

Klimatske promjene: općenito i prvi rezultati CCLM simulacija u sklopu CORDEX-a

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(<http://www.meteohmd.hr/>)

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Climate Limited-area
Modelling Community

Outline

Klima i klimatske promjene

Kvartar i ledena doba

Posljednji glacijalni ciklus

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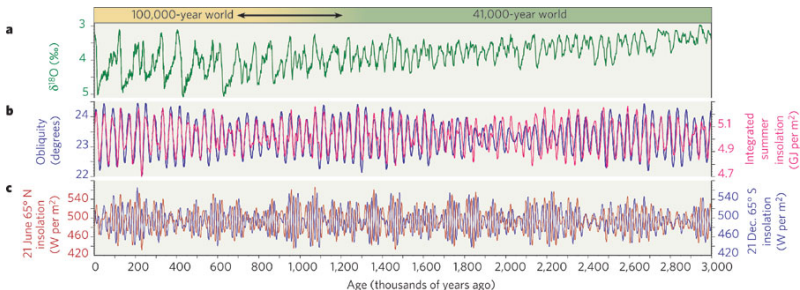


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Kvartar i ledena doba

Raymo & Huybers, Nature 2008

Zapis promjena $\delta^{18}O$, usporedba s nagibom zemljine osi i dozracene energije tijekom protekla 3 miliona godina



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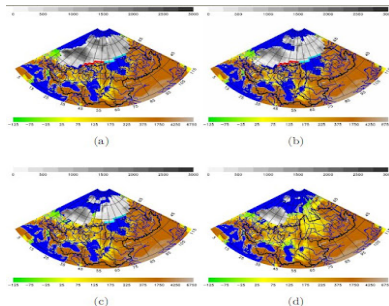
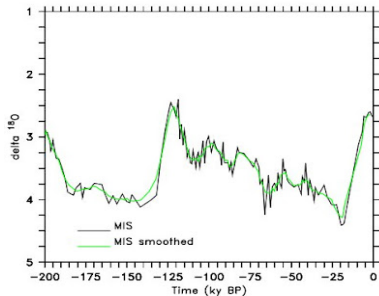


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Posljednji glacijalni ciklus

Georgievski 2008, PhD Thesis

$\delta^{18}\text{O}$ za posljednjeg glacijalnog ciklusa, raspodjela kopna i mora u vrijeme odledbe



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A COordinated Regional climate Downscaling EXperiment

WCRP formed a task Force on RCD aiming to bring together efforts in GCM and RCD communities in order to better understand climate change:

- (i) framework to evaluate and improve RCD techniques for use in downscaling global climate projections
- (ii) multi-model RCD-based high resolution climate change information for impact/adaptation work and IPCC AR5
- (iii) interaction and communication between global climate modelers, the downscaling community and end-users to better support impact/adaptation activities



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Experimental setup

evaluation, historical and RCPs run

- (i) evaluation run: forced with ERA-INTERIM, run for evaluation period 1989 - 2008
- (ii) historical run: forced with MPI-ESM_LR, HadGEM-ESM, CNRM-CM5, EC-EARTH December 1949 - 2005
- (iii) RCP (Representative Concentration Pathways): RCP4.5, RCP8.5 2006-2100.



Topography and evaluation domains

COSMO-CLM

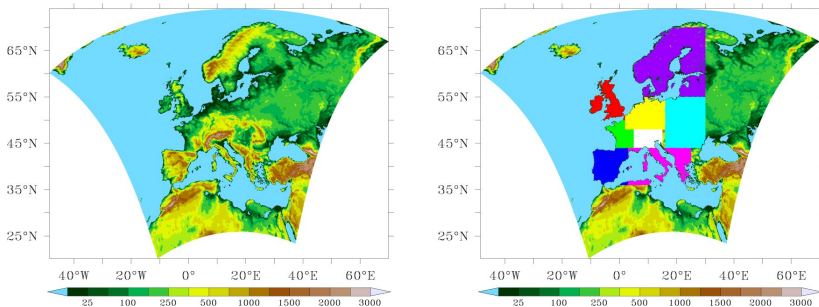


Figure: domain size 450 x 438 x 40, resolution 0.11°, boundary zone with 13 additional grid boxes, 10 soil layers down to 15 m



Namelist settings

pre-processing int2Im_091216_1.10_clm9 version

| | |
|----------------------|-----------------------------|
| experiment | CEU (eval & his) |
| LBC | ERA_INT 0.7° & ECHAM 1.875° |
| Imgrid | 450 × 438 × 40 |
| hincbound | 6h |
| irefatm & ivctype | 2 |
| lprog_qi | T |
| itype_w_so_rel | climatological |
| itype_t_cl | 1 |
| itype_rootdp | 3 |
| Imulti_layer_in & Im | T |
| lforest | T |
| lso | T |
| albedo | dry & moist |

Table: Relevant int2Im namelist parameters setting.



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Namelist settings

simulations COSMO_090213_4.8_CLM_17 version

| experiment | CEU (eval and his run) |
|--------------|------------------------|
| dt | 100s |
| l2tls | T |
| irunge_kutta | 1 |
| iadv_order | 3 |
| nincccon | 2 |
| lgsp | T |
| lprogprec | T |
| itype_conv | 0 |
| itype_gscp | 3 |



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Reference data

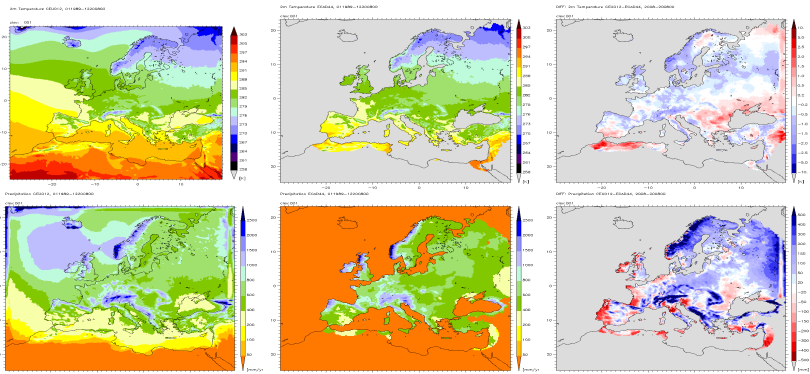
precipitation, air temperature at 2m

- Haylock et al 2008: A European daily high-resolution gridded dataset of surface temperature and precipitation. *J. Geophys. Res (Atmospheres)*, *E – OBS* : 0.225°
- Dee et al, 2011: The ERA-Interim reanalysis: configuration and performance of the data assimilation system. *Quarterly Journal of the Royal Meteorological Society*, ERA INTERIM: $\sim 0.7^\circ$
- Jones, Ph. and I. Harris 2008: CRU Time Series (TS 3.1) high resolution gridded datasets, University of East Anglia Climate Research Unit, CRU: 0.5°



T_{2M} and TOT_PREC evaluation run

Annual mean (1989-2008) geographical distribution (CEU, EOBS, difference)

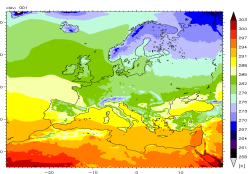


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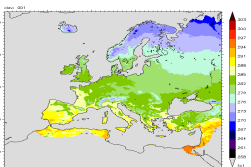
Historical run intercomparison

Annual mean ECAD44 (1986-2005) vs HISECH (1986-2005) geographical distribution

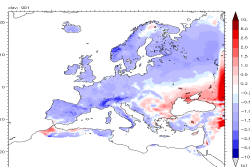
DJA Temperatura HISECH, 011986-122005



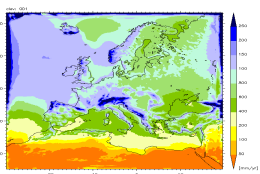
DJA Temperatura ECAD44, 011986-122005



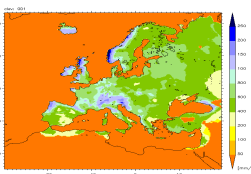
DJA: DiJ Temperatura HISECH-ECAD44, 2005-200900



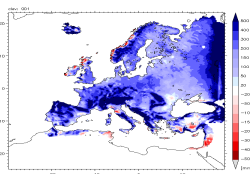
Precipitacija HISECH, 011986-122005



Precipitacija ECAD44, 011986-122005



DJA: Precipitacija HISECH-ECAD44, 2005-200900

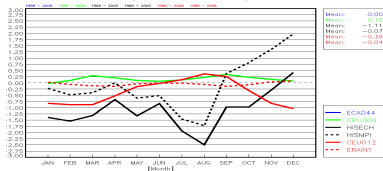


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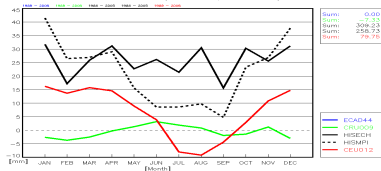
Historical run intercomparison

20 years average annual cycle

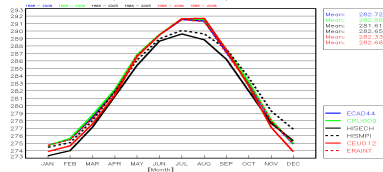
DIFF -367; AREA MEAN ME... (3972 POINTS, GRID: CEU012)



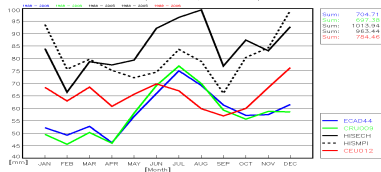
DIFF PRECIPITATION: AREA SUM ME... (3972 POINTS, GRID: CEU012)



367; AREA MEAN ME... (3972 POINTS, GRID: CEU012)



PRECIPITATION: AREA SUM ME... (3972 POINTS, GRID: CEU012)

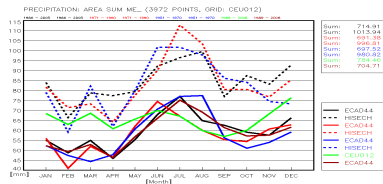
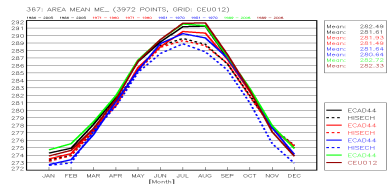
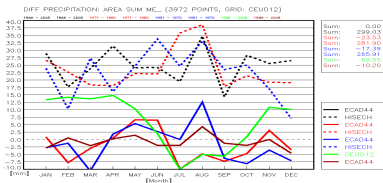
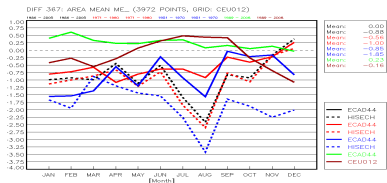


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Historical run intercomparison

climate change - 20 years average annual cycle comparison



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Summary and perspectives

- climate change on the long time scale we should heading towards ice age, but instruments shows warming up to 1.5 K since last 50 years
- evaluation run known problems (cold bias up to 1K in annual mean, and wet bias in monthly summ from 40 *mm/month*)
- historical run preliminary results (cold bias up to 2K in annual mean, wet bias up to 50 *mm/month*), but it captures trend of climate change in historical period



DKRZ - Deutsches Klimarechnenzentrum

IBM Power6 "blizzard"



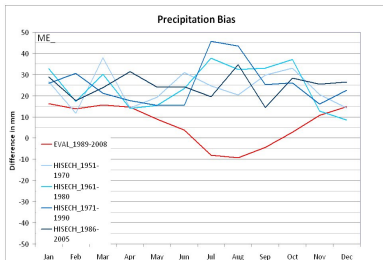
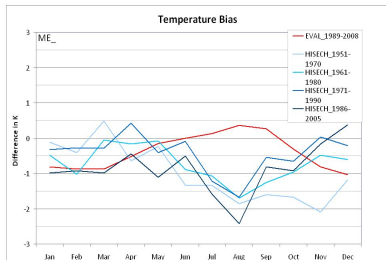
<http://www.dkrz.de/>



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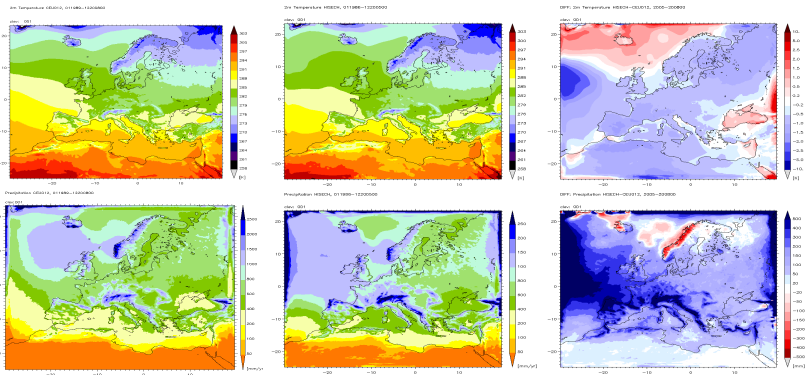
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climate change - 20 years average annual cycle comparison



Historical run intercomparison

Annual mean CEU012 (1989-2008) vs HISECH (1986-2005) geographical distribution



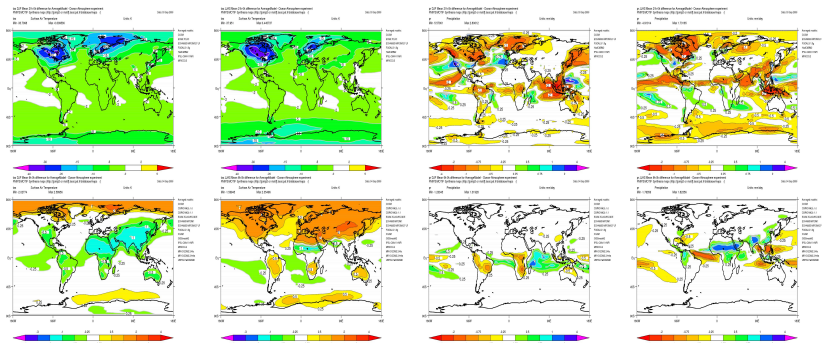
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Posljednji glacijalni maksimum i klimatski optimum

promjena temepratura i oborina

The Palaeoclimate Modelling Intercomparison Project - PMIP 2



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