



Study of fog dynamics in Bulgaria with the GNSS tropospheric products

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Content:

- THE AIM OF OUR STUDY;
- DATA AND METHODOLOGY;
- CASE STUDIES;
- RESULTS;
- CONCLUSIONS.

Fog & Fog forecasting



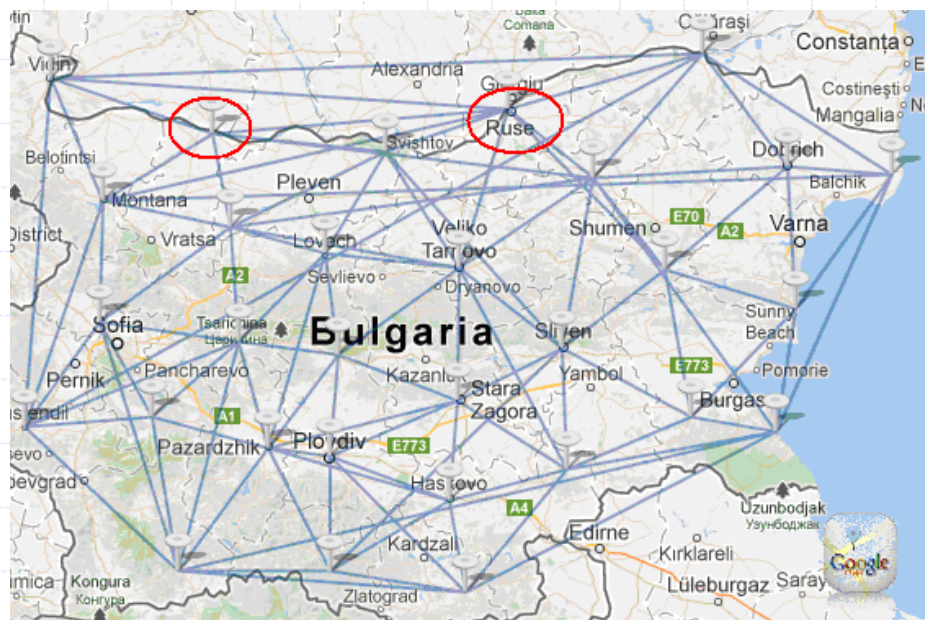
- A general decision for good forecast is not possible
 - Fog is a very local phenomenon;
 - Difficulties in parametrization of fog processes.
- Attracting new methods such as GNSS meteorology.



Methodology

GNSS tropospheric product & *Surface observations*

• IWV [kg/m²]



- 2 m air temperature t [°C];
- 2 m relative hum. RH [%];
- horizontal visibility (WMO, SYNOP), VIS [m];
- fog phase and type, wwWW – present and past weather (WMO, SYNOP);
- surf. air pressure, p [hPa];
- mixing ratio [g/kg];

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SYNERGY BETWEEN SYNOP OBSERVATIONS, GNSS TROPOSPHERIC PRODUCT, AND DETAILED SYNOPTIC ANALYSIS

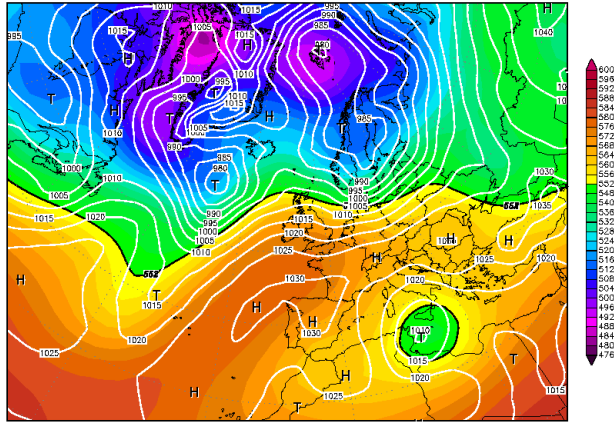
3 case studies in 2012:

21-23 Feb, 10-13 Nov, 25-30 Nov

- SYNOP 00, 03, 06, 09, 12, 15, 18, 21 UTC for Oriahovo and Ruse (North Bulgaria);
- GNSS data for IWV, 3-h temporal resolution;
- Synoptic charts.

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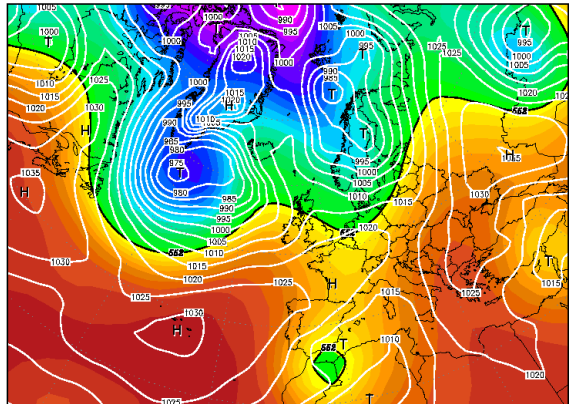
500 hPa Geopotential (gpm) und Bodendruck (hPa)



Daten: Reanalysis des NCEP
(C) Wetterzentrale
www.wetterzentrale.de

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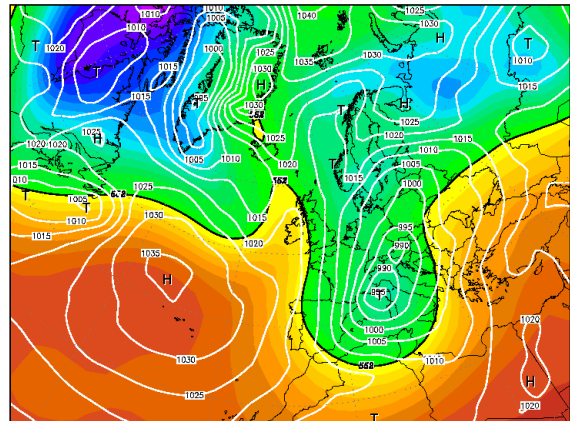
500 hPa Geopotential (gpm) und Bodendruck (hPa)



Daten: Reanalysis des NCEP
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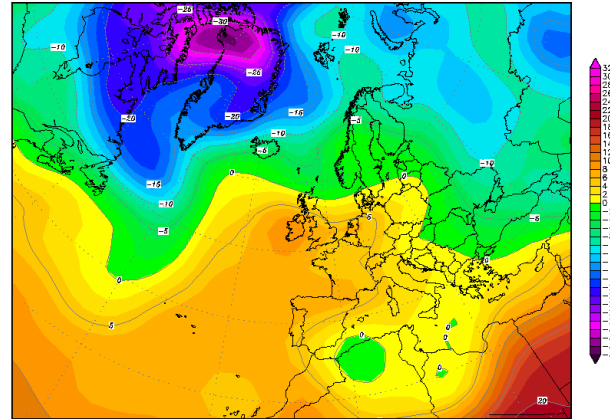
500 hPa Geopotential (gpm) und Bodendruck (hPa)



Daten: Reanalysis des NCEP
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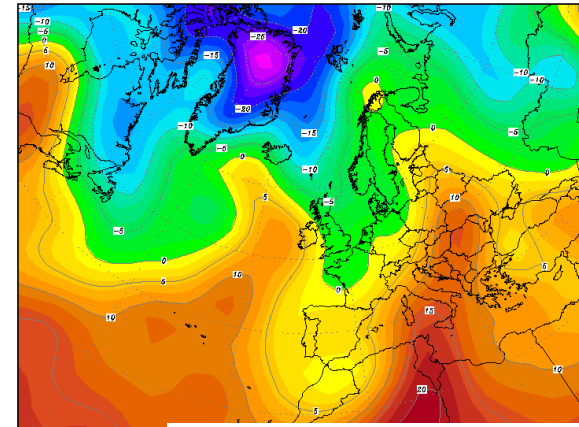
850 hPa Temperatur (Grad C)



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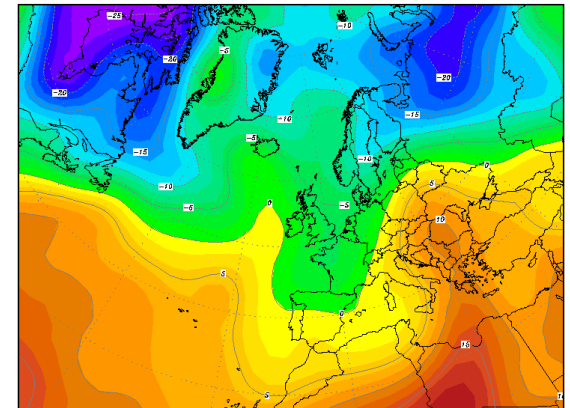
850 hPa Temperatur (Grad C)



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850 hPa Temperatur (Grad C)



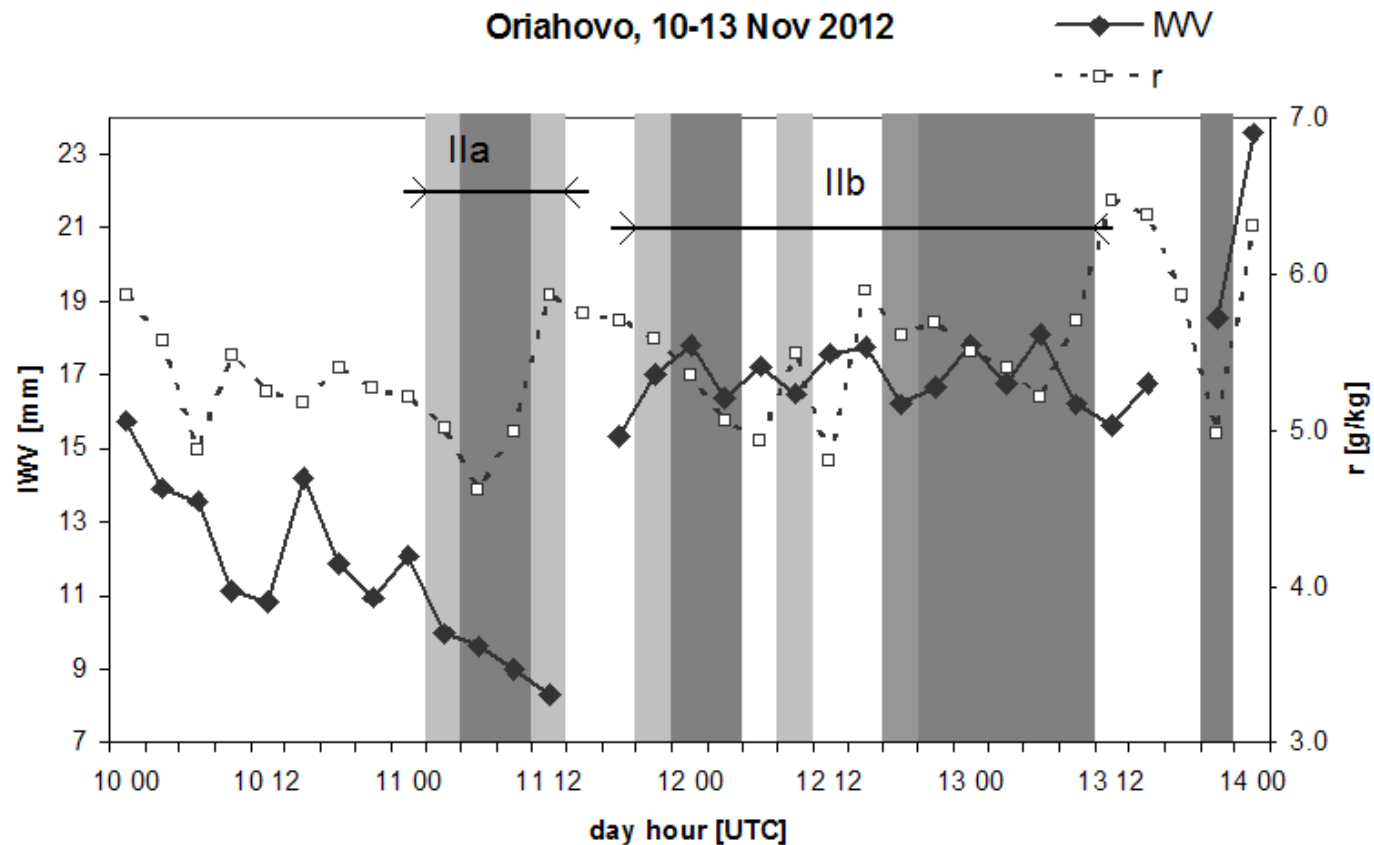
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Case study I:
fog duration
21-51 h

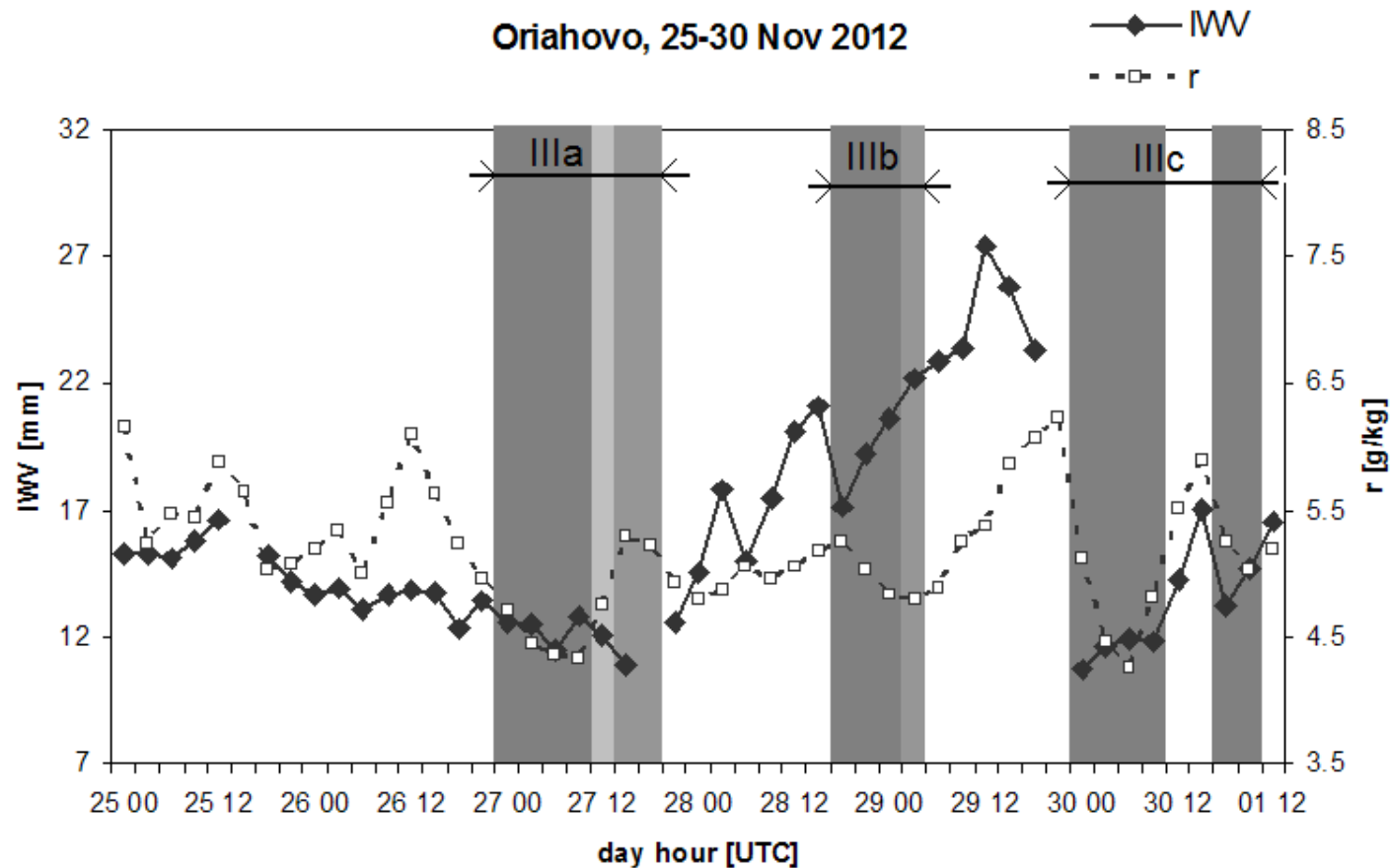
Case study II:
fog duration
30-48 h

Case study III:
fog duration
27-63 h

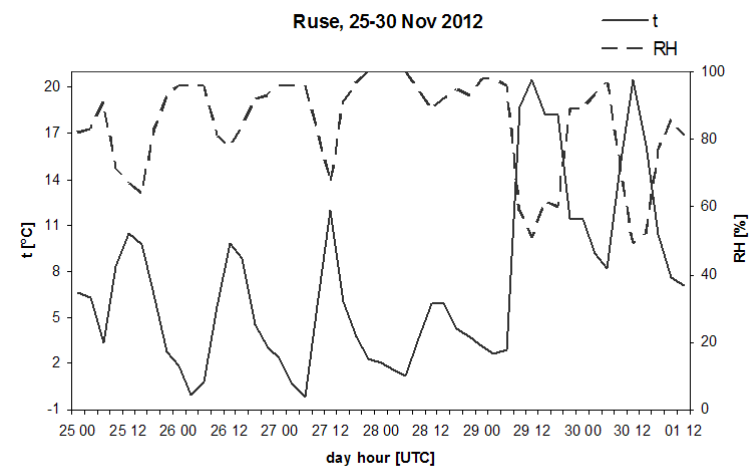
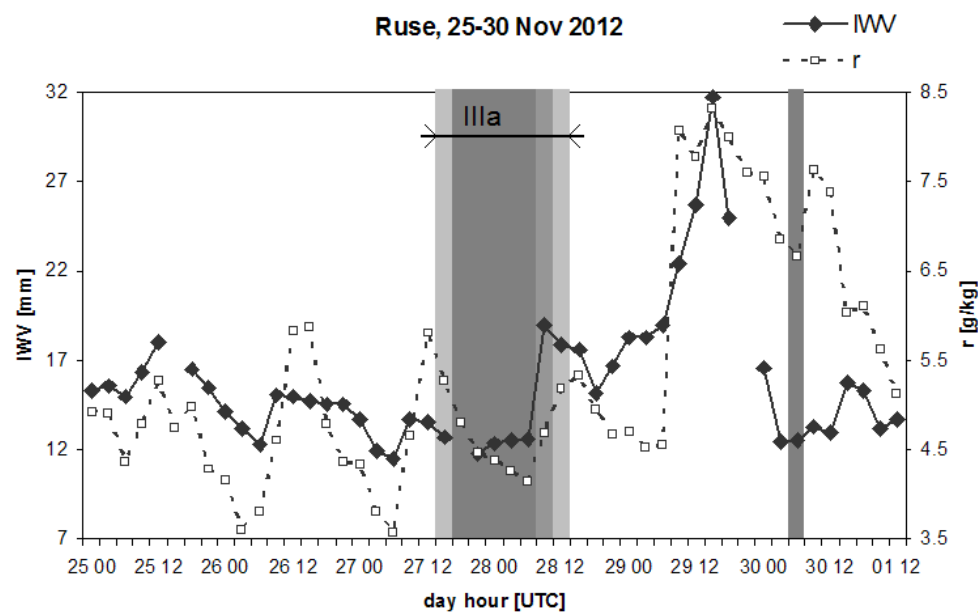
Case II: radiation part IIa and advection part IIb



Case III: radiation - advection - radiation / Western part of Danubian plane



Case III: radiation - advection - radiation / Eastern part of Danubian plane



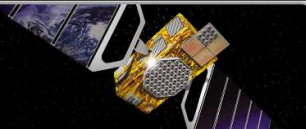
Conclusions

- IWV -> high sensitivity to air mass transformation;
 - Humid air advection at altitude -> tracked in IWV;
 - Low IWV -> low visibility for radiation fog;
 - IWV decrease -> fog formation and/or densification;
 - Increase of IWV -> fog dispersion;
 - IWV -> interaction between air masses and its local realisation over fog life cycle.
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- Extending the study;
 - Better temporal resolution;
 - Real-time GNSS tropospheric products;
 - More investigation -> more clear correlation.

Thank you for
the attention!

SUADA

Sofia University Atmospheric Data Archive



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15th EMS / 12th ECAM
07-11 Sept 2015, Sofia, Bulgaria

08 Sept 2015