Simulation of pollen concentrations over Europe in present and future climate conditions

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The issues

How are future airborne pollen loads evolve?

What is the uncertainty of these loads?

What are the drivers of future airborne pollen loads?

What is driving the uncertainty?
The processes involved

- Weather
- Climate
- Plant phenology
- Pollen release
- Plant invasion & density
- Pollen productivity
- Pollen dispersion and transport
- Land management
The bottlenecks

• Knowledge on plant presence and density: currently only presence but monitoring lacking, and density unavailable

• Seed diffusion mechanism

• Release mechanism largely unknown

• Phenology, production: lack of direct measurements
The modeling suites

Vegetation model ORCHIDEE

Climate Suitability Model SIRIUS

Plant density model

Seed diffusion

2 release dispersion models: RegCM & CHIMERE

2 Climate models RegCM WRF EUROCORDEX

Phenology model PMP
Model evaluation: sites
Models evaluation: means

**First guess [CHIMERE]**
- Observed vs. simulated yearly sums
- Correlation: 0.5
- Simulated yearly sums:
  - Mean model: 1736.18
  - Mean mediod: 6108.69
  - NRMSE: 158.3

**Calibration [CHIMERE]**
- Observed vs. simulated yearly sums
- Correlation: 0.77
- Simulated yearly sums:
  - Mean model: 1736.18
  - Mean mediod: 1416.51
  - NRMSE: 46.93

**Validation [CHIMERE]**
- Observed vs. simulated yearly sums
- Correlation: 0.73
- Simulated yearly sums:
  - Mean model: 1736.18
  - Mean mediod: 1440.14
  - NRMSE: 48.48

**First guess [REGCM]**
- Observed vs. simulated yearly sums
- Correlation: 0.75
- Simulated yearly sums:
  - Mean model: 1579.07
  - Mean mediod: 2286.55
  - NRMSE: 49.99

**Calibration [REGCM]**
- Observed vs. simulated yearly sums
- Correlation: 0.95
- Simulated yearly sums:
  - Mean model: 1579.07
  - Mean mediod: 1300.11
  - NRMSE: 29.62
Model evaluation: daily scale
Experiments

- 2 model suites
- 2 climate+LU scenarios (RCP4.5; RCP8.5)
- 3 invasion scenarios (rapid, best estimate, slow)
- Attribution experiments (with/without CC)
Conclusions

• FUTURE AIRBORNE RAGWEED POLLENS SHOULD INCREASE A LOT IN EUROPE, ESPECIALLY IN NORTHERN/CENTRAL EUROPE

• REASONS: INVASION (without CC), MORE CLIMATE SUITABILITY, MORE POLLEN PRODUCTION (due to CC)

• LARGEST UNCERTAINTY : SEED DIFFUSION