u izmjerene 1963. godine (Tabela 1).

Slučajno nevrijeme koje je zahvatilo Bosnu i Hercegovinu 3. februara, kada je snijeg gođno intenzivno da pada prouzrokovao je nove rekordne visine snijega za Sarajevo i Mostar. Područja koja su bila najviše pogodena ovim nevremenom bila su centralna Bosna i veliki dio Hercegovine. Izmjerene vrijednosti visine novog snijega za 4. februara u 07:00 sati kretale su se od 77 cm u Sarajevu do 17 cm u Tuzli. Tog 4. februara izmjereni su novi rekordi za visine snijega u Sarajevu (101 cm) i Mostaru (52 cm). Međutim, snijeg je nastavio padati nešto slabijim intenzitetom i 4. februara tako da su veći narednog dana izmjerene nove rekordne visine

Meteorološka stanica	Godina	Maksimalna visina snijega (1951-2011) u cm	Maksimalna visina snijega u februar 2012. godine u cm
Gradac as	1963	112	62
Bihac	2005	110	54
Tuzla	1984	57	42
Dvuar	1956	97	55
Sanski Most	1970	95	42
Sarajevo	1999	90	101
Livno	2002	89	56
Bugojno	1956	85	66
Zenica	1999	63	42
Mostar	1971	37	85

Tabela 1 - Maksimalna visina snijega u gradovima BiH za period 1951-2011 / februar 2012. godine

Annual agrometeorological analysis

The analysis relates to the production year.

Review of the influence of meteorological parameter on agricultural production, as well as their consequences during the period of one year and vegetation period

The screenshot shows a web browser window with the URL <http://www.fhmcibh.gov.ba/ihari/2011-05/tem.pdf>. The page content is an annual agrometeorological analysis for May and June 2011. It includes text describing temperature anomalies, precipitation, and agricultural conditions. Two photographs are included: 'Slika 6' showing a field with white flowers and 'Slika 7' showing golden wheat stalks. The browser's taskbar at the bottom shows the date 12.9.2014 and the time 16:00.

Maj 2011.
Promjenjive vremenske prilike obilježile su maj mjesec. Temperature zraka u prvoj polovini mjeseca imale su negativna, a u drugoj polovini mjeseca pozitivna odstupanja i do 3,6°C koliko je registrirano u Mostaru. Najveće negativno odstupanje od -2,7°C registrirano je u Tuzli. Takvi prvih dekad mjeseca bili je pojava slabih do umjerenih strazeva koji su napravili štetu na već godišnjem prirastu kultura. Padavine koje su registrirane početkom mjeseca opetno su povećale zalihe vlage u tlu. Zbog lokalnog karaktera i prostorne i količinske nejednakoosti padavina velika razlika u pristupnim količinama na teritorij FBiH. Uprkos neujednačenim padavinama, cvjetanje i oplođenje ozimih kultura proticali su u relativno povoljnim agrometeorološkim uvjetima.

Ukupne količine padavina u junu bile su nepod prosječne, višegodišnje sume za isti period i kretale su se od 30,8 l/m² u Mostaru do 90,0 l/m² u Drvaru.

Kiše koja je pala početkom treće dekade juna, doprinje došlo prosječnim uvjetima porasta kukuruza koji se nalazio u fazi završetka oplodnje i početka periode naličavanja zrna kada su im padavine najpovoljnije. Visoke temperature početkom treće dekade i suša su dovele do sušenja bilja na biljama. Kod ozimih materijalnih kultura ubrzo se u procesu zrenja usljed temperatura koje su prešle 33 stepena.

Juni 2011.
Juni mjesec započeo je sa kratkotrajnim zaobljenjem, i padavinama nakon čega je uslijedio period veoma toplog vremena sa temperaturama iznad 30 stepeni. Suho vrijeme omogućilo je ostavljanje žetve ozimih kultura.

Slika 6
Famulska šuma punog njištava drveća, krajem 12.05.11.

Juni 2011.
Srednje mjesačne temperature zraka u junu kretale su se od 8,3°C na Bjelašnici i 15,6°C na Ivan Gedu do 23,6°C u Štrpu i 24,7°C u Mostaru. Takvi su ti dekad u junu srednje dekadne temperature bile su više od prosječnih temperatura za isti period. Najveća odstupanja od prosječnih zabilježena su u prvih dekad i najmanja u trećoj dekad mjeseca.

Slika 7
Zlatna polja
Izvor: www.fhmcibh.gov.ba

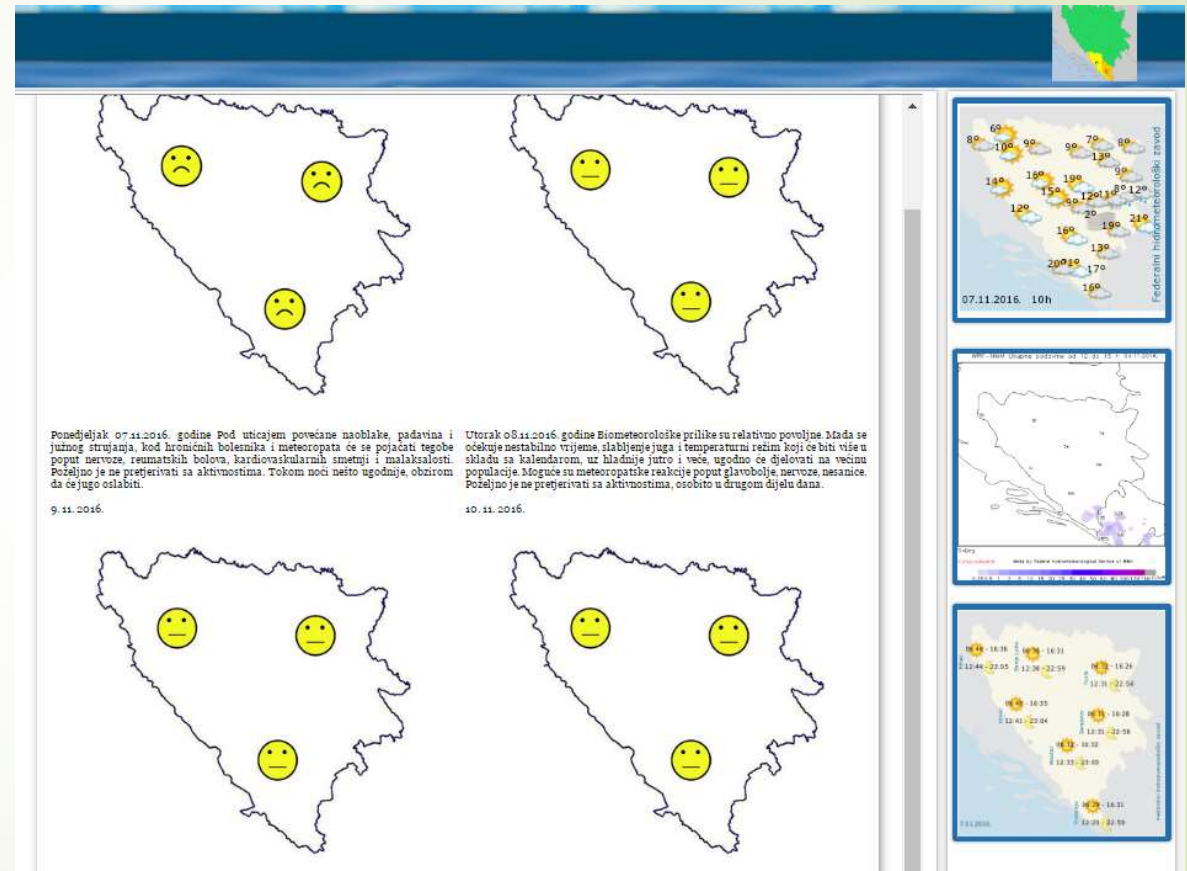
Prve dvije dekade mjeseca bile su toplije od prosječnih za isti period. Toplije od prosječne zabilježeno je u drugoj dekad, gdje je u Livnu registrirano odstupanje od 5,9°C. Druga dekada u Sarajevu, Tuzli, Bihaću i na Bjelašnici bila je najtoplije od početka sljedećih mjeseca na ovom prostoru. Niže temperature od prosječnih bile su u trećoj dekad.

Padavine koje su zabilježene u julu, omogućile njemu pojedincu dekad donijele su predah od vrućina i djelimično ublažile sušu koja traje još od početka godine. Prema podacima iz mreže meteoroloških

Biometeorological forecast is presented daily in the media, on public broadcasters, in newspapers, commercial radio and TV stations

Forecast is based on basic meteorological indicators, unfortunately without cooperation between our institute and relevant health institutions

(e.g. numerous institutes of public health, medical centers, hospitals)



Phenology

- Phenological observations are carried out at 14 main meteorological station
- The standard observation program
- Observation sheets are sent by e-mail every 15 - days to the agrometeorological office in FHMI, where the data are checked and stored

The image displays two overlapping windows from a computer screen. The background window is Microsoft Excel, titled 'BIHAC DO 15 4 2016 - Excel', showing a spreadsheet with columns A through K and rows 1 through 36. The spreadsheet lists various plant species and their observation dates. For example, row 2 lists 'Visibaba' with a date of '9.feb', and row 3 lists 'Maslačak' with a date of '18.mar'. The data is organized into columns, with some cells containing 'xxxx' to indicate observations. The foreground window is a Notepad application, titled 'Bihac-FEN_2016 do 15 4 2016 - Notepad', which contains a list of plant names and their corresponding observation dates, such as '1.Visibaba,9.Feb' and '18.Maslačak,18.Mar'. The Notepad window also shows some text that appears to be a list of observation sheets or reports, including 'Prolječni poljski radovi,1.Apr'.



Phenological database

- ▶ Phenological data have been stored in Excell for the period 1951-2015
- ▶ In our institute we use an Oracle database system. In a future, we planed to transffered data to ORACLE Pheno database
- ▶ Last few years some phenological observations are documented in photographs, in order to improve the quality od data (stations Sarajevo, Ivan Sedlo and Mostar)

Vegetation stages (Common horse chestnut / *Aesculus hippocastanum* and Small-leaved lime / *Tilia cordata* Mill.) in SARAJEVO - BJELAVE

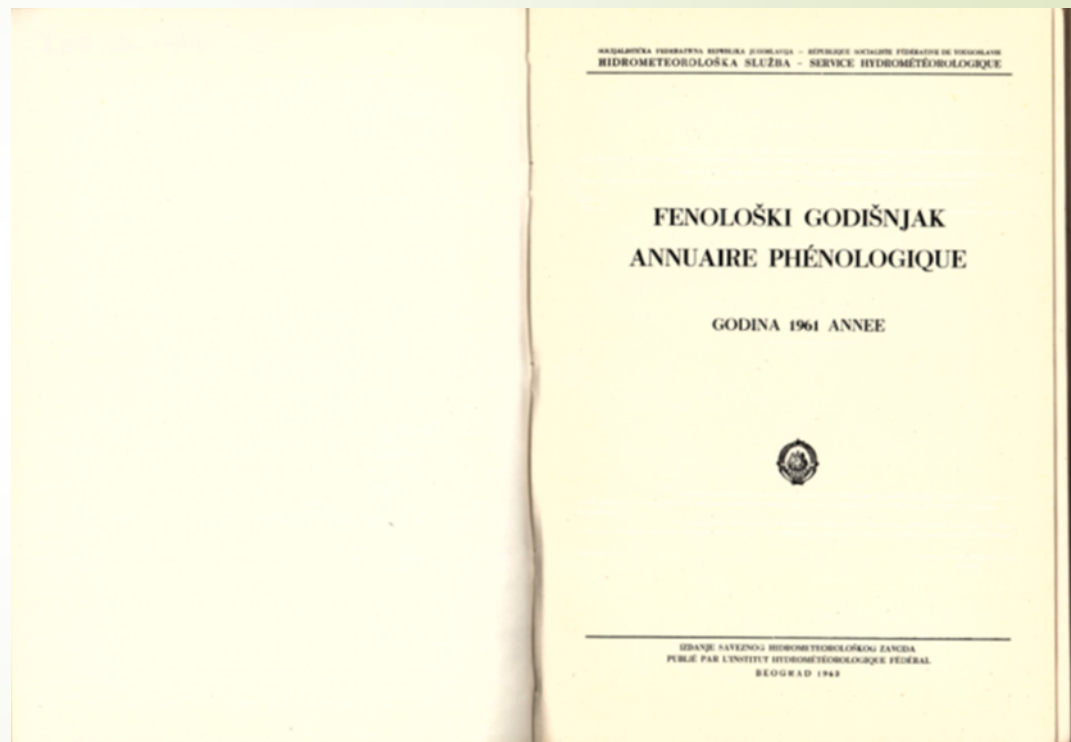


RESULTS OF THE PHENOLOGICAL OBSERVATION

Phenological yearbooks (1961-1990; 2000 -2015) has been scanned and presented on the website

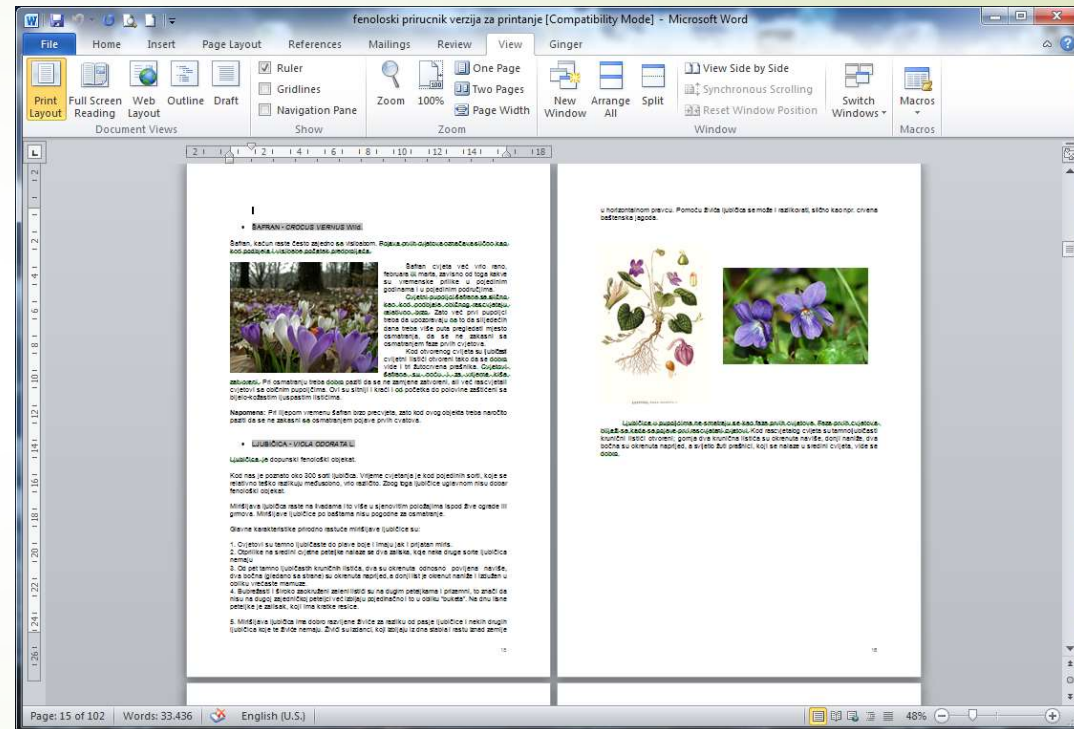


Phenological yearbook of Federal Hydrometeorological Institute



Phenological yearbook from former Yugoslavia

Phenological guide, prepared by our section

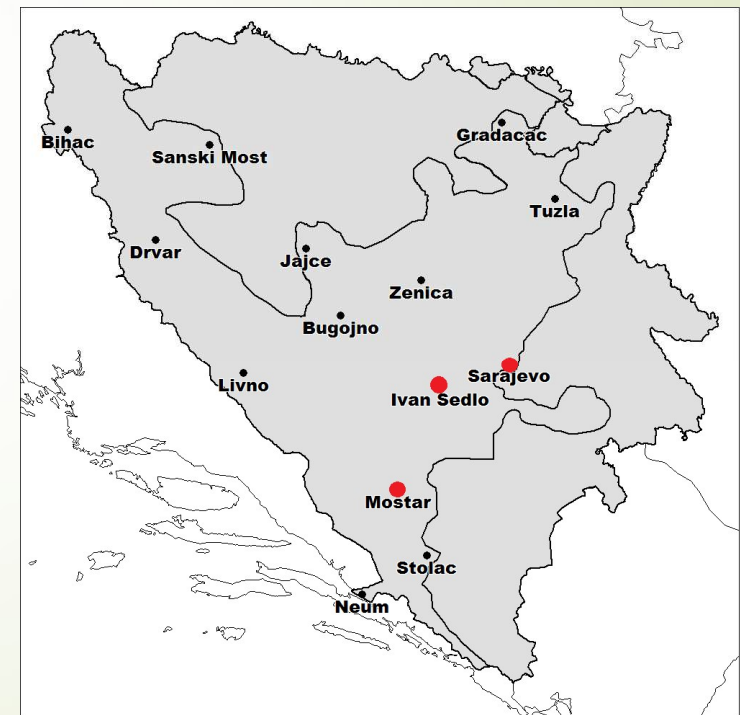
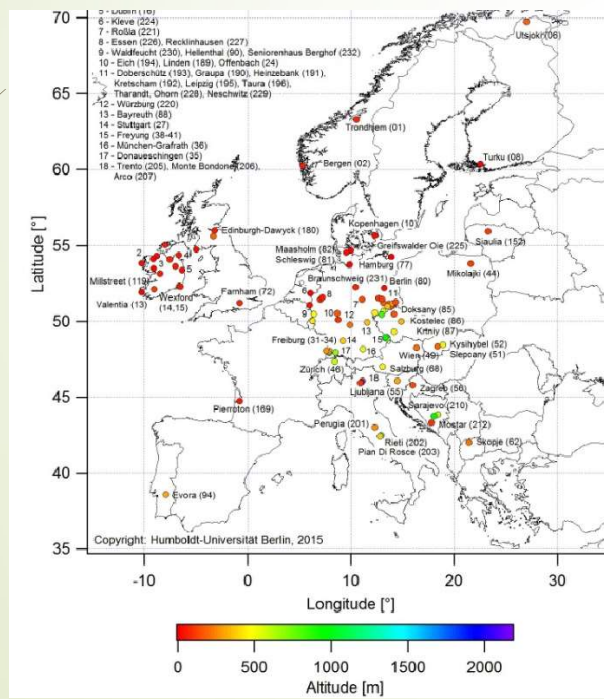


On-going projects

INTERNATIONAL PHENOLOGICAL GARDENS (IPG),

Project coordinator, HUMBOLDT University from Berlin,

Gardens established during 2013 and started with observations from January 2014



Results are presented on official web site

http://ipg.hu-berlin.de/ipg/faces/list_stations.xhtml

Home Map **Stations** Phases Plants Contact About the project

International Phenological Gardens of Europe

Welcome to the official website of the IPG program of the HU Berlin.

User: fhmzbih Password: [masked] Login

If you want to participate in the IPG program, please contact us by mail. Then, you will receive an access to the IPG database. As a registered member, you can manage your IPG station, add site information and edit your observations online.

Stations

Show inactive stations in list OK

Number	Country	Name	Location	Altitude	Observation period	
210	Bosnia and Herzegovina	Sarajevo	18.422° E, 43.867° N	630 m	2014 -	See details
211	Bosnia and Herzegovina	Sarajevo-Ivan Sedlo	18.036° E, 43.750° N	967 m	2014 -	See details
212	Bosnia and Herzegovina	Mostar	17.803° E, 43.343° N	99 m	2014 -	See details
220	Germany	Bot. Garten Universität Würzburg	9.917° E, 49.750° N	200 m	2012 -	See details
221	Germany	Roßla	11.067° E, 51.450° N	155 m	2010 -	See details
224	Germany	Kleve	6.169° E, 51.786° N	15 m	2009 -	See details
225	Germany	Greifswalder Oie	13.917° E, 54.233° N	3 m	2009 -	See details
226	Germany	Essen	7.017° E, 51.450° N	90 m	2009 -	See details
227	Germany	Recklinghausen	7.217° E, 51.583° N	56 m	2009 -	See details
228	Germany	Ohorn	14.049° E, 51.174° N	305 m	2012 -	See details
229	Germany	Neschwitz	14.350° E, 51.270° N	155 m	2012 -	See details
230	Germany	Waldfeucht	6.000° E, 51.070° N	32 m	2012 -	See details
231	Germany	Braunschweig	10.450° E, 52.283° N	81 m	2013 -	See details
232	Germany	Seniorenhaus Berghof	6.280° E, 50.020° N	420 m	2013 -	See details
998	Germany	PROBE Station of BERLIN	13.283° E, 57.450° N	51 m	2003 -	See details

IPG © copyright 2010 | For an optimal experience of our web site please use Mozilla Firefox

International Phenological Gardens of Europe

Logged in as fhmzbih | Edit my account | Logout

Welcome Nedžad Voljevića!

Welcome to the official website of the IPG program of the HU Berlin.

Observation sheet for station [210] Sarajevo (BA)

Show observations from year 2015

Show as days after year beginning

Show

General remarks:

Plant species	MS	UL	JS	BF	FF	RF	CL	FL
[111] Larix decidua* (Germany)		85					317	346
[121] Picea abies (early)* (Germany)								
[122] Picea abies (late)* (Germany)								
[131] Pinus sylvestris* (Poland)								
[211] Betula pubescens* (Germany)		110		125	135		315	366
[221] Fagus sylvatica (Hardeggen)* (Germany)		122					310	324
[224] Fagus sylvatica (Denmark)		121					315	324
[241] Prunus avium (Bovenden)* (Germany)		104					322	330
[242] Prunus avium (Lutter) (Germany)							312	324
[261] Robinia pseudoacacia* (USA)		113		132			295	322
[271] Sorbus aucuparia* (Czech Rep.)		108			130		298	324
[281] Tilia cordata* (Germany)		114		175	181		304	324
[311] Ribes alpinum* (Austria)							306	324
[321] Salix aurita* (Germany)		125		105	114		299	327
[323] Salix acutifolia* (Germany)		103		82	90		306	324
[326] Salix viminalis* (Germany)		103		82	90		311	326
[421] Forsythia suspensa, "Fortunei"™		112		100	103		318	324

Navigation

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Current orders
Order plant species

212 Mostar
210 Sarajevo
211 Sarajevo-Ivan Sedlo



IPG Sarajevo



IPG Mostar



IPG Ivan Sedlo

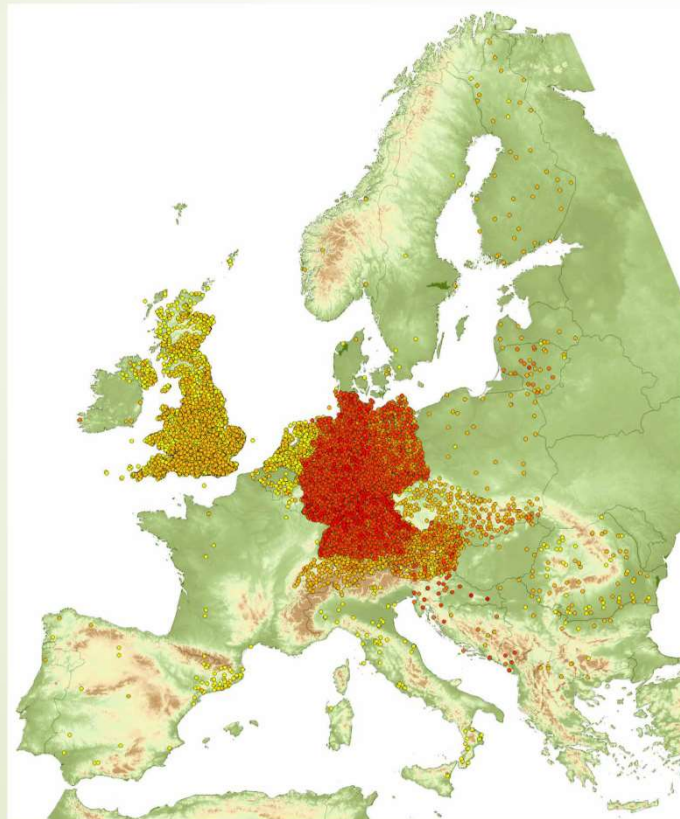
On-going projects

Pan European



Phenology DB

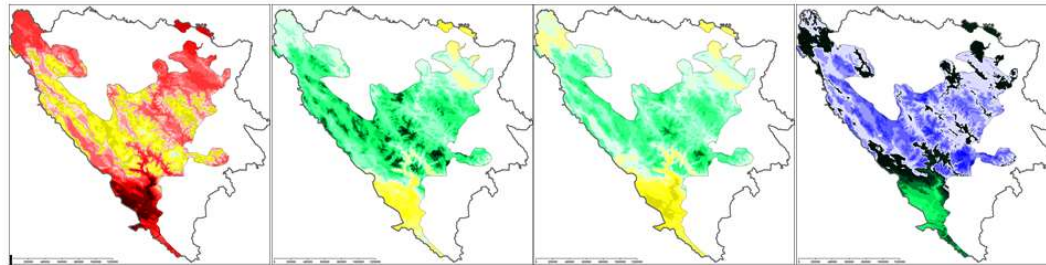
Coverage of PEP 725 2016



station_id	country	name	Lat	Long	altitude
1	BiH	Bihać	44°09'	17°54'	367
2	BiH	Bugojno	44°04'	17°28'	562
3	BiH	Tuzla	44°23'	18°42'	305
4	BiH	Mostar	43°21'	17°49'	99
5	BiH	Ilidza -Butmir	43°52'	18°26'	580
6	BiH	Ivan Sedlo	43°46'	18°02'	970

On-going projects

Climate atlas of Federation of Bosnia and Herzegovina, period 1961 - 1990

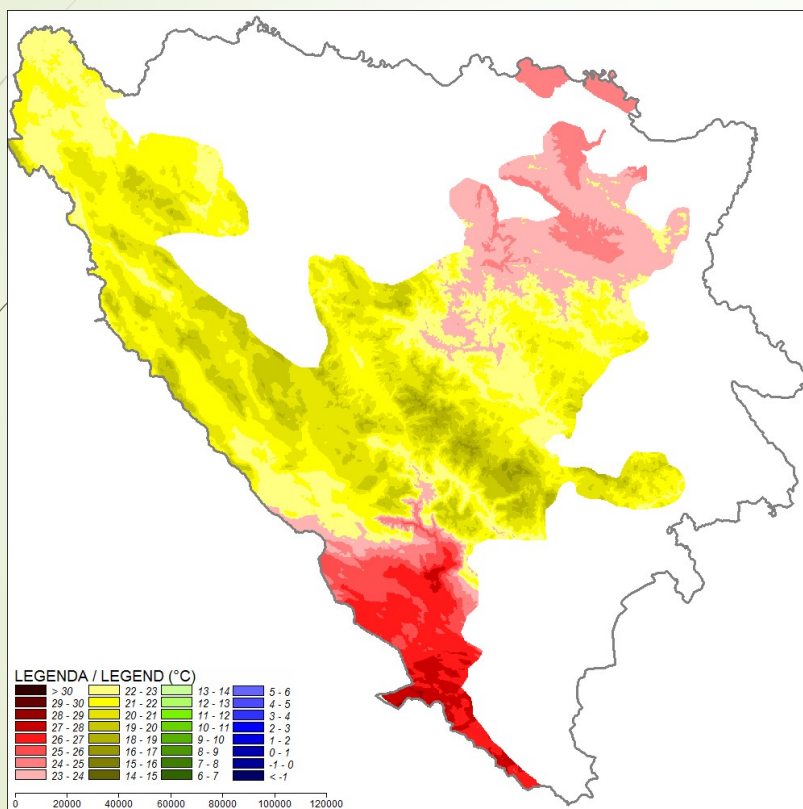


ATLAS KLIME FBIH
1961-1990

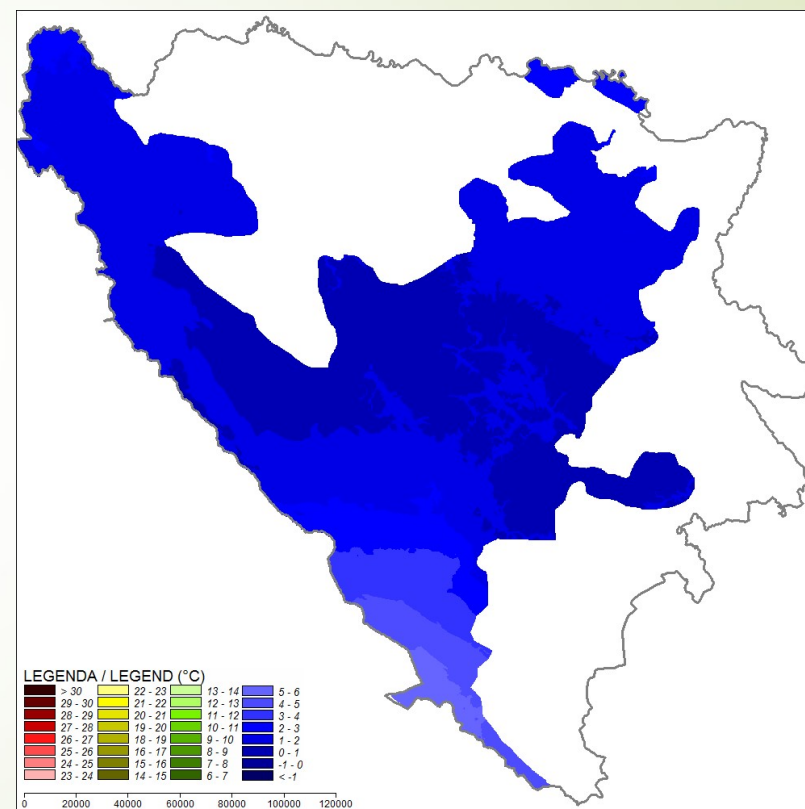


- prepared in coordination and with the help of colleagues from MHS of Croatia

Soil temperature at 5 cm depth, maps of average monthly values,
Reference period: 1961 - 1990
Federation of Bosnia and Herzegovina, (Climate atlas)

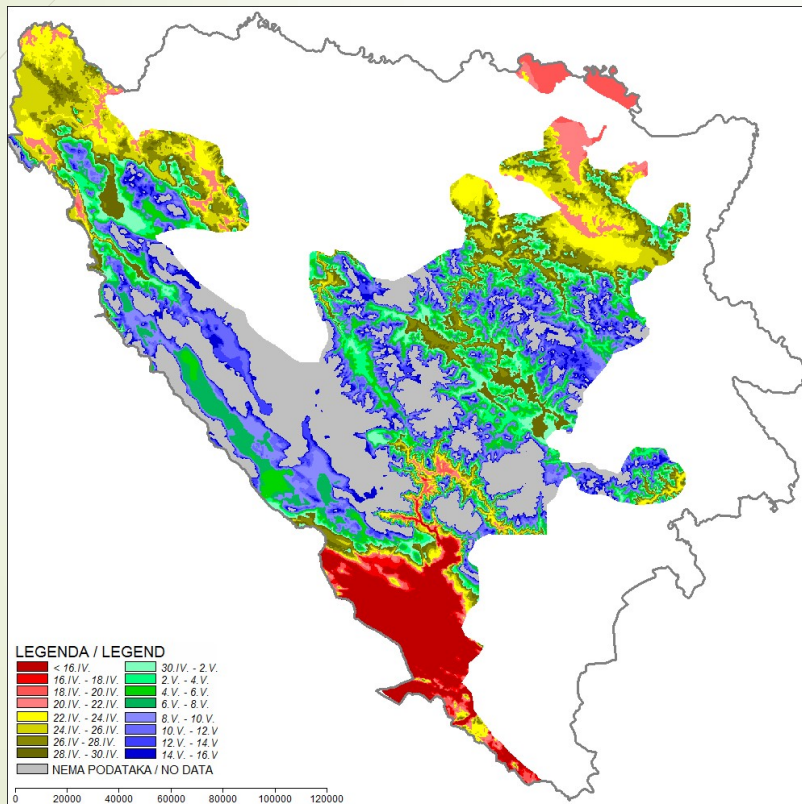


July, period 1961 - 1990

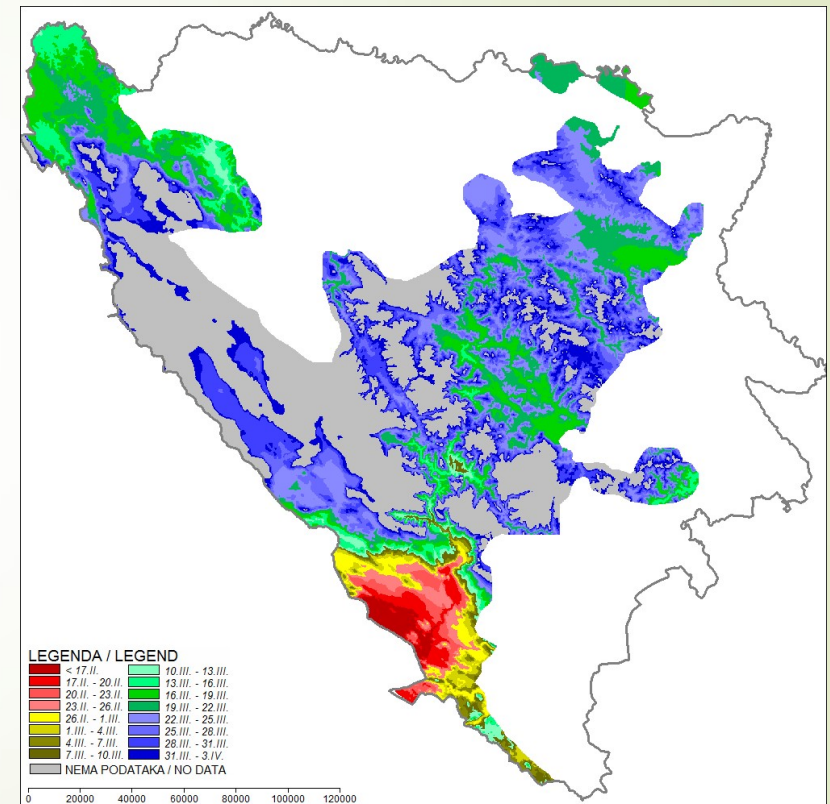


December, period 1961 - 1990

Beginning of flowering, maps of average dates,
 Reference period: 1961 – 1990,
 Federation of Bosnia and Herzegovina (Climate atlas)



Syringa vulgaris



Salix caprea

On-going projects

SWG RRD, ANC

- **Agrometeorologist from FHMI was included to Regional Expert Advisory Working Group on Development, Mapping and Analyses of Areas with Natural Constraints**
- Twenty two experts from Serbia, Bosnia and Herzegovina, Macedonia, Kosovo*, Albania and Montenegro held three meetings, prepared reports and conducted activities related to the development of a study on characterization and mapping of areas with natural constraints in the SEE countries. In that assignment The final regional study has been presented at the Agricultural Policy Forum in Tirana, Albania.
- This activity is part of the SWG project “Strengthening regional capacities for rural development through integrated forest and water resources management in Southeast Europe (LEIWW)” funded by GIZ (**Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)**).
- **Duration of the project is 01.01.2015 – 31.12.2017**
- Experts from region were supported by international experts from the International **Centre for Advanced Mediterranean Agronomic Studies (CIHEAM)**.

On-going projects

automatic stations

Automatic agrometeorological stations donated by the government of Japan (Odžak, Butmir, Kupres, Čapljina)
Implementation of the project is expected in 2017

JAPAN'S NON - PROJECT GRANT AID FOR PROVISION OF
JAPANESE SME'S PRODUCTS (2013) Weather Observation System
for Agriculture Sector

List of sensors:

Ultrasonic anemometer

Temperature and humidity sensor

Radiation shelter with natural ventilation

Rain gauge (with heater)

Pyranometer

Sunshine sensor

Soil temperature and soil moisture sensor

With 4 new stations density and quality of existing network will be significantly improved





Problems:

- we were faced with the problem of discontinuities in our time series at some meteorological stations,
- numerous interruptions, data gaps,
- lack of staff, engineers and technicians, observers (especially qualified),
- lack of instrumentation equipment,
- old equipment on stations,
- a general lack of funds,
- very often, other institutions take our job (many ministries, universities, and agencies)



Future activities of agrometeorological section

continued work on ANC project,

automatisation of agrometeorological station (Project JICA-Japan)

improving of phenological database, transferred data to ORACLE Pheno database

generally, improving of phenological observations (simply reason ... we do not need money for this)

improving of soil moisture monitoring

climate atlas – completion
crop modelling



Thank you for your attention!