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How complete is our understanding of polar ozone depletion?

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An ozone hole is formed inside the polar vortices in late winter/early spring when chlorine – originating largely from anthropogenic CFCs now regulated by the Montreal Protocol and its subsequent amendments – is activated by heterogeneous reactions on cold aerosol surfaces, provided for example by polar stratospheric clouds (PSCs), and subsequently destroys ozone in essentially two catalytic cycles, the ClO dimer cycle and the ClO/BrO cycle. This basic understanding of the formation of an ozone hole has been developed over the past 25 years and today is generally accepted. However, full quantitative understanding of polar ozone depletion is still lacking, and some important questions are not yet fully answered, including:

- What is the exact rate of ClO dimer photolysis, the most critical kinetic parameter driving the above-mentioned catalytic ozone destruction cycles?
- What is the role of chlorine activation on cold liquid binary aerosol?
- By what exact mechanisms, on what material, and at what exact rates does NAT nucleate, and how does this impact the formation of very large NAT particles – the so-called NAT rocks – and denitrification?
- How fast is transport and mixing at the vortex edge, and how does this influence various methods of estimating vortex O3 loss?

The EU project RECONCILE aims to answer these and other important questions quantitatively. This presentation will give a concise overview of “Where we stand” in our efforts to complete our understanding of polar ozone depletion and implement it in large scale chemistry climate models (CCMs).