## **Diagrams of Ice Growth Environments Designed for Educational Use Daniel M. Hueholt<sup>1,2\*</sup>**, Sandra E. Yuter<sup>1</sup>, Matthew A. Miller<sup>1</sup>

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## Background

- Ice habit diagrams plot ice shapes on temperature and moisture axes
- A web search will return diagrams with substantive differences due to inconsistent terminology and errors in source materials
- We present simplified ice diagrams for education based on the state of the science from in situ data and laboratory measurements<sup>7-3</sup>

## Ice growth forms



Columnar



Branched



Tabular polycrystalline



Side branched



Columnar polycrystalline



The ice growth form is the main direction or growth pattern of a crystal, which arises directly from crystal surface processes.

## **Sequences of growth forms**

- A precipitation-sized crystal undergoes a sequence of growth forms as it falls through different ambient conditions
- The particle shape when observed is a time-integrated result of this sequence
- High-resolution imagers like the Karlsruhe Institute of Technology Particle Habit Imaging and Scattering Probe (PHIPS)<sup>4</sup> reveal sequential growth

Images from the Investigation of Microphysics and Precipitation for Atlantic Coast-Threatening Snowstorms (IMPACTS)<sup>5</sup> field campaign



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**Key points** function of decreasing temperature and RHwater builds intuition for education and research

• Diagram emphasizes six ice growth forms as a • Connecting nomenclature to physical processes

Tabular, branched, side branched

**References: 1.** Bailey & Hallett (2002) doi.org/10.1002/qj.200212858304 **2.** Bailey & Hallett (2004) doi.org/10.1175/1520-0469(2004)061<0514:GRAHOI>2.0.CO;2 **3.** Bailey & Hallett (2009) doi.org/10.1175/2009JAS2883.1 4. Abdelmonem et al. (2016) doi.org/10.5194/amt-9-3131-2016 5. McMurdie et al. (2022) doi.org/10.1175/BAMS-D-20-0246.1

Columnar to branched to side branched

![](_page_0_Picture_35.jpeg)

Columnar to tabular to branched

![](_page_0_Picture_37.jpeg)