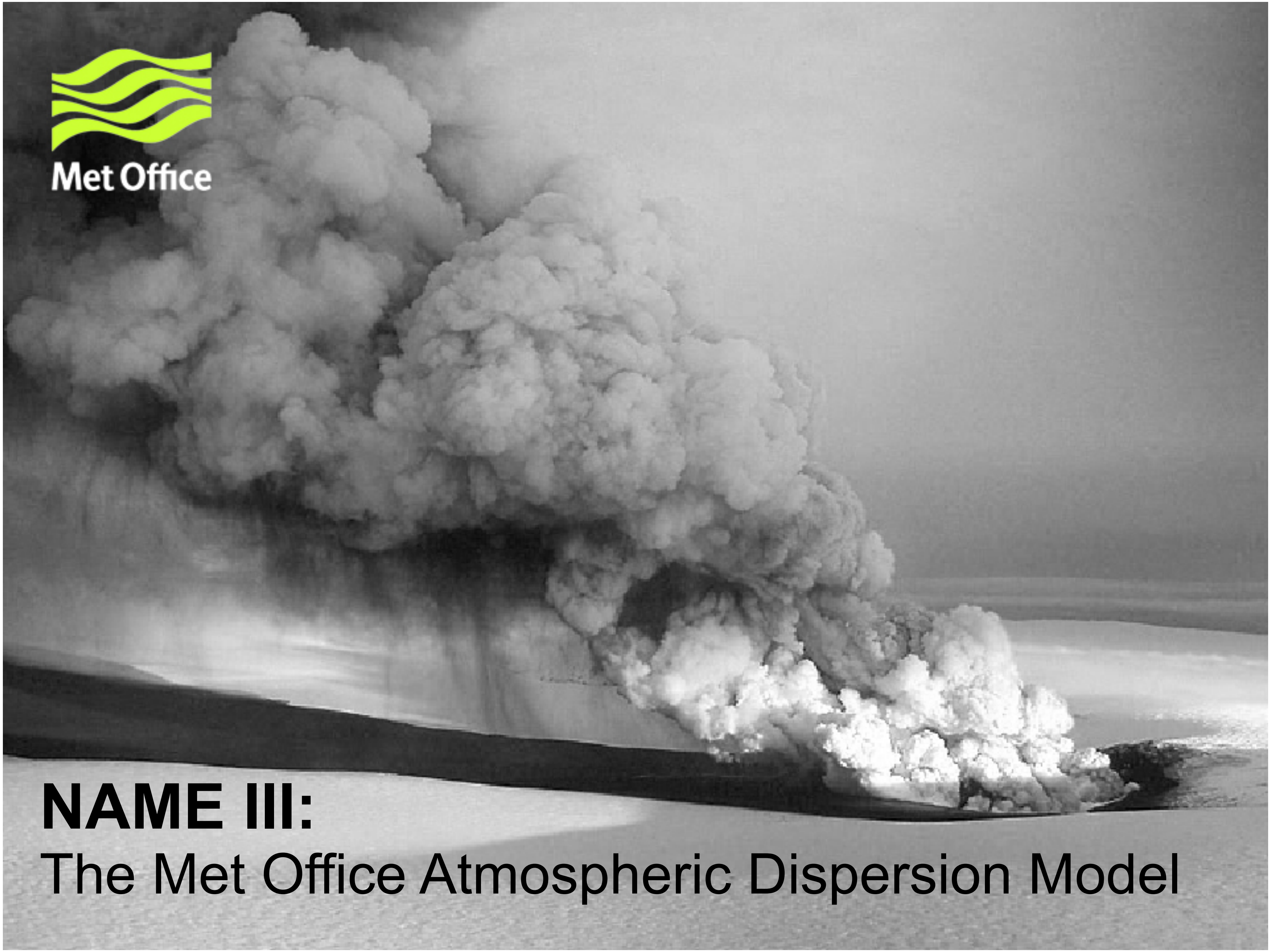


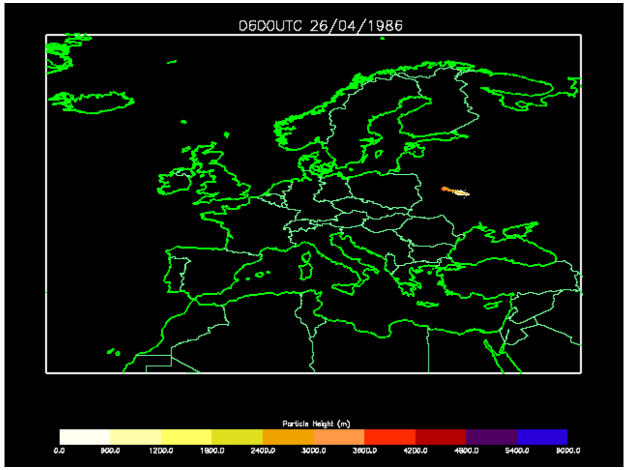
NAME III:

The Met Office Atmospheric Dispersion Model

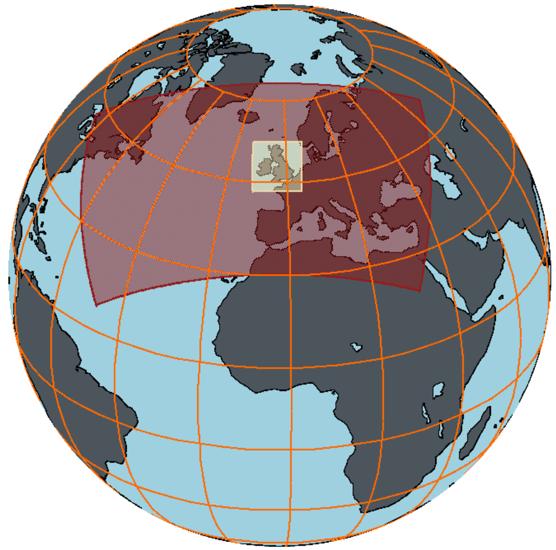
NAME

Numerical Atmospheric Dispersion Modelling Environment

- NAME – Lagrangian dispersion model
  - Development started following the Chernobyl accident to give emergency response dispersion predictions
  - NAME is under constant development. Used by 12 universities/organizations
- NAME III was redesigned from ground up to provide increased flexibility, including:
  - Ability to add sub-models (e.g. building effects, small scale terrain, fluctuation predictions)
  - Flexible choice of coordinates (e.g. lat-long, national grid, stereographic projections, height above ground/sea, pressure, flight levels, hybrid eta coordinates)
  - Output flexible; group by source, species, all; 1d, 2d, 3d and trajectories; lagrangian data
  - Output in mass (metric & imperial), volumetric (ppb), dobson units, various radiation units and conversions where appropriate.
- Code
  - Fortran 90/95 standard
  - Modular coding structure to enable new modules to be added with 'ease'
  - openmp parallelisation



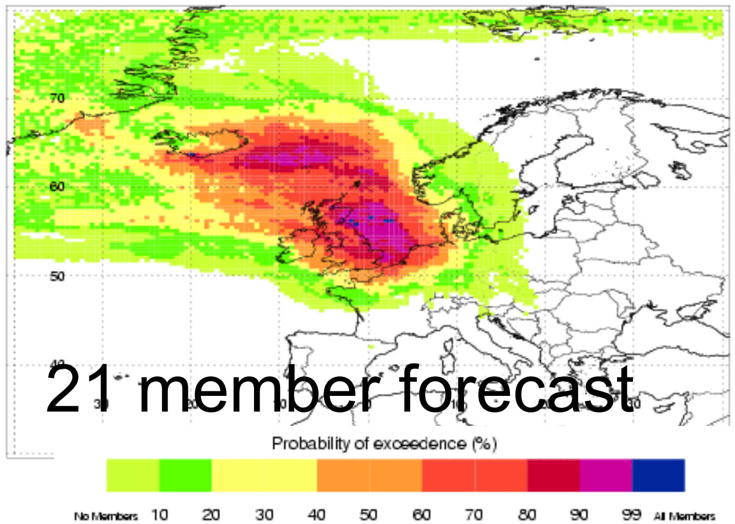
Meteorological Data



- Dispersion critically dependant on skill of NWP
- Pick best data for the job
    - High resolution limited area not always the best
- Ensemble predictions present significant challenges

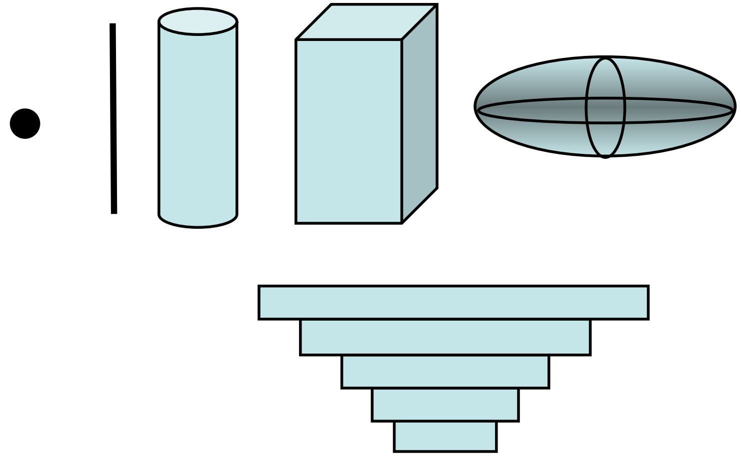
NAME Met Data:

- Numerical Weather Prediction (NWP) data
    - Deterministic and ensemble
    - Model level data used – better for near surface
    - 31 physical parameters e.g., velocity, temperature, pressure, cloud amount and height, precipitation, etc
- Radar rainfall data
- Local met observations
- Embedded flow models e.g. for buildings, hills, near source fluctuations
- All ‘met/flow’ data sets can be nested spatially and temporally

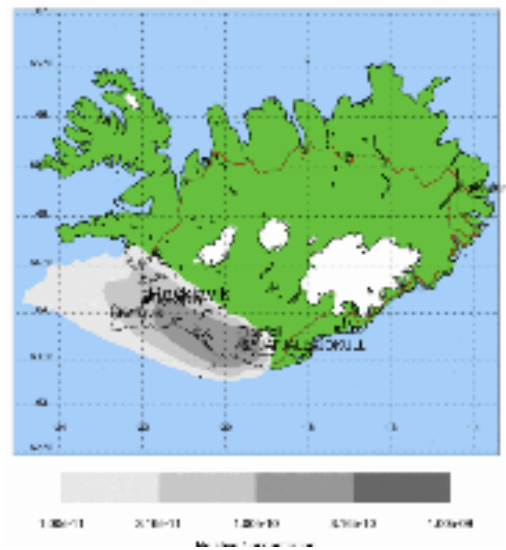


Emissions

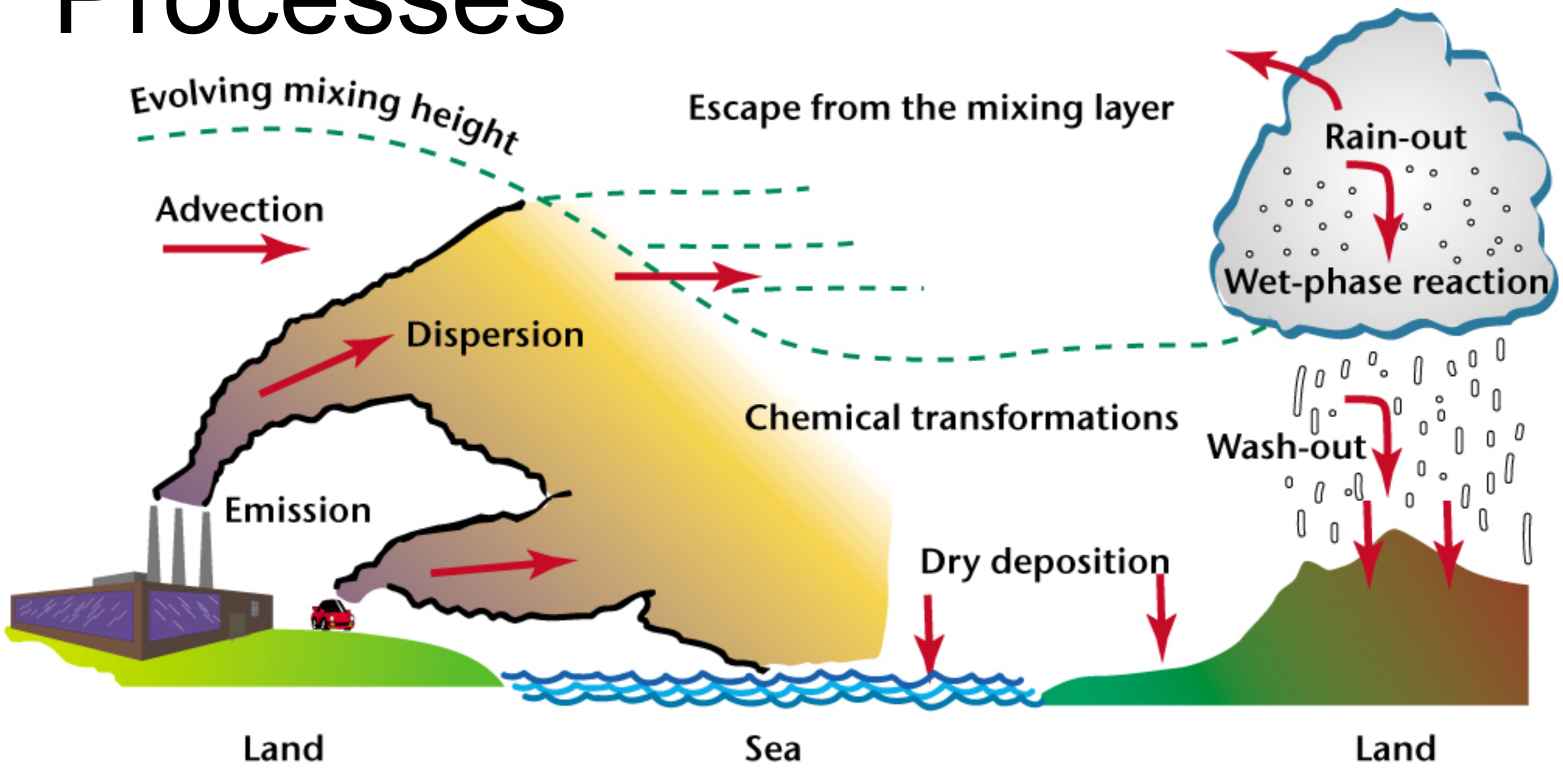
- Sources
  - Any number of independent sources
  - Shape: point, line, 2d plane, volume, composite
  - Instantaneous, time bound or time varying
  - Uniform, Gaussian mass distribution
  - User defined particle size distribution
  - Plume rise - integral approach, ambient entrainment/ interaction
  - Sources controlled/affected by environmental/ meteorological conditions e.g. wind blown ash



- Contaminant
  - Any number of different pollutants
  - Gases and Particulate
  - Stable or reactive – chemical and radiological
  - Individual wet and dry deposition characteristics



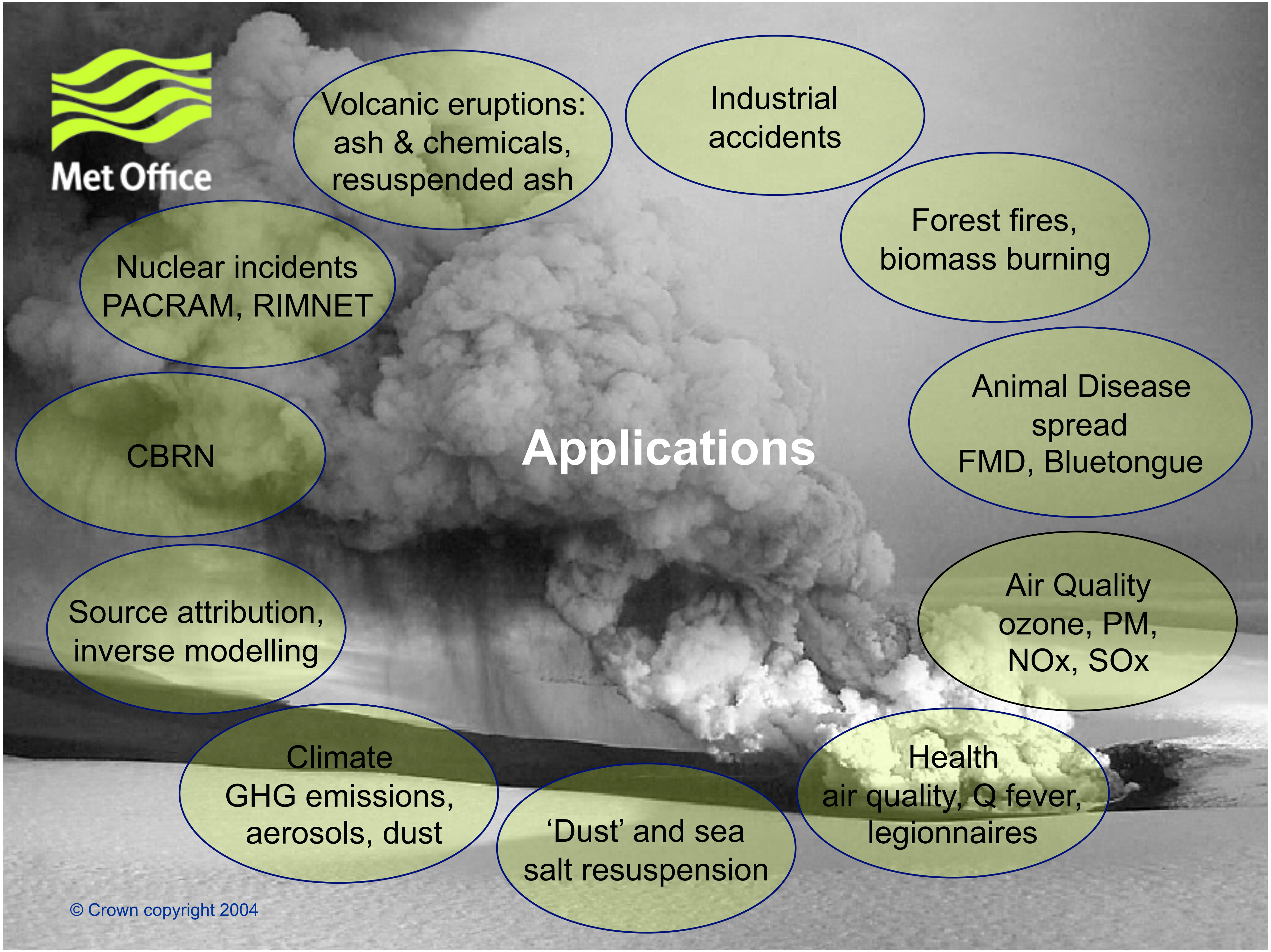
Processes



Turbulence:

- 2 Boundary layer parameterisations
  - Homogeneous turbulence - constant with height
  - Inhomogeneous turbulence - vary with height
- Free troposphere parameterisation - constant turbulence
- Near source mixing damped in homogenous scheme to give more accurate plume growth

- Wet (in & below cloud; snow & rain) and dry deposition
- Sedimentation
- Radioactive decay, decay products, cloud gamma
- Environmental effects on biological and other substance
- Chemical transformations
  - 100 reactions - gas and aqueous phase

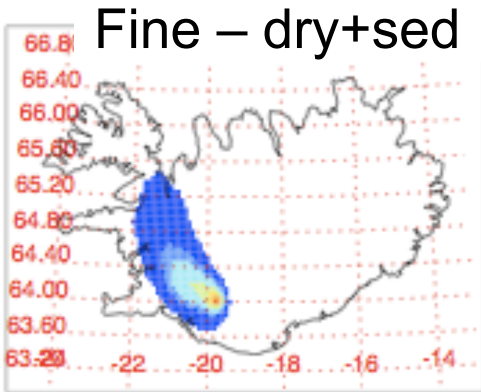

Met Office
Applications
Volcanic eruptions: ash & chemicals, resuspended ash
Industrial accidents
Forest fires, biomass burning
Nuclear incidents PACRAM, RIMNET
Animal Disease spread FMD, Bluetongue
CBRN
Air Quality ozone, PM, NOx, SOx
Source attribution, inverse modelling
Climate GHG emissions, aerosols, dust
'Dust' and sea salt resuspension
Health air quality, Q fever, legionnaires

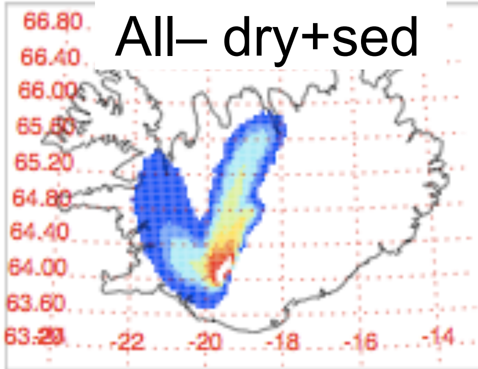
Met Office

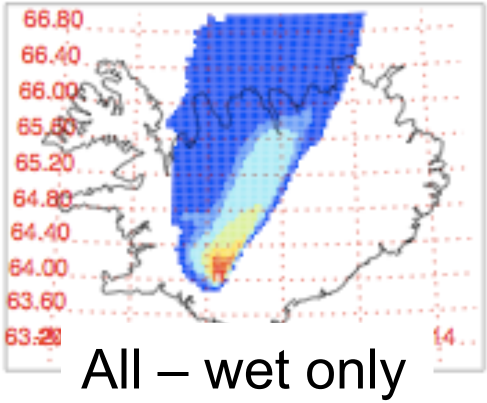
Benchmark - Hekla

Observations: Met

- NAME
  - Extracted data from ECMWF @ ‘native’ spatial resolution
  - Temporal resolution 6 hourly
  - More parameters
- Scenario vertical & horizontal resolution very different from ‘native’ (scenario vs. native)
  - 0.25 vs. 1.125 deg in horizontal
  - Approx 1/3 of native in vertical (near surface 75 vs 3 hPa)
    - Impact on vertical shear – important as seen in deposition plots
  - What impact on comparisons?
- Wet deposition:
  - Definition of cloud vertical extent
  - Scavenging coefficients







Observations: model setup

- Particle size distribution
  - Used discrete sizes – continuous varying would impact
  - Impact of particle sizes very significant
- Release height – model ground level or real ground level?
- Output
  - Averaging: in time and space can have a significant impact on appearance of results
  - Lagrangian models must average
  - Flight levels – real or feet?