Inter-regional Air Quality Assessment – bridging the gap between regional and kerbside PM

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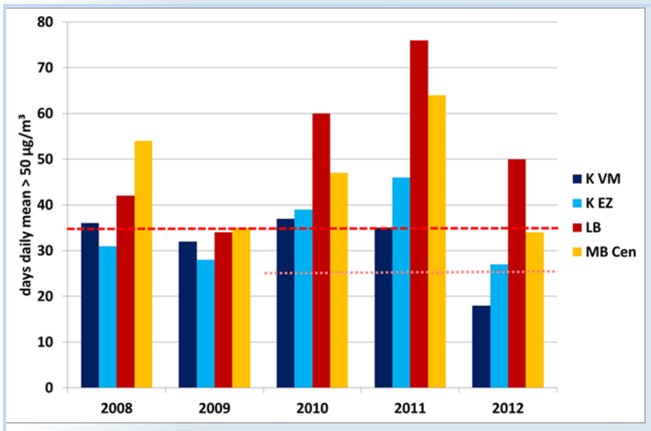
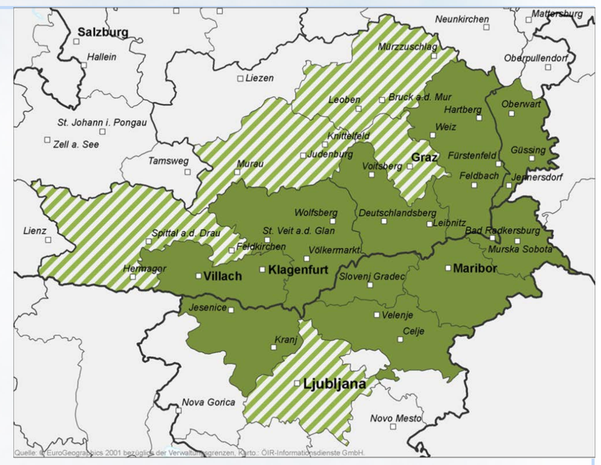


Critical air pollutant PM10 even in rural areas during winter

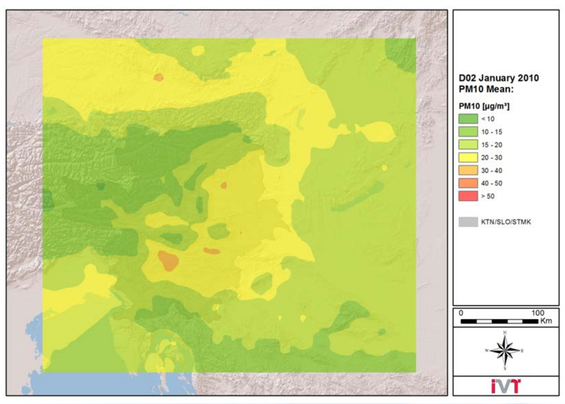
Air Quality Project PMinter (S-Austria & N-SLO)

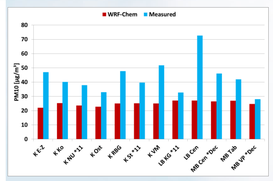
- Area of investigation: S-Styria, Carinthia & N-Slovenia with 3 local core areas Klagenfurt (K) pop. 90000, Leibnitz (LB) pop. 9000 & Maribor (MB) pop. 95000
- Low population, no big industries, N'l & EU AQ standard frequently exceeded
- Complex terrain, low prevailing wind speed in K, LB, MB
- Source receptor model → PM from traffic & residential heating main sources
- Aim of PMinter: support sustainable improvement of air quality in the PMinter region and thus reducing health risks for residents

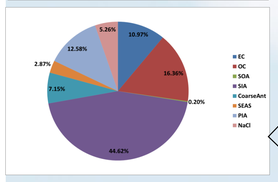
➡ Transport/Advection of PM?
➡ Impact of secondary formed PM?
➡ Wood smoke vs. Traffic related PM?
➡ Development of efficient air quality management plans



PMinter project area (in green)

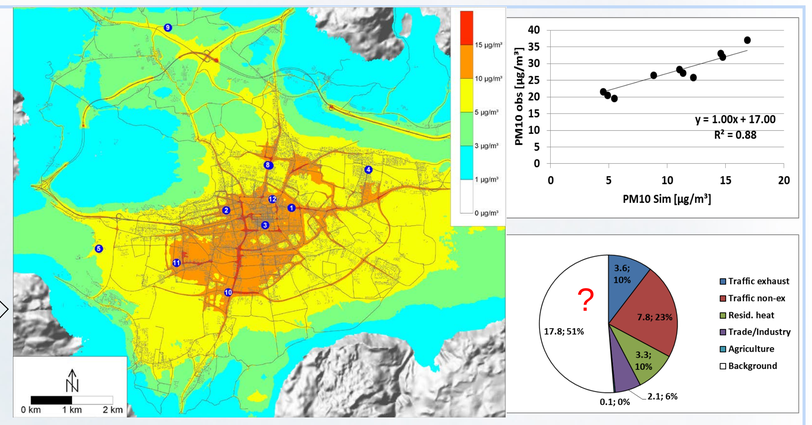






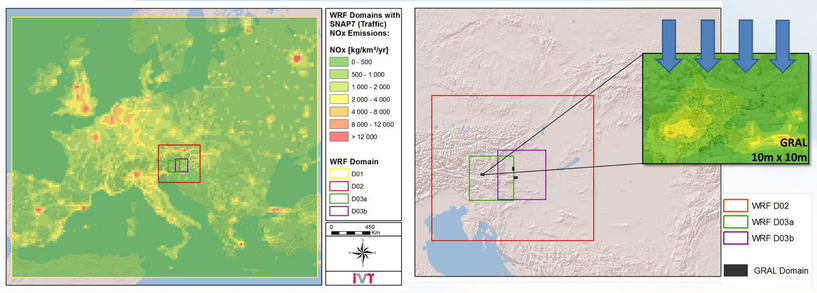
Challenge/Approach

- Complex Terrain → fine resolution required, no adequate emission data sets available
- Use multi-nesting technique & Combine both model concepts and establish complementing high resolution emission data bases



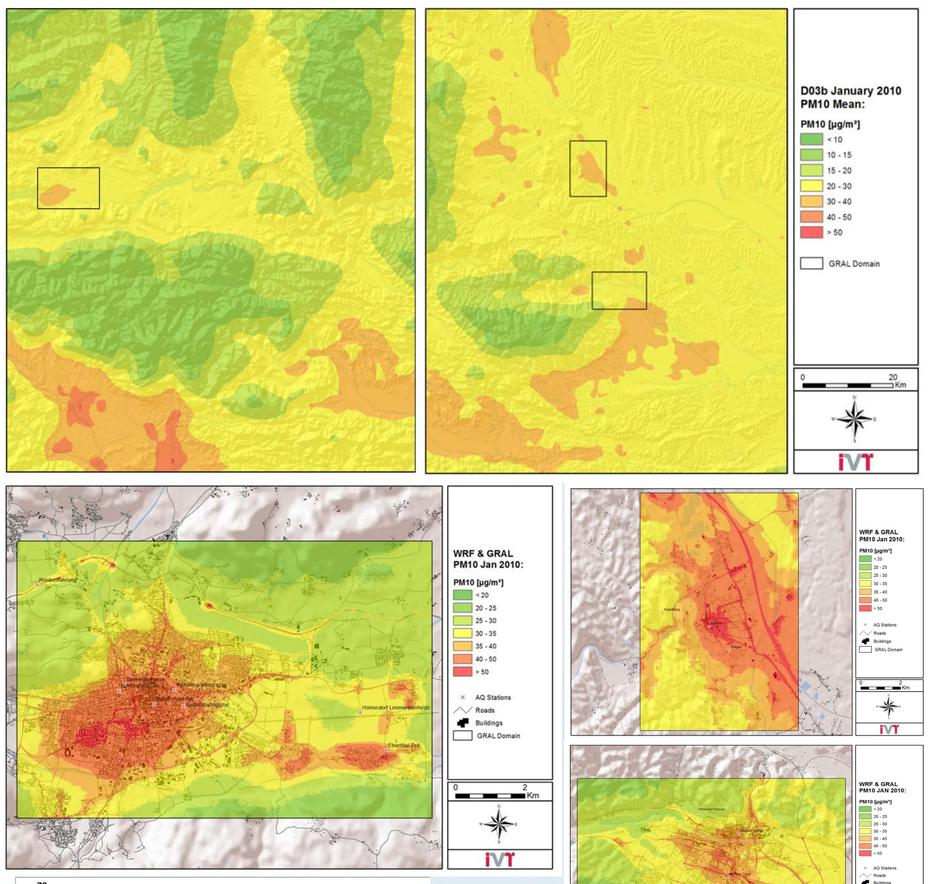
Eulerian chemistry transport model WRF-Chem (~5 km)

- Pro: Transport (Adv), Chemistry & Aerosol dynamics
- Con: Representation of gradients due to limitations in resolution (> ~1km), CPU and availability of emission data sets



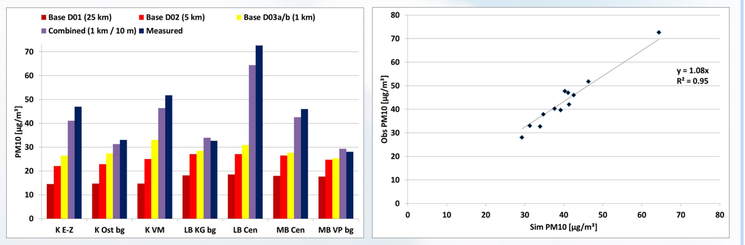
Lagrangian particle model GRAL AMV PM10 (10 m)

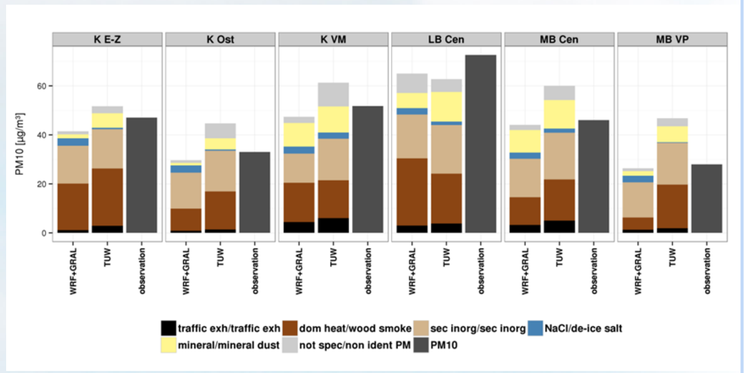
- Pro: representation of pollutants in the vicinity of strong sources
- Con: Transport through system boundaries, Secondary PM, Chemistry



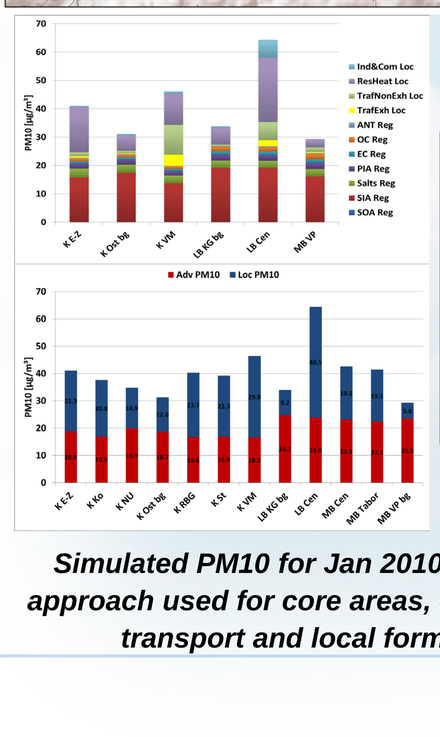
Results

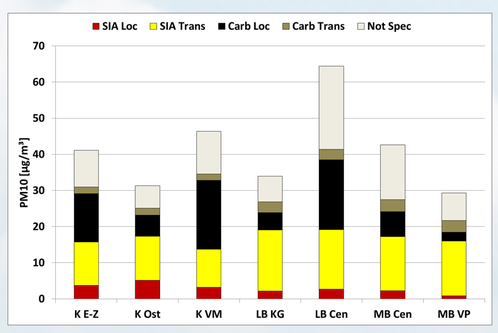
- High resolution emission data bases established
- Combined chemical composition & source receptor multi scale model system developed → mass of UFP can be inferred
- Concentration gradients well resolved & realistic PM composition
- Main PM components: secondary inorganic PM (SIA) & wood smoke related PM, traffic related PM only at main arterial roads a main source
- Agriculture (NH3) & traffic (NOx, NO2, HNO3) major PM precursor sources
- Measures related to SIA precursors efficient only on regional scale
- Region-wide NH3 measures are more effective in total PM reductions than measures on NOx



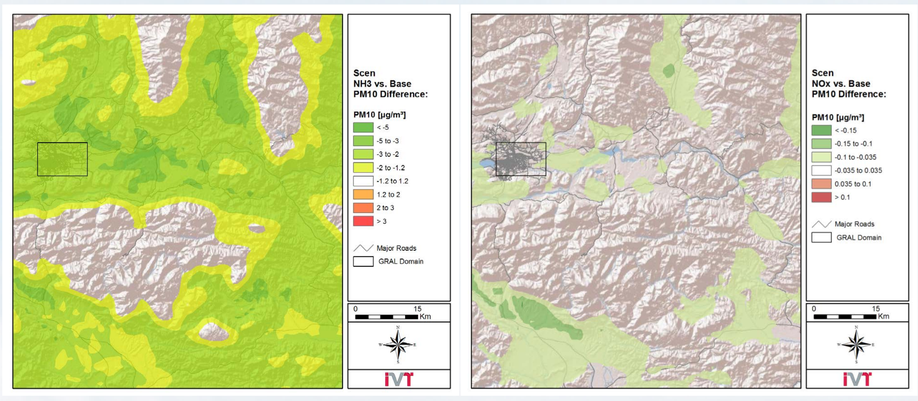


Impact of resolution (top, left) & validation of the combined model approach, base cases

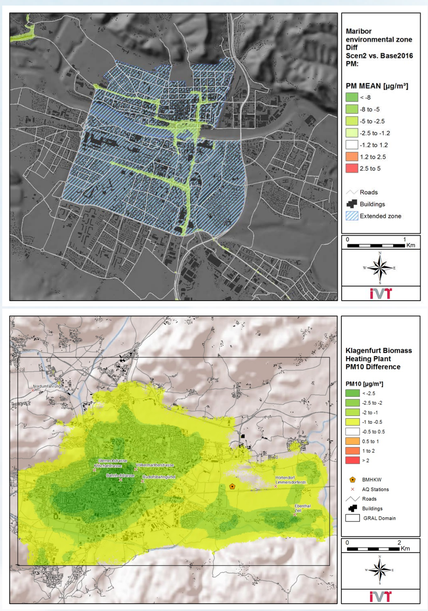




Simulated PM10 for Jan 2010 at the regional scale, combined approach used for core areas, chemical composition & impact of transport and local formed/emitted PM, base cases



Simulated changes in Jan mean PM10 2010 due to agricultural -35% NH3 reductions (left), traffic -35% NOx reductions (right) in the regional domain D3a (E-Carinthia / central N-SLO)



Simulated changes AMV PM10 Maribor environmental zone – BAU 2016 (top); Klagenfurt biomass district heating scenario minus base case 2010, mean PM10 change simulated by replacing individual heating facilities with biomass district heating plant (bottom)