



Bakre stöd för spridnings- beräkningar i Totalförsvaret

Metodkonferensen 2024-09-24

Bakgrund – ”reach-back”

- Reach-back: "(military) The ability to exploit resources and capabilities located elsewhere." (en.m.wiktionary.org)
- På svenska
 - Avancerat stöd
 - Expertstöd
 - Bakre stöd
- Vår hypotes – optimal operationell effekt uppnås endast med ett väl fungerande bakre stöd

CBRN

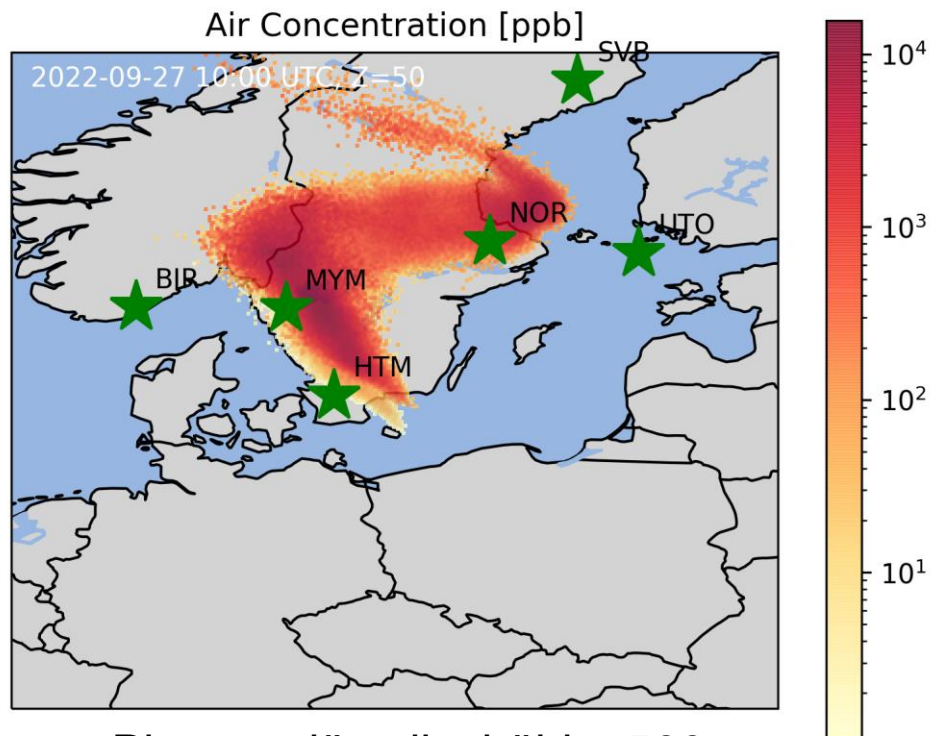
- Chemical
- Biological
- Radiological (kärnkraftsolyckor)
- Nuclear (kärnvapen)

Exempel på CBRN-händelser

Nord Stream, 2022-09-26, metanutsläpp

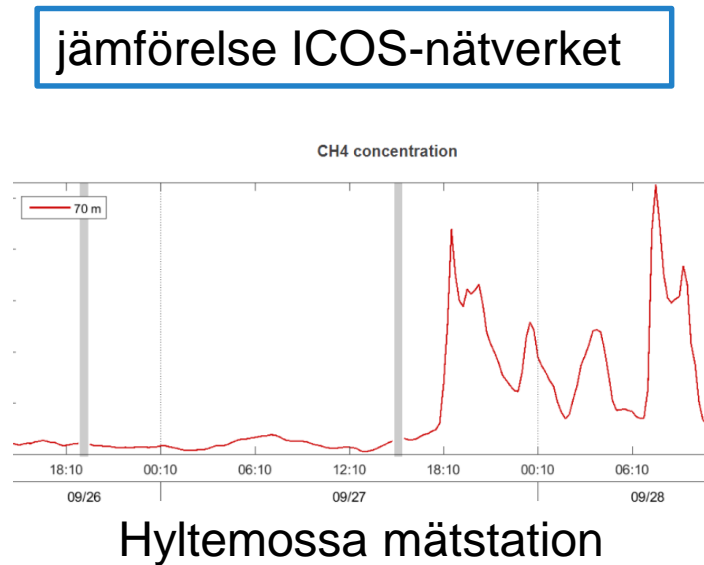
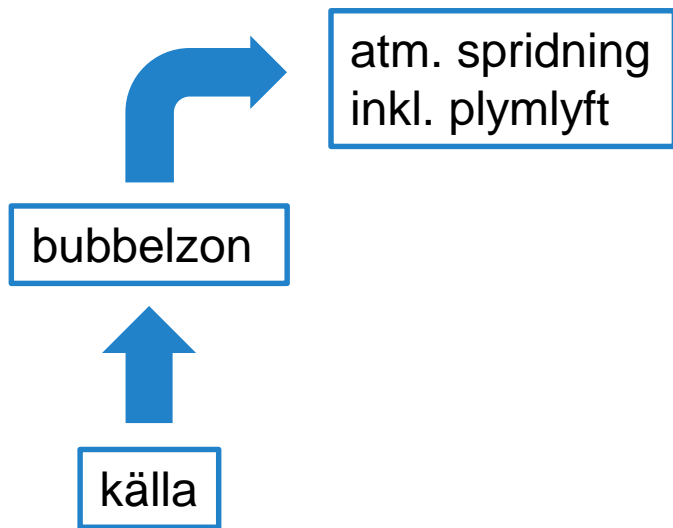


Riskområde brand 5 nm

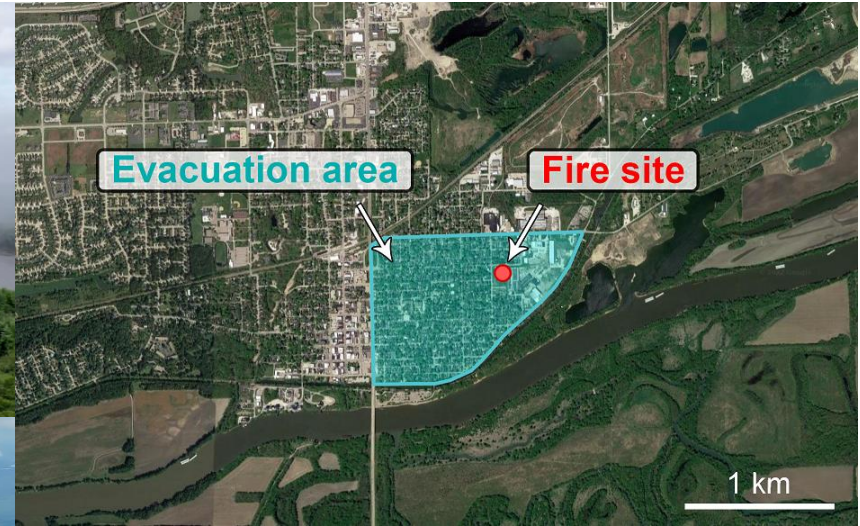


Plymens jämviktshöjd – 500 m

Modellkedja



Brand i batterilager, Morris IL, 2021-06-29

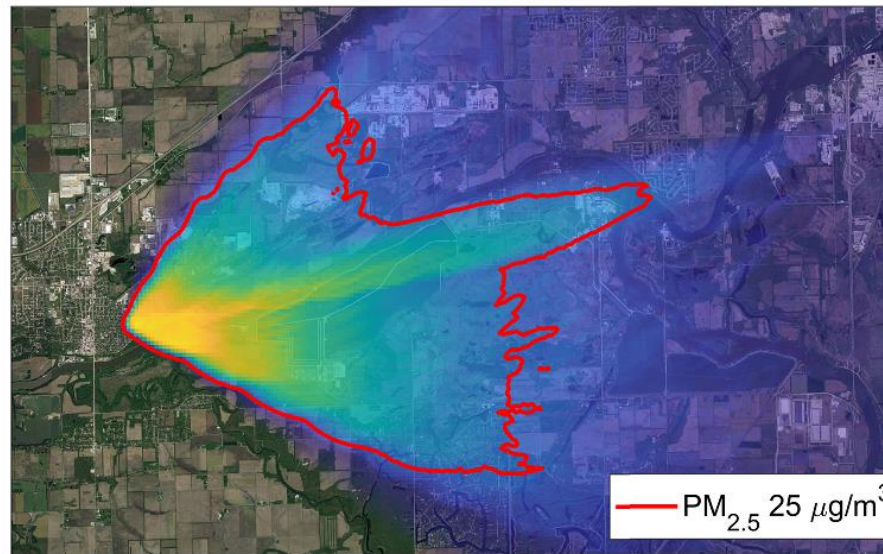


PM_{2,5}, HF (vätefluorid)

Simulering



LillPello partikkelmodell



Simulerat riskområde

Metoder inom spridningsberäkningar

NATO ATP-45

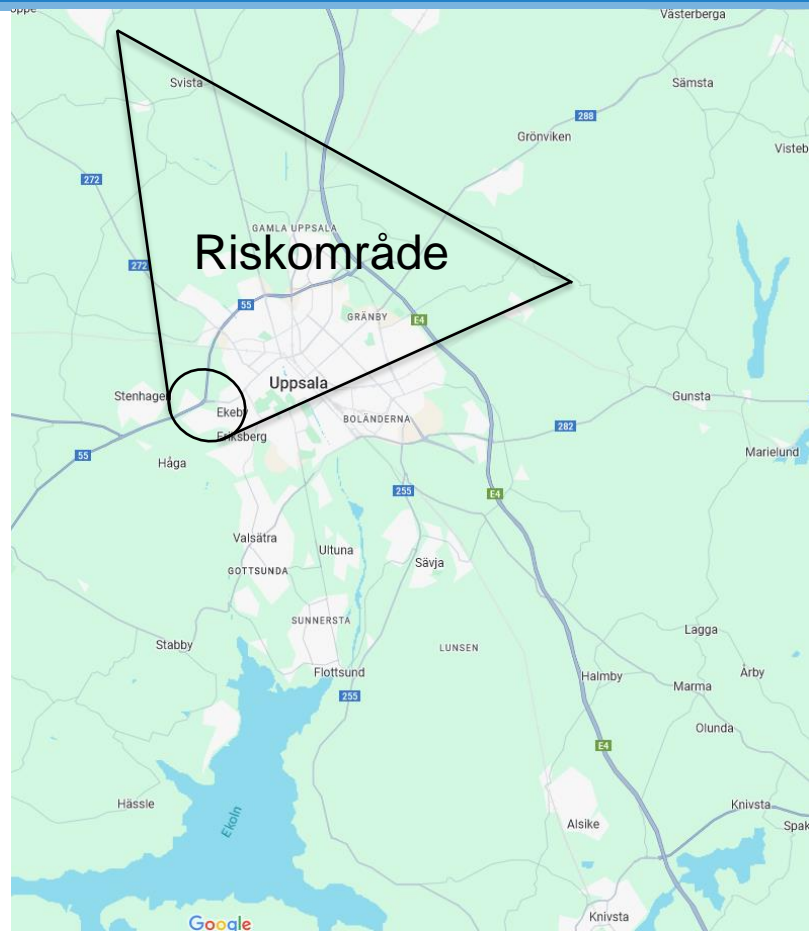
- Mallbaserad metod
- Manuell eller med datorstöd
- Indata via email, telefon el. radio:

OPER/-// MSGID/CBRN CDR/APP-11(E)/1/METOCC/-/-/-/SWE/EJ SEKRETESS//
GEODATUM/-//
DTG/-//
AREAM/NFEA11//
ZULUM/280031ZAUG2024/280600ZAUG2024/281200ZAUG2024//
UNITM/KM/DGG/KPH/C//
WHISKEYM/025/007/7/014/9/6/2//
XRAYM/015/007/7/016/8/0/2//
YANKEEM/335/006/1/018/7/0/2//

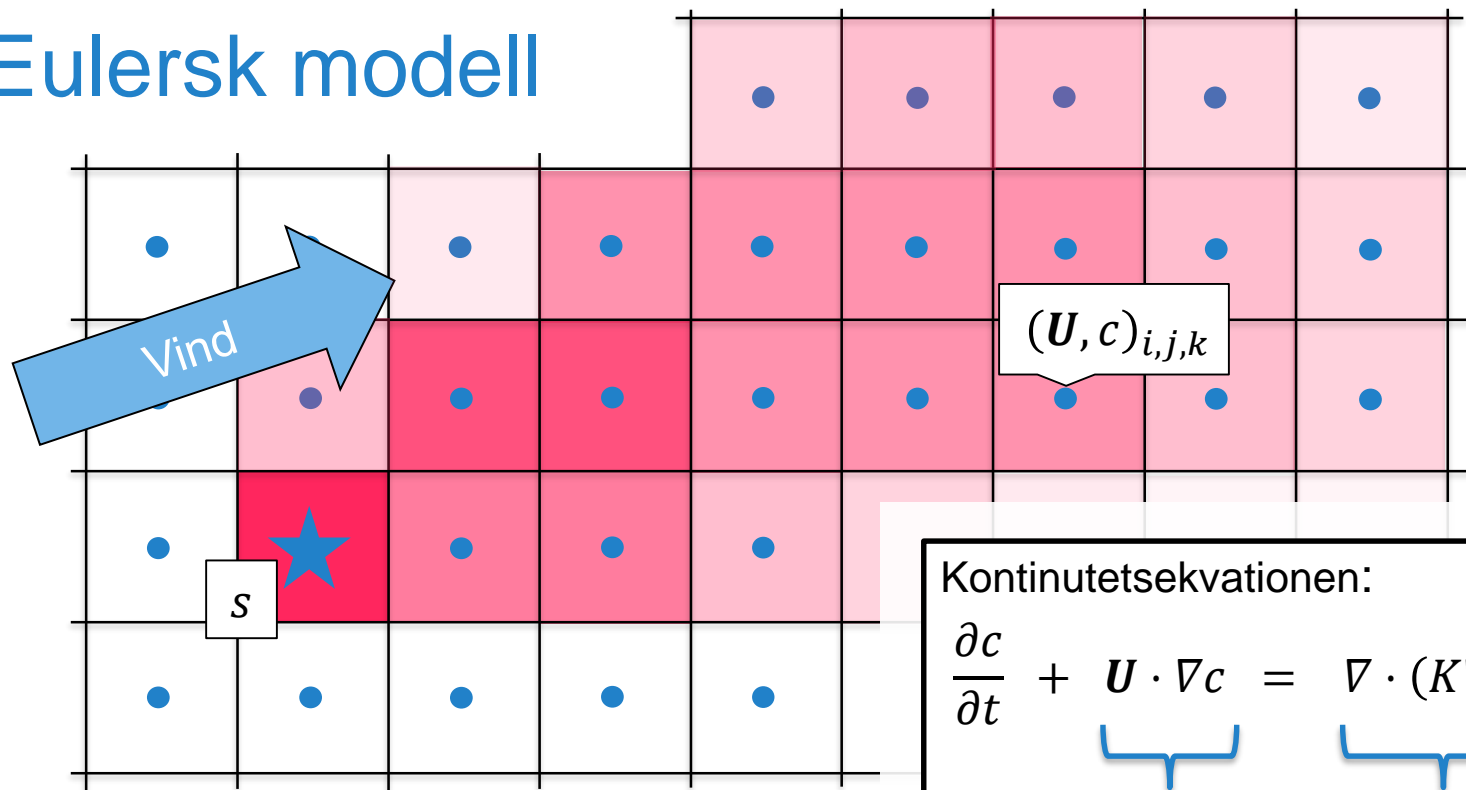
Väder

+

Källbeskrivning



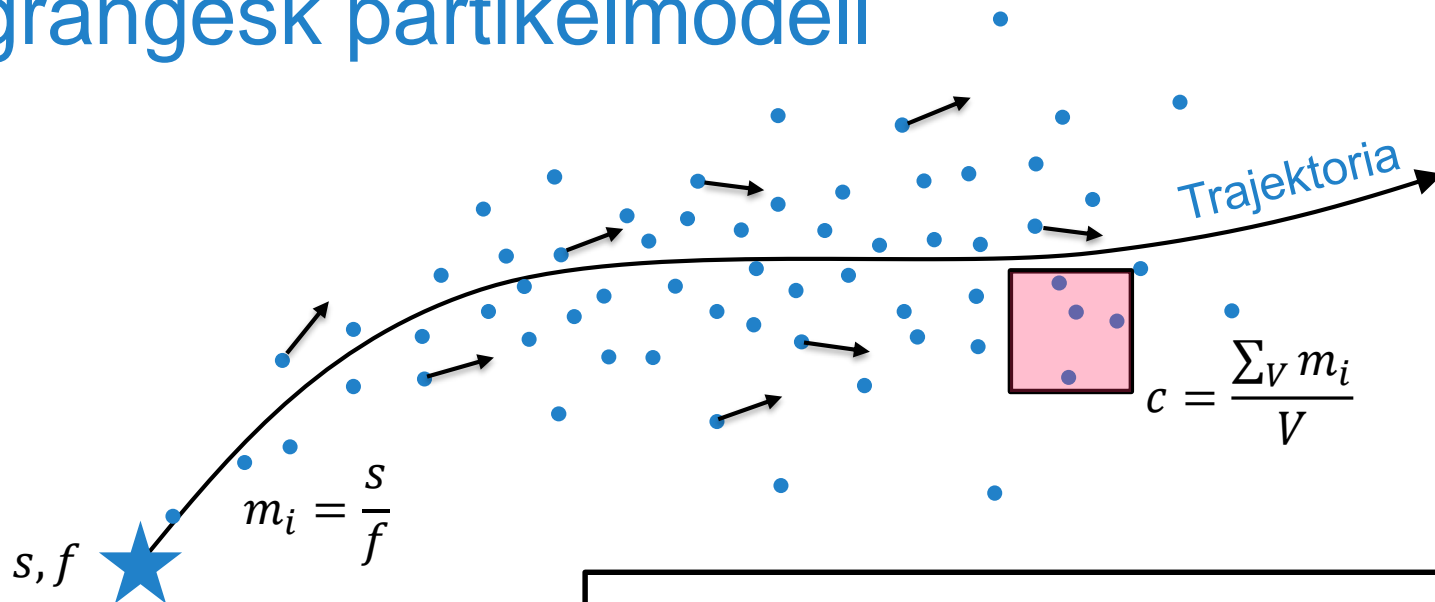
Eulersk modell



Kontinuitetsekvationen:

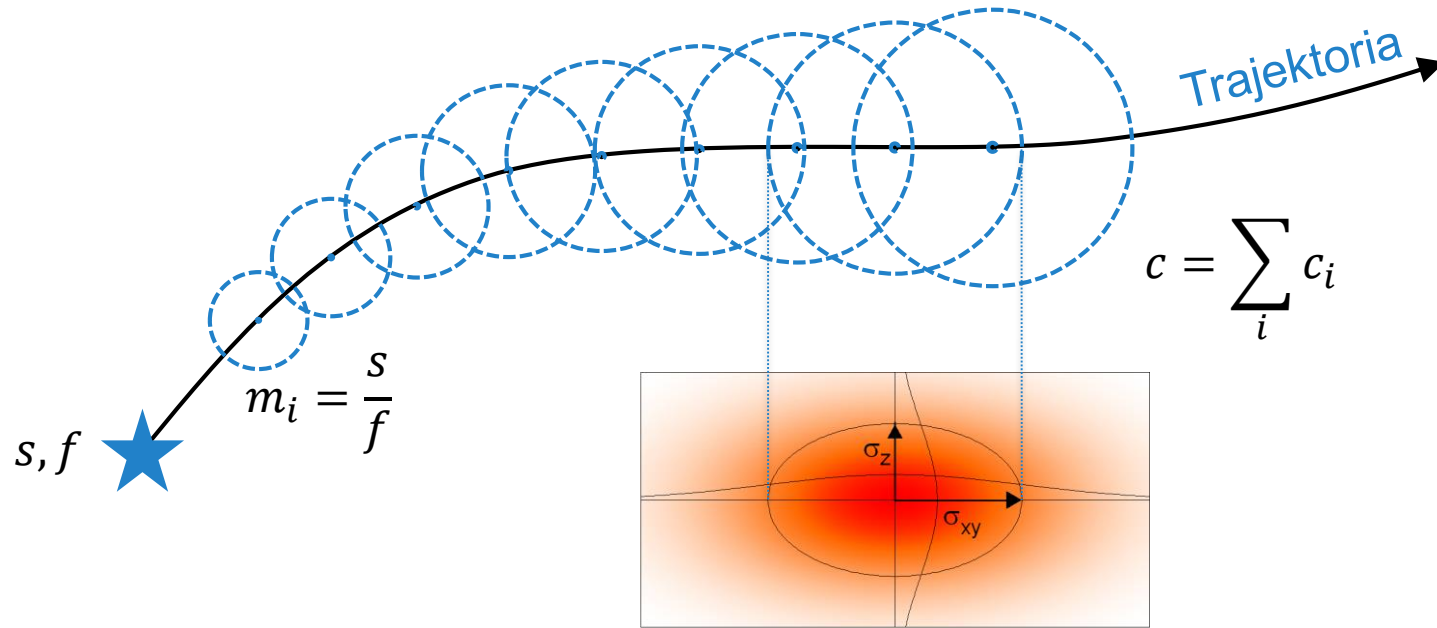
$$\frac{\partial c}{\partial t} + \underbrace{\mathbf{U} \cdot \nabla c}_{\text{advektion}} = \underbrace{\nabla \cdot (K \nabla c)}_{\text{diffusion}}$$

Lagrangesk partikelmodell

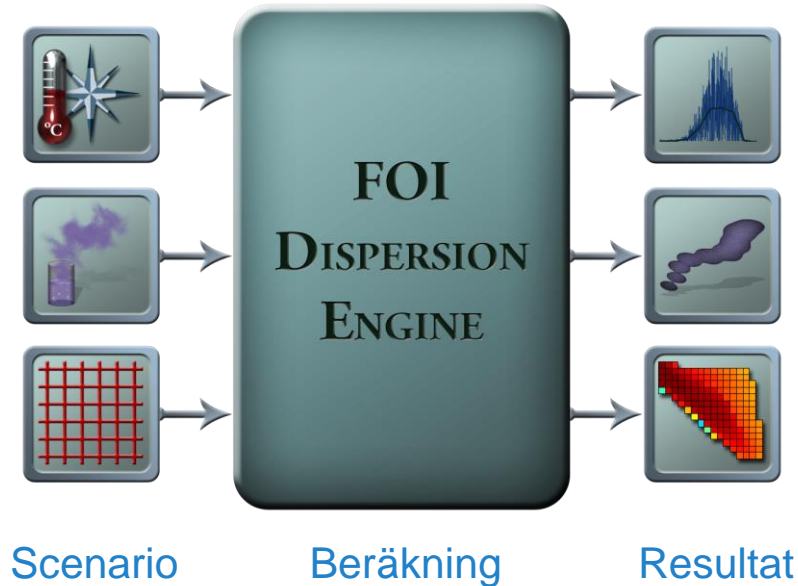


$$dx_i = \underbrace{a_i \cdot dt}_{\text{deterministisk}} + \underbrace{b_{ij} \cdot dW_j}_{\text{stokastisk}}, \quad dW_j \sim N(0, dt)$$

Lagrangesk puff-modell



Dispersion Engine – hela spridningskedjan

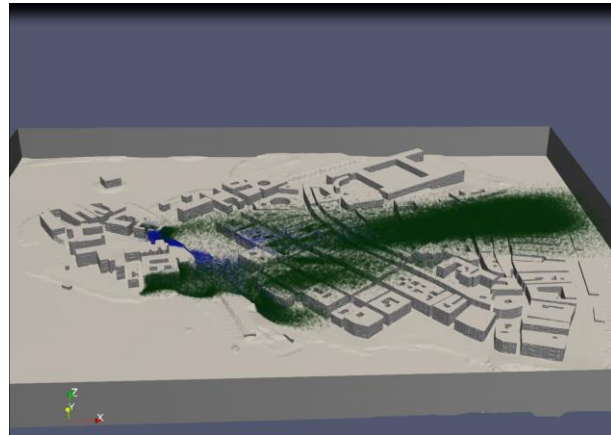


Användning

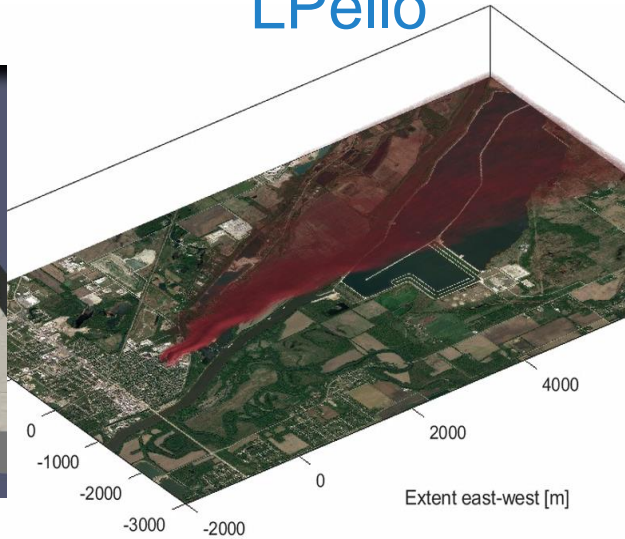
Internt
MSB
SSM/SMHI
EU-projekt

FOIs spridningsmodeller

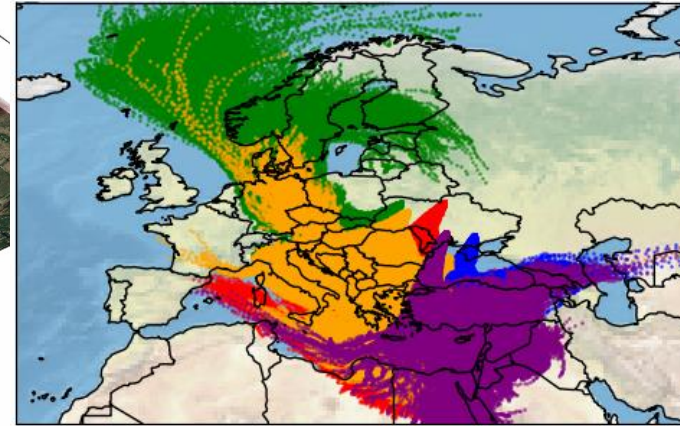
UPello



LPello



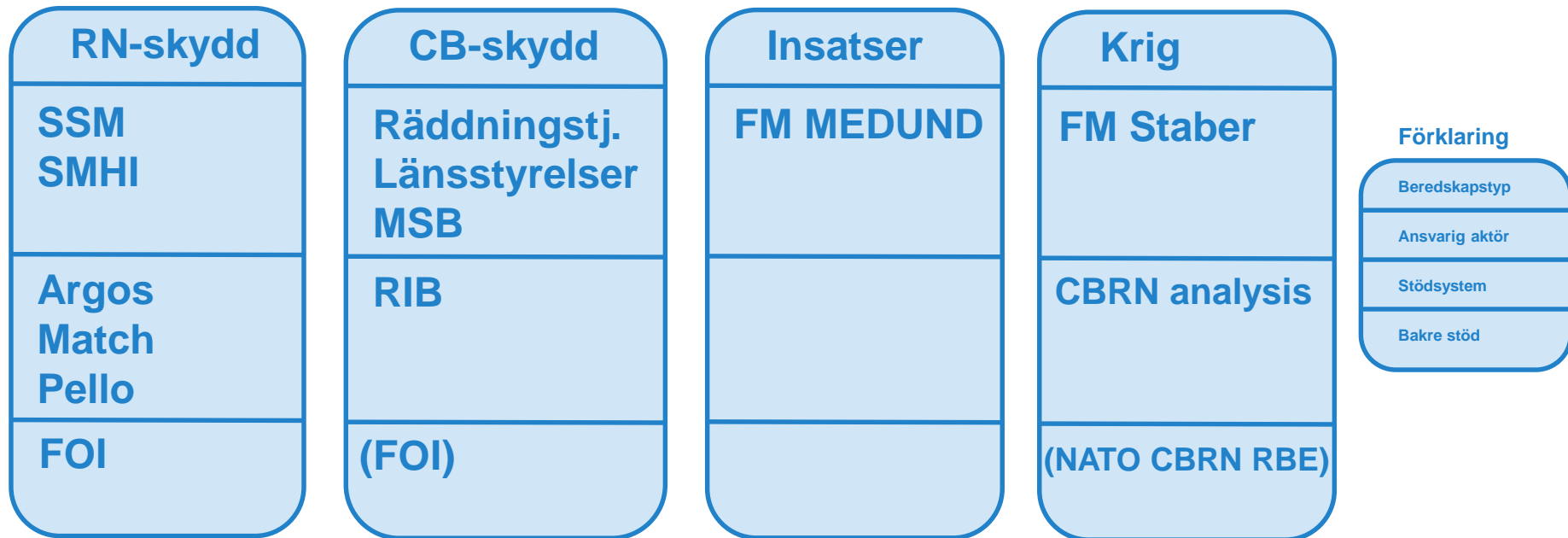
Pello



Puma...

Bakre stöd i totalförsvaret

Nuläge nationell beredskap

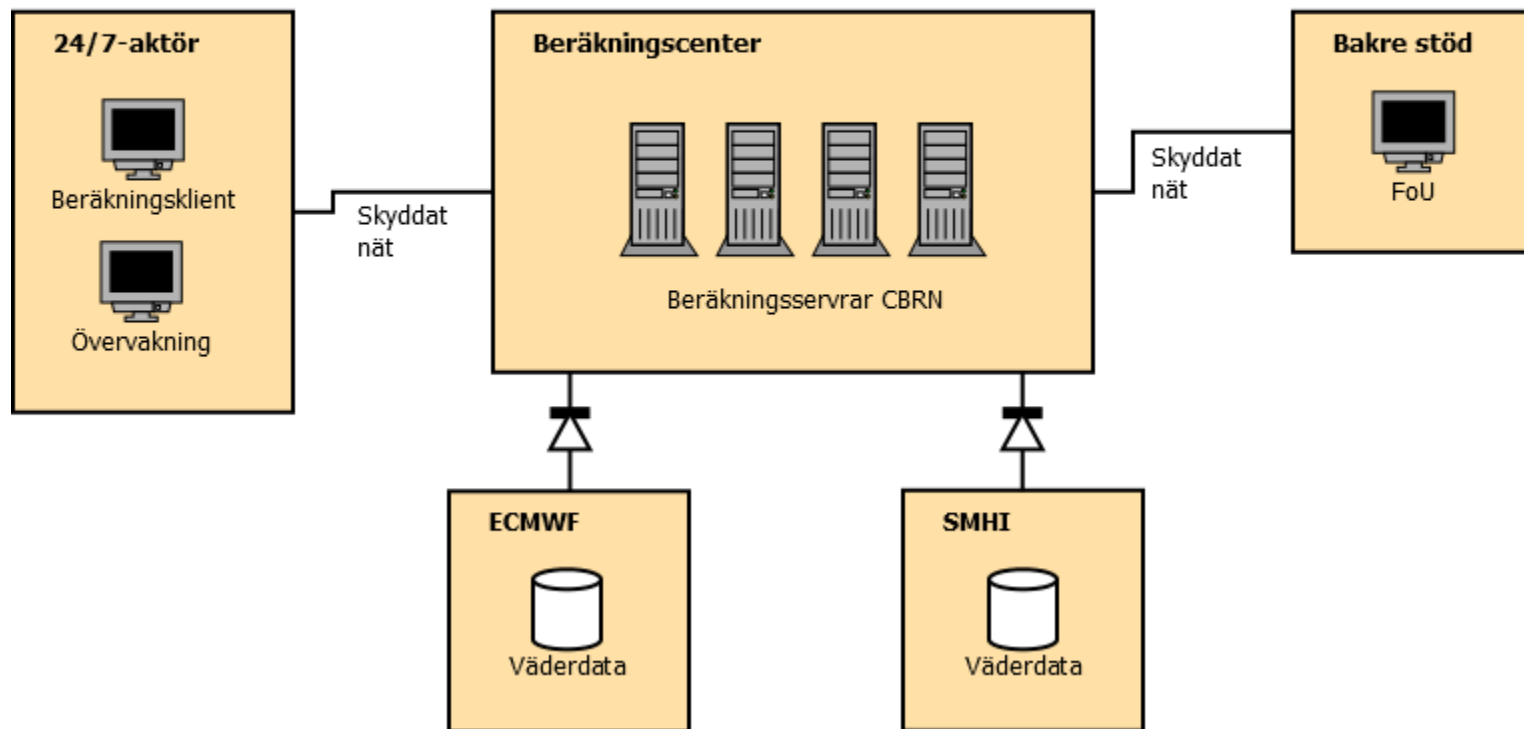


Demo

- FOI
 - EU-sense, EU-radion, Chimera → byggstenar i klient – server arkitektur
 - Internt behov av webb-baserat demoverktyg
- Andra institut
 - <https://www.ready.noaa.gov/HYSPLIT.php>



Förslag – systemskiss



Viktiga komponenter i en operativ kedja

Avancerat operativt stöd

- Iterativt arbetssätt
 - Kunskap
 - Utveckling
 - Övning
- Infrastruktur
- Diskussion

Vidare läsning

- HARMO22-115: Retrospect Atmospheric Dispersion Simulations of the Nord Stream Methane Leaks 2022 (unpublished)
- Lagrangian plume rise and dispersion modelling of the large-scale lithium-ion battery fire in Morris, USA, 2021
- The 2016 Al-Mishraq sulphur plant fire: Source and health risk area estimation
- ...