KRATKI SAŽETCI

Cilj skupa je, osim razmjene znanja među meteorolozima, ukazati na važnost meteorologije u mnogim djelatnostima te ojačati komunikaciju između meteorologa i drugih stručnjaka koji se koriste meteorološkim podacima. **Očekivani rezultati** su uža interdisciplinarna suradnja meteorologa s korisnicima iz svih područja društvenih i gospodarskih djelatnosti koje ovise o vremenu i klimi kao i povećana svjesnost sudionika skupa o potrebi nastavka razvoja modernih meteoroloških alata, porast razumijevanja ograničenja i prednosti naprednih tehnologija te demonstracija rješenja aktualnih meteoroloških izazova kao što su potreba za što gušćom mrežom meteoroloških mjerenja te brzim obradama velike količine izmjerenih i računalno generiranih podataka.

Pozvani predavači su Vladimir Đurđević (Institut za meteorologiju, Prirodoslovni fakultet, Beograd, Srbija), Ferenc Acs (Katedra za meteorologiju Sveučilišta Eötvös Loránd, Geografski i geofizički zavod, Budimpešta, Mađarska) i Heinz Jürgen Punge (Maks Plank institut za meteorologiju, Hamburg, Njemačka).

Pokrovitelji su Predsjednica Republike Hrvatske Kolinda Grabar Kitarović, gradonačelnik grada Zagreba Milan Bandić, Ministarstvo zaštite okoliša i energetike i Ministarstvo znanosti i obrazovanja.

PREDAVANJA
PRESENTATIONS

DIFFICULTIES IN SELECTING THE MOST APPROPRIATE MODEL SETUP OF RegCM FOR THE PANNONIAN REGION WITH A SPECIAL FOCUS ON PRECIPITATION

TÍMEA KALMÁR, ILDIKÓ PIECZKA, RITA PONGRÁCZ and JUDITH BARTHOLY

Eötvös Loránd University, Department of Meteorology
Pázmány Péter sétány 1/A, Budapest, Hungary
kalmartimea@caesar.elte.hu

ABSTRACT

In order to increase the potential success of regional/national adaptation strategies, impact studies from several aspects are needed in a timely manner. These climate change impact analyses certainly require information on the future climatic conditions of their target regions, for which the simulations of physically-based climate models are essential. Regional climate models with higher resolution result in a better representation of land surface heterogeneity and fine-scale forcing (which are important for simulating the local and regional aspects of climate) than global climate models. The Pannonian Basin is surrounded by the Carpathian Mountains and orographic differences (i.e. hill chains and lowlands) are present within the basin itself. Thus, the heterogeneity of the target region justifies the higher model resolution, which may require different approach and different parameterizations.

The current study focuses two model versions of RegCM (RegCM4.5 and RegCM4.6) that are used to compare different moisture parameterizations, specifically focusing on the Pannonian Basin. Before climate models can be used for projections, a thorough analysis required whether the model simulations of the past reconstruct the measurements appropriately. Therefore, the main validation goal in this study is to improve the reconstruction of the historical regional precipitation characteristics for the Pannonian region. For this purpose, several model experiments at 10 km horizontal resolution were completed for a one-year-long period (i.e. 1981) using ERA-Interim reanalysis data (with 0.75° horizontal resolution) as initial and boundary conditions. Our simulation matrix consists of hydrostatic and non-hydrostatic runs together with the different treatments of moisture, namely, SUBEX (Subgrid Explicit Moisture Scheme) and the newly developed NogTom scheme with different autoconversion schemes. In this detailed validation study RegCM outputs (e.g. precipitation, temperature) are compared to the homogenized, gridded CARPATCLIM data (with 0.1° resolution). Variables, which have important roles in the water cycle (e.g. convective precipitation, evapotranspiration, soil moisture) also are analysed.

On the basis of the results we can conclude that the RegCM4.6 produces substantially wetter and cooler climatic conditions than RegCM4.5, despite that the User's Guide does not mention any major modification in the program code except computational debugging. It should further be clarified and understood what causes these much greater biases in the RegCM4.6 simulations and then we will have to make some modifications (e.g. using different convective parameterization schemes and land-

surface scheme) to improve the result of our simulations. More specifically, the outputs of the convection permitting simulations with both versions (using non-hydrostatic approach and convective parameterizations) overestimate the precipitation in the mountainous areas, which is greater than in the simulations using the hydrostatic approach. The simulations with version 4.6 overestimate the precipitation (around 200%), whereas slight underestimations can be found in the southern subregions of the domain and the Carpathian Mountains. Furthermore, it is planned to use RegCM4.7 and compare the results to this third model version.

BIVARIJATNA KOREKCIJA PRISTRANOSTI MJESEČNE TEMPERATURE ZRAKA I OBORINE IZ REGIONALNOG I GLOBALNOG KLIMATSKOG MODELA

RENATA SOKOL JURKOVIĆ i IVAN GÜTTLER

Državni hidrometeorološki zavod
Grič 3, 10000 Zagreb, Hrvatska
renata.sokol@cirus.dhz.hr

SAŽETAK

Varijable modelirane klimatskim modelima (i globalnim i regionalnim) sadrže sustavne pogreške (pristranost), odnosno, modelirane varijable odstupaju od mjerenja u određenoj mjeri. Pristranost se u klimatskim modelima javlja zbog ograničene prostorne rezolucije, pojednostavljene fizike i termodinamike u modelu, numeričkih shema, itd. Provedena je bivarijatna korekcija pristranosti regionalnog klimatskog modela RegCM4 te statistička prilagodba globalnog klimatskog modela MPI-M-MPI-ESM-MR. Klimatski modeli su korigirani/prilagođeni na E-OBS ansambl podatke na mreži 0.1 x 0.1° za šire područje Hrvatske. Analiza je provedena za svaku sezonu posebno na mjesečnim vrijednostima temperature zraka i oborine. Za kalibraciju metode se koristilo razdoblje 1971.–1990., a za validaciju 1991.–2004. Bivarijatna ili multivarijatna metoda se upotrebljava u pripremi simuliranih podataka za upotrebu u modelima utjecaja koji koriste više ulaznih meteoroloških varijabli te je krajnji rezultat uvelike ovisan o međuodnosu dvije ili više varijabli. Bivarijatnom metodom se varijable korigiraju zajedno ne bi li se sačuvao fizikalni odnos među njima potvrđen iz mjerenja. Bivarijatna metoda se temelji na Gaussovoj kopuli koja opisuje međuovisnost dvije varijable. Marginalne razdiobe za oborinu i temperaturu su aproksimirane teorijskim razdiobama, gamma i normalnom.

Cilj ovog rada je bio dokumentiranje utjecaja bivarijatne metode korekcije pristranosti klimatskih modela na statističke mjere lokacije, raspršenja i simetrije te na trend i Spearmanov koeficijent korelacije.

SEASONAL SHIFTS IN THE MEDITERRANEAN TYPE CLIMATES

JELENA LUKOVIĆ[(1)] and JOHN CHIANG[(2)]

[(1)]University of Belgrade, Faculty of Geography,
Studentski trg 1, Belgrade, Serbia
[(2)]University of California Berkeley, Department of Geography, CA, USA
jlukovic@gef.bg.ac.rs
jch_chiang@berkeley.edu

ABSTRACT

The Mediterranean hydroclimate is strongly seasonal and recent changes in climate trends have had considerable economic and environmental impacts. Shifts in seasonal cycles, seen in early occurrence of spring, have been mainly studied from the temperature-driven perspective. However, questions regarding precipitation-driven seasonal changes remain open despite the fact that some of the regions experiencing Mediterranean type climate will potentially face persistent megadrought in the future.

In this study we explore and compare precipitation seasonality changes of the two regions: Western US and Mediterranean basin, by analyzing trends from past decades. Are there shifts in precipitation seasonality? What are the climate dynamics underpinning these changes? Are there changes in the onset and termination of rainy season? This study focuses on developing a fundamental understanding of hydroclimate dynamics behind precipitation seasonality shifts over the two regions with respect to the recent past. Knowing these shifts in advance can help water managers optimize reservoir operations and efficiently address competing demands, such as irrigation, environmental needs, and power generation. Due to analogies in climate between California and Mediterranean basin, a key study goal is to bridge the US and EU hydroclimate research and synergize with the European Horizon 2020 flagship initiative in Climate Action, Environment, Resource Efficiency and Raw Materials.

EXPECTED CLIMATE CHANGES IN DRY SPELLS OVER CROATIA

IVANA MARINOVIĆ[(1)], KSENIJA CINDRIĆ KALIN[(1)], IVAN GÜTTLER[(1)] and ZORAN PASARIĆ[(2)]

[(1)]Croatian Meteorological and Hydrological Service, Grič 3, 10000 Zagreb, Croatia

[(2)]Department of Geophysics, Faculty of Science, University of Zagreb, Horvatovac 95, 10000 Zagreb, Croatia

ivana.marinovic@cirus.dhz.hr

ABSTRACT

Drought in Croatia causes the highest economic losses inflicting serious damages, especially in agricultural sector. Present study performs a systematic analysis of dry spells (DS) in Croatia. DS are defined as consecutive sequences of days having daily precipitation less than a given precipitation-per-day threshold (5 mm in this study). Daily precipitation data from a dense national rain-gauge network (grouped into seven climatological regions) and spanning the time period 1961–2015 are employed. The spatial and temporal characteristics of mean and maximum seasonal and annual DS are analyzed as well as recent changes in DS using the trend estimations by means of Kendall's tau method. Additional period 1971–2000 is defined. For this period both observation based DS and regional climate models' based DS analysis is performed. Three regional climate models, RegCM4, CLM and RCA4, cover the EURO-CORDEX domain, and they are forced at the lateral boundaries using four CMIP5 global climate models. Regional climate models are applied at the 12.5 km horizontal resolution, resulting in a realistic orography and land-sea fields over Croatia. For the 1971–2000 period, models' systematic errors in terms of the DS climatology are examined. Finally, projections and future changes in the DS are based on the simulations under the high and medium greenhouse gases concentration scenarios (i.e., RCP8.5 and RCP4.5). The focus is on the climate change signal between 1971–2000 and the two future periods, 2011–2040 and 2041–2070.

MODERNIZACIJA METEOROLOŠKE MOTRITELJSKE MREŽE KAO TEMELJ ZA KONTINUIRANO PRAĆENJE KLIME I KLIMATSKIH PROMJENA

NATAŠA STRELEC MAHOVIĆ, STJEPAN IVATEK-ŠAHDAN
i ZVONIMIR JAKOPOVIĆ

Državni hidrometeorološki zavod
Grič 3, 10000 Zagreb, Hrvatska
strelec@cirus.dhz.hr

SAŽETAK

Od 1. listopada 2017. u provedbi je projekt METMONIC čija je svrha uspostava suvremenog sustava automatskih prizemnih meteoroloških postaja, oceanografskih plutača i daljinskih sustava mjerenja atmosfere, uključivši sustav meteoroloških radara, kako bi se osigurali sljedivi, reprezentativni, visokokvalitetni, pouzdani i pravovremeni podaci o stanju atmosfere i u Hrvatskoj.

Ključne komponente projekta su:

1. Modernizacija i unaprjeđenje prizemnih meteoroloških mjerenja
2. Modernizacija i unaprjeđenje visinskih meteoroloških mjerenja
3. Modernizacija i unaprjeđenje mreže radarskih mjerenja
4. Uspostava meteorološko-oceanografskog sustava mjerenja
5. Unaprjeđenje i modernizacija sustava prihvata, obrade, kontrole i pohrane podataka i osiguranje dostupnosti podataka
6. Unaprjeđenje umjernog meteorološkog laboratorija
7. Unaprjeđenje praćenja opterećenja ekosustava elementima u tragovima.

Modernizacijom motriteljske mreže osigurat će se potpuna i homogena pokrivenost meteorološkim, oceanografskim i radarskim mjerenjima kopna i teritorijalnog mora, javna dostupnost svih mjerenih podataka te moderna i sveobuhvatna sposobnost umjeravanja motriteljskih osjetnika. Projekt će omogućiti kontinuirano praćenje vremena, klime i klimatskih promjena te upozorenja na opasne vremenske prilike, s ciljem podrške sustavima prilagodbe na klimatske promjene i djelovanja u slučaju prirodnih nepogoda.Također će značajno doprinijeti razvoju ljudskih, tehničkih i znanstvenih kapaciteta, međunarodnoj razmjeni informacija, razvoju proizvoda prilagođenih potrebama korisnika u cilju održivog razvoja te lakšoj dostupnosti DHMZ-ovih arhiva i baza. Aktualni i arhivirani podaci će biti javno dostupni te će služiti znanstveno-istraživačkim institucijama, nevladinim organizacijama i zainteresiranim korisnicima podataka za istraživanja o klimatskim promjenama i planiranje mjera prilagodbe. Dosadašnji tijek provedbe projekta, planirana dinamika i očekivani rezultati bit će predstavljeni u radu.

KLIMATSKE PROMJENE I PRILAGODBA NA TERITORIJI BOSNE I HERCEGOVINE

ŽELJKO MAJSTOROVIĆ

Udruženje meteorologa u Bosni i Hercegovini
Višnjik 8, 71000 Sarajevo, Bosna i Hercegovina
z.majstor.majstor@gmail.com

SAŽETAK

Razmatranje tema u područjima života i gospodarstva koje ovise od vremenskih uvjeta u današnje vrijeme je nemoguće bez argumenata koji su vezani za klimatske promjene i prilagodbu na iste, jer one sve više utječu na promjenu uvjeta u kojima se ove životne djelatnosti odvijaju. Trendovi globalnog zagrijavanja dosežu cifru od preko jednog stupnja za 100 godina, što praktično znači pomjeranje izoterme za više od 150 metara u visinu, što u uvjetima brdsko-planinskog područja nije zanemarivo, što utječe pored ostalog i na sume oborina. Očigledan je utjecaj učinka staklenika i globalnog zatopljenja na klimu BiH. Trend porasta temperature je u skladu s globalnim procesima i ubrzava. Što se tiče suma oborina, one i dalje rastu malo ili stagniraju. Međutim, režim oborina se sve brže mijenja, s jedne strane imamo sve duže sušne periode, a s druge velike intenzitete oborina u kratkim intervalima, što uzrokuje poplave. U konačnici imamo sve lošije vodne bilance. Osim toga, češći su ekstremi i drugih vremenskih pojava (npr. potencijalne evapotranspiracije).

Ovo ima nesagledive posljedice na različita područja života u Bosni i Hercegovini, a posebno na vodne bilance o čemu će biti riječi u ovom radu. Jedan od načina za prilagodbu je izgradnja manjih suvremenih višenamjenskih akumulacija, iz kojih bi se voda mogla koristiti za razne svrhe. Moderno navodnjavanje "kap po kap" u poljoprivredi jedna je od mogućnosti.

UTJECAJ ENSO-A I NAO-A NA KLIMATSKU VARIJABILNOST EUROPE

SARA IVASIĆ, INES MUIĆ i IVANA HERCEG BULIĆ

Geofizički odsjek, Prirodoslovno-matematički fakultet, Sveučilište u Zagrebu
Horvatovac 95, 10000 Zagreb, Hrvatska
sivasic@outlook.com

SAŽETAK

El Niño – južna Oscilacija (ENSO) jedan je od najjačih izvora globalne klimatske varijabilnosti. Iako su na tu temu provedena brojna istraživanja, još uvijek postoje mnoga pitanja vezana uz utjecaj ENSO-a na područje Europe i Mediterana. Iako je na tom području detektiran signal povezan s ENSO događajima, on je općenito slab te pokazuje prostornu i sezonsku ovisnost. S druge strane, područje Europe je pod prevladavajućim utjecajem Sjevernoatlantske oscilacije (NAO), čiji je učinak dobro utvrđen i obilno dokumentiran u znanstvenoj literaturi. S obzirom da oba fenomena mogu istovremeno utjecati na europsku klimu, nije jednostavno izdvojiti i analizirati zaseban efekt samo jedne od tih pojava. Tako utjecaj ENSO-a, koji je relativno slab, može biti prikriven snažnijim djelovanjem NAO-a. Također, postoji mogućnost da je NAO signal moduliran ENSO-om, posebice tijekom snažnih ENSO događaja. Nameće se pitanje možemo li odvojiti ENSO i NAO signale i proučiti utjecaj samo jedne od tih pojava. U tu je svrhu u ovom radu korišten veliki ansambl dugačkih numeričkih simulacija. Napravljeno je 35 numeričkih simulacija za razdoblje od 1855. do 2010. godine pomoću modela opće cirkulacije atmosfere ICTP AGCM. Pozitivne, negativne i neutralne ENSO godine određene su na temelju zimskog (JFM) Nino3.4 indeksa, dok se klasifikacija NAO godina temelji na vrijednostima glavne vremenske komponente dobivene analizom empirijskih ortogonalnih funkcija. Analiza po skupovima događaja primijenjena je na anomalije različitih meteoroloških parametara (geopotencijalna visina, temperatura itd.) s ciljem analize atmosferskih polja odziva koja su povezana s određenim ENSO-NAO kombinacijama. Dodatno je napravljena analiza signala i šuma.

CLIMATE MAPS OF MONTHLY PRECIPITATION AMOUNTS

MELITA PERČEC TADIĆ and IRENA NIMAC

Croatian Meteorological and Hydrological Service
Grič 3, 10000 Zagreb, Croatia
melita.percec.tadic@cirus.dhz.hr

ABSTRACT

The presented climatic maps of monthly precipitation amounts for each month starting from the year 1981 to present are a part of a new set of spatial data of the Croatian Meteorological and Hydrological Service. A regression kriging method was used to produce monthly precipitation maps, preceded by an analysis of data quality measured at stations. The analysis included a homogeneity analysis and filling of missing monthly data. Spatial features of the precipitation field were discussed regarding the measurements. Statistical measures were used to evaluate the trends of measured and homogenized data, coefficient of determination was used to assess the performance of the regression model, and the leave-one-out cross-validation was applied for the evaluation of the regression kriging model.

ANALIZA LJETNIH I ZIMSKIH TEMPERATURA NA PODRUČJU GRADA ZAGREBA

IRENA NIMAC[(1)], IVANA HERCEG BULIĆ[(2)], MELITA PERČEC TADIĆ[(1)] i KSENIJA ZANINOVIĆ[(1)]

[(1)]Državni hidrometeorološki zavod,
Grič 3, 10000 Zagreb, Hrvatska

[(2)]Geofizički odsjek, Prirodoslovno-matematički fakultet, Sveučilište u Zagrebu,
Horvatovac 95, 10000 Zagreb, Hrvatska

inimac@cirus.dhz.hr

SAŽETAK

U skladu s globalnim zatopljenjem, temperatura zraka na području grada Zagreba bilježi pozitivan trend, ali on nije jednak na svim postajama. Budući da na klimu u gradovima značajno utječe urbanizacija koja pridonosi porastu temperature, takva područja su posebno osjetljiva na klimatske promjene. Prema projekcijama IPCC-a, područje Hrvatske je jedno od "žarišnih točaka" globalnog zatopljenja. Iako su urbana područja posebno osjetljiva na dodatno toplinsko opterećenje, ona ujedno posjeduju izniman potencijal za primjenu metoda ublažavanja klimatskih promjena. U sklopu HRZZ projekta „CroClimGoGreen" analizirat će se globalni i lokalni utjecaji na gradsku klimu pomoću dva pristupa: 1. analizom izmjerenih podataka i 2. primjenom urbanog modela MUKLIMO_3.

U ovom radu prikazat će se rezultati dobiveni empirijskom analizom. Fokus je na ljetnoj i zimskoj sezoni kada se javljaju temperaturni ekstremi zbog čega je moguća veća izloženost stanovništva toplinskom stresu. U ovom radu su korišteni podaci s četiri meteorološke postaje iz motriteljske mreže DHMZ-a: Zagreb Grič, Zagreb Maksimir, Pleso i Puntijarka. Osim razlike u nadmorskim visinama, meteorološki parametri koji se na njima mjere su pod utjecajem različitog okoliša što utječe na mikroklimatska obilježja oko samih postaja. Analizirane su srednje minimalne i maksimalne temperature zraka te pojedini temperaturni indeksi. Također su istraženi temperaturni ekstremi te su primjenom opće razdiobe ekstremnih vrijednosti (GEV) procijenjene očekivane ekstremne vrijednosti za različita povratna razdoblja. Osjet ugodnosti opisan fiziološkom ekvivalentnom temperaturom (PET) izračunat je primjenom modela RayMan.

APPLICATION OF VERIFICATION METHOD SAL ON A REGIONAL CLIMATE MODEL SIMULATIONS OF HEAVY PRECIPITATION EVENTS

SARAH IVUŠIĆ, IVAN GÜTTLER and KRISTIAN HORVATH

Croatian Meteorological and Hydrological Service
Grič 3, 10000 Zagreb, Croatia
sarah.ivusic@cirus.dhz.hr

ABSTRACT

During the first HyMeX Special Observation Period (SOP1) in autumn of 2012 the coastal mountainous region in Croatia was affected by heavy precipitation events (HPEs) which caused considerable damage. We are analysing the ability of regional climate model ALADIN-Climate (ALD) to reproduce the HPEs. The method used for the verification of quantitative precipitation is object-based three-dimensional quality measure SAL (S – the structure, A – the amplitude, L – the location). Reference data used for verification is precipitation analysis system MESCAN, available on 5.5 km resolution every 6 h. Additionally, SAL was computed for two ALD versions, version 5.2 (ALD5) and the newest 6.3 version (ALD6), both driven by ERA-Interim reanalysis over the Med-CORDEX domain on 0.11° (~12.5 km) grid resolution. Also, the spectral nudging technique (SN) is applied on both ALD versions (ALD5SN and ALD6SN). ALD6SN limits the rain overestimation and improves the A component, but the objects are still too large and/or too flat than in ALD5SN. SN improves model behaviour, comparing the ALD5 and ALD5SN, by giving less spread SAL values for all three components.

The results indicate that use of SN technique limits the timing errors and as such may be required for evaluation of cases. Overall, the study shows that it is relevant to evaluate RCMs on cases, despite the usual usage in climate mode.

ANALYSES OF AGROCLIMATIC INDICES APPLIED TO CROATIAN GRAPEVINE GROWING REGIONS IN PRESENT AND IN THE FUTURE CLIMATE

BRANIMIR OMAZIĆ[(1)], MAJA TELIŠMAN PRTENJAK[(1)], VIŠNJICA VUČETIĆ[(2)], IVAN PRŠA[(3)] and MARKO KAROGLAN[(4)]

[(1)]Department of Geophysics, Faculty of Science, University of Zagreb, Horvatovac 95, 10000 Zagreb, Croatia

[(2)]Croatian Meteorological and Hydrological Service, Grič 3, 10000 Zagreb, Croatia

[(3)]Institute of Enology and Viticulture, Croatian center for agriculture, food and rural affairs, Jandrićeva 42, 10000 Zagreb, Croatia

[(4)]Faculty of Agriculture, University of Zagreb, Svetošimunska 25, 10000 Zagreb, Croatia

bomazic@gfz.hr

ABSTRACT

The factors which significantly affect the viticulture are temperature and precipitation. Consequently, viticulture is highly affected by climate change. The agroclimatic indices describe the suitability of particular region for wine production. For the purpose of this study six indices (Average growing season temperature, Growing degree days, Huglin index, Dryness index, Cool night index and Composite index) were calculated using daily output from three CORDEX Regional Climate Models' (RCMs) simulations (CLMcom-CCLM4-8-17, SMHI-RCA4, CNRMALADIN5.3) for Croatian domain and using daily near-surface measurements (minimum, maximum and mean air temperature, relative humidity, wind speed and total precipitation). All RCMs are forced by Global Climate Models (GCMs) with a moderate (RCP4.5) and a high-end (RCP8.5) greenhouse gass (GHG) scenario. All the simulations have horizontal grid spacing of 0.11◦. First historical analysis was done comparing two periods (1961–1990 and 1988–2017) to establish present situation and to determine changes in indices so far. Then, in order to determine future changes in agroclimatic indices, spatial distribution of the indices in historical runs (1971–2000) is compared to three different 30-year periods (2011–2040, 2041–2070 and 2070–2099). The sign and the robustness of future changes depend on the location/region analyzed.

The results revealed good skill of the RCM in simulating bioclimatic characteristics. The results also show, whether the part of the country, which is suitable for grape cultivation in present climate (1971–2000) continues to be favorable in the future. We can also reveal whether some other parts of Croatia become suitable for cultivating grapevine in the future climate.

AGROMETEOROLOŠKE INFORMACIJE NA MREŽNIM STRANICAMA DHMZ-A ZA POTREBE POLJOPRIVREDNIKA

PETRA SVILIČIĆ

Državni hidrometeorološki zavod,
Grič 3, 10000 Zagreb, Hrvatska
svilicic@cirus.dhz.hr

SAŽETAK

Nove mrežne stranice Državnog hidrometeorološkog zavoda pružaju izvor mnoštvu meteoroloških informacija pa tako i agrometeoroloških prognoza i podataka. U svrhu pružanja što kvalitetnije informacije krajnjem korisniku, cilj predavanja je prikazati gdje se sve mogu naći agrometeorološke informacije na mrežnim stranicama s obzirom na njezin novi izgled. Također, ukratko će se pokazati koje se još dodatne meteorološke informacije, koje Državni hidrometeorološki zavod pruža, mogu iskoristiti za potrebe poljoprivrednika.

Od agrometeoroloških podataka sedam dana unatrag mogu se naći: ekstremne temperature zraka, minimalna temperatura zraka na 5 cm iznad tla, temperatura tla na dubinama od 5 cm i 20 cm, relativna vlažnost zraka, trajanje sijanja Sunca (osunčavanje) i količina oborine. Mjesečno, sezonsko i godišnje odstupanje temperature zraka i količine oborine od višegodišnjeg prosjeka služi za utvrđivanje ocjene ispod ili iznad prosječnih temperaturnih i oborinskih prilika. Praćenje ekstremnih dnevnih oborinskih uvjeta prikazano je pomoću kumulativne količine oborine za pojedine gradove. Suša, koja uzrokuje najveće gospodarske gubitke u Hrvatskoj, posebno se prati i pomoću standardnog oborinskog indeksa (SPI). Poljoprivrednicima su također korisne dnevne informacije o potencijalnoj opasnosti od požara raslinja, električnom izbijanju (udari groma) te radarske slike. U planiranju poljodjelskih radova mogu im poslužiti i najave toplinskih/hladnih valova. Osim izmjerenih meteoroloških podataka na mrežnoj stranici nalaze se i agrometeorološke prognoze za pet područja u Hrvatskoj četiri dana unaprijed te izgledi vremena za još sljedeća tri dana. U sklopu tekstualne prognoze vidljiv je grafički prikaz prognoze temperaturnih suma za odabrane gradove. U svakodnevnom praćenju vremena za poduzimanje određenih agrotehničkih mjera dostupne su im i dnevne prognoze.

UTJECAJ KLIME NA OSUTOST KROŠANJA I ODUMIRANJE STABALA OBIČNE JELE (*ABIES ALBA MILL.*) U GORSKOM KOTARU

DAMIR UGARKOVIĆ i IVICA TIKVIĆ

Šumarski fakultet, Sveučilište u Zagrebu
Svetošimunska cesta 25, 10000 Zagreb, Hrvatska
damir.ugarkovic@gs.htnet.hr

SAŽETAK

Osutost krošanja i odumiranje stabala obične jele je posljedica različitih nepovoljnih čimbenika. Odumiranje stabala ima važnu ulogu u funkcioniranju i dinamici šumskih ekosustava i ono je jedan od najvećih ekoloških i gospodarskih problema u šumarstvu.

Cilj ovog rada je bio utvrditi odnos između osutosti krošanja i odumiranja stabala obične jele i nekih klimatskih elementa i pojava. Prikupljeni su i analizirani klimatski podaci kao i podaci o osutosti krošanja i odumiranju stabala obične jele na dvije stalne pokusne plohe na području Gorskog kotara. Vizualne procjene osutosti krošanja napravljene su u srpnju i kolovozu za razdoblje od 1994. do 2013. godine. Analizirani su klimatski podaci sa klimatološke postaje Vrelo Ličanke koja se nalazi u neposrednoj blizini trajnih pokusnih ploha. Pomoću programa KlimaSoft 2.0 utvrđene su sušne godine, vrijeme trajanja suše u danima, vodna bilanca i potencijalna evapotranspiracija prema metodi Thornthwaite. Utvrđena je statistički značajna i pozitivna korelacija između temperature zraka u vegetacijskom razdoblju (0,30*), potencijalne evapotranspiracije (0,23*), te sušne godine (0,15*) i osutosti krošanja.

U ovom je istraživanju utvrđeno da klimatski uvjeti značajno utječu na povećanje osutosti krošanja i odumiranje stabala obične jele u istraživanom području Gorskog kotara. Od klimatskih uvjeta najznačajniji su temperatura zraka i potencijalna evapotranspiracija u vegetacijskom razdoblju te suša.

EKSTREMNI VREMENSKI UVJETI TIJEKOM PREHLADNE KIŠE U SJEVEROZAPADNOJ I GORSKOJ HRVATSKOJ U VELJAČI 2014.

VIŠNJICA VUČETIĆ[(1)], IVANA CAREVIĆ[(2)], IVANA ČAVLINA TOMAŠEVIĆ[(1)] i ANTUN MARKI[(3)]

[(1)]Državni hidrometeorološki zavod,
Grič 3, 10000 Zagreb, Hrvatska

[(2)]N1 televizija,
Krste Pavletića 1, 10000 Zagreb, Hrvatska

[(3)]Geofizički odsjek, Prirodoslovno-matematički fakultet, Sveučilište u Zagrebu,
Horvatovac 95, 10000 Zagreb, Hrvatska

vucetic@cirus.dhz.hr

SAŽETAK

Sjeverozapadnu i gorsku Hrvatsku je 1.–2.2.2014. zahvatila prehladna kiša koja je oštetila oko 50000 ha šuma. Cilj je proučiti koje ekstremne vremenske prilike pogoduju nastanku ove vrlo rijetke pojave. Zbog dugotrajnog i izraženog južnog strujanja na visini od 30.1. do 6.2.2014. prema sinoptičkim kartama stvoreni su uvjeti za jaku visinsku temperaturnu inverziju koja je jedan od preduvjeta za prehladnu kišu. Analiza dnevnih hodova temperature zraka s 13 meteoroloških postaja u sjeverozapadnoj i gorskoj Hrvatskoj pokazuje na većini postaja hladnije pri tlu u odnosu na prosjek 1961.–1990. tijekom prehladne kiše. U sjeverozapadnoj Hrvatskoj količina oborine bila je ispod prosjeka, a u gorskoj iznad prosjeka. Prema radarskim snimkama radara LISCA u noći 1./2.2.2014. kiša je najviše padala u sjeverozapadnoj Hrvatskoj, a u popodnevnim satima istog dana zahvatila je istočnu Sloveniju i Gorski kotar. Snježni pokrivač se zadržao nakon padanja prehladne kiše jer je uz tlo i dalje bilo hladno. Međutim, na visinskoj postaji Zavižan i u Lici snijeg se vrlo brzo otopio zbog pritjecanja toplog zraka sa SE i u prizemni sloj atmosfere. Analiza produkata modela ALADIN/HR za Zagreb-Maksimir daje dobro slaganje prognoziranih i radiosondažnih vrijednosti. Iz vertikalnih profila slijedi postojanje sloja izražene temperaturne inverzije između 800 m i 900 m u kojem vjetar mijenja smjera od NE na SE. Prizemni vjetar je slab, postupno raste s visinom te na oko 1,5 km postiže olujnu jačinu. Dakle, bili su ispunjeni svi ekstremni vremenski uvjeti za nastanak prehladne kiše: postojanje sloja hladnog zraka pri tlu i izražene visinske temperturne inverzije.

PRIMJENA WorldView 2 SATELITSKIH SNIMAKA ZA PROCJENU ŠTETA NA ŠUMSKIM SASTOJINAMA UZROKOVANIH VELIKIM PRIRODNIM NEPOGODAMA

RENATA PERNAR, MARIO ANČIĆ i JELENA KOLIĆ

Šumarski fakultet, Sveučilište u Zagrebu
Svetošimunska cesta 25, 10000 Zagreb, Hrvatska
rpernar@sumfak.hr

SAŽETAK

U današnje vrijeme svjedoci smo sve učestalijih prirodnih nepogoda (ledolomi, snjegolomi, vjetrolomi, poplave, požari i dr.), kojima su zahvaćeni šumski ekosustavi. Kako bi mogli pristupiti procjeni i sanaciji šumskih šteta, potrebno je prioritetno lociranje sastojina, da bi se pravovremenim mjerama održala njihova vitalnost i proizvodnost na optimalnoj razini. Primarni zadatak kod toga je utvrđivanje stupnja oštećenja (npr. slomljena, savijena, izvaljena ili naslonjena stabla) i zahvaćene površine, broja oštećenih i uništenih stabala i slično. To se uobičajeno provodi terestričkim opažanjima, što zahtijeva angažiranje velikoga broja stručnjaka i najčešće je povezano s velikim troškovima i produženim vremenskim rokom provedbe terestričke inventure na velikim površinama. Kako se najčešće radi o obuhvatima većih razmjera uz smanjen ili potpuno onemogućen pristup, primjena metoda daljinskih istraživanja nameće se kao izuzetno brza i pouzdana metoda određivanja prostornog obuhvata nepogoda. Budući da je u što kraćem vremenskom roku potreban uvid u stanje na terenu, sve više su u primjeni satelitske snimke visoke prostorne rezolucije. Prema definiranom obuhvatu područja Gorskoga kotara, jednom satelitskom scenom, ukupno je snimljena površina od 230 km^2. Interpretacijom satelitske snimke određena je površinska rasprostranjenost, ustanovljeno je i analizirano stanje šuma (razmjer/intenzitet), značajke terena (nadmorska visina, nagib, ekspozicija), te utvrđen njihov eventualni utjecaj na stanje šuma.

Rezultatima provedenih analiza utvrđeno je da su najveće štete pretrpjele sastojine na nadmorskim visinama od 800–1100 m, a da su štete najmanje na nadmorskim visinama iznad 1100 m, što se može protumačiti temperaturnim inverzijama, no za tumačenje uočenih pojava potrebno je za modeliranje uključiti i meteorološke parametre.

MUNJE KAO ALAT ZA PROMATRANJE KARAKTERISTIKA TUČE

DAMJAN JELIĆ[(1)], OTILIA ANNA MEGYERI[(2)], ANDREINA BELUŠIĆ[(1)]
i MAJA TELIŠMAN PRTENJAK[(1)]

[(1)]Geofizički odsjek, Prirodoslovno-matematički fakultet, Sveučilište u Zagrebu
Horvatovac 95, 10000 Zagreb, Hrvatska

[(2)] Sveučilište Eötvös Loránd, Meteorološki odjel,
Pázmány Péter sétány 1/A, Budimpešta, Mađarska

djelic@gfz.hr

SAŽETAK

Gotovo svaka dovoljno razvijena konvektivna oluja popraćena je značajnijom grmljavinskom aktivnosti. Takve oluje često su okarakterizirane pljuskovima, propadima i/ili tučom no s obzirom na prostorne i vremenske skale samih oluja navedeni fenomeni često prođu neopaženi. Za razliku od njih s posebnim naglaskom na tuču, grmljavinska aktivnost se vrlo uspješno prati mrežama za detekciju munja koje su u današnje vrijeme jako rasprostranjene i nude vrlo visoku prostornu i vremensku rezoluciju. Unazad nekoliko godina uspostavljena je solidna veza između dinamike munja i pojave tuče, propada pa čak i tornada. Ta se veza očituje u naglom porastu aktivnosti munja (eng. *Lightning jump*) 10-ak minuta prije opažanja jedne od pojava.

Do sada se metoda uspješno koristila u “Nowcasting-u”, a u ovom izlaganju prikazat će se prvi pokušaji primjene takve metode na arhivske podatke LINET mreže za razdoblje od 2008 od 2015 godine za područje Hrvatske i verifikacija iste na području istarske županije s ciljem izvlačenja klimatoloških karakteristika tuče. Ovakav klimatološki pristup otvara mogućnosti analize tuče ali i ostalih ekstrema povezanih s konvekcijom prvenstveno na područjima koja nisu pokrivena radarom ali i ostalim područjima kao svojevrsni alat za verifikaciju. Također, ovom se metodom mogu pokriti daleko veće udaljenosti nego što to omogućavaju druga daljinska mjerenja kao šo su radari ili sateliti koji obuhvaćaju ekvivalentna područja no uvjetuju relativno grubu rezoluciju usporedno s rezolucijom munja.

HLADNI VAL U HRVATSKOJ U DRUGOJ DEKADI TRAVNJA 2017.

TANJA TROŠIĆ LESAR i TANJA LIKSO

Državni hidrometeorološki zavod
Grič 3, 10000 Zagreb, Hrvatska
trosic@cirus.dhz.hr

SAŽETAK

U sklopu praćenja klime velika važnost daje se analizi ekstremnih događaja, kao što je pojava mraza i hladnih valova, jer utječe na ljude i ekonomiju. Prepoznavanje ovakvih perioda je od iznimne važnosti radi njihovog utjecaja na ekonomiju (agrikultura, turizam, transport i dr.) te utjecaja na zdravlje ljudi.

U radu će se obraditi pojava hladnih valova u 2017. godini s posebnim naglaskom na analizu hladnog vala u drugoj dekadi travnja koji je zahvatio velik dio Hrvatske, uključujući Dalmaciju, kada je proglašena i elementarna nepogoda u velikom broju županija. Pritom će se prikazati i sinoptička analiza te uvjeti koji su doveli do pojave tog ekstremnog događaja.

PROSTORNE I VREMENSKE KARAKTERISTIKE TUČE U HRVATSKOJ S FOKUSOM NA ISTRU

DAMJAN JELIĆ[(1)], OTILIA ANNA MEGYERI[(2)], ANDREINA BELUŠIĆ[(1)] i MAJA TELIŠMAN PRTENJAK[(1)]

[(1)]Geofizički odsjek, Prirodoslovno-matematički fakultet, Sveučilište u Zagrebu
Horvatovac 95, 10000 Zagreb, Hrvatska

[(2)] Sveučilište Eötvös Loránd, Meteorološki odjel,
Pázmány Péter sétány 1/A, Budimpešta, Mađarska

djelic@gfz.hr

SAŽETAK

Iako su mjerenja tuče u Hrvatskoj prisutna već 60-ak godina, sveobuhvatna analiza još uvijek nije napravljena. U ovom izlaganju pokazat će se kratki pregled dosadašnjih istraživanja tuče u Europi te usporedbe s istraživanjima u Hrvatskoj. Nadalje, bit će izložene grublje karakteristike tuče na području cijele Hrvatske bazirane na mjerenjima glavnih meteoroloških postaja. Rezultati tog istraživanja sugeriraju značajne prostorne i vremenske varijacije tuče iako jasnih trendova o porastu ili padu aktivnosti tuče nema. U sklopu projekta VITCLIC napravljen je fokus na Istarsku županiju, koja je jedna od tučom najzahvaćenijih regija u Hrvatskoj, a uključuje analizu gotovo svih dostupnih arhivskih podataka; od glavnih i klimatoloških postaja do kišomjernih postaja. Ti su podatci po prvi put u potpunosti (datum, vrijeme, trajanje i intenzitet) izvučeni iz dnevnika motrenja i opširno analizirani.

Na prostornoj skali od svega 3500 četvornih kilometara prisutne su jake varijacije. Vremenska skala sugerira prisutnost tuče kroz cijelu godinu iako je glavnina događaja koncentrirana u ljetnom periodu. Također, uočeni su trendovi u broju događaja tuče iako značajnih promjena u broju dana s tučom nema. Za pripadne dane s tučom napravljena je i objektivna analiza tipova vremena korištenjem numeričke metode predložene od strane DWD-a te prilagođene za naše potrebe, na ERAINTERIM podatcima za razdoblje od 1979 do 2014.

ŠKOLSKA MREŽA AUTOMATSKIH METEOROLOŠKIH POSTAJA NA PODRUČJU OTOKA VANCOUVER (BC, CANADA) KAO ALAT ZA PRAĆENJE METEOROLOŠKIH EKSTREMA NA PROSTORNO-VREMENSKOJ SKALI VISOKE REZOLUCIJE

JADRANKA ŠEPIĆ

Institut za oceanografiju i ribarstvo
Šetalište I. Meštrovića 63, 21000 Split, Hrvatska
sepic@izor.hr

SAŽETAK

Prostorno-vremenska promjenjivost ekstremnih meteoroloških pojava (primjerice oborine i vjetra) je znatna: maksimalne vrijednosti se bilježe na ograničenom području i tijekom kratkog vremenskog intervala. Za analizu promjenjivosti ekstrema nužni su podaci prikupljeni na meteorološkim mrežama visoke prostorno-vremenske rezolucije. Službene meteorološke organizacije čija je zadaća pokrivati velika zemljopisna područja u pravilu ne razvijaju takve mreže. S druge strane, razvoj automatskih meteoroloških postaja omogućio je širokoj bazi korisnika instaliranje meteoroloških postaja: od amatera/zaljubljenika u meteorologiju, preko industrije kojoj su potrebna meteorološka mjerenja, pa sve do znanstvenika koji se bave istraživanjem specifičnih meteoroloških fenomena. Znanstvenici Sveučilišta u Victoriji (Britanska Kolumbija, Kanada) razvijaju i održavaju školsku mrežu visokokvalitetnih automatskih meteoroloških postaja. Ova mreža je prvenstveno namijenjena edukaciji učenika osnovnih i srednjih otoka Vancouver. No, uslijed njenog prostornog obuhvata i visoke vremenske rezolucije mjerenja (1 min), podaci s ove mreže su idealni za proučavanje lokalne promjenjivosti ekstrema. Veći dio postaja instaliran je u širem području grada Victorie, gdje se nalazi čak 96 postaja na području od 975 km^2, odnosno približno 1 postaja/300 m. Prve postaje instalirane su 2005. godine, a od tada se svake godine kontinuirano nadodaju nove postaje. Ovakva mreža postaja omogućava veoma detaljno praćenje prostorne i vremenske promjenjivosti ekstremnih pojava.

U predavanju će biti predstavljeni preliminarni rezultati analize mjerenih podataka temperature zraka, vjetra, udara vjetra, oborine i tlaka zraka.

ESTIMATION OF TURBULENCE TRIPLET COVARIANCES FOR BORA FLOWS

BARBARA MALEČIĆ, ŽELJKO VEČENAJ and BRANKO GRISOGONO

Department of Geophysics, Faculty of Science, University of Zagreb,
Horvatovac 95, 10000 Zagreb, Croatia
barbara.malecic@gmail.com

ABSTRACT

In this work we study the turbulent characteristics of bora – strong, relatively cold and gusty wind that usually blows from the northeastern quadrant at the east coast of the Adriatic Sea. The data used are from the measuring tower on Pometeno brdo in the hinterland of the city of Split. From April 2010 until June 2011, three components of wind speed and sonic temperature were measured. The measurements were performed at three heights, 10, 22 and 40 m above the ground. During the observed period, 114 bora episodes were isolated. Using Fourier spectral analysis, a suitable time scale that separates processes on the macroscale from those on the microscale is determined. Using Reynolds's decomposition, turbulent perturbations of individual wind speed components and sonic temperature have been obtained.

The main objective of this work is to estimate the 30-minute averages of the third order moments (turbulence triplet covariances) which will then be used to study their behavior with height and their dependence on the static stability of the atmosphere. This is the first analysis of this kind, addressing turbulence triplet covariances, in the broader region of Croatia. We expect that the given analysis will expand our insights into the processes that occur in the turbulence regime of bora flows.

CASE STUDY OF A BORA EVENT AT THE DUBROVNIK AIRPORT

LADA GABELA ŠEPERIĆ[(1)], JADRAN JURKOVIĆ[(1)], ŽELJKO VEČENAJ[(2)] and BRANKO GRISOGONO[(2)]

[(1)]Croatia Control Ltd.,
Rudolfa Fizira 2, Velika Gorica, 10150 Zagreb-Airport, Croatia
[(2)]Department of Geophysics, Faculty of Science, University of Zagreb,
Horvatovac 95, 10000 Zagreb, Croatia
lada.seperic@crocontrol.hr

ABSTRACT

Bora is a strong gusty wind that causes significant difficulties in the processes of taking off and landing of aircraft at Dubrovnik airport (DA). Therefore, it is of essential importance to map, as well as possible, the spatial and temporal features of bora wind speed, gusts and turbulence in the horizontal and vertical vicinity of the DA runway. For this purpose, within the SESAR 2020 programme (solution PJ.04-02), in the period from 14 December 2017 to 14 April 2018, a WINCUBE400S-AT LIDAR and ultrasonic anemometer were installed in the vicinity of DA. Volume, Plan Position Indicator (PPI) and Range Height Indicator (RHI) scans from the LIDAR and three wind speed components from the anemometer, as two sets of measurements, were performed to provide as much data as possible to measure the structure of the mean airflow and turbulence. During the above mentioned period, 14 episodes of bora were detected.

The chosen case study shows a comparison between measurements performed by the LIDAR and the anemometer. In order to have comparable sets of data to determine and compare turbulence kinetic energy (TKE) from both instruments, special LIDAR scans were made aimed at the anemometer tower. We expect to find a correlation between the TKE's obtained from the anemometer and the LIDAR, which will allow us to obtain a fine spatio-temporal structure of turbulence at DA.

(IN)COMPATIBILITY BETWEEN HOST AND MOST FOR NEAR-NEUTRAL AND STABLY STRATIFIED SURFACE LAYER

BRANKO GRISOGONO[(1)], JIELUN SUN[(2)] and DANIJEL BELUŠIĆ[(3)]

[(1)]Department of Geophysics, Faculty of Science, University of Zagreb, Horvatovac 95, 10000 Zagreb, Croatia

[(2)]National Center for Atmospheric Research, Boulder, CO, USA

[(3)]Swedish Meteorological and Hydrological Institute, Norrköping, Sweden

bgrisog@gfz.hr

ABSTRACT

The surface layer (SL) is important for a multitude or reasons, ranging from weather forecasting, meteorological extremes distributions, environmental issues, agrometeorology, renewable energies, etc. Thus, this subject belongs to any of the themes of the conference. People spend most of their lives in the SL. Meanwhile, many forecasters are not fully aware that daily weather prediction of minimum and maximum temperature, frost, dew, etc. are really boundary layer and especially SL forecasts. Moreover, the SL affects trapping air-pollution, most of traffic occurs there, crops grow in the SL, condensation nuclei are stirred up from there, etc.

An extended form from Monin-Obukhov Similarity Theory (MOST) is compared with an observed HOckey-Stick Transition (HOST) for near-neutral and stably stratified surface layer (SSL). The results indicate that the extended form may not capture the observed characteristics of the relationship between the friction velocity and the mean wind speed. Hence, a drag-coefficient perspective (supposed to be generally closer to MOST, yet not opposing HOST a priori), is adapted and extended. In this way, a new result is obtained where the drag coefficient method produces a ski-like behavior, which is a crucial HOST feature, at least in a qualitative sense. A threshold mean wind speed for sustainable continuous turbulence in the SSL is estimated in terms of drag coefficient and a minimum (background), or alternatively, critical friction velocity. The approach is checked on three data sets.

EXTREME AIR TEMPERATURE AT THE SOUTHWESTERN SLOPE OF PIRIN MOUNTAIN (BULGARIA) DURING THE PERIOD 2012–2018

NINA NIKOLOVA, GEORGI RACHEV and DIMITAR KRENCEV

Sofia University "St. Kliment Ohridski",
Tsar Osvoboditel Blvd. 15, Sofia, Bulgaria
nina@gea.uni-sofia.bg

ABSTRACT

The characteristics of air temperature in mountainous areas give important information about climate change and variability and are essential for the occurrence of various geomorphological processes as well as for touristic activities development. The increasing of the temperature and frequency of occurrence of extreme high temperatures during the recent years is one of the feature of climate which is associated with the global climate change.

The present study aims to analyse the observed changes of air temperatures at the southwestern slope of Pirin Mountain and in particular the region of River Begovitsa by the investigation of extreme hot and extreme cold events and related synoptic conditions. The research is based on the hourly data for air temperature for the period July 2012 – May 2018. The data are taken from the environmental monitoring organized by the Department of Climatology, Hydrology and Geomorphology, Sofia University, Bulgaria, in relation to various scientific projects and operates now in the frame of the project titled “Environment under climate change in the Pirin Mountain“, contract N ДН 14/6, 13.12.2017, financed by National Scientific Fund, Ministry of Education and Science – Bulgaria. The study area includes a part of river Begovitsa catchment which is situated above 1700 m a.s.l. An automatic weather station (AWS) Wireless Vantage pro2 and temperature logger LOGTAG TRIX - 8 were installed at the region.

The regime of air temperature is analysed by the monthly average values but the accent of the study is the occurrence of extreme hot and cold temperatures which are revealed on the basis of the following indices: number of frost days (the days with daily minimum temperature < 0 °C); number of icing days (the days with daily maximum temperature < 0 °C) and number of summer days (the days with daily maximum temperature > 25 °C). The number of frost and icing days are determined for the period November – April and number of summer days – for June – August. The present study brings to the improvement of the capacity for studying environmental processes, completing the insufficient meteorological data for Pirin Mountain and clarifying the peculiarities of climate in the mountainous areas. Apart from purely scientific interests, environmental monitoring is fundamental for defining the state of the environment, conducting reliable risk assessments, and dealing effectively with environmental change-related challenges.

EXTREME ATMOSPHERIC PRECIPITATIONS ON THE TERRITORY OF GEORGIA

MARIAM ELIZBARASHVILI and ELIZBAR ELIZBARASHVILI

Ivane Javakhishvili Tbilisi State University,
Chavchavadze aven 3, Tbilisi, Georgia
mariam.elizbarashvili@tsu.ge

ABSTRACT

Global warming intensification causes the increase in frequency and intensity of extreme phenomena of weather and climate. Extreme phenomena have a serious impact on society, agriculture, economics, and human health and even on the security of the country. Therefore, the study of extreme phenomena is of great importance to individual countries or regions. Extreme precipitations and also the sum of significant precipitations fallen for several days lead to strong floods, mudflows, snow avalanches and other natural disasters, which eventually leads to emergency situations.

On the basis of the data of 20 weather stations of Georgia, the diurnal maximum precipitations of more than 50 mm and peculiarities of the spatial-time distribution of extreme precipitations fallen for 5 days are presented in the paper for the territory of Georgia. Number of days with more than 50 mm precipitation, as well as the amount and intensity of fallen precipitation varies significantly depending on the physical-geographical conditions. The greatest number of days with extreme precipitation is observed on the Black Sea coast, and the average is 2–5 days a year, and in the individual years it reaches 15 days. In addition, the maximum diurnal precipitation is 170–230 mm. The number of days with 50 mm precipitation on the Kolkheti lowland does not exceed 2 days, and the maximum diurnal precipitation decreases to 90–130 mm. Precipitation of such intensity does not occur annually in eastern Georgia and Caucasus, but the sum of diurnal precipitation is quite high, 116–185 mm. The sum of the precipitation fallen consistently for 5 days is highest also on the Black Sea coast and reaches 340–380 mm. In Kolkheti lowland it reduces to 250 mm, and in eastern Georgia it makes 175 mm.

The obtained results are important for preventing the harmful effects of catastrophic atmospheric precipitations in different physical-geographical conditions of Georgia, ensuring minimization of adverse consequences of climate change.

DROUGHT WATCH WITHIN DriDanube INTERREG PROJECT

ALEŠ GRLJ[(1)], ANDREJA SUŠNIK[(2)], GREGOR GREGORIČ[(2)] and ŽIGA KOKALJ[(3)]

[(1)]Slovenian Centre of Excellence for Space Sciences and Technologies Space-SI,
Novi trg 2, 1000, Ljubljana, Slovenia

[(2)]Slovenian Environment Agency,
Vojkova 1b, 1000 Ljubljana, Slovenia

[(3)]Research Centre of the Slovenian Academy of Sciences and Arts,
Institute of Anthropological and Spatial Studies and Slovenian Centre of Excellence for Space Sciences and Technologies Space-SI,
Novi trg 2, 1000 Ljubljana, Slovenia

grlj.ales@space.si

andreja.susnik@gov.si

gregor.gregoric@gov.si

ziga.kokalj@zrc-sazu.si

ABSTRACT

In the future, more frequent droughts and stronger negative effects can be expected in the Danube region. In line with this trend, we need to better prepare for this phenomenon and its impacts.

In this presentation we present the DriDanube project and more specifically one of the project's products, Drought Watch web platform from its design to the implementation. Drought Watch is a web-based tool for the viewing and analysis of drought related spatial datasets. The purpose of the tool is to upgrade the systems for monitoring the drought in the Danube river basin with the goals of mitigating the effects of drought and preparing potential users for a timely reaction.

SEKCIJA V: PROGNOZA VREMENA
SESSION V: WEATHER FORECAST

HRT METEO

ZORAN VAKULA

Hrvatska radiotelevizija (HRT),
Kolarova 16, 10000 Zagreb, Hrvatska
zoran.vakula@hrt.hr

SAŽETAK

HRT METEO je jedinstvena aplikacija za pametne mobilne telefone koja omogućuje praćenje mjerenja i motrenja sa službenih meteoroloških postaja Državnog hidrometeorološkog zavoda (DHMZ) i većine ostalih europskih meteoroloških službi, te radarske slike oborine i vremenske prognoze stručnjaka DHMZ-a, koje su se do ove aplikacije mogle čuti i vidjeti samo u programima Hrvatske radiotelevizije (HRT). U aplikaciji su dostupne i prometne informacije Hrvatskog auto-kluba (HAK), uključujući i kamere iz većine hrvatskih krajeva.

Za razliku od gotovo svih ostalih sličnih aplikacija, u kojima su prognoze rezultat kompjutorskog izračuna jednog modela atmosfere, u HRT METEO školovani meteorolozi-prognostičari s višegodišnjim iskustvom svakodnevno analiziraju podatke aktualnog vremena i prognoze stotinjak izračuna različitih modela atmosfere te daju svoje procjene budućeg stanja atmosfere i mora za mjesta i područja, i to ne samo prognoze, nego i upozorenja na opasne vremenske pojave, koja se pojavljuju u aplikaciji samo poneku minutu nakon što ih je napisao meteorolog u DHMZ-u.

Vjerojatnost pogreške je smanjena jer se za više od dva dana unaprijed prognozira za područje, ne za mjesto. Prognoze za danas i sutra postoje za 55 hrvatskih mjesta i još 44 europska grada, a za prekosutra i sljedeća dva dana za osam većih hrvatskih područja, te za još dodatna dva dana – peti i šesti u odnosu na dan izrade prognoze – postoje najvjerojatniji izgledi vremena – prognoza znaka prevladavajućeg ili značajnog vremena, po potrebi i vjetra, te najniže i najviše dnevne temperature zraka, posebno za cijelo kopneno i primorsko područje Hrvatske.

PROJEKT eGAFOR

STJEPKO JANČIJEV

Hrvatska kontrola zračne plovidbe
Rudolfa Vizira 2, 10150 Velika Gorica, Hrvatska
stjepko.jancijev@crocontrol.hr

SAŽETAK

Kroz projekt eGAFOR će se razviti posve nov zrakoplovno meteorološki proizvod za generalnu avijaciju za područje zemalja partnera. Definirat će se novi proizvod u kojem će se osim pojava koje uzrokuju smanjenje vidljivosti ili snižavanje podnice naoblake, prognozirati i druge pojave opasne za generalnu avijaciju na definiranim rutama. Osim toga će se u svim zemljama partnera koji još nemaju GAFOR rute te rute tijekom projekta morati definirati, te se povezati s rutama u susjednim zemljama.

Projekt je iniciran i vođen od strane HKZP-a u kojem osim HKZP-a sudjeluje 7 partnera. Radi se o slijedećim partnerima: ARSO (Slovenija), BHANSA (BiH), OSMZ(Mađarska), ROMATSA (Rumunjska), SHMU (Slovačka), SMATSA (Srbija) i IBL (Slovačka).

Projekt je sufinanciran u iznosu od 85 % sredstvima EU kroz CEF 2016 Transport Call.

FIRST RESULTS OF FORECAST VERIFICATION OF TERMINAL AERODROME FORECAST DURING THE LAST 10 YEARS

JADRAN JURKOVIĆ and IGOR KOS

Croatia Control Ltd.,
Rudolfa Fizira 2, Velika Gorica, 10150 Zagreb-Airport, Croatia
jadran.jurkovic@crocontrol.hr

ABSTRACT

As part of a quality management system, ICAO Annex 3 requires proving the accuracy of forecasts for aviation. For the flight planning purposes, one of the most important forecasts is the Terminal Aerodrome Forecast (TAF). Written by the forecaster, it contains wind, visibility, weather phenomena, cloud conditions and temperature forecasts for the airport for a 24 hours period. Recently, standard verification procedure of TAF forecasts in Croatia Control Ltd. has been established and regular seasonal verification reports for winter and summer are produced. Verification follows the approach proposed by Mahringer (2008) which is used in Austro Control. In order to obtain the lowest critical values, we had analyzed results for the past 10 years.

Most of the results show seasonal variability eg. better results during winter for wind, visibility, and ceiling. Majority of meteorological variables show positive trends forecast accuracy, especially for thunderstorm and wind gusts. Only forecast for ceiling and temperature show a slow and insignificant decrease. Changes in personnel, new and optimized organization of forecasting tasks, and big changes in forecasters' tools could have attributed to negative trends. Development of forecasting procedures, improvement of numerical models and additional effort in training in some special topics such as convection, wind gusts or fog, could be related to positive trends. After all, despite limitations of the verification system (imperfect measurements, form of the forecasts, choosing the verification approach and choosing the verification scores), permanent monitoring of accuracy of forecasts should provide better forecasts, which in the end improves the safety in aviation.

IMPLEMENTACIJA NOWCASTING SUSTAVA U HRVATSKOJ

SUZANA PANEŽIĆ, ANTONIO STANEŠIĆ i BARBARA VODARIĆ ŠURIJA

Državni hidrometeorološki zavod
Grič 3, 10000 Zagreb, Hrvatska
panezic@cirus.dhz.hr

SAŽETAK

Zbog sve učestalijih i razornijih meteoroloških ekstrema javlja se potreba za razvojem sustava koji će omogućiti učestalu izradu analiza i vrlo kratkoročnih prognoza visoke prostorne rezolucije. Na Državnom hidrometeorološkom zavodu (DHMZ) implementiran je INCA (Integrated Nowcasting through Comprehensive Analysis) nowcasting sustav analize i vrlo kratkoročne prognoze, s ALADIN (Aire Limitée Adaptation dynamique Développement InterNational) prognostičkim modelom (horizontalna rezolucija 4 km) kao pozadinom. INCA sustav svodi prognostička polja pozadinskog modela na rezoluciju od 1 km horizontalno i 200 m vertikalno te ih korigira korištenjem svih dostupnih meteoroloških mjerenja (synop, automatske meteorološke postaje, meteorološki radari, ...). Za analizu oborine koriste se 15 min OPERA (Operational Programme for the Exchange of weather RAdar information) radarski kompoziti oborine i podaci s automatskih kišomjernih postaja. Osim analize, sustav izračunava i prognostičke produkte do nekoliko sati unaprijed, što za potrebe DHMZ-a znači do 12 sati unaprijed. Dodana vrijednost INCA kratkoročne prognoze u odnosu na ALADIN model potvrđena je verifikacijskim rezultatima za ljetno razdoblje 2018. Verifikacija je provedena na uzorku od 7 postaja, od kojih 4 ne ulaze u sustav analize, za datume od 20. srpnja 2018. do 20 kolovoza 2018. Zbog nedostatka meteoroloških radara nad Jadranom, efikasnost INCA modula oborine je ograničena na kontinentalni dio Republike Hrvatske, ali prvi rezultati su obećavajući.

REGIONALNA SURADNJA NA MODELU ZA OGRANIČENO PODRUČJE ZA SREDNJU EUROPU RC LACE

MARTINA TUDOR

Državni hidrometeorološki zavod / RC LACE
Grič 3, 10000 Zagreb, Hrvatska
tudor@cirus.dhz.hr

SAŽETAK

Regionalna suradnja na modelu za ograničeno područje za srednju Europu RC LACE (Regional Cooperation on Limited Area Modelling for Central Europe) kao članice ima meteorološke službe Austrije, Republike Češke, Hrvatske, Mađarske, Rumunjske, Slovačke i Slovenije. RC LACE provodi zajedničko istraživanje na području numeričkog modeliranja prvenstvano u svrhu operativne prognoze vremena, iako se u nekim zemljama članicama isti model (s istim postavkama) koristi i za modeliranje klime. Istraživanje je organizirano u 4 područja: asimilacija podataka, ansambl prognoza, dinamika i fizika modela. Neke istraživačke i razvojne teme obuhvaćaju više područja ili su više usmjerene na organizacijske ili tehničke probleme. RC LACE također pruža tehničku podršku operativnoj prognozi numeričkim modelima u nacionalnim službama zemalja članica kroz osiguravanje provjerenih mjerenih podataka u prikladnom formatu za asimilaciju kroz sustav za pred-procesiranje OPLACE. U okviru RC LACE provodi se zajednička operativna ansambl prognoza ALADIN-LAEF na rezoluciji 5 km sa 16 perturbiranih članova. Produkti operativnih prognoza članica RC LACE-a su dostupni ostalim članicama kroz zajedničku platformu. Također je razvijena zajednička platforma za verifikaciju pomoću koje je moguće pratiti kvalitetu prognostičkih polja te uspoređivati sa rezultatima drugih modela (svih za koje su nam dostupni podaci, ARPEGE, IFS ...). Na području istraživanja, razvijena je nehidrostatska jezgra modela, prediktor-korektor shema, multiskalni paket fizikalnih parametrizacija i cjelovit sustav jednadžbi modela.

IMPROVING INITIAL CONDITION PERTURBATIONS IN A CONVECTION-PERMITTING ENSEMBLE PREDICTION SYSTEM

ENDI KERESTURI[(1)], YONG WANG[(2)], FLORIAN MEIER[(2)], FLORIAN WEIDLE[(2)] and CHRISTOPH WITTMANN[(2)]

[(1)]Croatian Meteorological and Hydrological Service
Grič 3, 10000 Zagreb, Croatia

[(2)] Central Institution for Meteorology and Geodynamics,
Hohe Warte 38, 1190 Vienna, Austria

endi.keresturi@cirus.dhz.hr

ABSTRACT

One of the main challenges presented by a Limited Area Model Ensemble Prediction System (LAMEPS) concerns the limited capacity for its initial condition perturbations to correctly represent large-scale flow uncertainties due to its limited-size domain and deficiencies in formulating lateral boundary conditions. In addition, a mismatch between LAMEPS (initial condition) and host EPS lateral boundary perturbations can form spurious gravity waves at the boundaries.

In the present work, an ensemble Jk blending method is proposed for improving representation of large-scale uncertainties and for addressing consistent initial conditions and lateral boundary perturbations. Our approach involves employing Jk blending within a framework of 3D-Var ensemble data assimilation (EDA). In such a system, small-scale perturbations are generated from 3D variational EDA, while large-scale perturbations are generated from the host ensemble via Jk blending. The ensemble Jk method is implemented to the C-LAEF (Convection-permitting Limited-Area Ensemble Forecasting) system and is compared to the standard perturbed-observation EDA approach, i.e., perturbed-observation EDA without large-scale constraint. The comparison shows that the ensemble Jk method gives a more skillful and reliable EPS, especially for upper-air variables. In addition, positive effect on the surface pressure and precipitation of large-scale perturbations are shown. Finally, the ensemble Jk method's capacity to alleviate perturbation mismatches is demonstrated.

EXPERIENCE IN CONDITIONAL PROBABILITY APPLICATION FOR SHORT-TIME FOG FORECAST AT ZAGREB AIRPORT

MARKO ZOLDOŠ and JADRAN JURKOVIĆ

Croatia Control Ltd.,
Rudolfa Fizira 2, Velika Gorica, 10150 Zagreb-Airport, Croatia
marko.zoldos@crocontrol.hr

ABSTRACT

Long-lasting fog events at major airports can cause significant delays. Therefore, studies of fog are important in aviation meteorology, as improved forecasts can lead to considerable savings. During last cold season a simple statistical model for probabilistic short-range visibility forecasting was put into use at the operational forecasting service in the Croatian Air Navigation Service.

A first-order autocorrelation process is the theoretical foundation of the model, which combines climatology and persistence. From that, a simple forecast equation for a given meteorological element (developed by Gringorten, 1971) can be defined. It links the correlation between values of the meteorological element at different time steps with the conditional probability for onset of predefined values. Hourly correlation coefficients, which describe the climatological persistence of visibility, are calculated for each month, and then used to forecast visibility 9 hours in advance. Besides the median forecast of visibility, 50 % and 80 % confidence intervals are calculated as well. The forecast by percentile is also provided for comparison.

This conditional probability model was presented to the forecasters last year at a training seminar. Its use in forecasting low visibility at Zagreb Airport began in October. In February this year a short assessment was made for each forecaster. Its results show that forecasters are now able to use conditional probability and related knowledge in forecasting. There are some minor issues that can be corrected along the way, but in general, conditional probability theory can be successfully applied in improving short-range fog forecasting.

METEOROLOŠKE PROGNOZE U ZAŠTITI OD POŽARA RASLINJA

TOMISLAVA HOJSAK i MARIJA MOKORIĆ

Državni hidrometeorološki zavod,
Grič 3, 10000 Zagreb, Hrvatska
hojsak@cirus.dhz.hr

SAŽETAK

U ovom radu analizirane su specijalne vremenske prognoze koje se izdaju u slučajevima kada bi meteorološki uvjeti mogli utjecati na ekstremno ponašanje požara. Analizirane su za petogodišnje razdoblje (2013.–2017.), te veći dio 2018. godine, a evaluirane su za 2017. godinu. Specijalne prognoze izdavane su za 5 vremenskih tipova, češće za Dalmaciju. Najviše ih je bilo 2017., a potom 2015. godine. Analizom najžešćih šumskih požara prema izgorjeloj površini i korištenju vatrogasnih snaga u 2017. godini utvrđeno je da su specijalne prognoze bile izdane na vrijeme. Evaluacija je ujedno pokazala nužnost daljnjih analiza meteoroloških parametara prilikom ekstremnih požara raslinja kako bi bilo moguće izraditi kriterije za više stupnjeva meteoroloških upozorenja za potencijalno ekstremno ponašanje nastalog požara.

NAPREDNE TEHNOLOGIJE U OPERATIVNOJ PROGNOZI VREMENA

IZIDOR PELAJIĆ, KRUNOSLAV MIKEC, TOMISLAV KOZARIĆ, TANJA RENKO, NEVENKA KADIĆ VLAHOVIĆ i BLAŽENKA MATJAČIĆ

Državni hidrometeorološki zavod,
Grič 3, 10000 Zagreb, Hrvatska
pelajic@cirus.dhz.hr

SAŽETAK

Napredne su tehnologije od velikog značaja za moderno društvo koje se neprekidno mijenja i prilagođava novim načinima proizvodnje, komunikacije i organizacije. Unatoč nedostatku jasne definicije, inovacije su općenito implementacije novih ili značajno boljih produkata, usluga ili organizacije u radnu okolinu ili suradnju s okolinom. One moraju biti operativne i nuditi novitete, a inovacija je moguća u sredini u kojoj nije postojala iako je drugdje već u primjeni.

Očekivanja javnosti kao krajnjeg i najvažnijeg korisnika su sve veća, te se državni i javni sektor mora stalno prilagođavati i mijenjati. Po svojoj prirodi vremenska prognoza oduvijek je težila inovacijama i izrazito je ovisna o razvoju IT sektora, od telekomunikacijskih sustava preko vizualizacijskih do numeričkih modela atmosfere, tla i mora. Posljednjih je godina u operativu vremenske i pomorske analize i prognoze uveden niz rješenja koja zajednički doprinose napretku konačne usluge – vremenske prognoze, smanjuju potrošnju ljudskih resursa te olakšavaju pravodobno spajanje ključne i jasne informacije s konačnim korisnikom. Na inovativnost utječu način rada, pravila i procedure, dostupnost podataka i znanja, te naravno ljudi. Od navedenih faktora najviše je promjena uvedeno kroz značajno unaprijeđenje infrastrukture (način rada), ali zastupljeni su i ostali faktori.

Novi centralizirani integrirani sustav vremenske i pomorske analize i prognoze predstavlja značajan iskorak u informatičkom smislu koji je u operativnoj upotrebi od 2017. Sustavom je omogućena integracija postojećih numeričkih modela, mjerenja i klimatoloških podloga s drugim pomoćnim podacima i izrada novih produkata prilagođenih posebnoj namjeni ili korisniku (“tailored products”). Pristup meteorološkoj informaciji – prognozi, olakšan je široj javnosti kroz redizajniranu web stranicu *meteo.hr* koja je zajedno s novim sadržajem, osobito upozorenjima na opasne vremenske pojave dostupna na svim platformama od srpnja 2018., a pozitivni rezultati vidljivi su već u prvim mjesecima. Uz partnerstvo s Hrvatskom radiotelevizijom i HAK-om pravodobna informacija o opasnim vremenskim prilikama dostupna je korisnicima pametnih telefona od 2016. koristeći geolociranje. Također, komunikacija unutar operativne službe poboljšana je upotrebom Slack softvera za suradnju koji je baziran na oblaku (“cloud-based”), a dostupan na Windows, macOS, iOS, Linux i Android operativnim sustavima.

AGRICULTURAL METEOROLOGY AND CLIMATOLOGY
BOOK PRESENTATION

BRANISLAVA LALIĆ[(1)], JOSEF EITZINGER[(2)], ANNA DALLA MARTA[(3)], SIMONE ORLANDINI[(3)] and ANA FIRANJ SREMAC[(5)]

[(1)]Faculty of Agriculture, University of Novi Sad,
Trg Dositeja Obradovića 8, 21000 Novi Sad, Serbia

[(2)] University of Natural Resources and Life Sciences,
Gregor Mendel str. 33, 1180 Vienna, Austria

[(3)]Department of Agrifood Production and Environmental Sciences,
University of Florence,
Piazalle della Cascine 18, 50144 Firenze, Italy

lalic.branislava@gmail.com

ABSTRACT

"Agricultural Meteorology and Climatology" is an introductory text book for courses focusing on meteorology and climatology at agricultural faculties and agrometeorology and agroclimatology at all other faculties that have this subject in their curricula. Regarding the fact that scientific knowledge and practical experience have increased exponentially, the "Agricultural Meteorology and Climatology" design gives open access to new information by extending its content beyond the book, such as on-line availability, numerical examples and additional recommended reading material.

To capture the reader's attention, the book is divided into three sections: Basics, Applications and Agrometeorological measurements with Numerical examples.

The “Basics” section discusses the structure and important processes of the atmosphere. The origin of the Earth creates atmospheric content. Combined with incoming solar radiation and surface characteristics, the composition of the atmosphere determines Earth’s heating and cooling. Since soil, fauna and flora, combined with the atmosphere, complete the list of main pillars of the climate system, their most important interactions and feedbacks are clearly presented.

In the section “Applications”, we address the impacts of weather and climate on plant phenology and growth processes, including the impacts of extreme weather events and consequential agricultural risk managements. The impacts of climate change on agriculture, including modelling techniques and mitigation and adaptation measures from global to farmland scales, are presented.

The section “Agrometeorological measurements”, which has numerical examples, should encourage readers to apply their gained knowledge when solving practical problems by measuring phenomena or using measured data for farm management options.

A COORDINATED EFFORT TO INVESTIGATE TRANSPORT AND EXCHANGE PROCESSES IN THE ATMOSPHERE OVER MOUNTAINS – EXPERIMENT (TEAMx)

IVANA STIPERSKI, MATHIAS W. ROTACH, M. ARPAGAUS, J. CUXART, S. F. J. DE WEKKER, V. GRUBIŠIĆ, N. KALTHOFF, D. J. KIRSHBAUM, M. LEHNER, S. D. MOBBS, A. PACI, S. SERAFIN and D. ZARDI

Department of Atmospheric and Cryospheric Sciences, University of Innsbruck, 6020 Innsbruck, Austria

ivana.stiperski@uibk.ac.at

ABSTRACT

Mountainous areas contribute in major ways to synoptic-scale and meso-scale atmospheric flows (e.g., orographic precipitation; gravity wave drag; thermally driven flows). Both weather and climate models need to get these processes right. Indeed, interaction with mountainous terrain constitutes one of the major uncertainties in Earth-system modelling. Important internationally coordinated activities in the past (such as ALPEX, PYREX, MAP) have addressed these issues and have substantially advanced our knowledge with respect to the impact of mountainous terrain on the atmosphere.

Only recently, we begin to be able to model in a physically consistent manner what traditionally is called 'earth-atmosphere exchange', i.e., the coupling between the surface and the atmosphere – *even over complex mountainous terrain*. While this task over flat terrain essentially corresponds to using concepts of boundary layer meteorology, it *includes processes at distinctly different scales* (from synoptic and meso-scale to the local boundary layer and near-surface micro-scales), as well *as their interactions* over mountainous terrain.

Output of numerical models ('Numerical Weather Prediction', NWP) is nowadays used to provide point-specific weather information (weather apps) – what is extremely challenging in mountainous terrain. Increasingly, it is *also* used as input for applied models for, e.g., hydrology (flood warning, hydro power), health-related forecasts (heat stress, air pollution), energy smart-net regulations and potential assessment (solar, wind, hydro), economic decision models (airport management systems, agricultural models) or ecological budgeting (CO_2 source/sink appointment, anthropogenic/biogenic aerosol sources). Similarly, climate services in relation to *climate change* call for our ability to correctly model scenarios for future climate states. Mountainous areas not only seem to exhibit a stronger climate sensitivity (e.g., stronger presently observed temperature increase over mountains than in the global average) and are thought to be particularly vulnerable, but also pose a particularly challenging task to the climate modelling community due to unresolved processes, terrain representation and scale interactions. Due to longer integration times, possible errors in surface ↔ atmosphere exchange will likely have even stronger impact for the assessment of input data for climate services modelling (again, the entire range of energy, agriculture, health, hydrology applications) than for Earth System services.

Atmospheric composition is not only relevant with respect to climate forcing, but also – on shorter time scales – in view of air pollution. Mountainous terrain does not only trigger its characteristic pollution threats (such as smog episodes in a stably stratified valley) with their feedbacks to Earth-System Services, but also largely increases the

complexity by introducing air chemistry as another process that needs to be taken into account. The interactions between chemical transformations and turbulence diffusion (which are complicated enough) are thereby augmented by additional length and timescales related to meso-scale processes in complex terrain.

All these developments make it highly timely to plan and execute – some twenty years after the last major international project on mountain meteorology, MAP – a new internationally coordinated project focusing on the investigation, experimental assessment and numerical modelling of the *exchange of energy, mass, and momentum between 'mountainous terrain' and the free atmosphere at all scales and especially their interactions*. The present presentation summarizes the state of affairs for the corresponding endeavour 'TEAMx' (Transport and Exchange processes in the Atmosphere over Mountains – experiment).

SMALL MESOSCALE FEATURES DURING BORA AT DUBROVNIK AIRPORT

JADRAN JURKOVIĆ[(1)], LADA GABELA ŠEPERIĆ[(1)], IGOR KOS[(1)], BRANKO GRISOGONO[(2)] and ŽELJKO VEČENAJ[(2)]

[(1)]Croatia Control Ltd.,
Rudolfa Fizira 2, Velika Gorica, 10150 Zagreb-Airport, Croatia
[(2)]Department of Geophysics, Faculty of Science, University of Zagreb
Horvatovac 95, 10000 Zagreb, Croatia
jadran.jurkovic@crocontrol.hr

ABSTRACT

Bora wind could strongly affect the safety of air traffic operations especially if its direction is perpendicular to the runway direction as is the case at Dubrovnik airport. Influence of the crosswind and wind shear on air traffic is examined within SESAR 2020 programme, in the solution PJ.04-02 – Enhanced Collaborative Airport Performance Management. In order to obtain flow structure, lidar measurements were performed during winter 2017/2018. These were first 3D lidar measurements of bora wind in Croatia. Owing to the complex terrain surroundings and possible different profiles of wind and stability, varieties of flow were expected and measured.

We present several cases of 3D lidar measurements of the bora flow focusing on the small mesoscale features. Generally, violent bora episodes with high wind speeds measured at the airport show flow structure with strong turbulence and sometimes with a hydraulic jump. These are so-called shallow bora episodes. In case of deep bora layer, a broad area of north-east wind flow is measured, but with small moving patches of high wind speed with strong turbulence near the airport. Moreover, during one episode of bora which lasted for 30 hours, several different wind regimes were found. After all, measurements confirmed that one of the most turbulent areas in surroundings of the airport is located just before the landing at preferred runway RWY12.

ADVANCED METEOROLOGICAL SERVICE FOR AIR TRAFFIC MANAGEMENT IN CROATIA

IGOR KOS and ALEN SAJKO

Croatia Control Ltd.,
Rudolfa Fizira 2, Velika Gorica, 10150 Zagreb-Airport, Croatia
igor.kos@crocontrol.hr

ABSTRACT

Air traffic management (ATM) is an aviation term encompassing all systems that assist an aircraft to depart from an aerodrome, transit airspace, and land at a destination aerodrome. ATM's main task is to safely separate aircrafts in the sky as they fly and at the airports where they land and take off again. In this process, weather plays a very big role and bad weather presents a big safety issue. Therefore, meteorological service for air navigation (MET) is important factor in safety, capacity and efficiency of ATM.

Due to air traffic characteristics in Croatia, most problems with bad weather in ATM occur during the en route phase of the operations. Deep convection (thunderstorms) presents the biggest challenge in both the planning (pre-tactical) and executing (tactical) phases of ATM operations. Traditional ICAO (International Civil Aviation Organization) MET products were defined over 60 years ago and they don't represent the type of MET information needed for modern ATM. Croatia Control Ltd., as a designated MET provider for Croatia, started a process of special emphasis on MET service for ATM, particularly in detection and forecasting of deep convection. MET specialists and forecasters underwent additional education on ATM processes, forecasters have been trained in up-to-date techniques of ingredients-based deep convection forecasting, common workshops between MET and ATM experts were held, and new MET products and briefings were introduced in the Zagreb Area Control Centre.

Future steps include verification and validation of introduced changes and the development of new products and procedures which will include more automation of deep convection detection and nowcasting, MET conflict detection and resolution tools for air traffic controllers, better probabilistic forecasts and cross-border harmonization of MET services.

REGIONAL MODELLING AND ASSESSMENT OF ATMOSPHERIC PARTICULATE MATTER CONCENTRATIONS AT RURAL BACKGROUND LOCATIONS IN EUROPE

GORAN GAŠPARAC[(1)], AMELA JERIČEVIĆ[(2)] and PRASHANT KUMAR[(3)]

[(1)]GEKOM d.o.o.
Fallerovo šetalište 22, 10000 Zagreb, Croatia
[(2)]Croatian Agency for Civil Aviation,
Ul. grada Vukovara 284, 10000 Zagreb, Croatia
[(3)]Global Centre for Clean Air Research (GCARE), Department of Civil and Environmental Engineering, Faculty of Engineering and Physical Sciences, University of Surrey, Guildford, Surrey GU2 7XH, United Kingdom
ggasparac@gekom.hr

ABSTRACT

Temporal and spatial variability of observed particulate matter (PM) was investigated at available rural background stations in Europe during 2011. A special attention was given to the regional characteristics and sources of the PM in Eastern and Central Europe of regionally observed high daily PM concentrations (75 μgm^{-3}) at background stations during 10 days in November 2011. The episode was analyzed using monitored and modeled air quality and meteorological data. Two different regional air quality modelling systems (offline EMEP and online WRF-Chem) were applied to simulate the transport of pollutants as well to test their individual performance using background measurements from stations classified according to the altitude in order to provide practical information's for air quality assessment with focus on stable atmospheric conditions. The models were validated against measurements from mast tower of Karlsruhe Institute of Technology and Cabaw tower as well as against soundings and surface measurements. Within the analyzed episode, the accumulation of pollutants was governed by largescale anticyclones conditions that prevailed over the Eastern and Central Europe, enabling long-lasting statically stable atmospheric conditions characterized by low dispersion. The effect of different planetary boundary layer parametrizations and resolutions was investigated in the WRF-Chem model during the episode of increased PM concentrations in stable atmospheric conditions.

Although relatively good overall model performance is found for both models, the underestimated modelled PM concentrations indicated the importance of accurate assessment of regional air pollution transport in stable atmospheric conditions and the necessity of further model improvements. These results contribute to the better understanding of available regional air quality model's performance in simulating background aerosol distribution, particularly in stable atmospheric conditions. The systematic and continuous evaluation of the model's abilities is very important, as models are inherent scientific and regulatory tools for air quality assessment.

POSTERI
POSTERS

TRENDS OF THE PHENOLOGICAL PHASES AND GROWING DEGREE DAYS FOR OLIVE TREES IN CROATIA

MARKO VUČETIĆ and VIŠNJICA VUČETIĆ

Croatian Meteorological and Hydrological Service
Grič 3, 10000 Zagreb, Croatia
mvucetic@cirus.dhz.hr

ABSTRACT

How much olive marks Croatian coastline shows that the Mediterranean climate is also referred as the olive climate. The aim is to determine the trends in phenological phases of olive and the changes of heat accumulation from one phase to next using growing degree days (GDD) with the temperature thresholds of 7°C in the period 1986–2015 related to normal 1961–1990.

Five phenophases from seven stations have been analyzed in the period 1961–2015. The beginning, full and end of flowering are a week earlier in the mid-Adriatic than northern. First ripe fruits are usually by the middle of October, while the picking is in the first ten days in November. Linear trend analysis shows earlier flowering by 2 days/decade in northern Adriatic, while in mid-Adriatic by 3 days/decade. Earlier olive ripe 3 days/decade is observed in mid-Adriatic, while earlier picking (2–4 days/decade) is not just a result of weather conditions, but it depends on market demand for certain oil quality. The spring phenophases require in average around 750–1000°C growing-degree days, 3100–3400°C for the first ripening and 3200–3600°C for picking over last 30 years. GDDs for flowering are similar for both periods but GDDs for the autumn phenophases increase by 150–300°C in the recent period. Using the phenological data (1961–2015) and GDD for each phenopahes (1877–2015) for the mid-Adriatic station of Hvar, the olive phenophases has been reconstructed in the past. The trends in estimated autumn phenophases (21–27 days/century) are faster than for flowering (5–6 days/century).

GRAPEVINE PHENOLOGY AND AGROCLIMATIC INDICES IN CROATIA UNDER CLIMATE CHANGE

VIŠNJICA VUČETIĆ[(1)], MARKO VUČETIĆ[(1)], BRANIMIR OMAZIĆ[(2)], MAJA TELIŠMAN PRTENJAK[(2)], IVAN PRŠA[(3)] and MARKO KAROGLAN[(4)]

[(1)]Croatian Meteorological and Hydrological Service
Grič 3, 10000 Zagreb, Croatia

[(2)]Department of Geophysics, Faculty of Science, University of Zagreb
Horvatovac 95, 10000 Zagreb, Croatia

[(3)]Institute of Enology and Viticulture, Croatian center for agriculture, food and rural affairs, Jandrićeva 42, 10000 Zagreb, Croatia

[(4)]Faculty of Agriculture, University of Zagreb,
Svetošimunska 25, 10000 Zagreb, Croatia

vucetic@cirus.dhz.hr

ABSTRACT

As wine production has a long tradition in Croatia, it is important to determine whether the part of the country, which is suitable for grape cultivation, continues to be favorable in the future. Seven developmental stages of eight phenological stations for the well-known Croatian grapevine varieties have been analyzed in the period 1961–2017. To indentify the effect of climate change, agroclimatic indices: Huglin heliothermal index (HI) and growing degree days (GDD), which are frequently used to indicate suitable areas for wine production, have been evaluated in the period 1987–2016 compared to the normal 1961–1990.

Linear trend analysis of phenological data showed that dates of leaf unfolding, beginning and end of the flowering occurred earlier by 1–3 days/decade in the Adriatic area and 3–5 days/decade in the continental area. The duration of the ripening period has been reduced by half (on 17–20 days) over the last 30 years. The shortening of the vegetation period is more due to the harvest beginning earlier in the summer. In the period 1961–1990 HI was up to 2500°C and GDD up to 2300°C for the mid-Adriatic, up to 2050°C and 1500°C respectively for the continental area and below 1600°C and 1000°C for mountainous area. In the last 30 years, the increase of HI and GDD is evident in the whole Croatia (up to 300°C).

Thus, in the near future in the continental part it could become possible to grow thermally more demanding red grape varieties, while earlier varieties could be cultivated in some mountainous parts.

ENERGY BUDGET AT THE EXPERIMENTAL VINEYARD IN ZAGREB

IVAN KOROTAJ, IVAN VUJEC, DAMJAN JELIĆ and ŽELJKO VEČENAJ

Department of Geophysics, Faculty of Science, University of Zagreb
Horvatovac 95, 10000 Zagreb, Croatia
ikorota@gmail.com

ABSTRACT

Within the collaboration of VITiculture and CLImate Change in Croatia (VITCLIC) project and Croatian-Hungarian bilateral scientific program, a micrometeorological measurements are performed in the Faculty of Agriculture experimental vineyard near Zagreb in the hilly experimental field during the vegetation periods 2017–2018 and 2018–2019. Microclimate of two places of cordon cultivated grape have been studied for the investigation of the effect of cultivation method. In one row grape was left to be naturally covered by leaves while in the other the leaves were being thinned corresponding to the cultivation method. For characterizing the microclimate the relative humidity and air temperature, wind speed and direction, UV, leaf wetness and leaf temperature were measured inside the cordon rows among the leaves. Air temperature, relative humidity and wind speed gradient have been also measured above the plants. Radiation budget components were detected with CNR1 net radiometer. Heat flux into the soil and the soil temperature and moisture profiles from the surface to a depth of 1 m were also determined. Two soil heat flux plates were set at 8 cm deep. Measurement frequency was 5 seconds and the averaging time was 1 minute using Campbell data collecting systems.

Our goal, besides the agroclimatological investigations, is the estimation of soil and surface energy budget components (using Bowen-ratio and gradient methods) and the determination of the optimum roughness length and displacement height as a function of the wind velocity. Daily variation of meteorological elements and energy budget components are demonstrated with case studies.

CONVECTION NOWCAST FOR AIR TRAFFIC MANAGEMENT VERIFICATION

VINKO ŠOLJAN and JADRAN JURKOVIĆ

Croatia Control Ltd.,
Rudolfa Fizira 2, Velika Gorica, 10150 Zagreb-Airport, Croatia
vinko.soljan@crocontrol.hr

ABSTRACT

Widespread deep convection can cause large air traffic detours and congestion of airspace around convectively active areas, increasing workload on air traffic controllers. For that reason, precise and accurate short range forecasts of convective coverage and cloud tops are essential for tactical planning and flow planning in Air Traffic Management (ATM), and are of great importance for flight safety in general.

To address some of these issues, in 2016 and 2017, Croatia Control meteorological division tested a new forecast product for ATM—Convection Nowcast. ATM Convection Nowcast (ATCoN) is a graphical forecast of deep moist convection horizontal and vertical coverage of ATC sectors in the next six hours. It is manually generated by forecasters, using ingredients-based methodology and remote sensing data.

During the testing period verification data was generated using IR satellite images and lightning detection data in the same format as original nowcast. All forecasts were compared to observations in order to answer two key questions:
1. how good is forecast of convective coverage and
2. how good is forecast of convective cloud tops?

Usual verification measures were used in this process. This poster presents details about the ATCoN product and verification results for the testing period in 2016 and 2017.

OPERATIVNI SUSTAV PRIPREME MJERENIH PODATAKA ZA RC LACE (OPLACE)

MARTINA TUDOR[(1)], ALENA TROJÁKOVÁ[(2)] i MATE MILE[(3)]

[(1)]Državni hidrometeorološki zavod / RC LACE,
Grič 3, 10000 Zagreb, Hrvatska
[(2)]Czech Hydrometeorological Institute / RC LACE,
Na Šabatce 2050/17, 14306 Praha 412-Komořany, The Czech Republic
[(3)]Hungarian Meteorological Service / RC LACE,
Kitaibel Pál u. 1, H-1024 Budapest, Hungary
tudor@cirus.dhz.hr

SAŽETAK

Sustav pred-procesiranja (pripreme) mjerenih podataka koji se koriste u operativnoj asimilaciji podataka u numeričkom modelu za prognozu vremena je zahtjevan zadatak. Potrebno je automatizirati procesiranje sirovih mjerenih podataka, uključujući zaprimanje podataka automatski u realnom vremenu, prijenos, procesiranje, provjeru kvalitete i arhiviranje podataka. Svaki tip mjerenja zahtjeva specifični postupak za svaki od navedenih koraka. Male nacionalne meteorološke službe rijetko imaju sredstava da razviju takav sustav samostalno. Nedostatak takvih sustava je još uvijek najveća zapreka pri uspostavi lokalnih sustava za asimilaciju podataka.

Unutar konzorcija RC LACE (koji se sastoji od službi Austrije, Češke, Mađarske, Rumunjske, Slovačke, Slovenije i Hrvatske), uspostavljen je zajednički sustav za pripremu mjerenih podataka OPLACE. Priprema podataka uključuje automatiziranu kontrolu kvalitete, promjene formata zapisa, te mnoge zahtjevnije funkcije. OPLACE se nalazi u meteorološkoj službi Mađarske i trenutno osigurava SYNOP podatke, radiosondažna mjerenja, profile vjetra i avionska mjerenja. Osim konvencionalnih mjerenja, obuhvaća i raznolika daljinska mjerenja, kao što su AMSU-A, AMSU-B, HIRS, ATMS, IASI i SEVIRI, vektori i ASCAT podaci. Nadalje, članice RC LACE-a razmjenjuju mjerenja sa nacionalnih mreža postaja i Mode-S MRAR podatke u realnom vremenu kroz OPLACE. Sustav isporučuje obrađene podatke provjerene kvalitete koji se mogu koristiti u proceduri asimilacije podataka za prizemnu asimilaciju kao i varijacijsku 3D ili 4D analizu. Sustav OPLACE je omogućio meteorološkim službama članicama RC LACE da razviju lokalnu numeričku prognozu vremena korištenjem asimilacije te se pridružuju i službe koje nisu članice RC LACE.

ALADIN LAEF

MARTINA TUDOR[(1)], MARTIN BELLUŠ[(2)], FLORIAN WEIDLE[(3)],
CHRISTOPH WITTMAN[(3)] i SIMONA TASCU[(4)]

[(1)]Državni hidrometeorološki zavod / RC LACE,
Grič 3, 10000 Zagreb, Hrvatska

[(2)]Slovak Hydrometeorological Institute / RC LACE,
Jesséniova 17, 83315 Bratislava, Slovak Republik,

[(2)]Central Institution for Meteorology and Geodynamics / RC LACE,
Hohe Warte 38, Vienna, Austria

[(2)]Meteo Romania / RC LACE

tudor@cirus.dhz.hr

SAŽETAK

Mnogi nacionalni meteorološki centri u Europi izračunavaju operativnu prognozu numeričkim modelima za prognozu vremena na rezoluciji od 5 km ili manjoj. Takve male skale su povezane s većom neodređenosti, pogotovo u nestabilnim vremenskim situacijama male prediktabilnosti. Za prognoziranje u takvim uvjetima, potreban je ansambl numeričkih prognoza vremena. Međutim, takva operativna prognoza je računalno vrlo zahtjevna te male nacionalne meteorološke službe rijetko imaju dovoljne računalne kapacitete za to. Zbog toga je operativna ansambl prognoza većinom u djelokrugu aktivnosti većih prognostičkih centara koje su načešće usredotočene na srednjoročnu i dugoročnu prognozu.

Zbog toga je mezoskalni ansambl prognostički sustav ALADIN-LAEF, utemeljen na modelu za ograničeno područje ALADIN, razvijen u sklopu suradnje RC LACE, usmjeren na kratkoročnu vjerojatnosnu prognozu te se temelji na multiskalnoj ALARO fizici. Glavna svrha LAEF ansambla je operativna vjerojatnosna prognoza za nacionalne meteorološke službe koje su partneri u RC LACE koji to samostalno ne bi mogli postići. Također služi kao pouzdan izvor vjerojatnosne prognoze koju je moguće primijeniti u hidrološkim, energetskim i sličnim aplikacijama.

LAEF sustav je postao operativan 2011. godine. Tada je imao rezoluciju 18 km i 37 nivoa u vertikali. 2013. godine je rezolucija povećana na 11 km u horizontali i 45 nivoa u vertikali na većoj domeni. Optimizirana je simulacija greške modela, razvijena je ansambl asimilacija tla s perturbacijama mjerenja na 2 i 10 m. Trenutno se uspostavlja novi ALADIN-LAEF sustav sa horizontalnom rezolucijom od 5 km na 60 nivoa u vertikali. Sustav radi operativnu prognozu na HPCF-u u ECMWF-u dva puta dnevno s početkom u 00 i 12 UTC i radi do 72-satne prognoze. Ansambl se sastoji od neperturbirane kontrolne prognoze i 16 perturbiranih članova koji obuhvaćaju nesigurnost početnih uvjeta, simulaciju greške modela i povezivanje sa perturbiranim lateralnim rubnim uvjetima iz ECMWF ansambla.

BIAS CORRECTION OF MONTHLY TEMPERATURE AND PRECIPITATION FROM REGIONAL CLIMATE MODEL – CALIBRATION AND VALIDATION

RENATA SOKOL JURKOVIĆ and IVAN GÜTTLER

Croatian Meteorological and Hydrological Service
Grič 3, 10000 Zagreb, Croatia
renata.sokol@cirus.dhz.hr

ABSTRACT

The use of climate projections in different impact models requires input with very low or without any bias that usually global and regional climate models contain. Therefore, the bias in climate model results should be corrected. Data corrected by univariate bias correction methods, i.e. methods which correct each variable individually (e.g. temperature and precipitation), in combinations that are found in impact models can cause unrealistic final results.

The aim was that the physical relationship between the two variables confirmed in the observations retains in the model results, that is, the variables should be corrected together to preserve the physical relationship between them. Using bivariate bias correction method (variables are corrected simultaneously) with Gauss copula function and gamma and normal distribution as marginal distribution for precipitation and temperature, respectively, the regional model was corrected. The RegCM4 regional model with boundary conditions from the MOHC-HadGEM2-ES global model was corrected. Monthly precipitation and mean air temperature correction were performed for each season. Historical simulations were used and 1971–1990 as calibration and 1991–2004 as validation period. The correction was performed according to E-OBS with data at 0.25×0.25°. Spearman's coefficient of correlation was observed as a validation measure.

In comparison to univariate bias correction, results show significant improvement in Spearman' s correlation coefficient after applying bivariate method.

FUTURE HEATING AND COOLING NEEDS AT TWO CROATIAN LOWLAND LOCATIONS

LIDIJA CVITAN and MIRTA PATARČIĆ

Croatian Meteorological and Hydrological Service
Grič 3, 10000 Zagreb, Croatia
cvitan@cirus.dhz.hr

ABSTRACT

Climate change impact on future heating and cooling needs are analysed for two locations in Croatian part of Pannonian plain. Zagreb is one that is placed on its western edge while Osijek is on its eastern edge.

Investigation of the differences between the future heating and cooling needs in the western and the eastern location are performed by the implementation of the commonly used degree-days method. Two temperature parameters were analysed for the whole particular season, that is, heating degree-day (HDD) for the heating season (October–April) and cooling degree-day (CDD) for the cooling season (May–September). To assess heating and cooling parameters in future climate, a subset of nine regional climate models from the EU FP6 ENSEMBLES project was used. The assessment was done for two future periods: 2011–2040 (P1) and 2041–2070 (P2) when all models follow A1B greenhouse gases emission scenario. Horizontal resolution of each model was 25 km. Future projections of heating and cooling parameters for Zagreb-Grič and Osijek stations were determined by using simulated 2-m air temperatures from the grid points which are closest to the stations.

In order to evaluate the temperature simulations against observations, temperature biases (model minus observations) averaged over three periods over the year (January–April, May–September and October–December) and all months for the 1961–1990 control period were determined. For the same control period, nine present day simulations of heating and cooling degree-days were also calculated. Comparison of the degree-day simulations with temperature biases over the control period helped in detecting the simulations that are closest to the observations (i.e. the most realistic simulations). For P1 and P2 future climates, projected degree-day trends are shown as well as the range of degree-day changes that could be expected based on all considered simulations.

SENSITIVITY OF TURBULENCE INTEGRAL LENGTH SCALES FOR BORA FLOWS ON DATA FILTERING

ANA ŠLJIVIĆ, ŽELJKO VEČENAJ, DAMIR PTIČAR and BRANKO GRISOGONO

Department of Geophysics, Faculty of Science, University of Zagreb
Horvatovac 95, 10000 Zagreb, Croatia
sljivic.ana@gmail.com

ABSTRACT

Autocorrelation functions (AF) and Fourier spectra (FS) are basic mathematical tools used to obtain one of the fundamental properties of turbulence in the atmosphere – a corresponding integral length scale (ILS). Besides being a fundamental property in the theory of turbulence, the ILS is used as an important variable in numerical weather prediction and climate models. Therefore, it is of an essential importance to estimate properly the ILS from the atmospheric wind speed measurements using AF and FS, in order to be able to validate NWP and climate models. However, the values of ILS obtained from AF and FS are very sensitive to preprocessing of the data, such as the data filtering, so one has to be very careful in preparing the data for AF and FS analysis.

In this work we study the sensitivity of ILS values for bora flows (obtained using AF and FS analysis) on the data filtering, which is in practice a first step in the analysis of the atmospheric turbulence in general. The measurements that we use were performed on a state-of-the-art micrometeorological tower installed 200 m at the front of the new Maslenica Bridge (motorway and hinterland of the city of Zadar). The 10 m tall tower was equipped with three levels of Gill WindMaster ultrasonic anemometers (2, 5 and 10 m) gathering the 3D wind speed and sonic temperature with the sampling rate of 20 Hz. The main objective of this work is to find a suitable high-pass filter length that will allow us to estimate proper ILS values for bora flows.

FIRST LIDAR MEASUREMENTS IN CROATIA

LADA GABELA ŠEPERIĆ[(1)], IVAN BALETIĆ[(1)], JADRAN JURKOVIĆ[(1)], ALEN SAJKO[(1)] and LUDOVIC THOBOIS[(2)]

[(1)]Croatia Control Ltd.,
Rudolfa Fizira 2, Velika Gorica, 10150 Zagreb-Airport, Croatia
[(2)]Leosphere,
14-16 rue Jean Rostand; 91400 Orsay, France
lada.seperic@crocontrol.hr

ABSTRACT

Demand/capacity balance strongly relies on the impact of weather on airline, airport and aircraft operations that the operational staff can use in its planning. This requires the development of a decision support tool that allows the operational staff to assess the scenario-based impact of the likelihood of the occurrence of key meteorological conditions and a combination of meteorological conditions on the operations.

Bora wind at Dubrovnik airport, as a crosswind regarding the orientation of the runway, could have a significant impact on stakeholder operations. Therefore, the influence of the crosswind and wind shear on air traffic is being examined within two SESAR 2020 programmes, in the solution PJ.04 Total Airport Management and PJ.18 Trajectory Management.

In the period from 14 December 2017 to 14 April 2018 in the vicinity of Dubrovnik airport a WINDCUBE400S-AT LIDAR was installed. Volume, Plan Position Indicator (PPI) and Range Height Indicator (RHI) scans were performed to provide as much data as possible to measure and define the structure of the mean airflow and turbulence. The LIDAR measurements will be used in the mentioned projects; in PJ.04 the measured data will be used for simulating aerodrome operations in episodes of strong cross winds, and in PJ.18 the data will be used for developing bora wind tools.

These were the first 3D LIDAR measurements of bora wind in Croatia, and will also be used in other research for understanding the bora airflows around Dubrovnik airport.

IMPACTS ON AIR QUALITY DUE TO AVIATION EMISSIONS

AMELA JERIČEVIĆ[(1)] and GORAN GAŠPARAC[(2)]

[(1)]Croatian Agency for Civil Aviation,
Ul. grada Vukovara 284, 10000 Zagreb, Croatia
[(2)]GEKOM d.o.o.
Fallerovo šetalište 22, 10000 Zagreb, Croatia
amela.jericevic@ccaa.hr

ABSTRACT

Air transportation growth has rapidly increased over the years and notable influences of aviation emissions on local and regional air quality as well as on climate are identified. The environmental impacts of atmospheric emissions from aircraft have been addressed in two separate ways; aircraft pollutant emissions occurring during the landing and take-off (LTO) phase (local pollutant emissions), and the non-LTO phase (global/regional pollutant emissions). Aircraft pollutant emissions are an important source of pollution and directly or indirectly harmfully affect human health and ecosystems.

In this work harmonized methodology for emissions estimation as well as recent estimated emissions for Croatia will be presented in relation to European and global trends. The WRF-Chem model is applied with modified aviation emissions in order to calculate local air concentrations of CO_2, PM_{10}, NO_x and SO_2 around the Zagreb airport in Croatia. The EMEP model is used to estimate the background contributions with several different emission scenarios. The local impacts are further assessed using Aermode, a Gaussian type model. The management of air quality have to include major sources within the urban area and the application air quality models is essential in identification of environmental impacts.

DRIDANUBE PROJECT – THE ROLE OF DHMZ

KSENIJA CINDRIĆ KALIN, KORNELIJA ŠPOLER-ČANIĆ, LIDIJA SRNEC,
IVANA MARINOVIĆ, BLAŽENKA MATJAČIĆ and LOVRO KALIN

Croatian Meteorological and Hydrological Service
Grič 3, 10000 Zagreb, Croatia
cindric@cirus.dhz.hr

ABSTRACT

DriDanube stands for Drought risk in the Danube region and it is project under the umbrella of EU's The Danube Transnational Programme. Project gathers 10 countries with 23 partners in total and it is coordinated by Slovenian's ARSO. DHMZ is main partner and MZOE is associated partner from Croatia. The project lasts three years and has started in January 2017.The main objective of the project is to increase the capacity of the Danube region to manage drought related risks. The special goals of the project are: (i) to develop Drought User Service which will enable more accurate and efficient drought monitoring and timely early warning; (ii) to harmonize the currently heterogeneous methodologies for drought risk and impact assessments; and (iii) to prepare the DriDanube Strategy which will improve decision-making process in all parts of the drought management cycle and strengthen capacities of the stakeholders.

In this work current achievements regarding the three main goals of the project will be presented with special light on DHMZ's role. Maps of estimated drought impact on main crop yield, fruits, viticulture, olives and forest will be shown and the experience in establishing the national drought reporters network will be presented. These maps are published weekly on DHMZ's web site. Also, the preliminary model for DriDanube Strategy to improve drought emergency response will be presented and the involvement of the stakeholders in Croatia will be explained.

ANALIZA ŠUMSKOG POŽARA KOD SPLITA, 17. – 19. SRPNJA 2017.

TANJA TROŠIĆ LESAR i MARIJA MOKORIĆ

Državni hidrometeorološki zavod,
Grič 3, 10000 Zagreb, Hrvatska
trosic@cirus.dhz.hr

SAŽETAK

Ljetne mjesece 2017. u Hrvatskoj su obilježila sušna razdoblja i ekstremno visoke temperature zraka, kao i četiri izražena toplinska vala, a najviše temperature zraka zabilježene su početkom treće dekade srpnja. Takvi vremenski uvjeti pogodovali su povećanoj učestalosti požara raslinja od kojih su neki bili ekstremni. Požar raslinja u blizini Splita koji je izbio 17. srpnja, a lokaliziran 19. srpnja je bio jedan od najekstremnijih. Ekstremni požar koji je zahvatio Splitsko područje zbog jake bure, koja s obzirom na orografiju može imati smjer od istoka do sjeveroistoka (sjeveroistočni kvadrant – NE kvadrant u ruži vjetrova), 17. srpnja se brzo širio šumovitim padinama planine Mosor. To je bio tzv. „požar vođen vjetrom“, pri čemu je i orografija terena bila od utjecaja. U požaru je sveukupno izgorjelo oko 4300 hektara raslinja, a fronta požara vođena burom je povremeno bila duga 40-tak kilometara. Prikazana je vremenska i sinoptička analiza tijekom trajanja požara, te prognostičko polje turbulentne kinetičke energije. Analiza pokazuje da je ponašanje požara bilo je uvjetovano, ne samo brzinom vjetra, već i kombinacijom smicanja vjetra, odnosno turbulencijom u prizemnom sloju atmosfere, nestabilnošću u suhom zraku te termodinamičkim procesima koji su bili uvjetovani samim ekstremnim požarom.

PROJECT EUMeTrain / SATELLITE METEOROLOGY YESTERDAY, TODAY, TOMORROW

MARKO BLAŠKOVIĆ and KRISTINA KLEMENČIĆ-NOVINC

Croatian Meteorological and Hydrological Service
Grič 3, 10000 Zagreb, Croatia
blaskovic@cirus.dhz.hr

ABSTRACT

Satellites have been used in meteorology for a long time now and their usage has spread from implementation in models to analysis of synoptic situations and nowcasting convection. The challenge meteorologists face with satellites and their data is the need for education in usage of specific satellite products. The EUMeTrain project stands here as a carrier of new information on satellite meteorology. The project is under EUMETSAT's supervision and financial help and is holding several courses, event weeks, monthly weather briefings and other similar events during the year with the goal of teaching meteorologists and other geo scientists the skills they need to understand and apply satellite products in combination with NWP data. The EUMeTrain project will also be involved in creating new material and courses for the new MTG satellites that will be launched in the next (approximately) 5 years. What characteristics do current satellites like Meteosat 9, Meteosat 10 and Meteosat 11 have and what characteristics will the future satellites from the MTG series have? What kind of benefits will be there from using the new satellites? Will there be any new instruments onboard the satellite? All of these questions and maybe more will be answered throughout this poster.