

## Breakout: modelling group

List the 5 biggest advances and since 2010 and 5 challenges (provide recommendations keeping in mind operations)

Main topic	Advances since 2010	Challenges
1. Plume (source term) characterization	<ul style="list-style-type: none"> <li>• <b>Inverse modelling for source term (fine ash only)</b></li> <li>• <b>Use of pre-defined ESPs</b></li> <li>• <b>TOTAL</b> Mass eruption Rate (MER) characterization from plume height and wind</li> </ul>	<ul style="list-style-type: none"> <li>• Quantify entrainment coefficients for 1D BPT models</li> <li>• Gravity current modelling (umbrella cloud)</li> </ul>
2. Model physics, performance and accuracy	<ul style="list-style-type: none"> <li>• <b>Inter-comparison exercises of plume and dispersal models</b></li> <li>• Increased use of multiple models (small ensembles) to characterize forecast uncertainty</li> <li>• Modelling volcanic SO<sub>2</sub></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Data assimilation/inverse modelling for plume (ESPs) and virtual sources (far-range)</b></li> <li>• More validation and model sensitivity studies</li> <li>• <b>Near-source processes including ash aggregation and turbulence in the plume</b></li> <li>• <b>Development of and access to well-characterized datasets for model validation</b></li> </ul>
3. Operations	<ul style="list-style-type: none"> <li>• <b>Quantitative operational outputs and model validation</b></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Bring probabilistic forecasts into operations and communication of probabilistic products</b></li> <li>• Determination of PDFs for ESPs.</li> <li>• <b>Bring scientific advances into operations (VAACs)</b></li> </ul>
4. NWP and dispersal coupling	<ul style="list-style-type: none"> <li>• On-line modelling, e.g. explore coupling and feedback effects</li> </ul>	<ul style="list-style-type: none"> <li>• On-line coupling of plume/cloud with atmospheric processes</li> <li>• Utilizing NWP to its full resolution (i.e. increase dispersal model resolution)</li> </ul>
5. Ash resuspension	<ul style="list-style-type: none"> <li>• Experimental operational setups</li> </ul>	<ul style="list-style-type: none"> <li>• Develop ash resuspension emission schemes (currently we use dust schemes)</li> </ul>
6. Others	<ul style="list-style-type: none"> <li>• <b>Improved links across different communities</b></li> </ul>	<ul style="list-style-type: none"> <li>• Training for VAAC and VO staff</li> </ul>

**Recommendations (preliminary)**

- 1) Set up working groups across disciplines to develop better model validation datasets
- 2) Set up working group to deal with probabilistic modeling and communicating probabilistic model output