G.Guerova

Storm Demo Design PhysOn WRF SUADA Portal

311202

Thanks

HPC application for severe weather monitoring in Bulgaria

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> HPC Forum, Sofia Tech Park, Sofia, Bulgaria 16 November 2023

Why

- Storm Demo Design PhysOr WRF SUADA Portal
- SW2022
- Thanks

Motivation: Severe weather forecasting

- WMO nowcasting "detailed description of current weather and forecasts 0 to +6 h"
- phenomena: 1) convective storms 2) mesoscale events associated with extra-tropical & tropical storms 3) fog & low clouds 4) locally forced precipitation events 5) sand & dust storms 6) snow, ice, glazed frost, blizzards, avalanches 7) wildfires 8) air pollution
- benefits: 1) fatalities & injuries reduction 2) private, public, industrial property damage reduction 3) savings for industry, transportation, agriculture



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Why

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Storm nowcasting state-of-the-art:

- weather radar data extrapolation
- "blending" 1) in-situ and remote sensing observation, 2) Numerical Weather Prediction (NWP), 3) model output statistic data, 4) high resolution topography, 5) heuristic rules



*Figure from: Otsuka et al. 2016. Precipitation Nowcasting with Three-Dimensional Space-Time Extrapolation of Dense and Frequent Phased-Array Weather Radar Observations, Weather and Forecasting, 31(1), 329-340.

Storm Demo Design

PhysOr WRF SUADA Portal

SW2022

Thanks

GNSS storm nowcasting demonstrator (Storm Demo)



Why

- Storm Demo Design PhysOr
- WRF SUADA
- Portal
- SW2022
- Thanks

PHYSON: University of Sofia Parallel Computer Center

- 2005 National Scientific Research Fund
- 256 core high performance Linux cluster
- http://physon.phys.uni-sofia.bg/about-physon-en



Why Storm Demo Design

WRF

Portal

SW2022

Thanks

Weather Research and Forecasting (WRF) model: set-up

- 2 daily forecasts5
- 2 km horizontal resolution
- 45 vertical levels





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Why Storm Demo Design PhysOn WRF SUADA Portal

PHYSON: StormDemo Geoportal*

- hosted by Sofia University Atmospheric Data Archive
- public access with real-time and near-real time IWV update for operational use
- http://suada.phys.uni-sofia.bg/?page_id=4838



*Guerova et al. 2022. GNSS storm nowcasting demonstrator for Bulgaria, Remote sensing, 14/15, 3746. doi:10.3390/rs14153746

SW2022

Severe weather in Bulgaria: 1-3 September 2022

- National Institute of Meteorology & Hydrology yellow and orange code
- record daily precipitation registered 200 mm/day
- intense thunder storm activity







(e)



(f)

(d)

Why

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- PhysO WRF SUADA
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Severe weather in Bulgaria: 2 September 2022

- · observed humidity above the monthly threshold
- WRF model underestimates the humidity during severe weather
- exceptionally high values for classification function including humidity observations

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- Why Storm Demo Design
- PhysOr WRF
- SUAD/ Portal
- SW2022
- Thanks

Severe weather in Bulgaria: 3 September 2022

- StormDemo clear sky from west to east
- drop in humidity below the monthly threshold
- technical problems at one station close to the region of the flooding

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Conclusions

- HPCMeteo G.Guerova
- Why Storm Demo Design
- PhysOr WRF
- Portal
- Thanks

- PhysOn critical infrastructure for Storm Demonstrator
- HPC computation + SQL database + Web server
- First Storm Demonstrator for Bulgaria in real time
- High temporal resolution of humidity information comparable with weather radar data
- Geoportal with public access and timely update of observations and Numerical Weather Prediction Model

THANK YOU!