Interreg
Danube Transnational Programme
DriDanube

Monitoring agricultural drought and its impacts

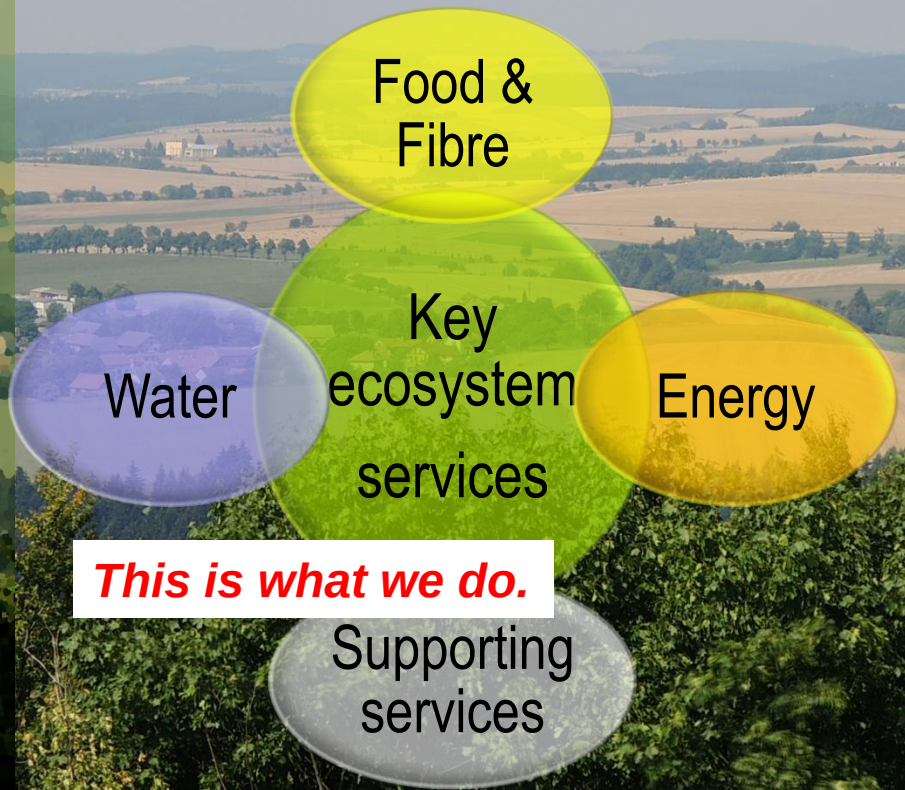
Czech and DriDanube experience

Project co-funded by European Union funds (ERDF, IPA)

CzechGlobe

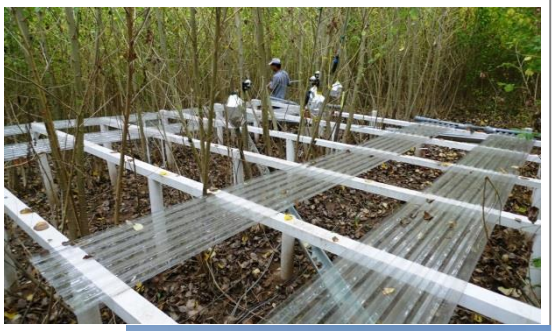
Research focus

PAST 500 BC - 2016	PRESENT 2016	FUTURE 2016~ 2100+
UNDERSTANDING PAST CLIMATE	**PRESENT STATUS, FORECASTS & WARNING**	**TRENDS & RISKS**
Natural proxies, documents, models, instrumental records,	Field and landscape scale experiments Models Observations & Monitoring&Forecast	Models & experiments Forecasts & projections



This is what we do.

Research facilities



HIGH INTENSITY sites – from Alps to semi-arid lowlands

Field crops & bioenergy experiments

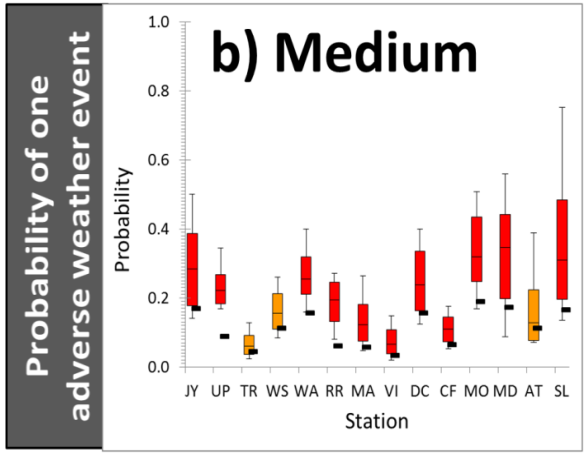
Manipulation experiments

RESOURCES = RESPONSIBILITY TO SOCIETY

Team motto: From interesting to usable

From interesting to usable – example WHEAT

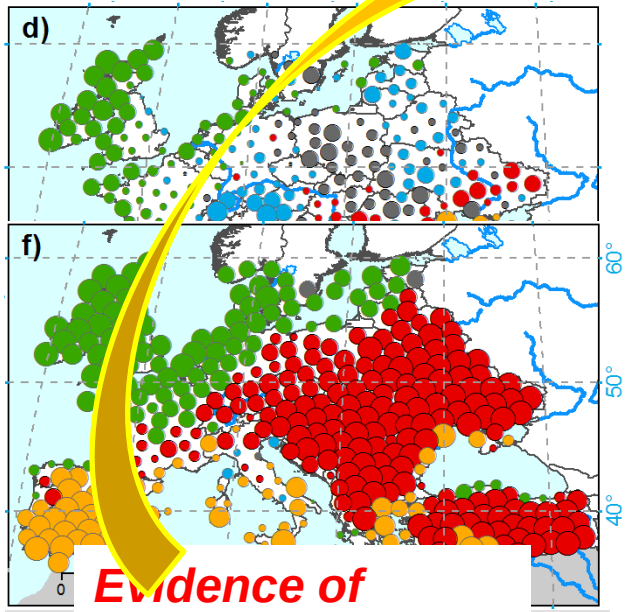
STEP 1 – SMALL SCALE MODELLING



Nature Climate Change, 2014

Evidence of agromet extreme events will be increasing at site level

STEP 2 – EUROPEAN SCALE MODELLING



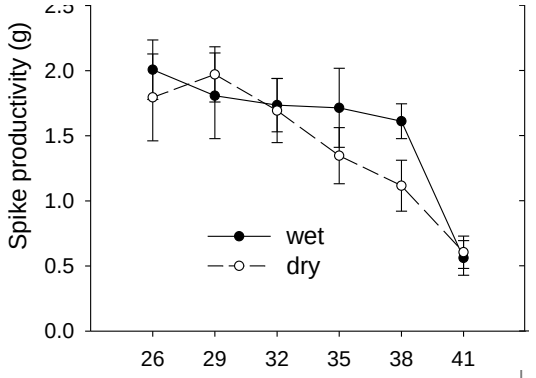
Evidence of agromet extreme events will be increasing across Europe - HEAT

Royal Soc. Interf., 2015

STEP 3 – MANIPULATION

KROK 6 – NEW EXPERIMENTS

Selecting cultivars according to drought resilience+ Description of the drought stress response



Results as now

Novel adaptation technique development – in planning

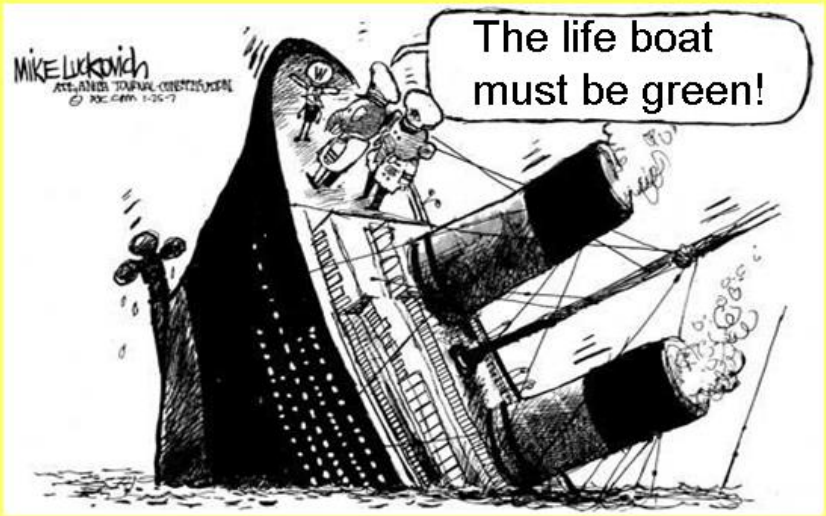
Climate Change – Actors have the same data but different responses

Contrarians

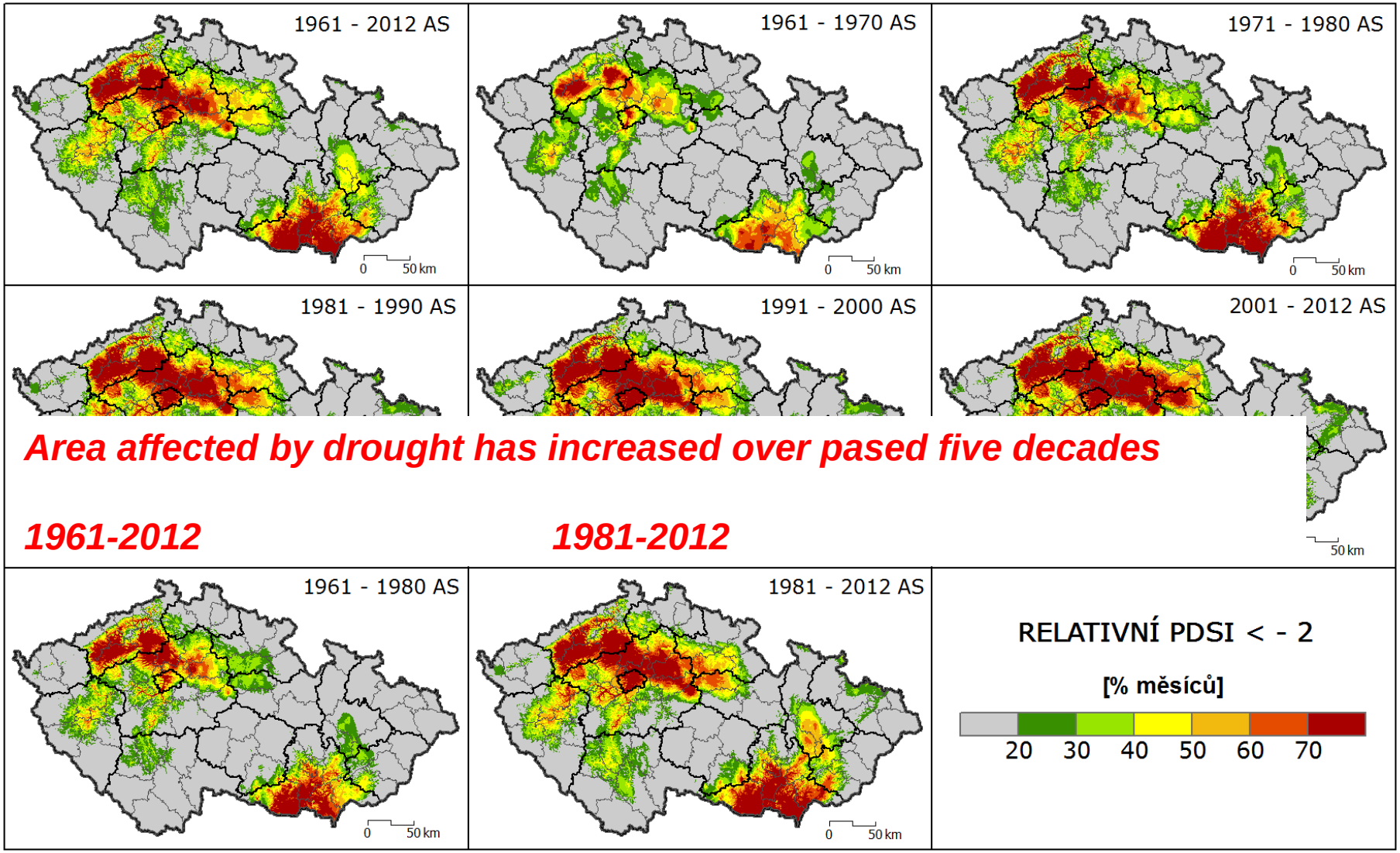
Climate scientists

No regret

Environmentalists



How serious are problems in Czechia?



Area affected by drought has increased over pased five decades

1961-2012

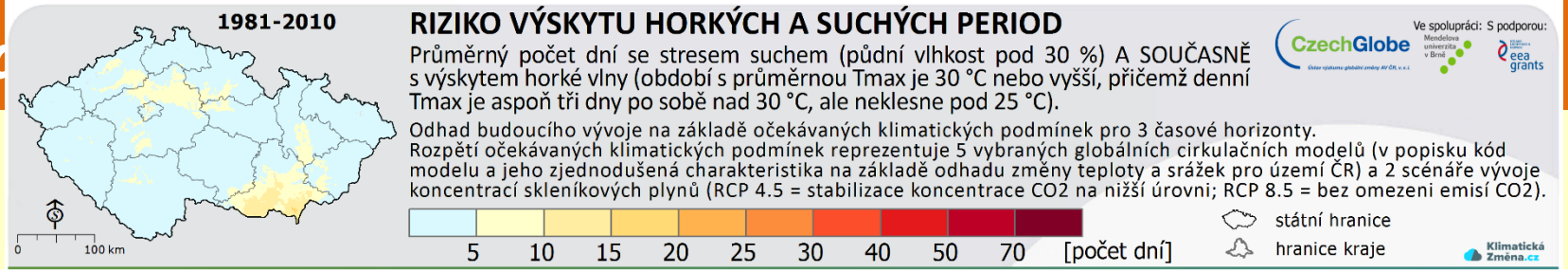
1981-2012

Education, awarness, dissemination

Droughts in the past

Real time drought monitoring

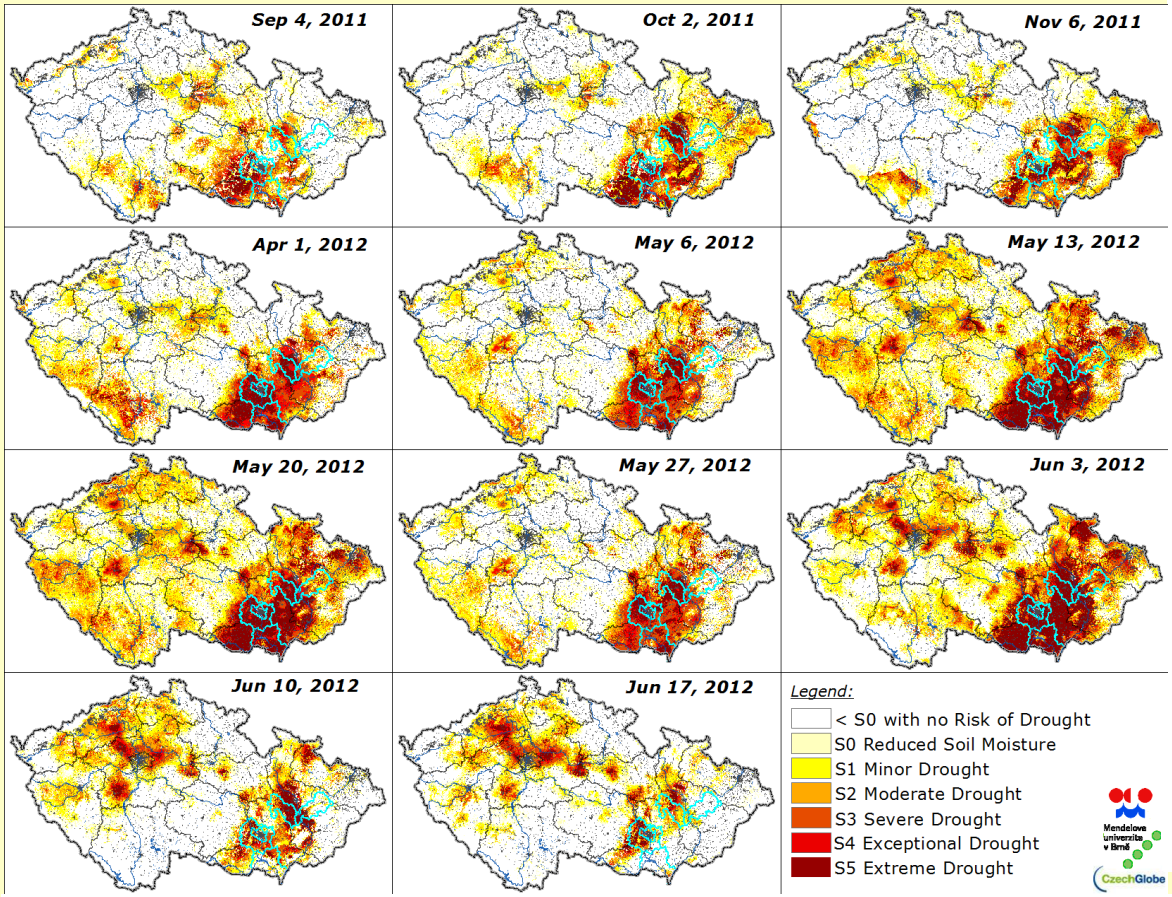
Brázdil a Trnka *et al.*, 2015, Drought in the Czechlands

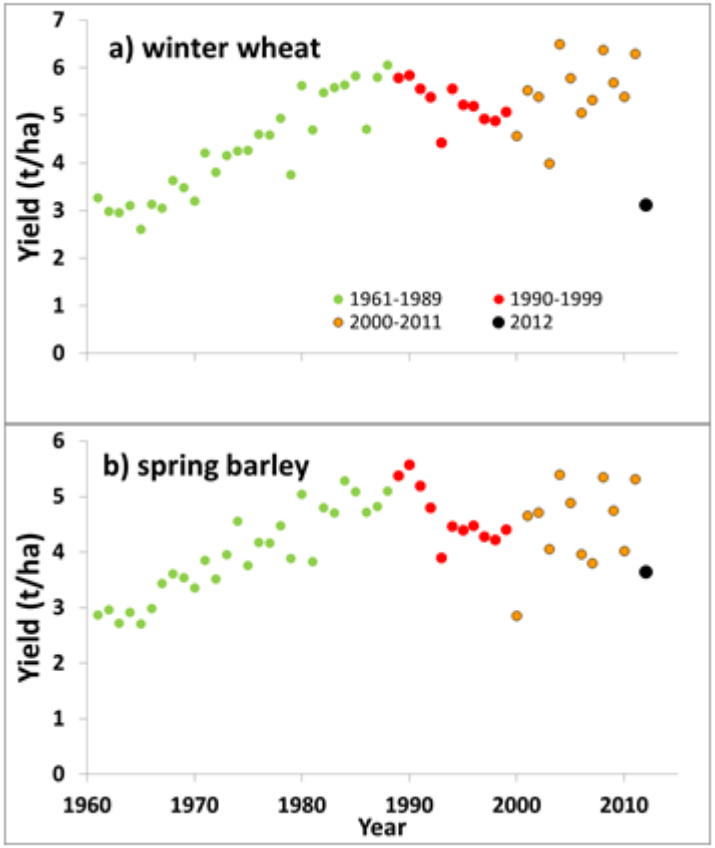


NO ROCKET SCIENCE - The impact of the combined heat and drought stress on the crops/forests will be greater than each stress factor alone☹

Why to bother?

Droughts but also other agrometeorological extremes can be local and can be devastating…..





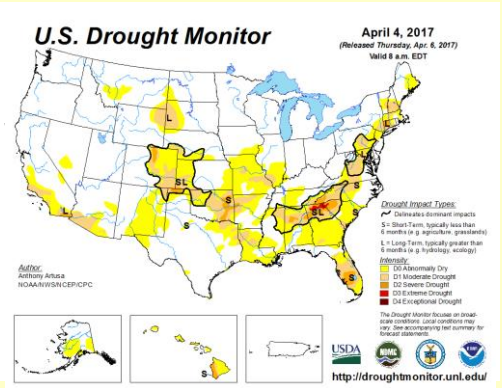
Farms are large and great deal dependent on the field crop production …

Example of our work – how have we started?

***CzechGlobe** in collaboration with the **Czech Hydrometeorological Institute** lead the way in development of agricultural drought monitoring and forecasting tool & are developing more advanced systems.*

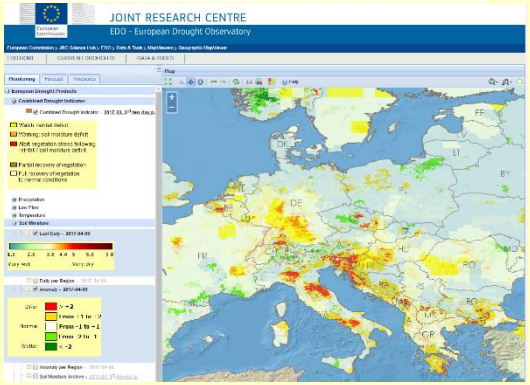
www.intersucho.cz

Efforts globally



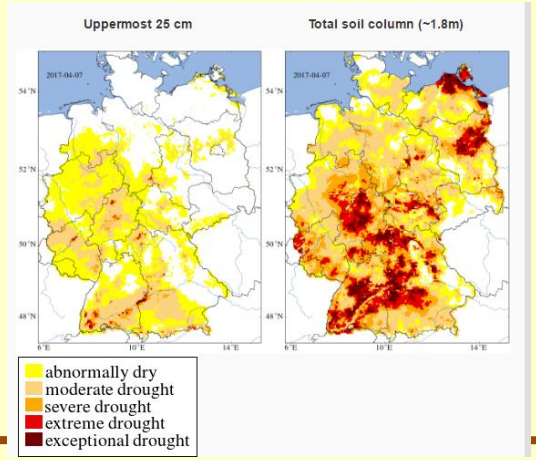
USA

1. Since 1995 - resolution cca 20 km;
2. Convergence of evidence approach - subjective
3. Feedback from reporters on the ground



EU - EDO

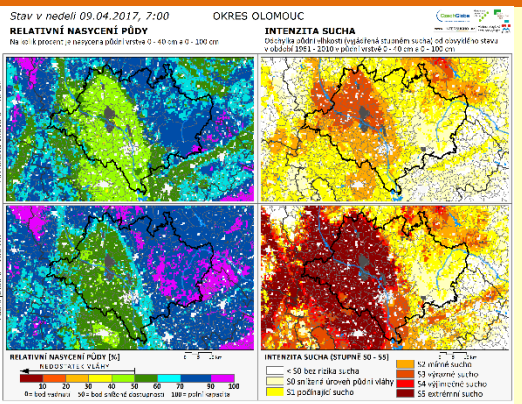
1. Since 2011/resolution cca 5 km;
2. Multiple methods – objective
3. NO feedback from reporters

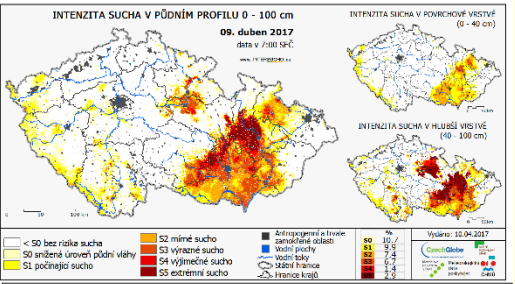


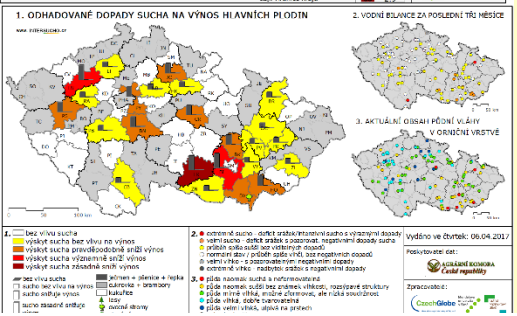
Germany

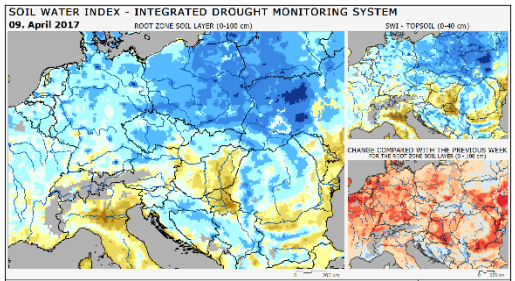
1. Since 2014/resolution cca 4 km;
2. Single soil moisture and hydrology model - objective
3. NO feedback from reporters

Czech efforts









Czech Republic

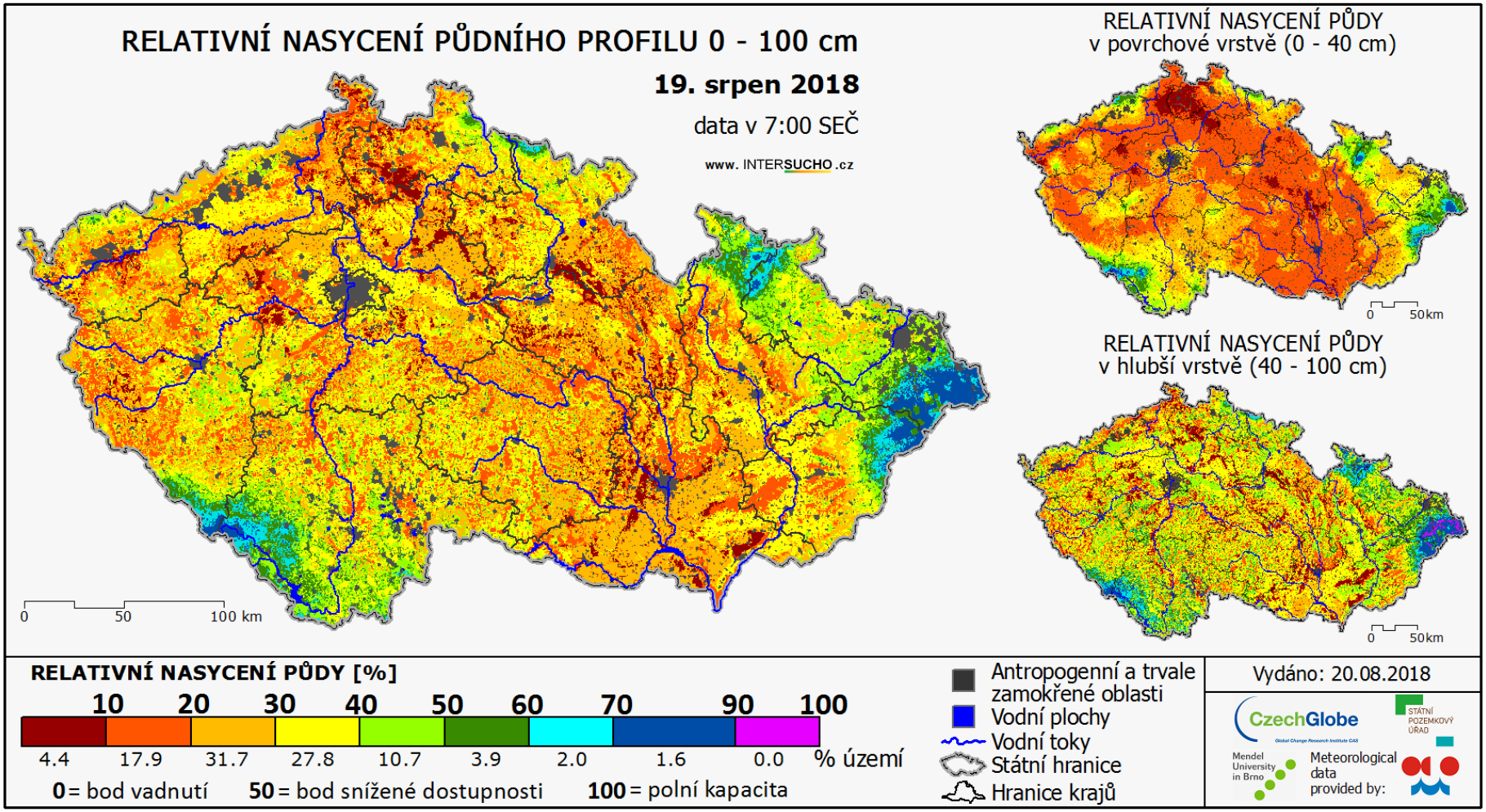
1. Since 2014/ resolution 0,5 km
2. 200 climate sites + 400 raingauges of the Czech Hydrometeorological institute + ecosystem sites (CzechGlobe) – daily interpolated to 500 m grid
3. Then soil moisture modeled by SoilClim model and compared to 1961-2016 soil moisture status
4. PLUS two independted satelite systems

- Meteosat soil moisture estimate through microvawe radar 8 km (from TUW)
- Condition of vegetation Terra – 250 m – 5 km aggregate
- Comparison with EDO product

5. Real time validation with soil moisture measurements (CHMI + CzechGlobe – 55 sites)
6. Drought forecasting (daily)
7. 600+ registered reporters up to 230-240 active each week

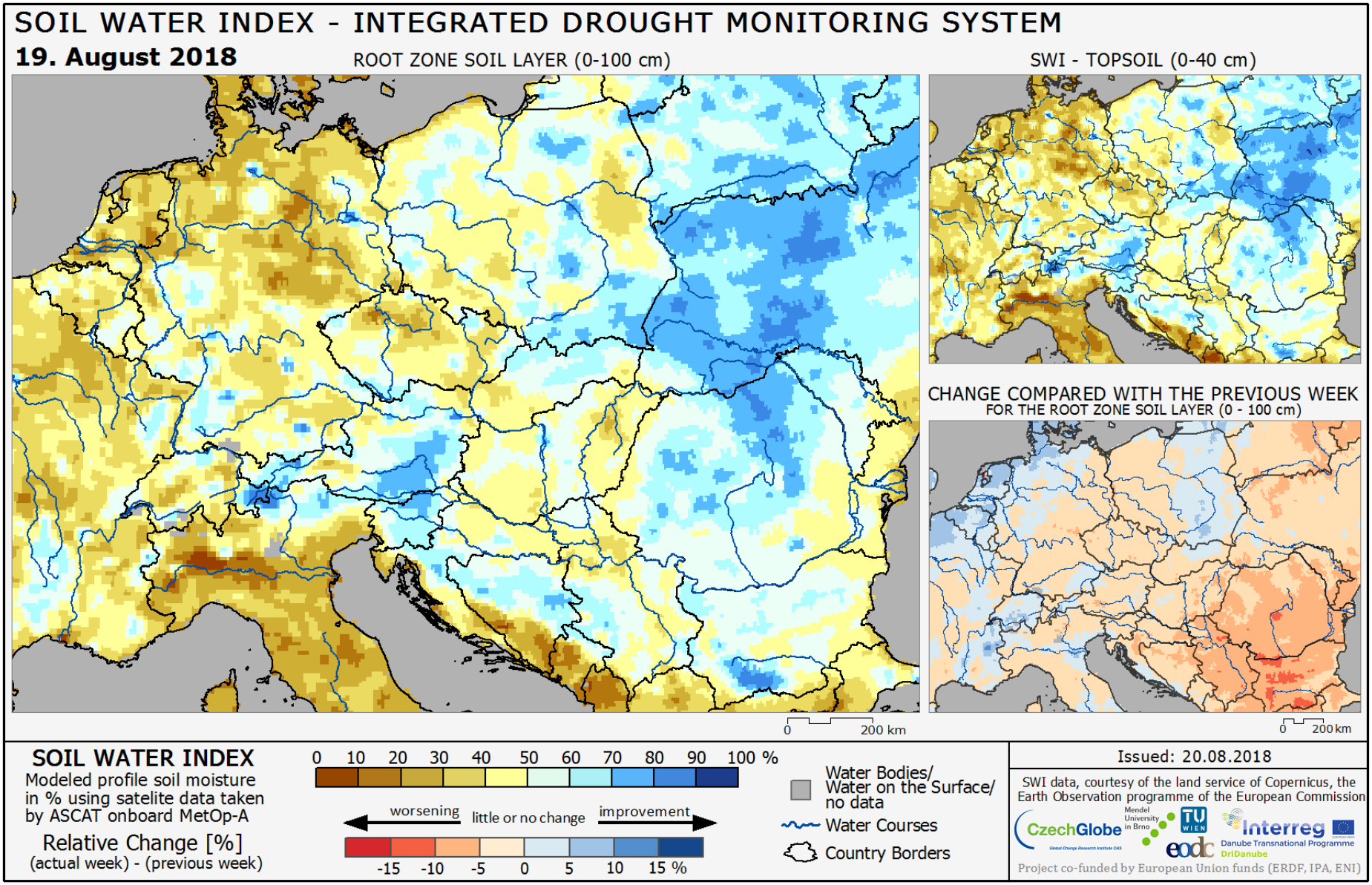
Consortium of Czech Academy of Sciences, Mendel University and State Land Office with support of **Czech Hydrometeorological Institute**

Pilar I: Soil moisture content

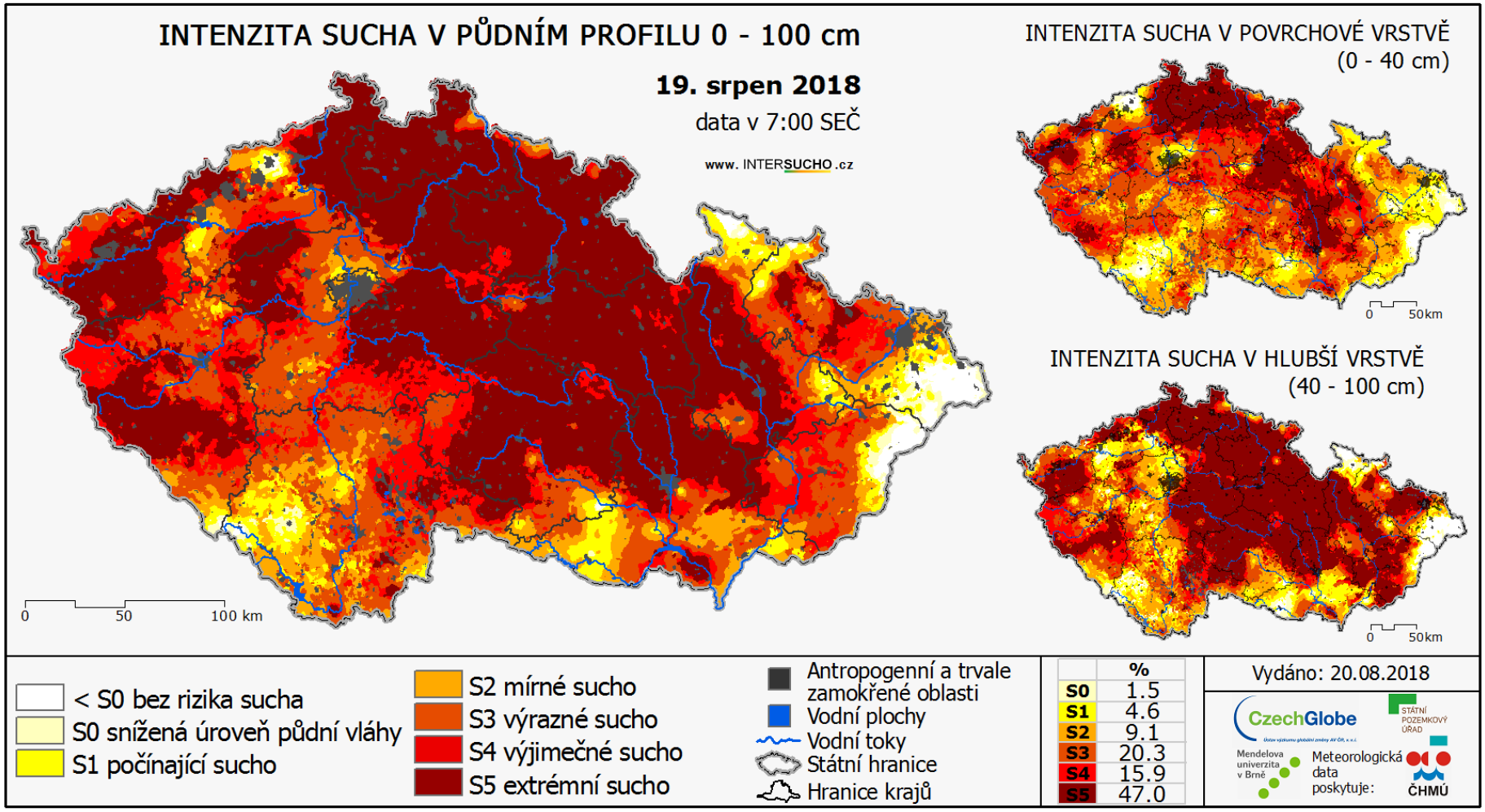


It uses daily soil water balance model in 500m resolution with real soil and terrain, dynamic canopy and high number of weather stations to do the trick! Every week and every day….for free.

Microwave radar soil moisture estimate

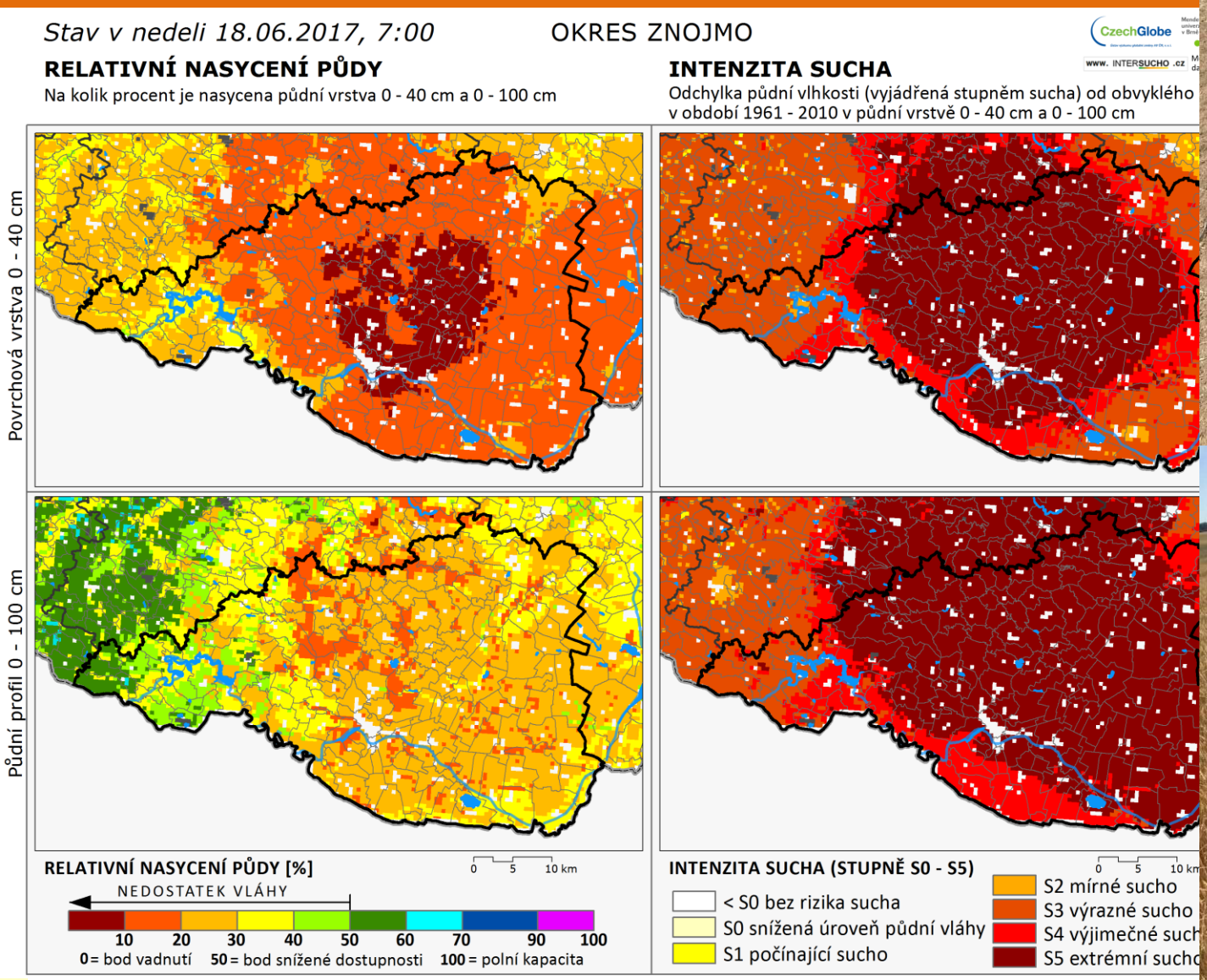


Pilar I: Soil moisture content deficit



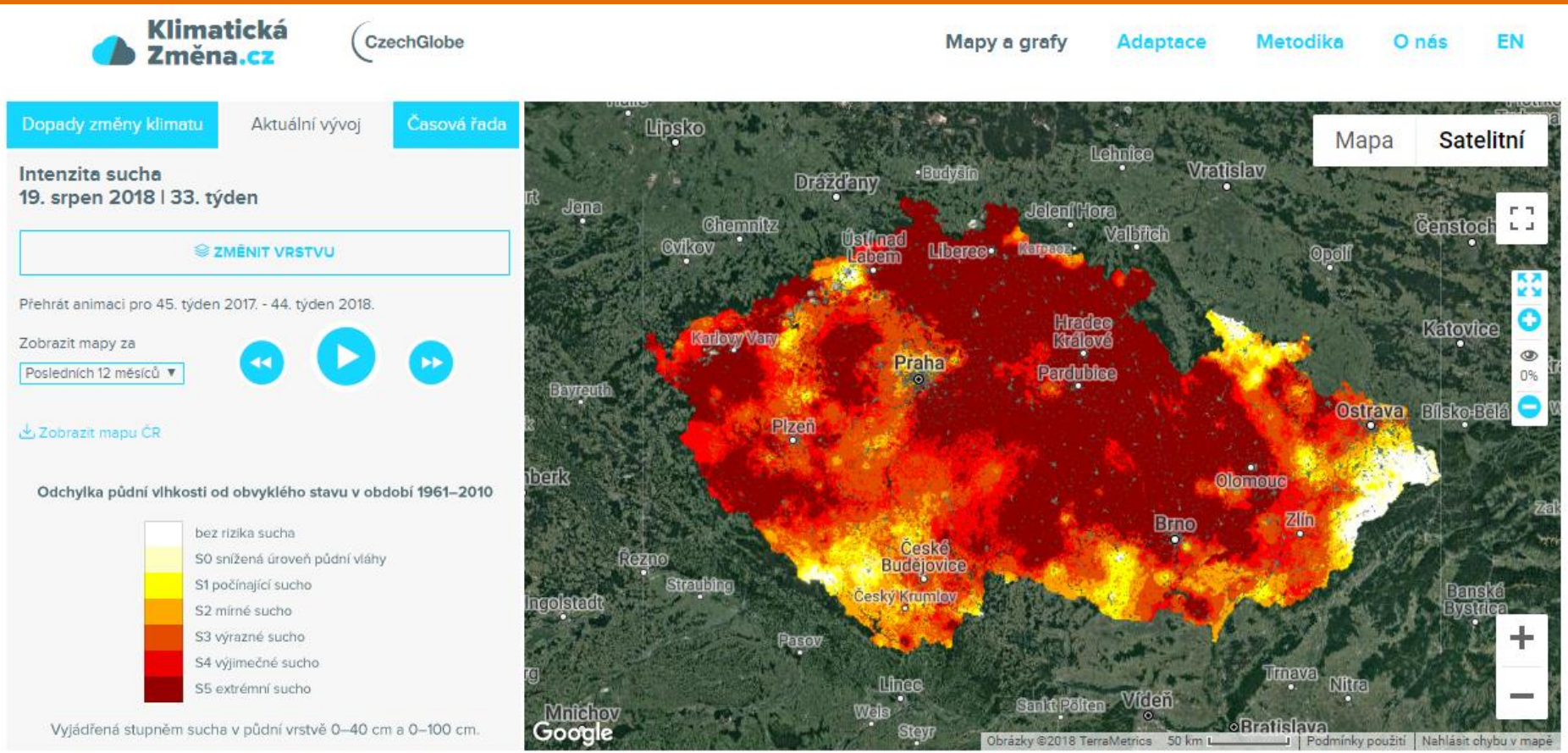
It uses daily soil water balance model in 500m resolution with real soil and terrain, dynamic canopy and high number of weather stations to do the trick! Every week and every day….for free.

Pilar II: Drought intensity in high resolution



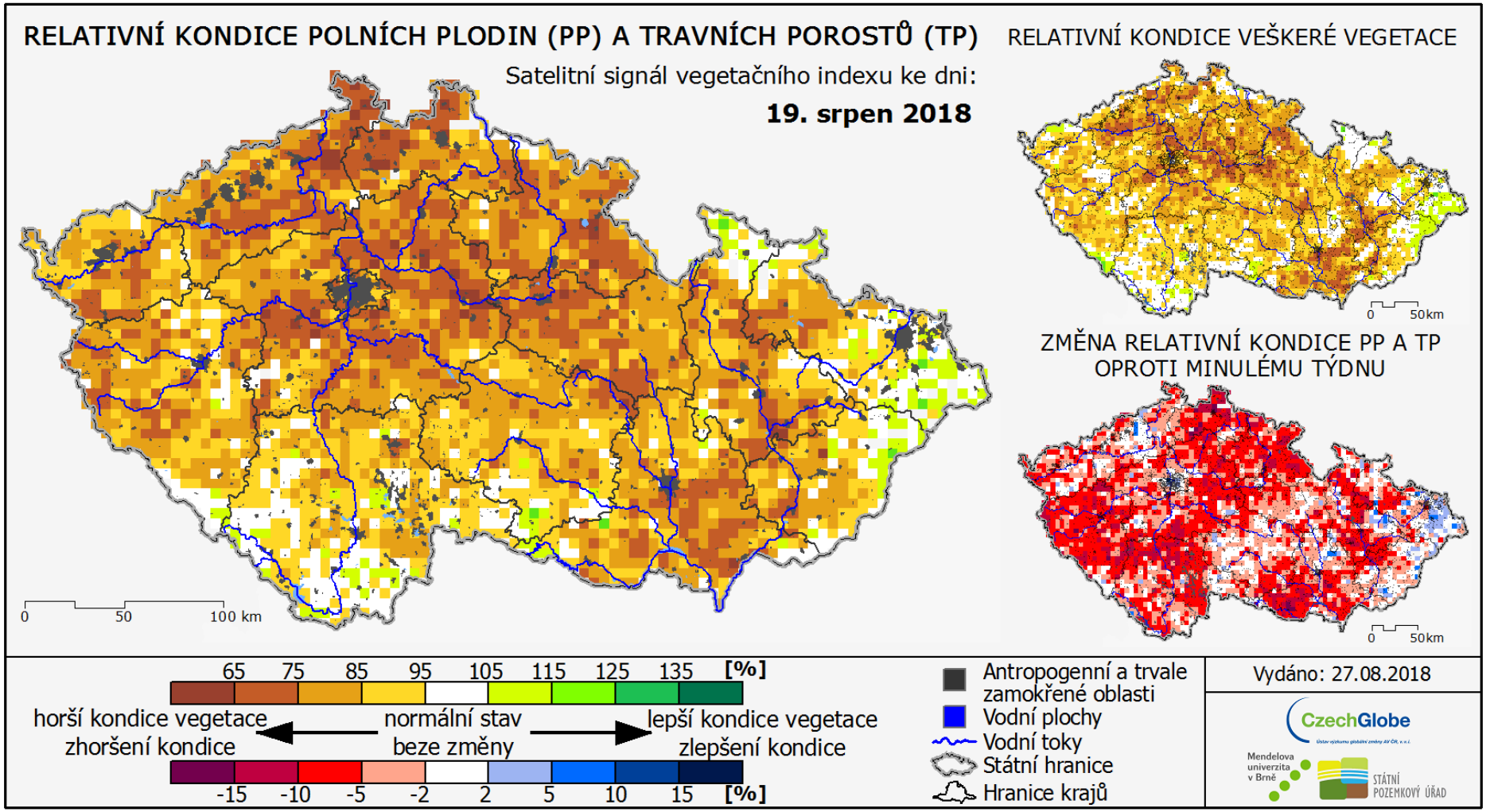
This allows farmers to find their territory in a quick way….

Pilar II: Drought intensity in high resolution



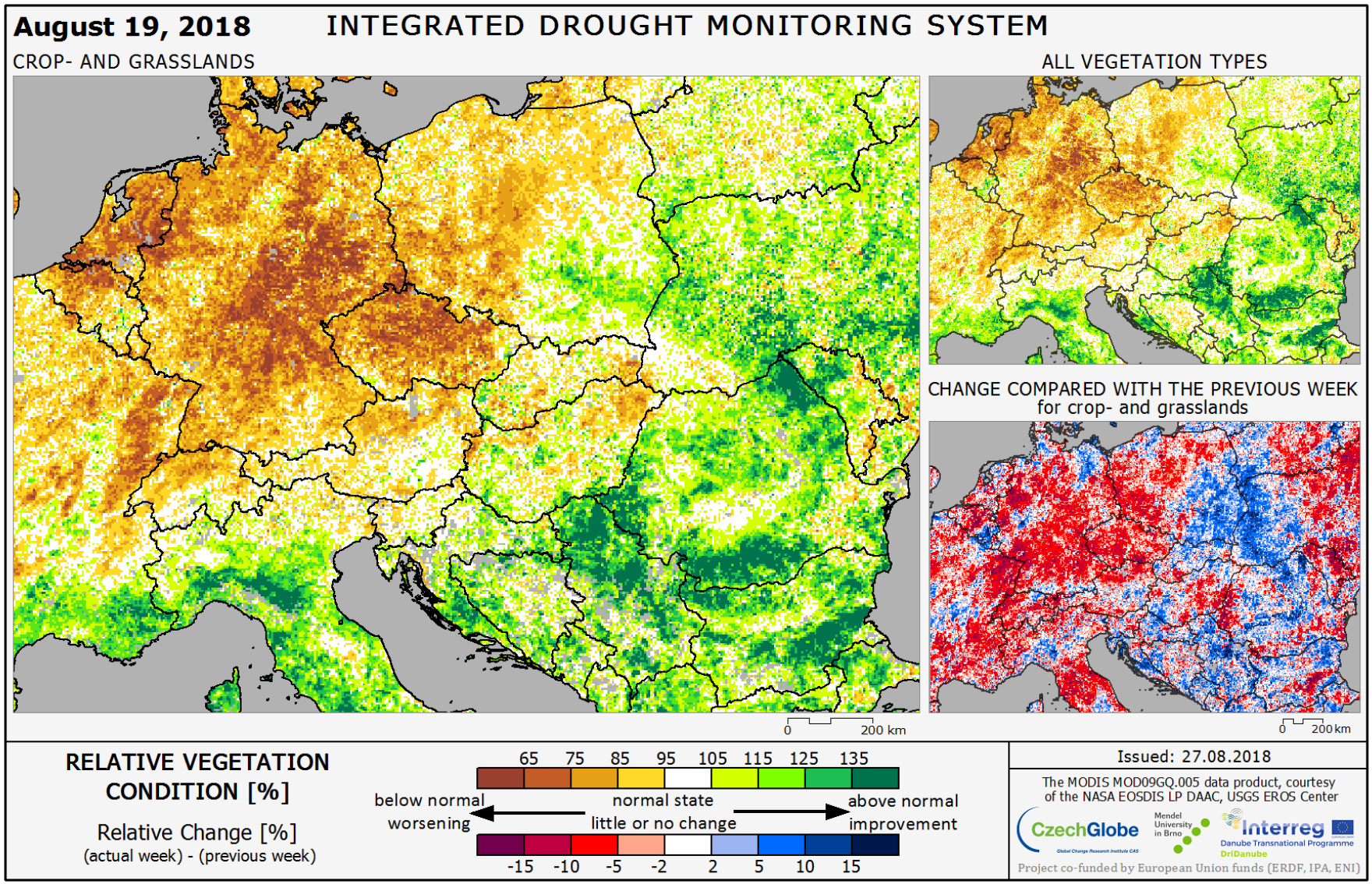
Or google maps could be used as well on the different portal….
CONNECTING WEATHER & CLIMATE WEBSITES

Pilar III: Near real time vegetation status monitoring



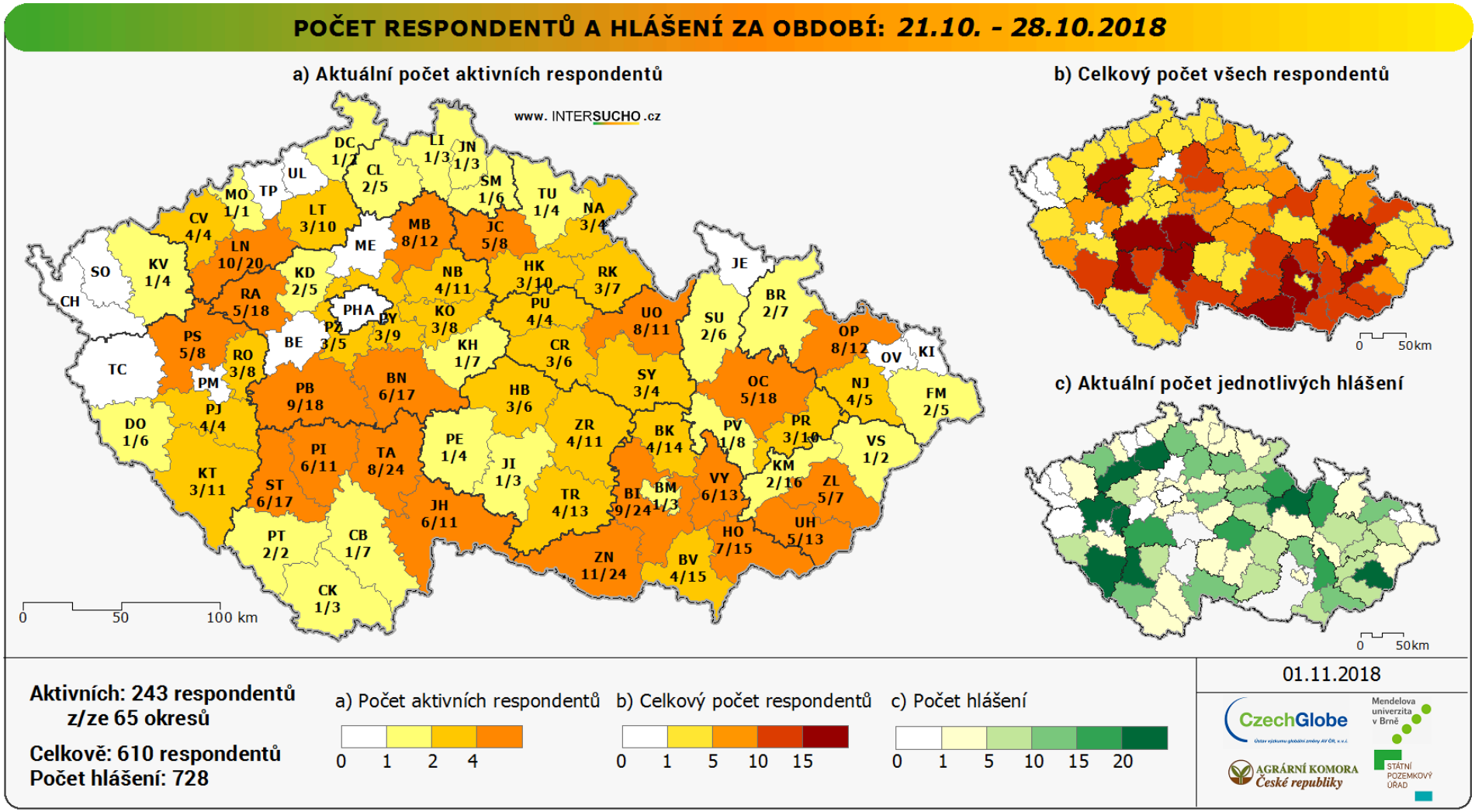
Soil moisture modelling is coupled with EVI index from Terra satelite indicating Status of vegetation on agricultural land and over the country in 5 km resolution to supress noise.

Pilar III: Central European view



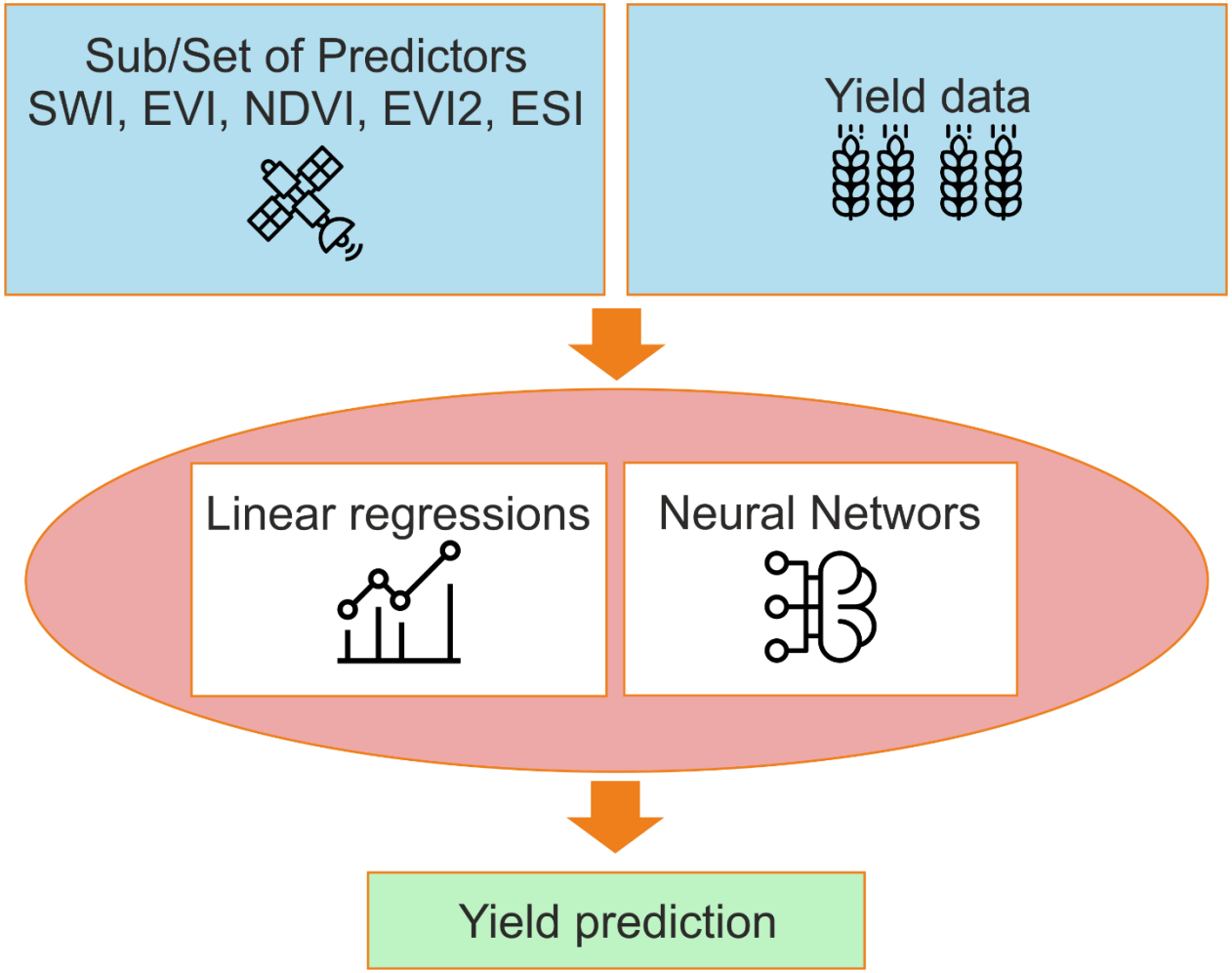
And we hope to initiate networking for presented domain…..including – regional monitoring would be valuable….

Pilar IV: Reported drought impacts



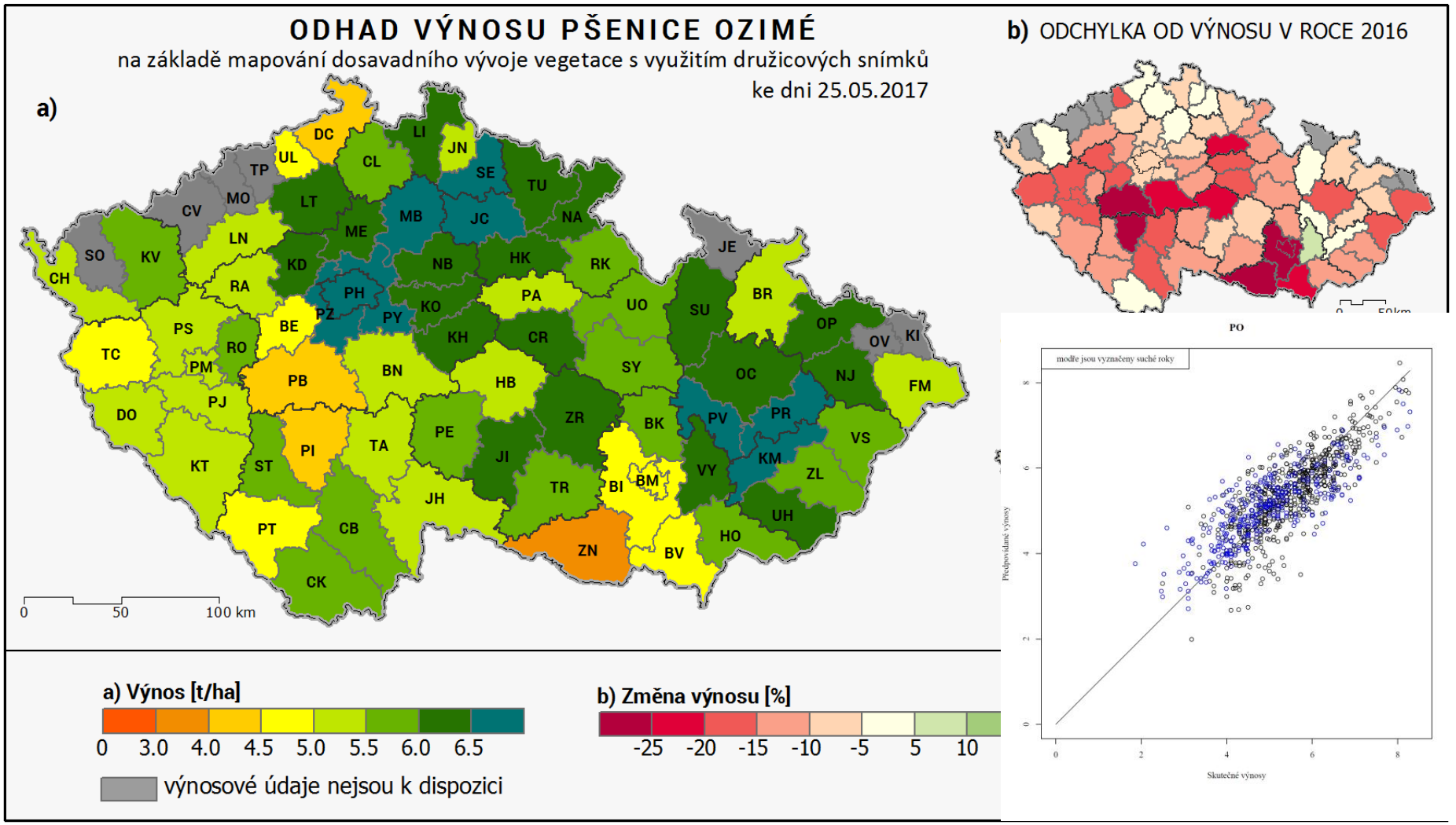
Every week over 200+ reporters are reporting back the moisture and crop status – aim is to have network of 700+ trained farmers + „super-reporters“

Pilar IV: Estimated Yield Impacts



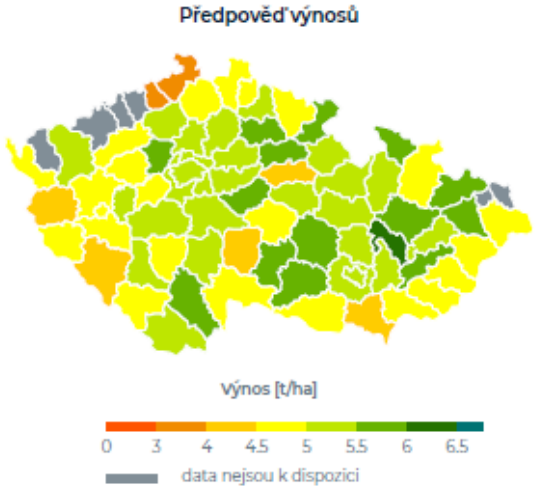
- Relation between predictors and actual yield is processed by linear regressions and neural networks
- Best results of both methods are combined into final prediction

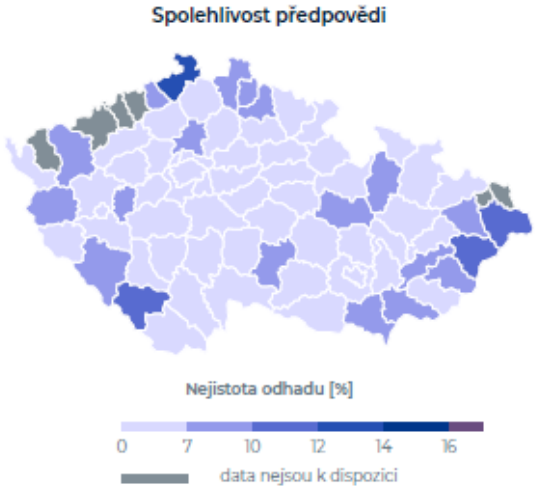
Pilar IV: Estimated Yield Impacts

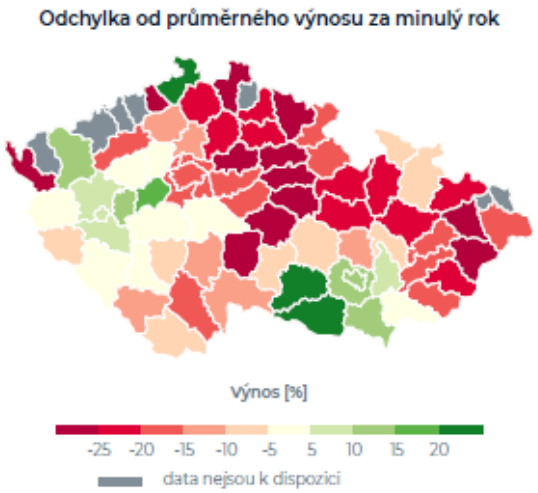


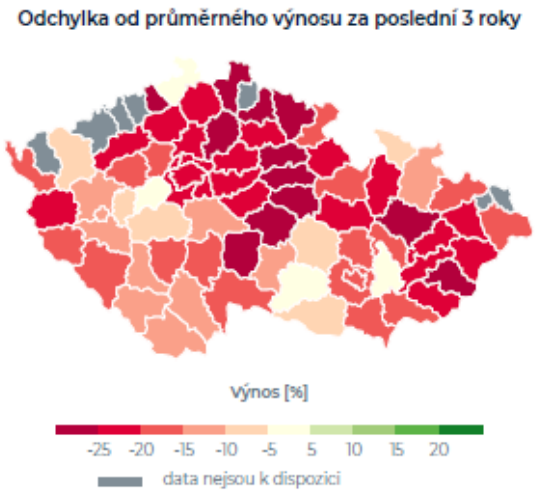
Yied impact estimates for 8 crops based on ensemble of statistical models.

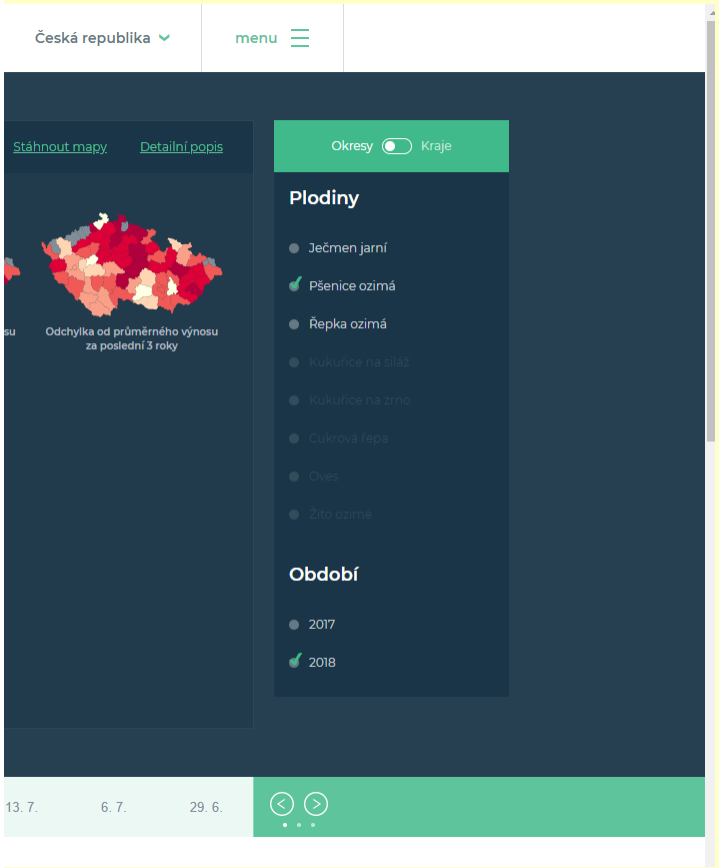
Pilar IV: Estimated Yield Impacts





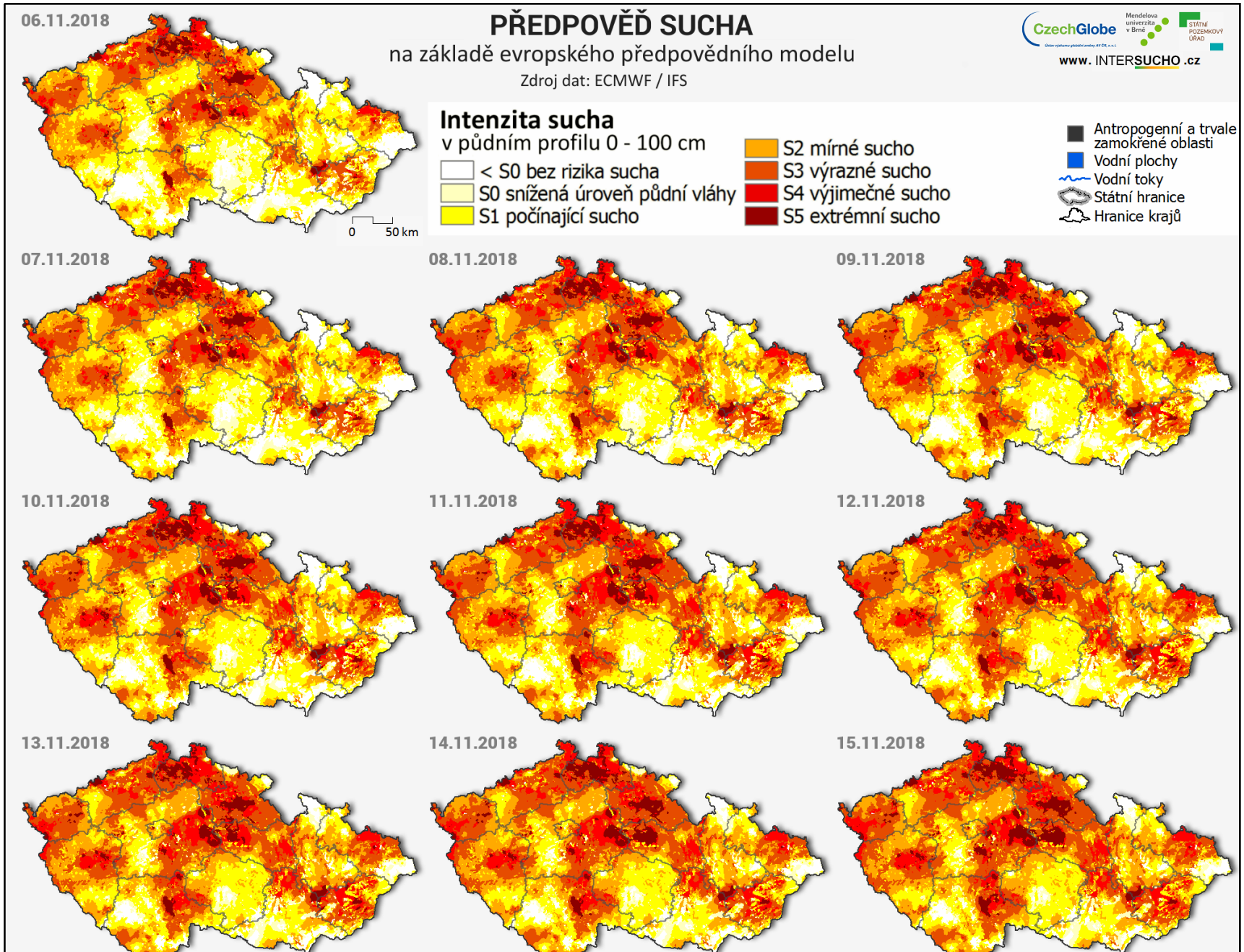




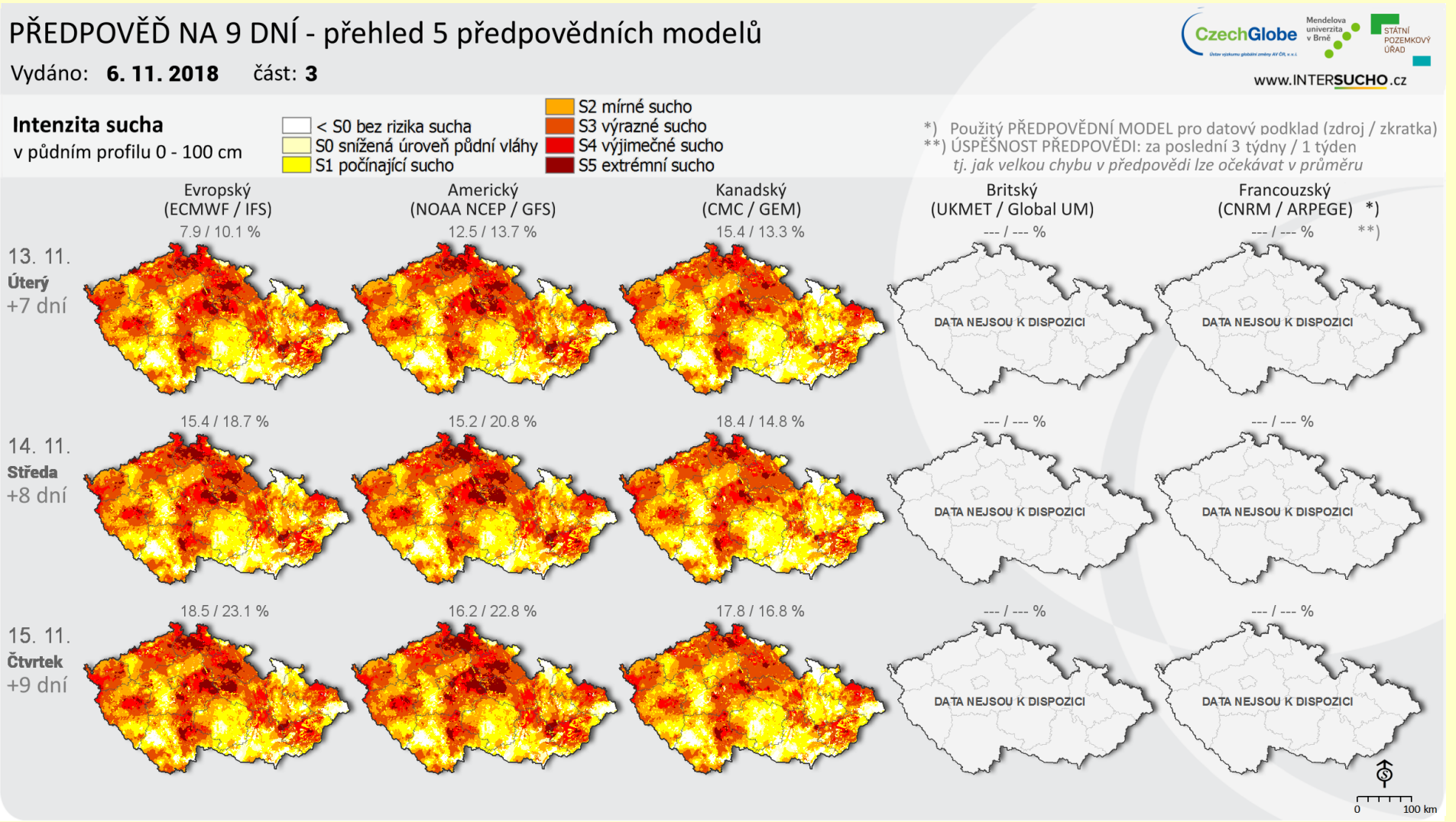


High resolution yied impact estimates for wheat, barely and oil-seed rape based on ensemble of statistical models + other 5 crops in lower resolution

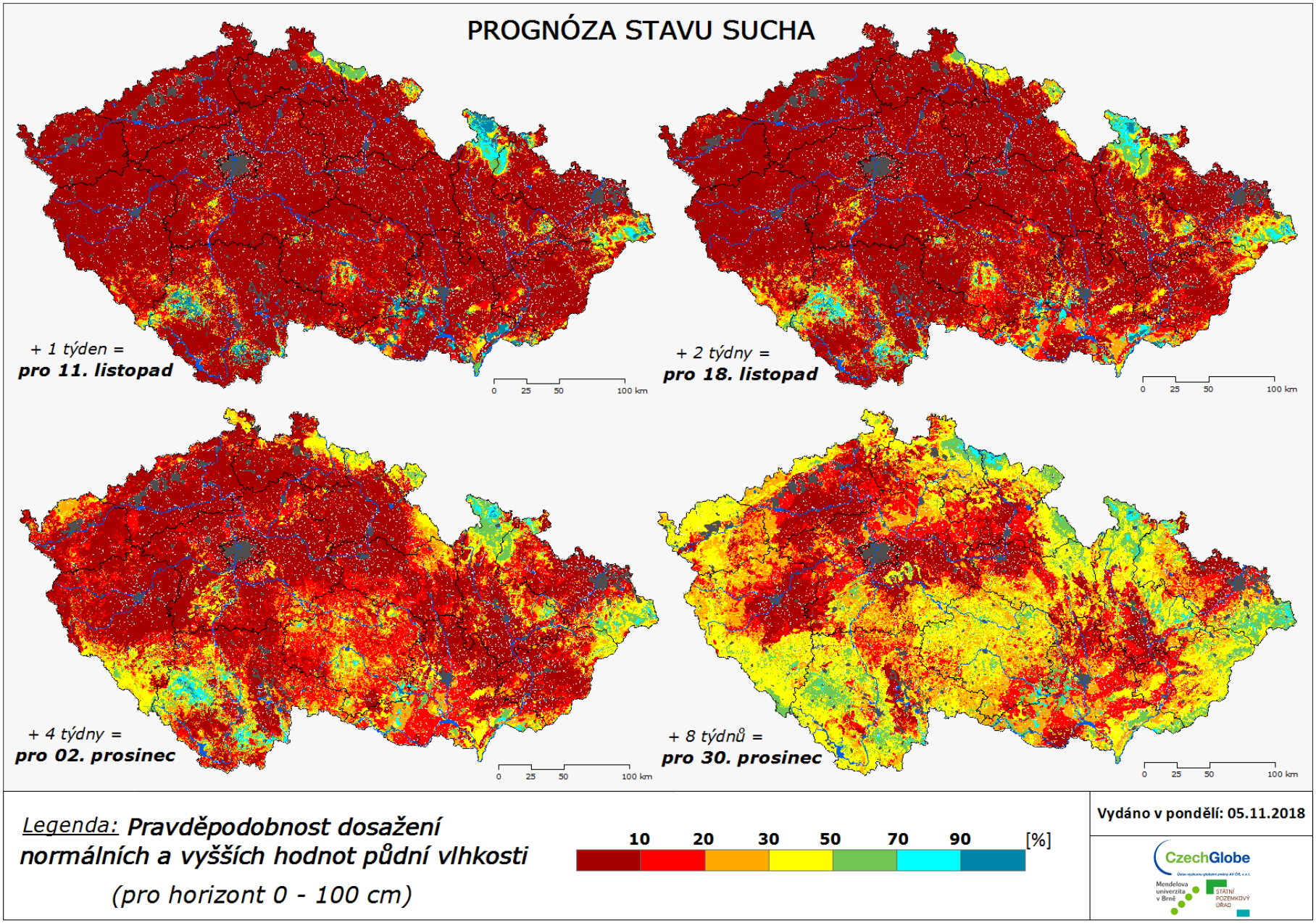
Current products: 10 day IFS model based Forecast



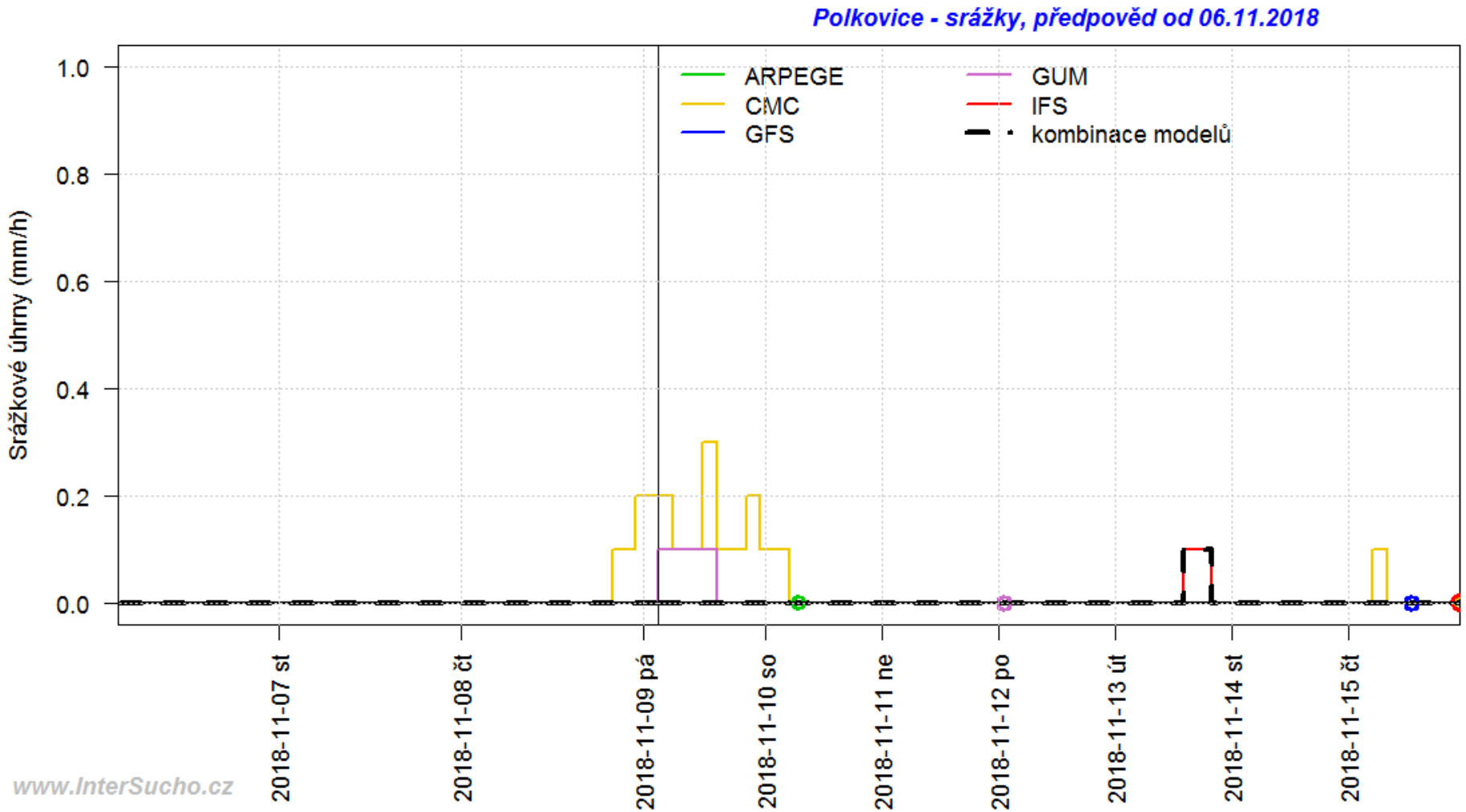
Current products: 5 NWP models ensemble



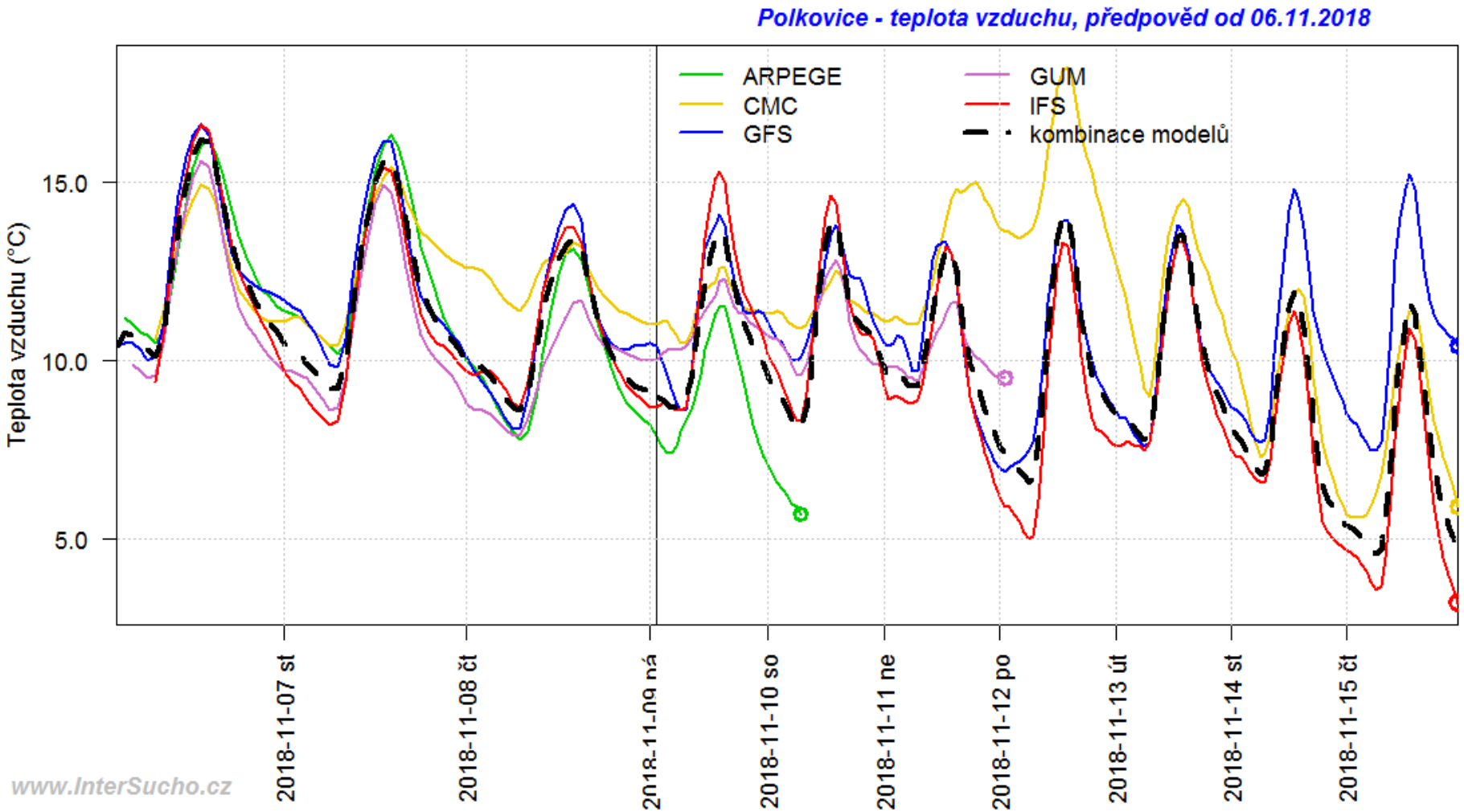
We try to extend it…using probabilistic forecast



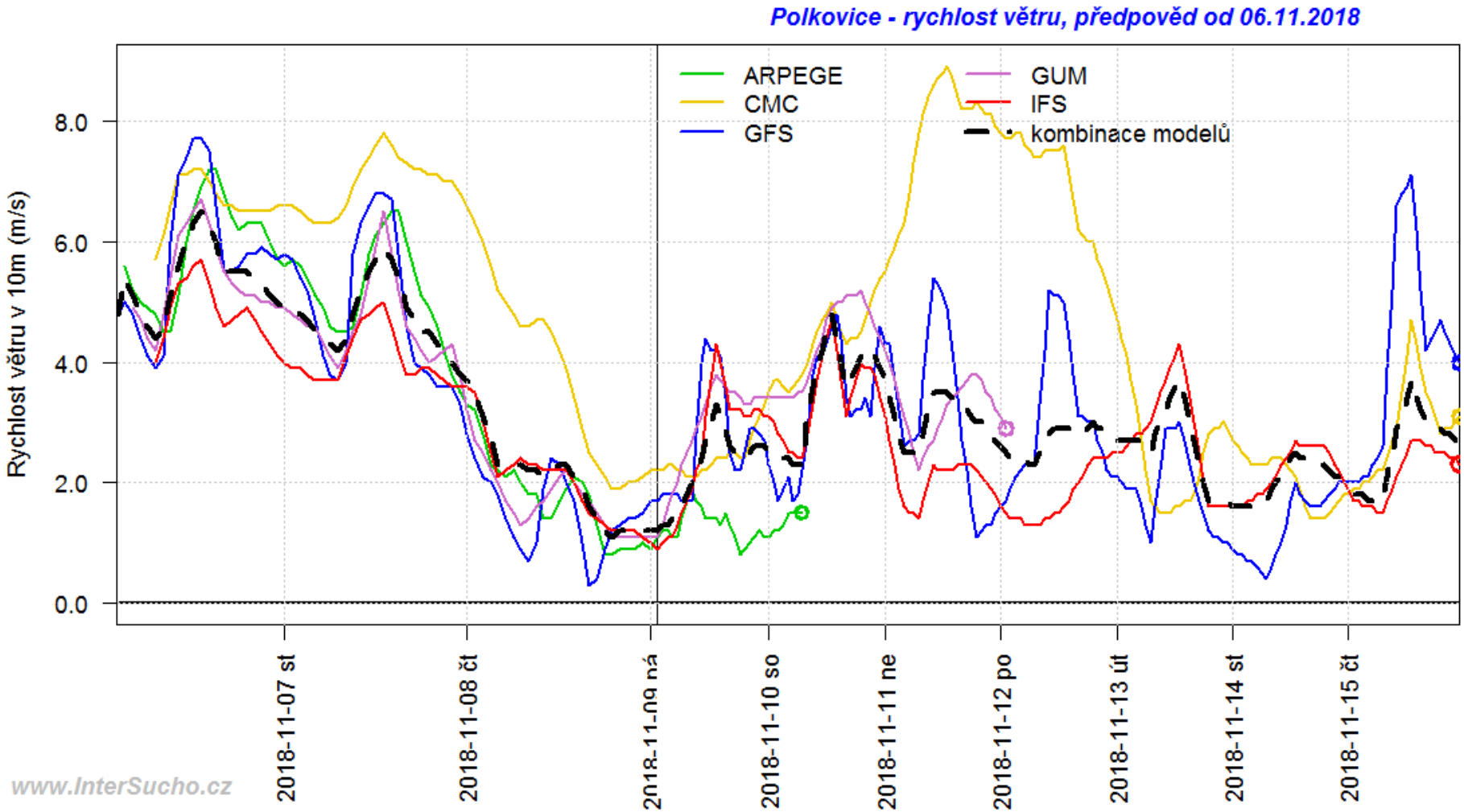
We try to extend it…and localize it



We try to extend it…and localize it

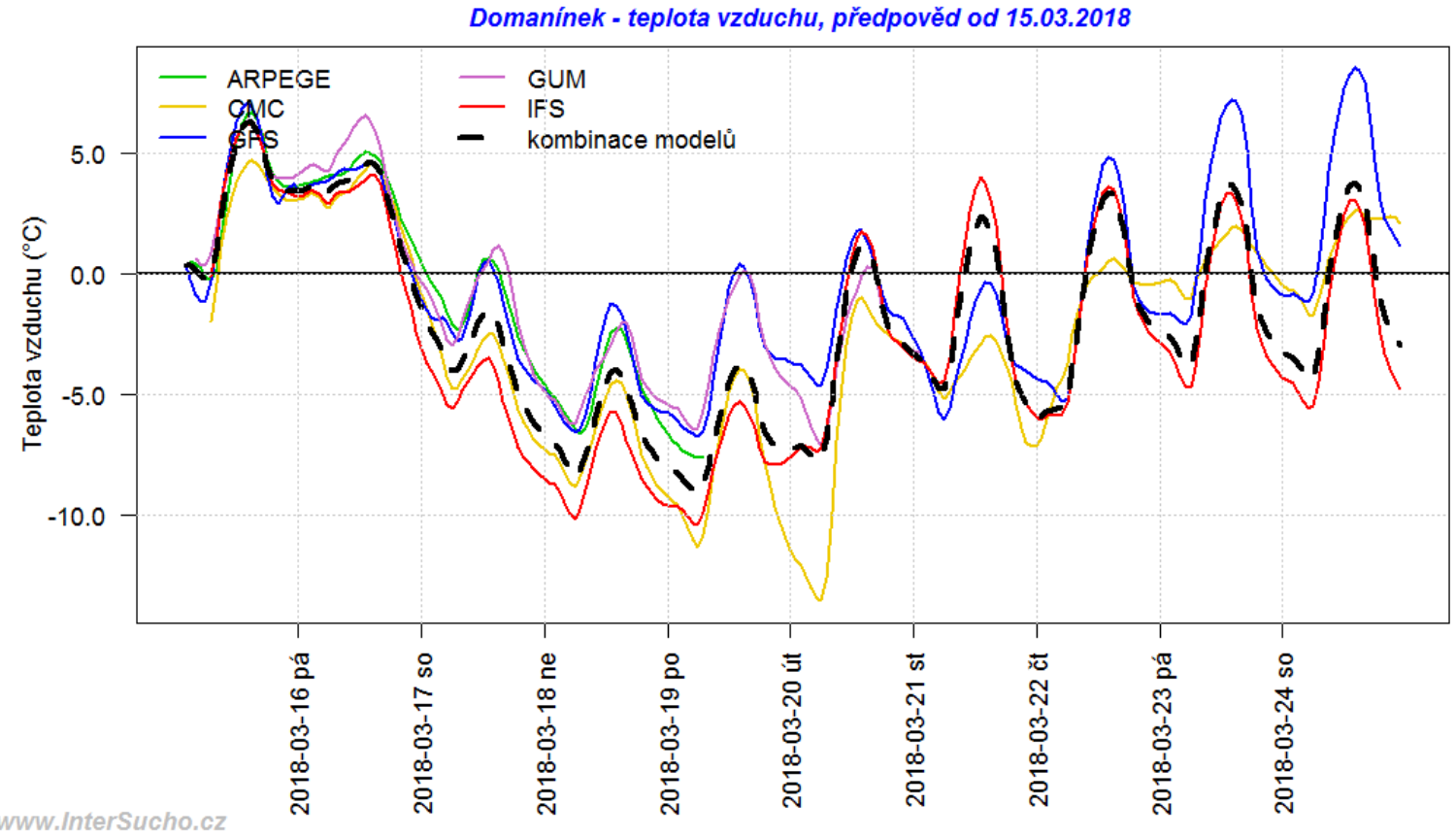


We try to extend it…and localize it



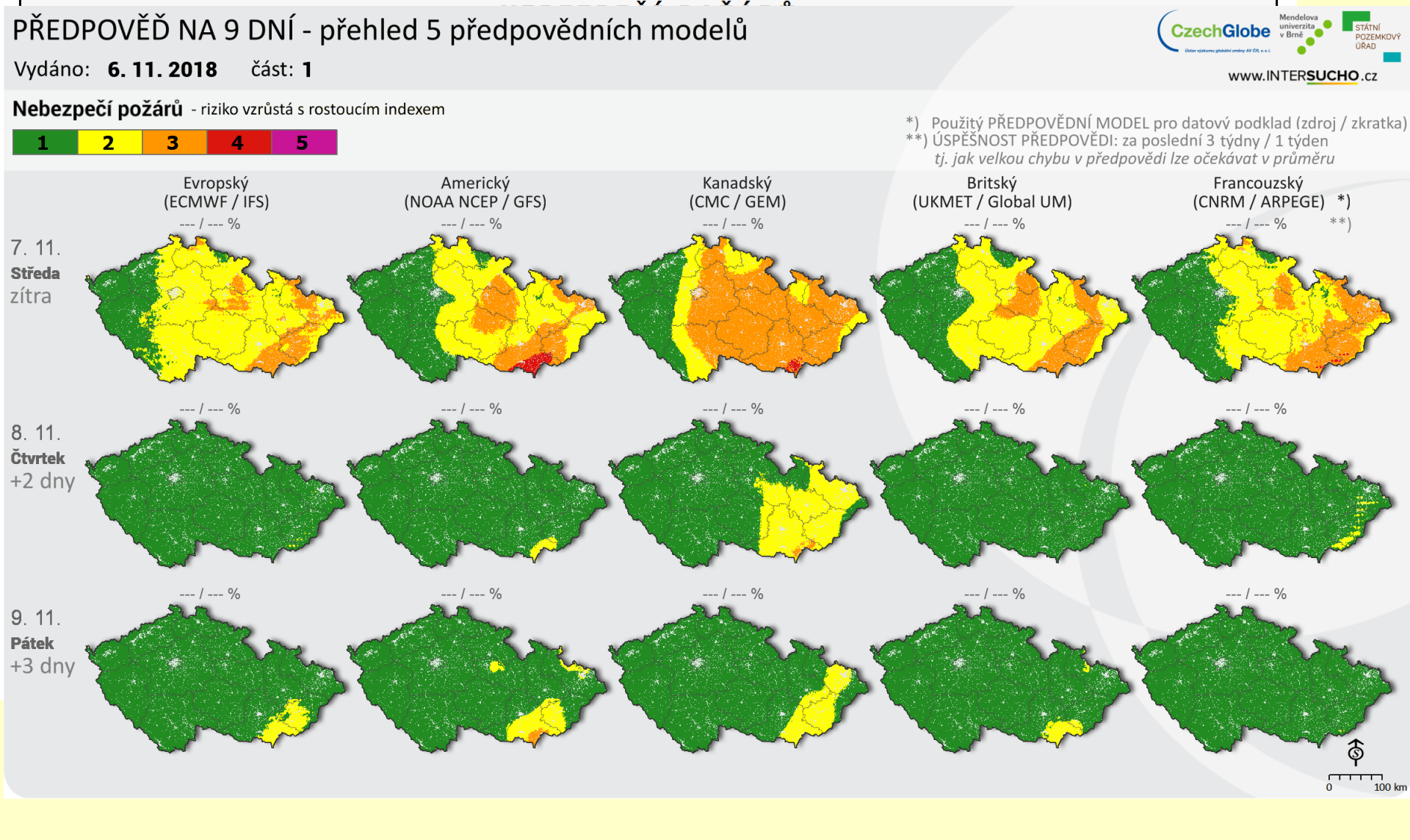
…..and motivate farmers to report

This operational forecast can help to prevent losses

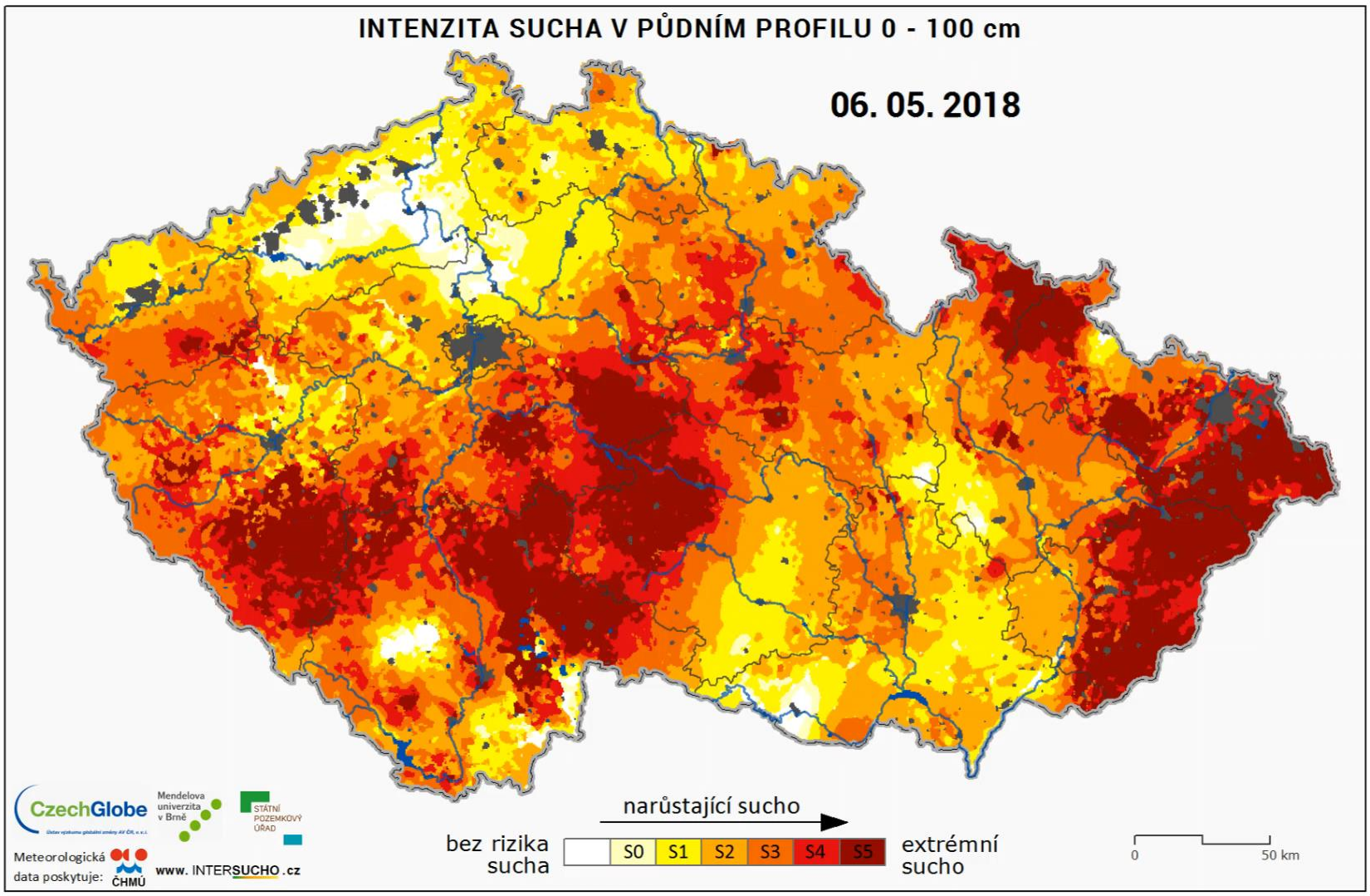


We forecast drought & Wild Fire Risk

To increase usefulness the forecast of soil moisture is issued daily….5 forecast models (IFS, GFS, GEM, GLOBAL UM, ARPEGE) RUN AS ENSEMBLE



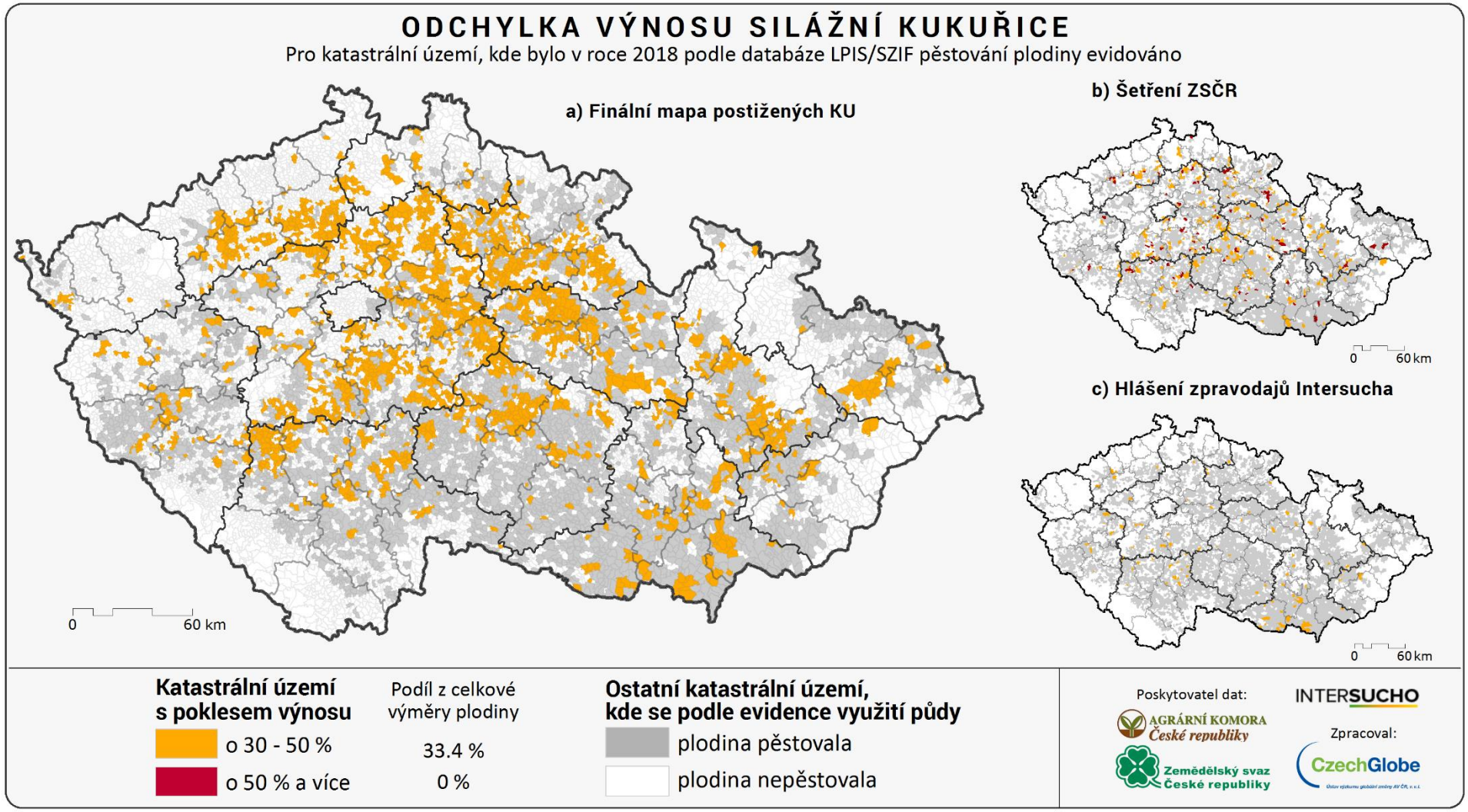
We evaluate impacts in near real time



We evaluate impacts in near real time

2018 – assessment of drought impact

- On cadastre level (13 000+ cadastres)
- For all crops including special cultures



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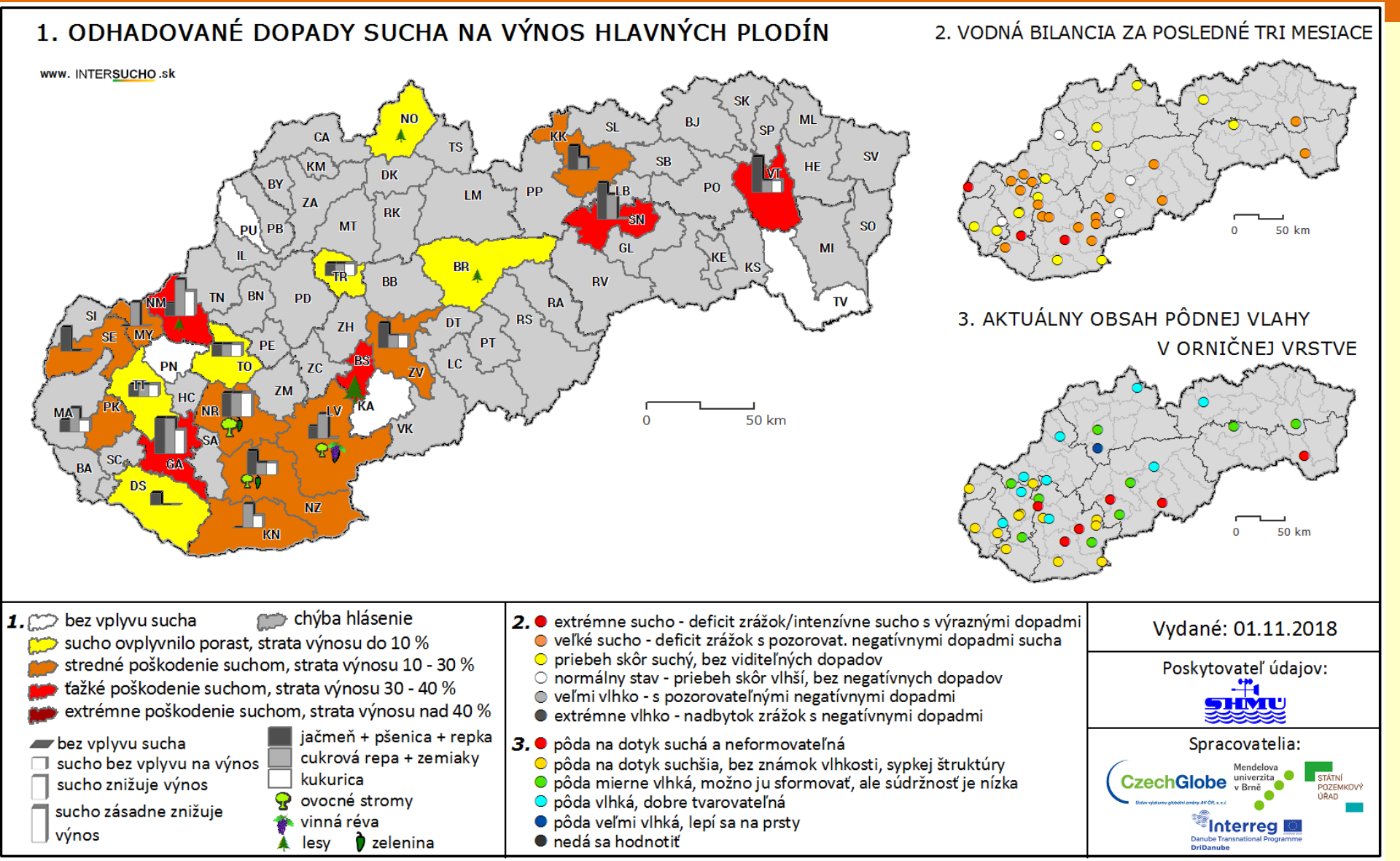
Danube Transnational Programme
DriDanube

Can we tranfer the knowlege?

Yes- DIRECTLY SHARING THE METHODS– SLOVAKIA + AUSTRIA



1.
- bez vplyvu sucha
- chýba hlásenie
- sucho ovplyvnilo porast, strata výnosu do 10 %
- stredné poškodenie suchom, strata výnosu 10 - 30 %
- ťažké poškodenie suchom, strata výnosu 30 - 40 %
- extrémne poškodenie suchom, strata výnosu nad 40 %

- bez vplyvu sucha
- sucho bez vplyvu na výnos
- sucho znižuje výnos
- sucho zásadne znižuje výnos
- jačmeň + pšenica + repka
- cukrová repa + zemiaky
- kukurica
- ovocné stromy
- vinná réva
- lesy
- zelenina

2.
- extrémne sucho - deficit zrážok/intenzívne sucho s výraznými dopadmi
- veľké sucho - deficit zrážok s pozorovat. negatívnymi dopadmi sucha
- priebeh skôr suchý, bez viditeľných dopadov
- normálny stav - priebeh skôr vlhší, bez negatívnych dopadov
- veľmi vlhko - s pozorovateľnými negatívnymi dopadmi
- extrémne vlhko - nadbytok zrážok s negatívnymi dopadmi

3.
- pôda na dotyk suchá a neformovateľná
- pôda na dotyk suchšia, bez známok vlhkosti, sypkej štruktúry
- pôda mierne vlhká, možno ju sformovať, ale súdržnosť je nízka
- pôda vlhká, dobre tvarovateľná
- pôda veľmi vlhká, lepí sa na prsty
- nedá sa hodnotiť

Vydané: 01.11.2018

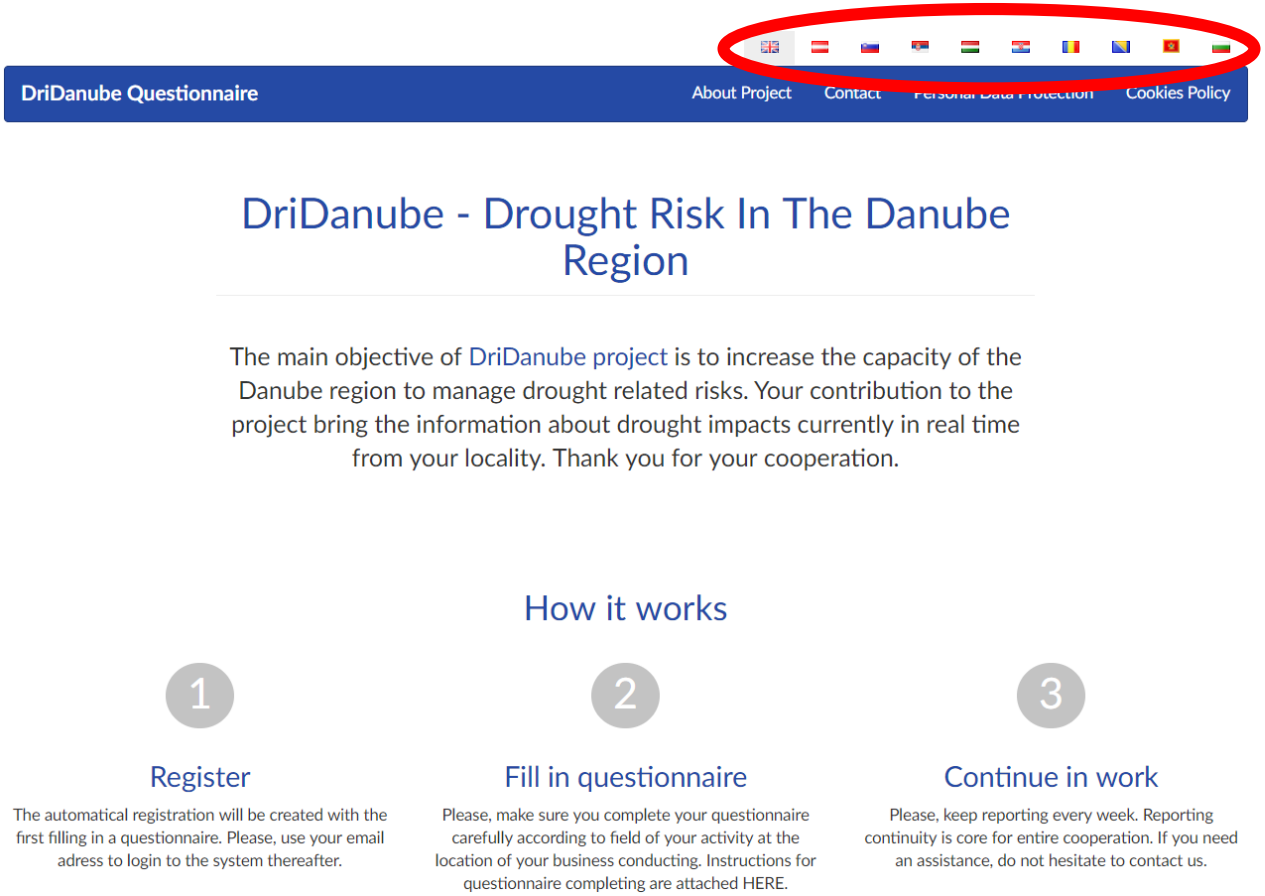
Poskytovateľ údajov: SHMÚ

Spracovatelia: CzechGlobe, Mendelova univerzita v Brně, Státní pozemkový úřad, Interreg Danube Transnational Programme DriDanube

We are open and we run „no-cost“ monitoring scheme with our Slovak and Austrian partners….

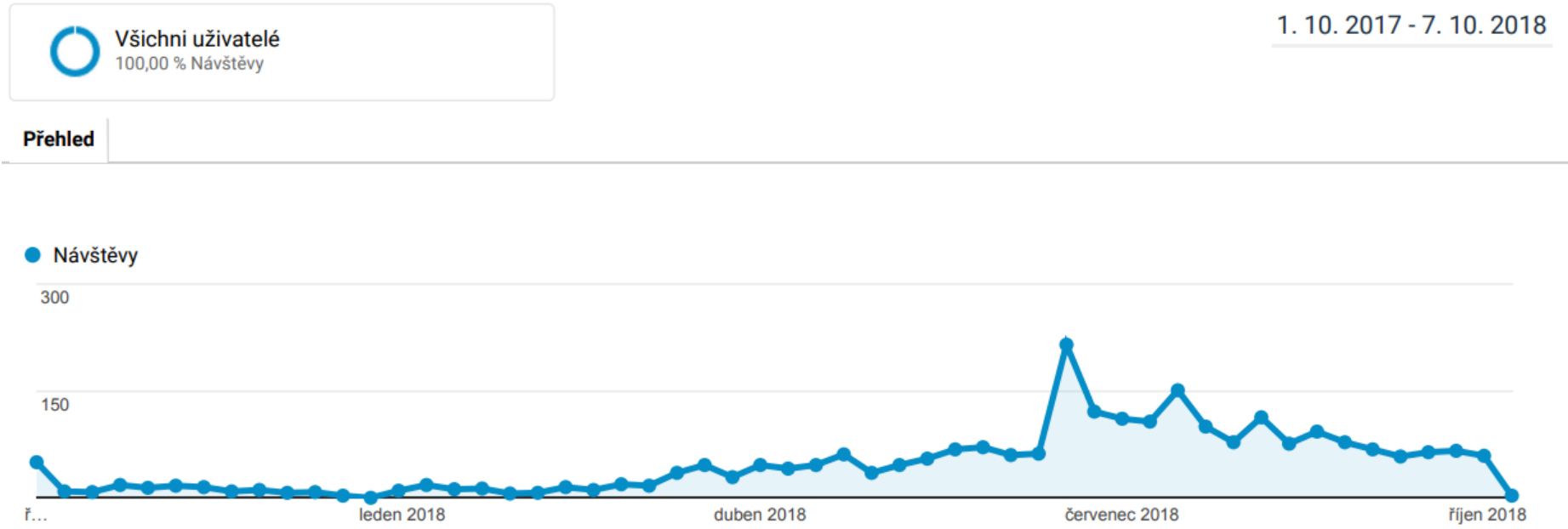
YES– BUILDING REGIONAL PRODUCT

Interreg
Danube Transnational Programme
DriDanube

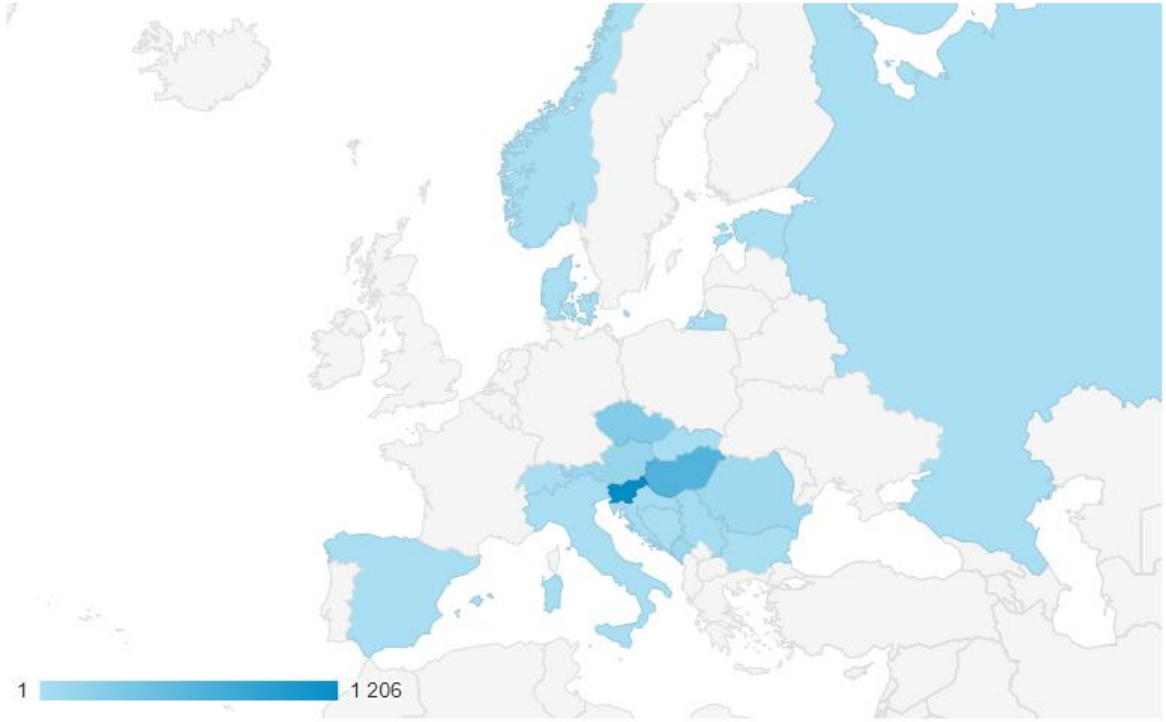


Questionnaire page now running for all involved countries, all translations are finished – thanks for your excellent cooperation!

Number of visitors of http://questionnaire.intersucho.cz by weeks (X 2017 – X 2018)



Visits of http://questionnaire.intersucho.cz by countries (X 2017 – X 2018)

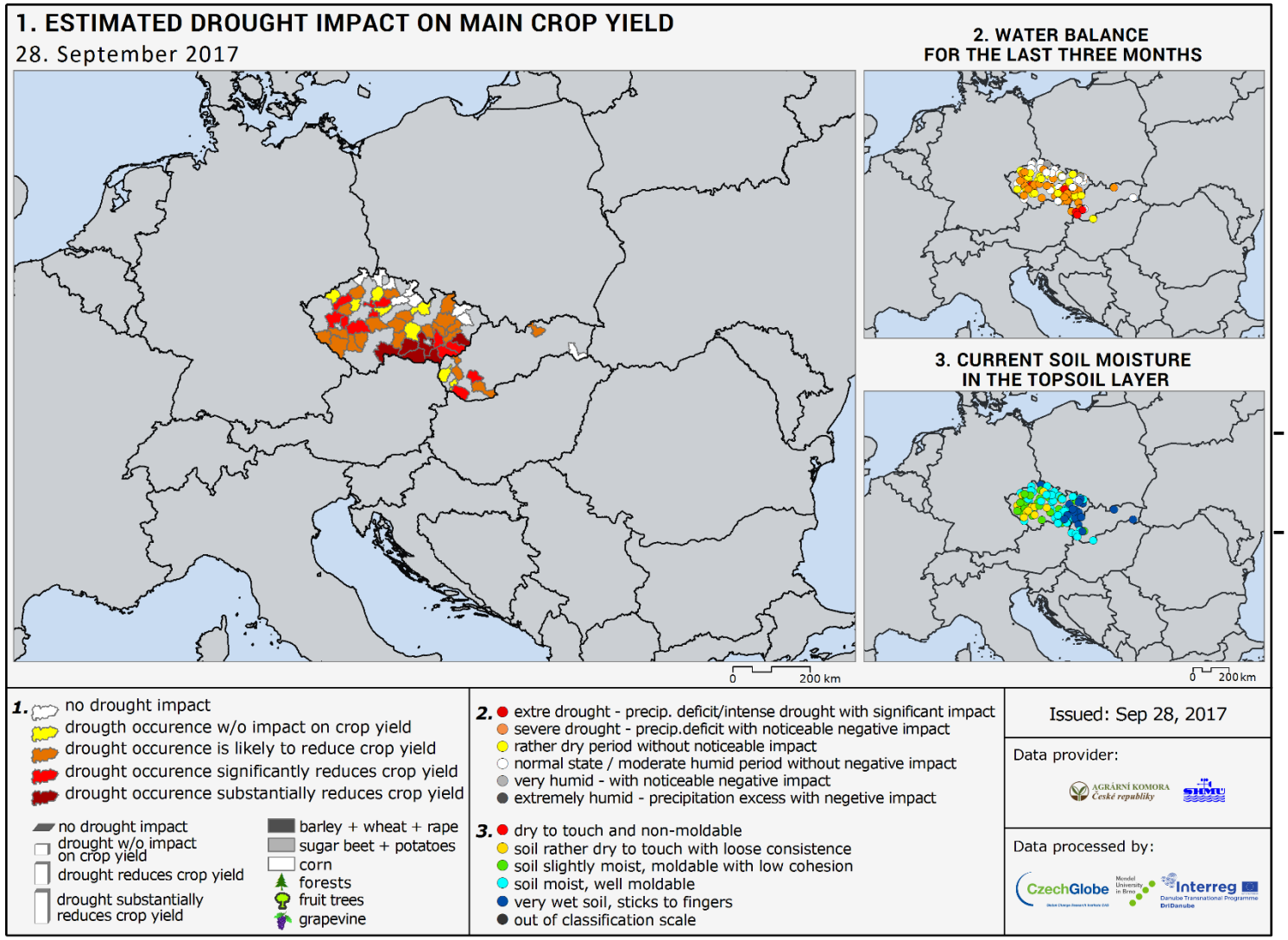


1.	Slovenia
2.	Hungary
3.	Czechia
4.	Austria
5.	Montenegro
6.	Romania
7.	Serbia
8.	Croatia
9.	Slovakia
10.	Bosnia & Herzegovina
11.	Bulgaria

Drought impacts assessment - maps

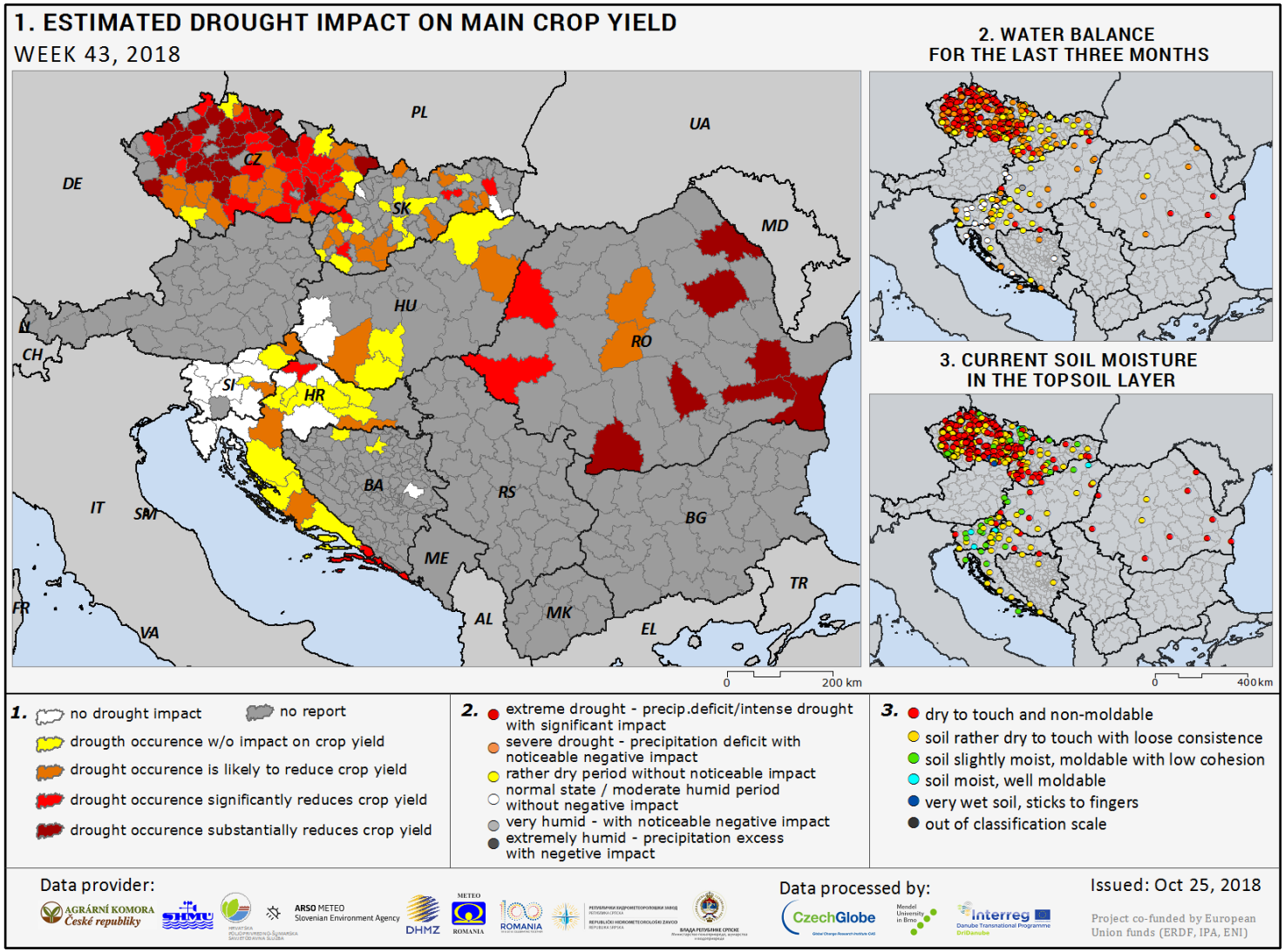
- Weekly getting data for maps from 4 (5) countries (+ Czech and Slovak republic)

  - Croatia: 40 reporters,
  - Hungary: 30
  - Slovenia: 25
  - Romania:10



Map of drought impacts – October 2017

- Just an „idea“ how it may look
- Functional examples in the Czech and Slovak republic

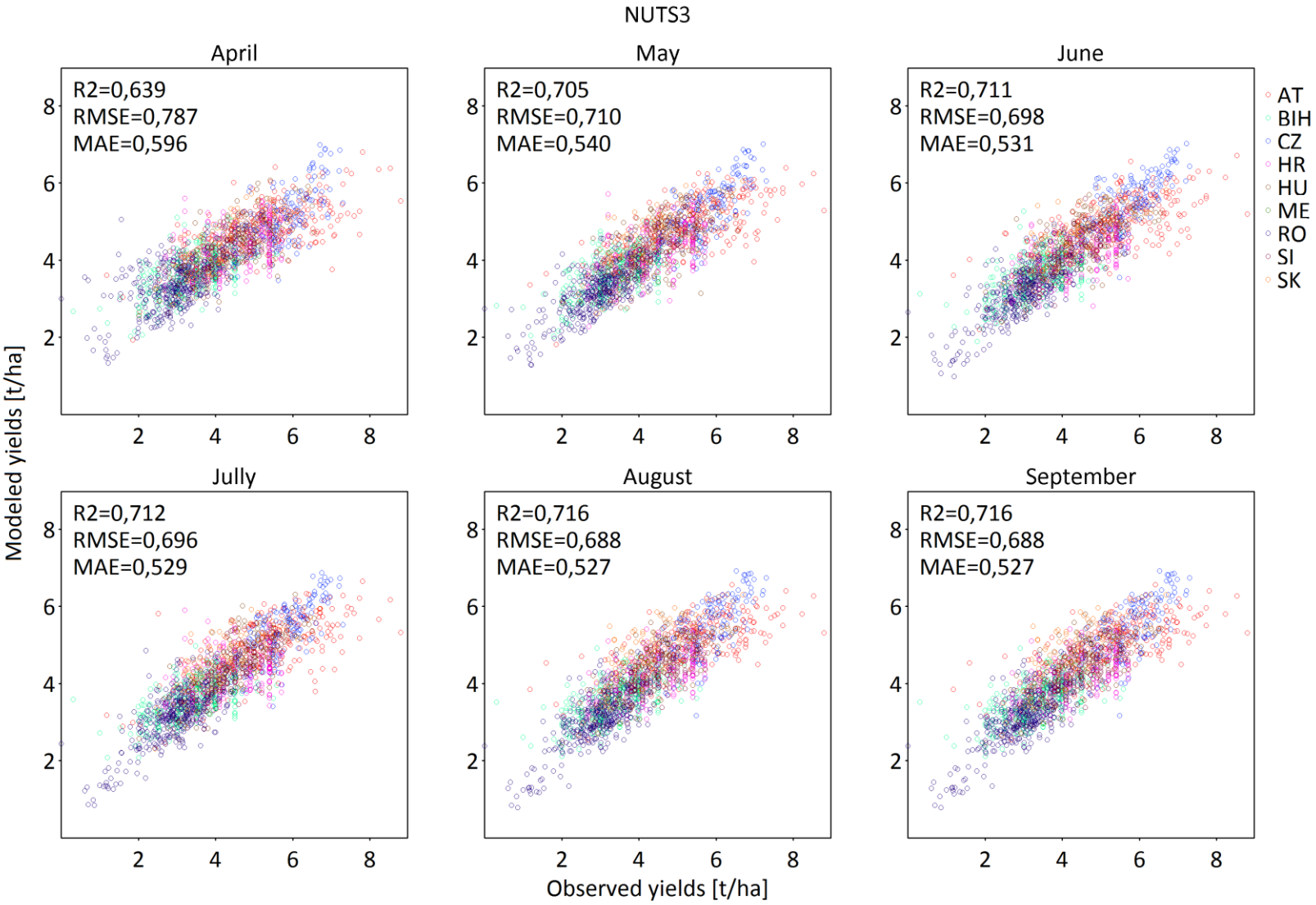


Map of drought impacts – October 2018

Yield prediction

- Based on yield database collected by you on your national levels
- Now operational
- First maps for the most common crops (published in DriDanube bulletin No. 7)

Yield prediction - training



Yield prediction **now operational** for 5 most common crops – Barley, Maize, Potato, Sugar Beet, Wheat

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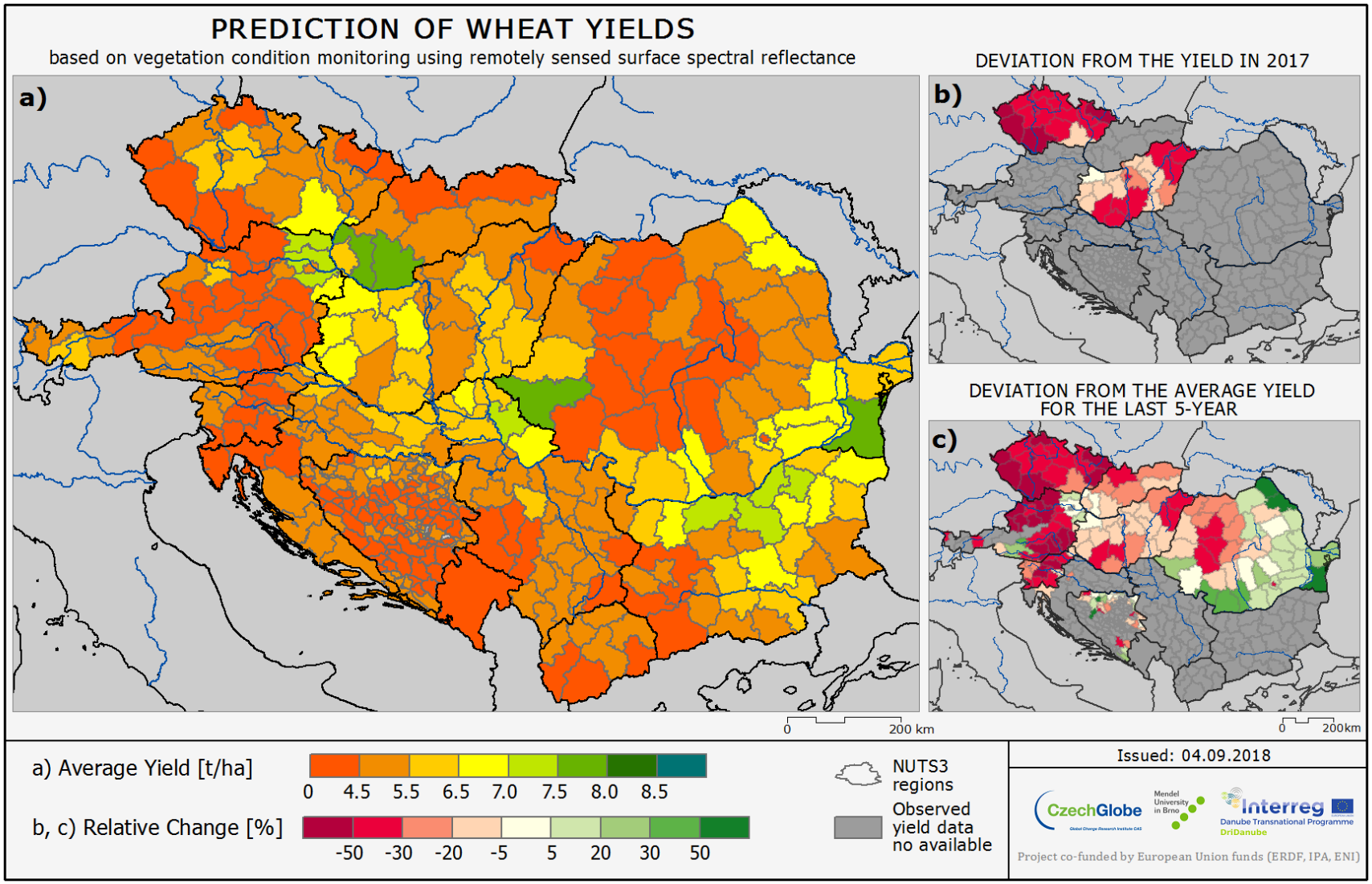
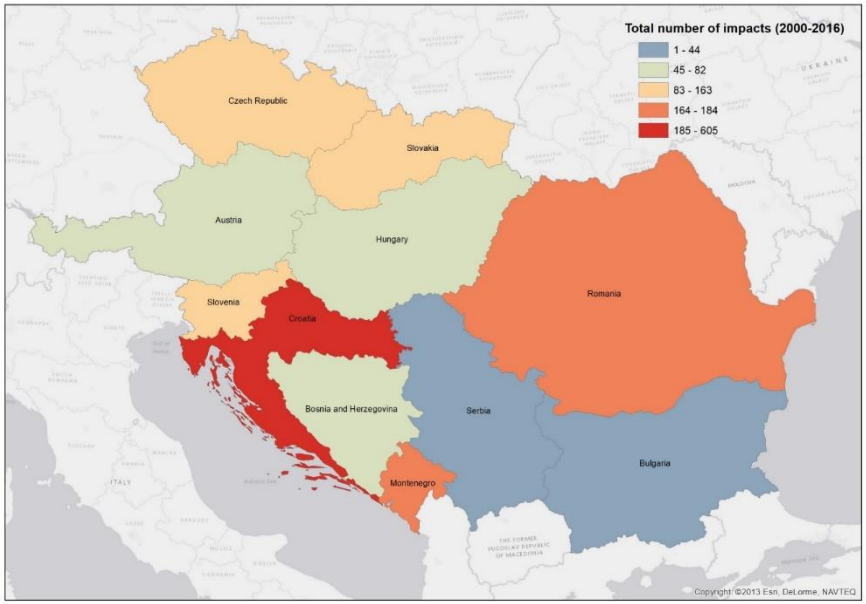
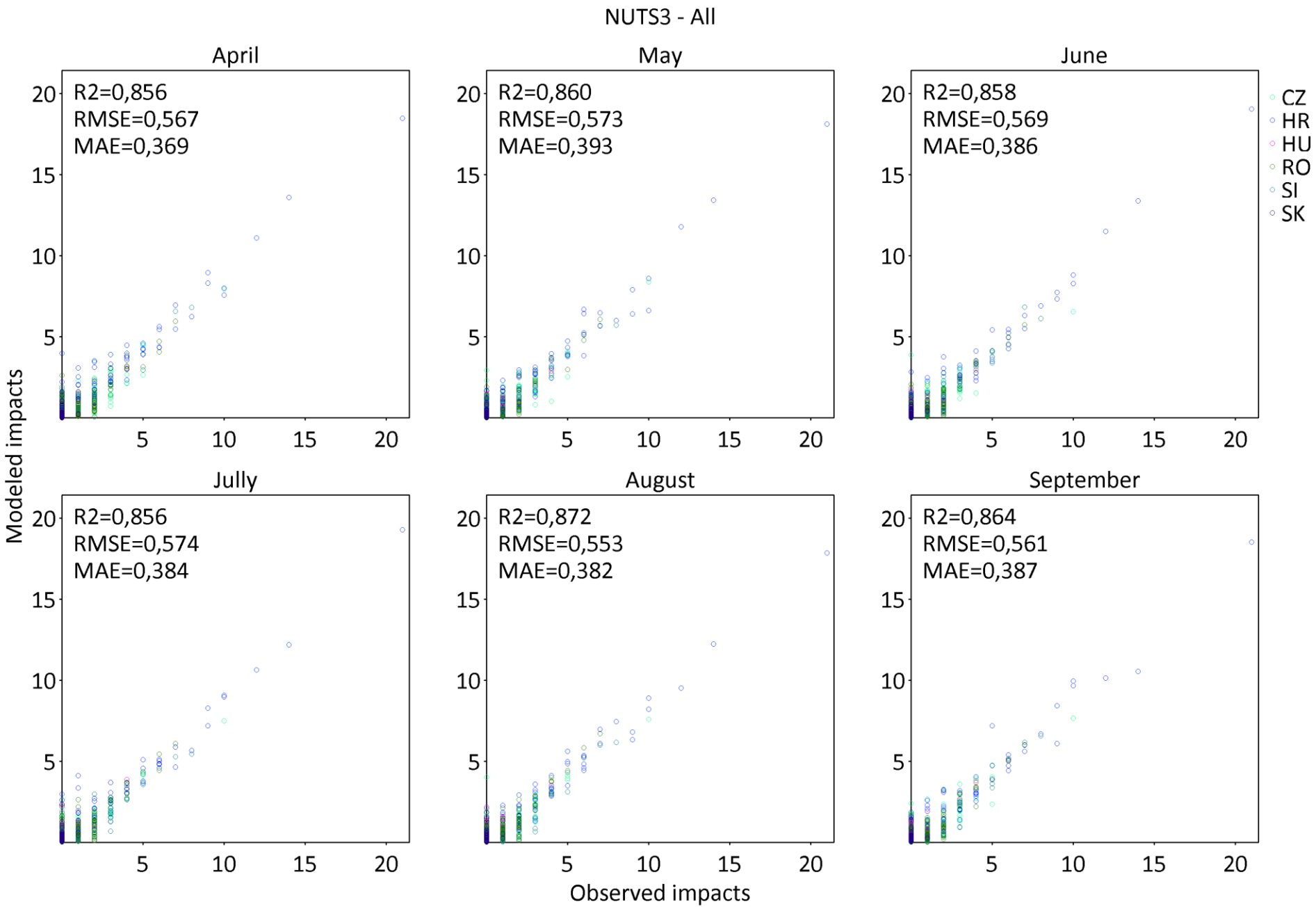


Impact database + prediction

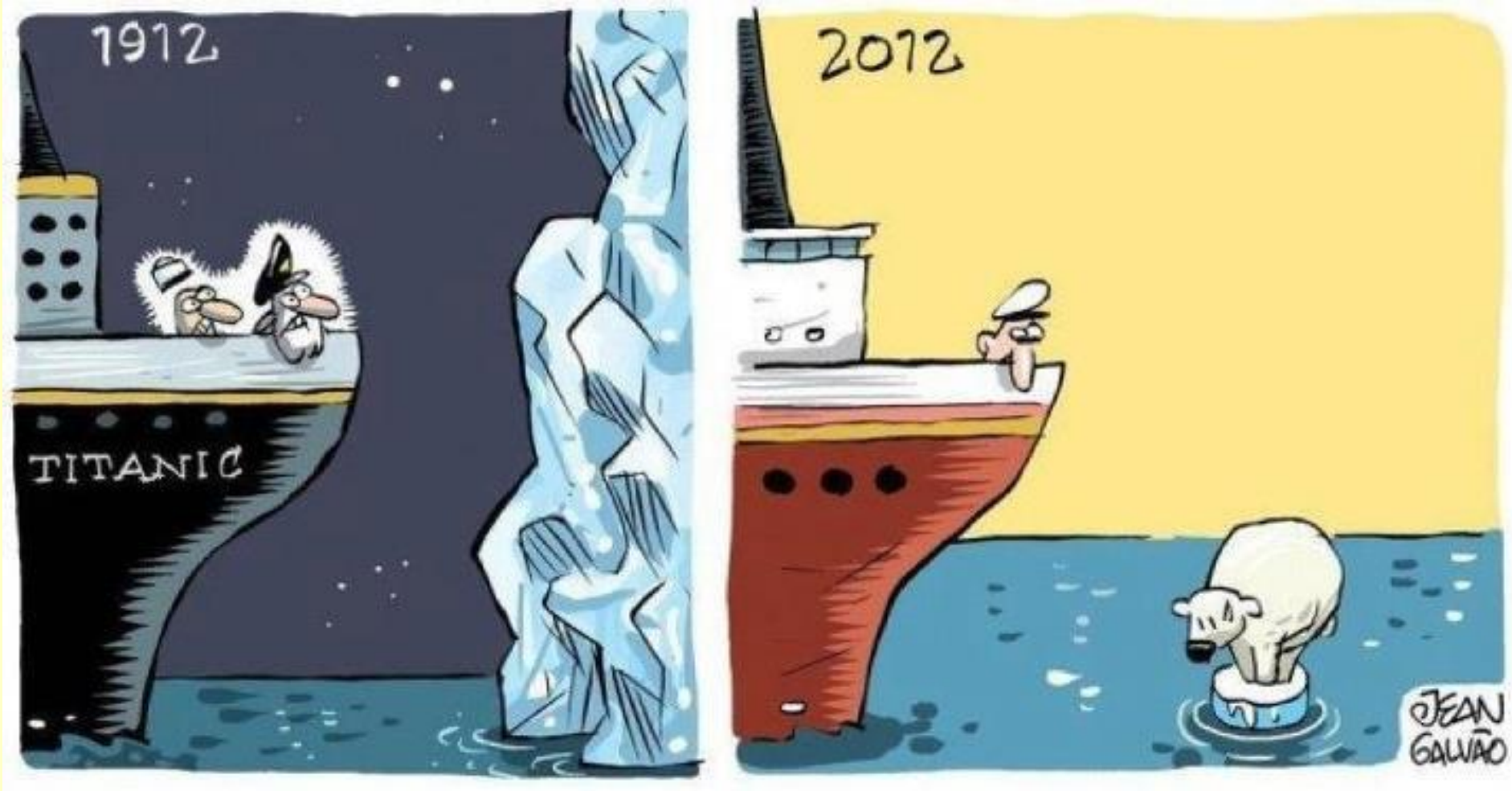
- Data collected from Interreg partners processed into model
- Estimating the drought impact gravity early in the season



Impact database + prediction



Thank You for Your attention…



Questions….if not answered at the spot to mirek_trnka@yahoo.com