

# **Assessing the importance of aerosol indirect effects on arctic boundary clouds using ISDAC data**

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# Outline

## ■ Three indirect effects proposed for mixed-phase arctic clouds

### 1. Glaciation indirect effect:

- ◆ IN increase → Ni increase

### 2. Riming indirect effect

- ◆ CCN increase → NI increase → DI decrease  
→ less riming growth → IWC decrease

### 3. Cold 2<sup>nd</sup> indirect effect

- ◆ CCN increase → NI increase → DI decrease  
→ less ice crystal formation → Ni decrease

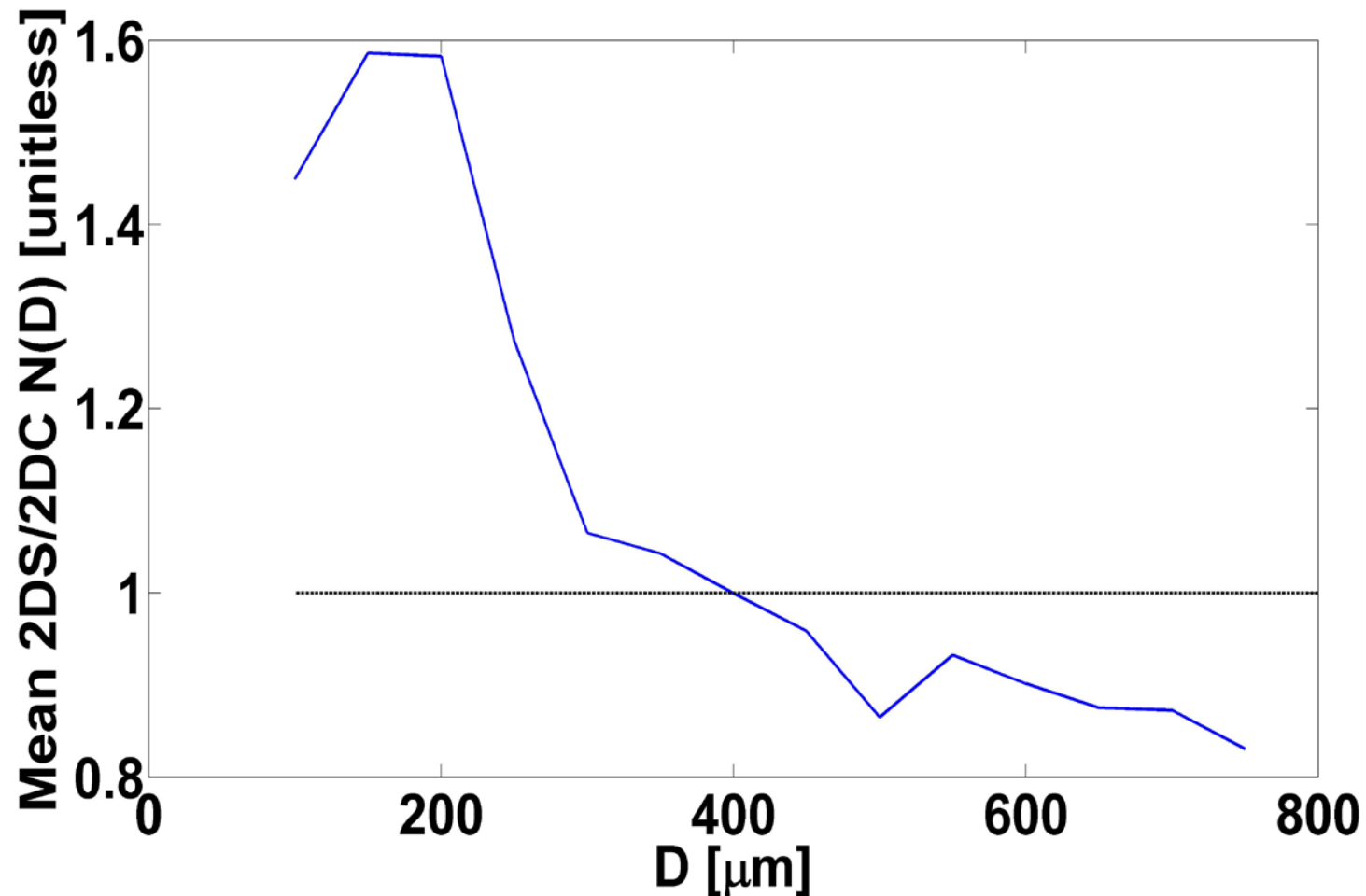
# Methodology

Data from 20 bulk & size-resolved probes combined to give value added product



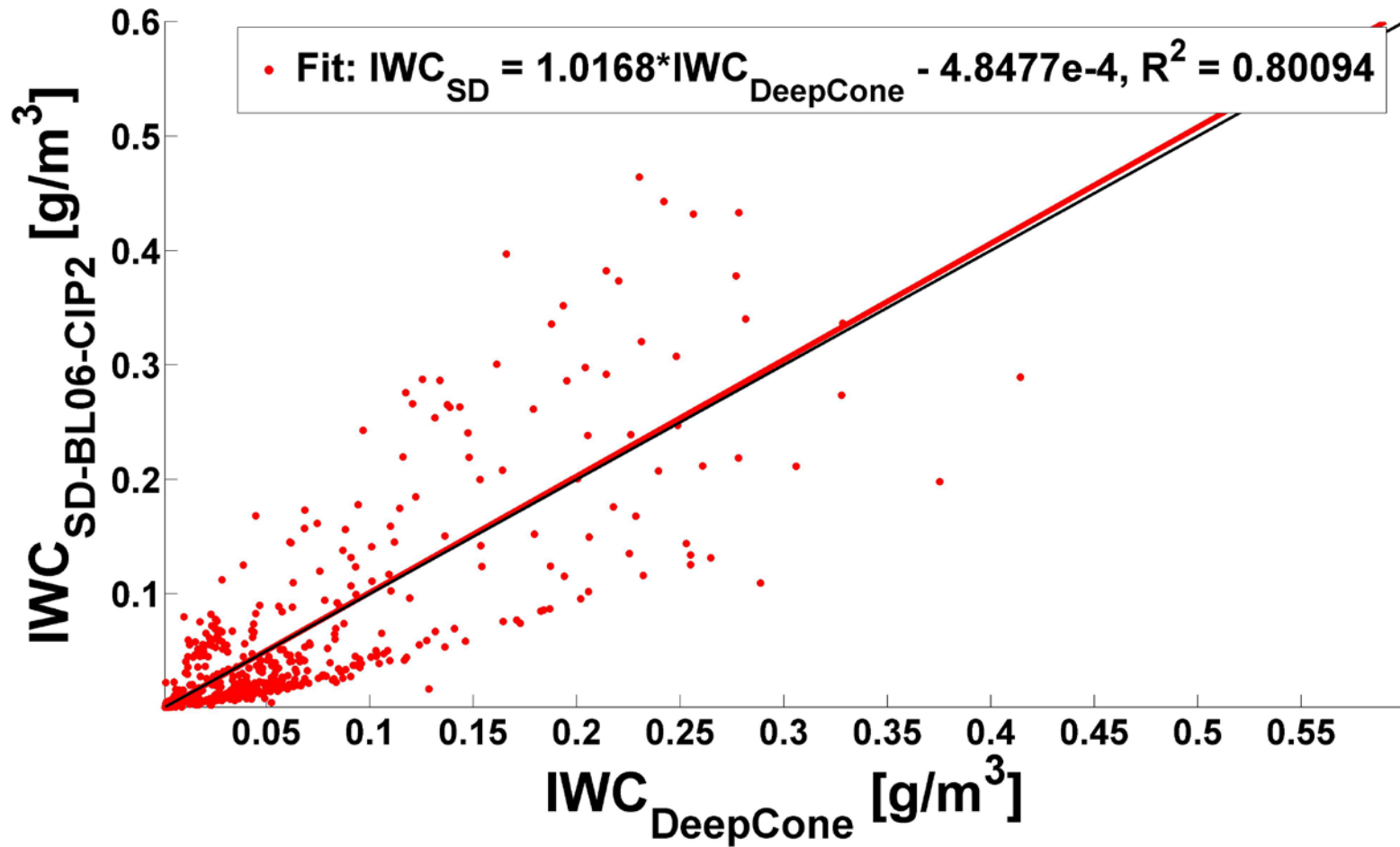
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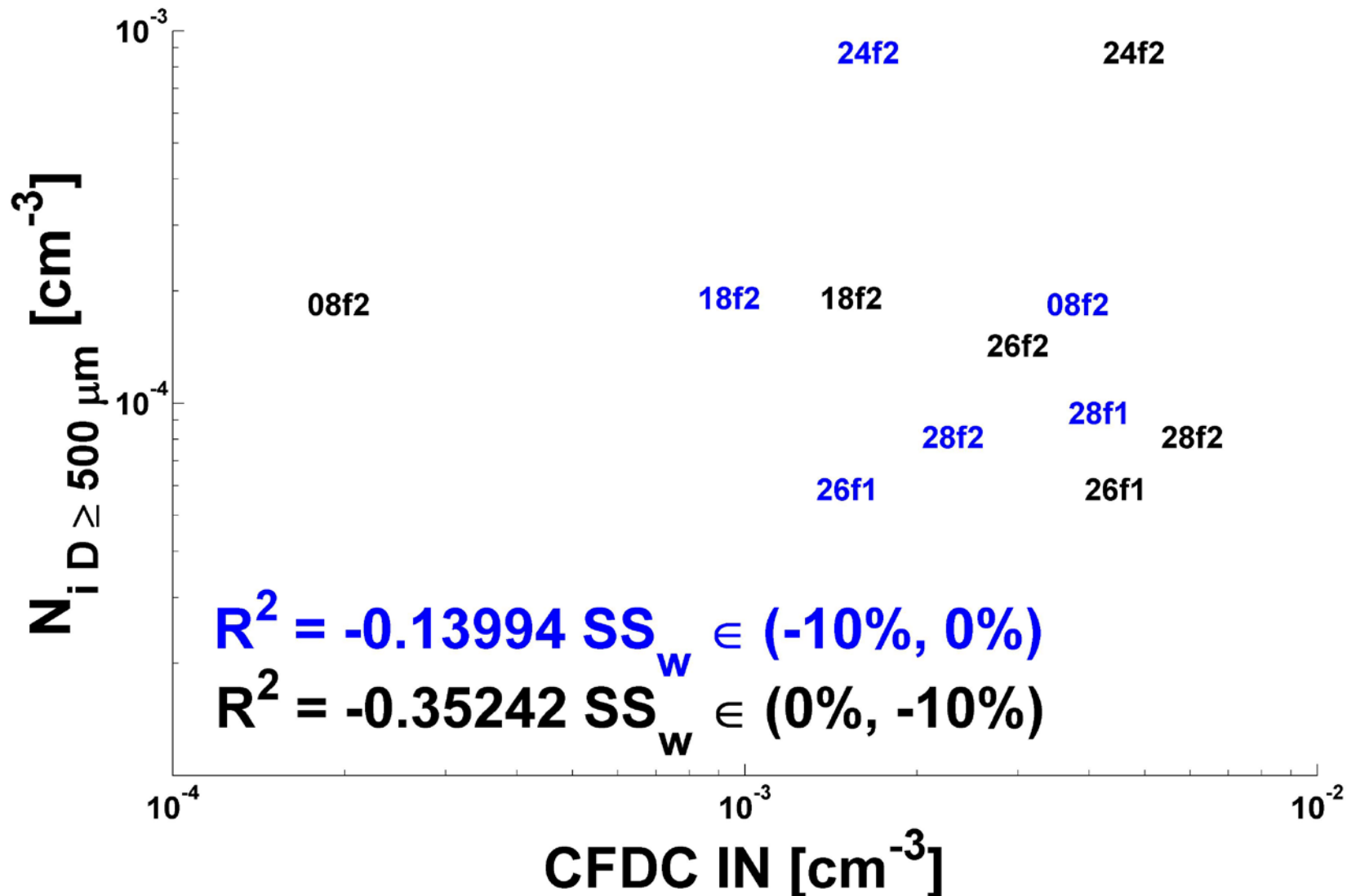


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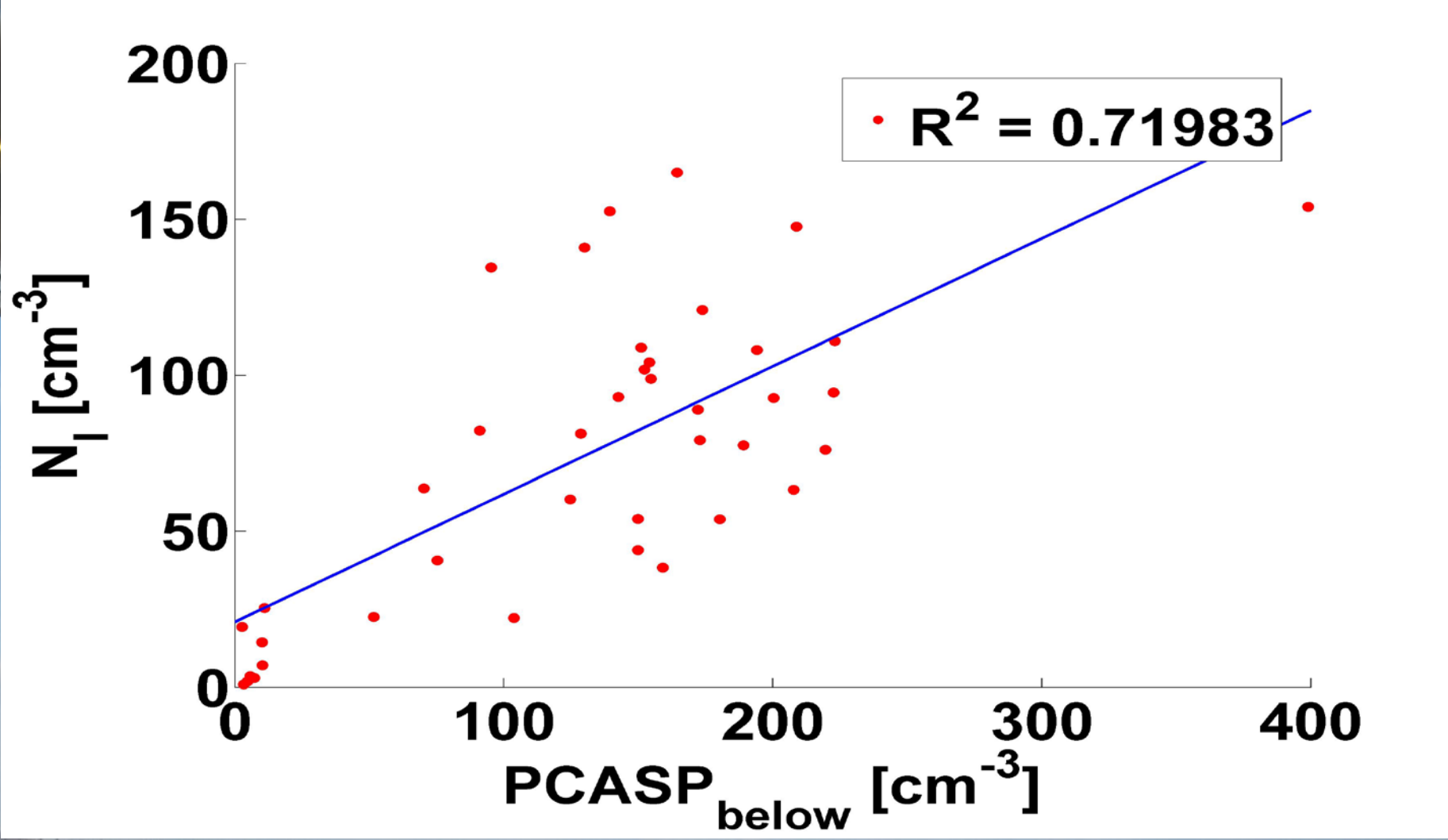


# Glaciation indirect effect?



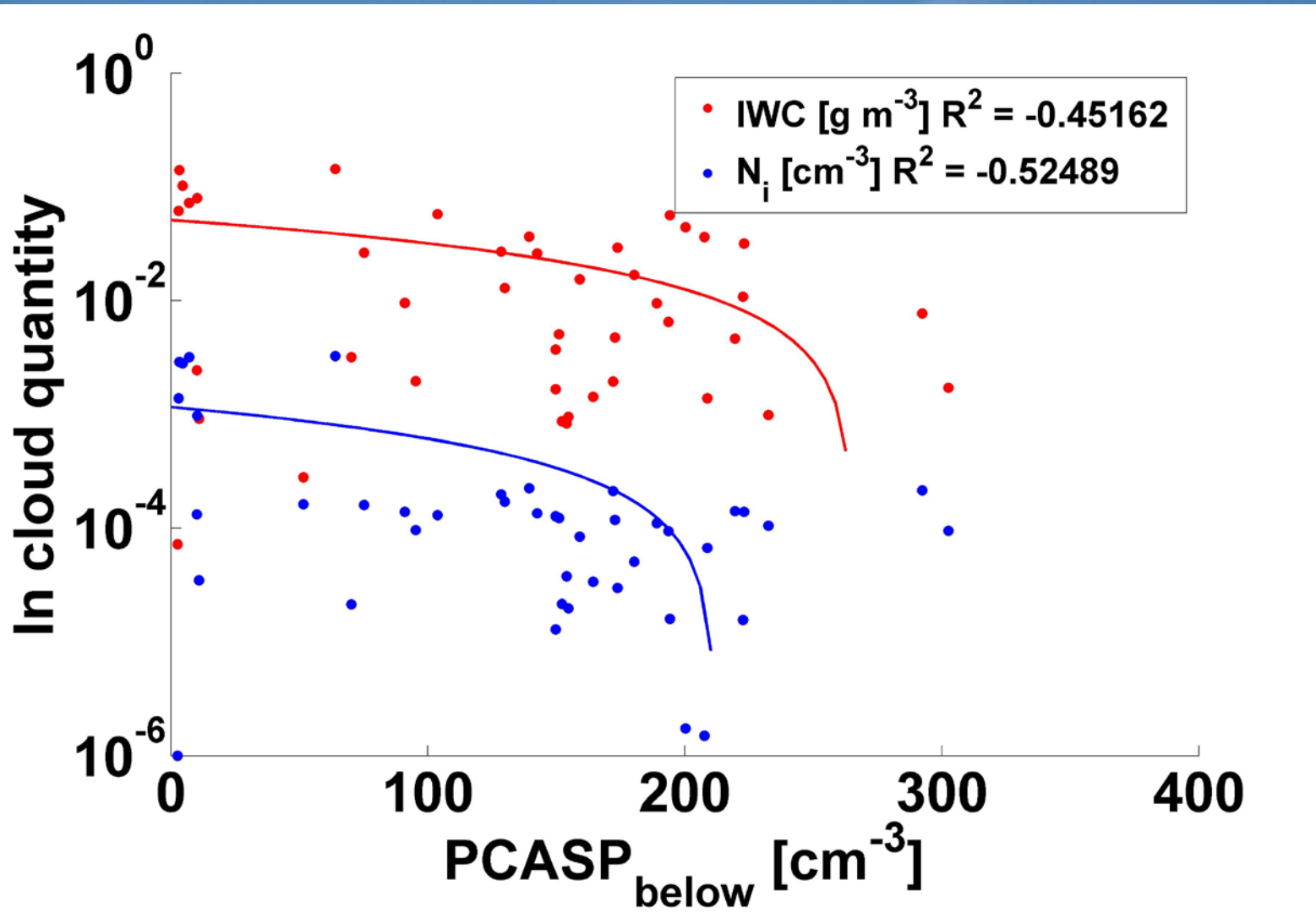
Data show little evidence of such an effect

# Liquid indirect effect



Liquid concentrations and drop sizes well correlated with PCASP concentration below cloud

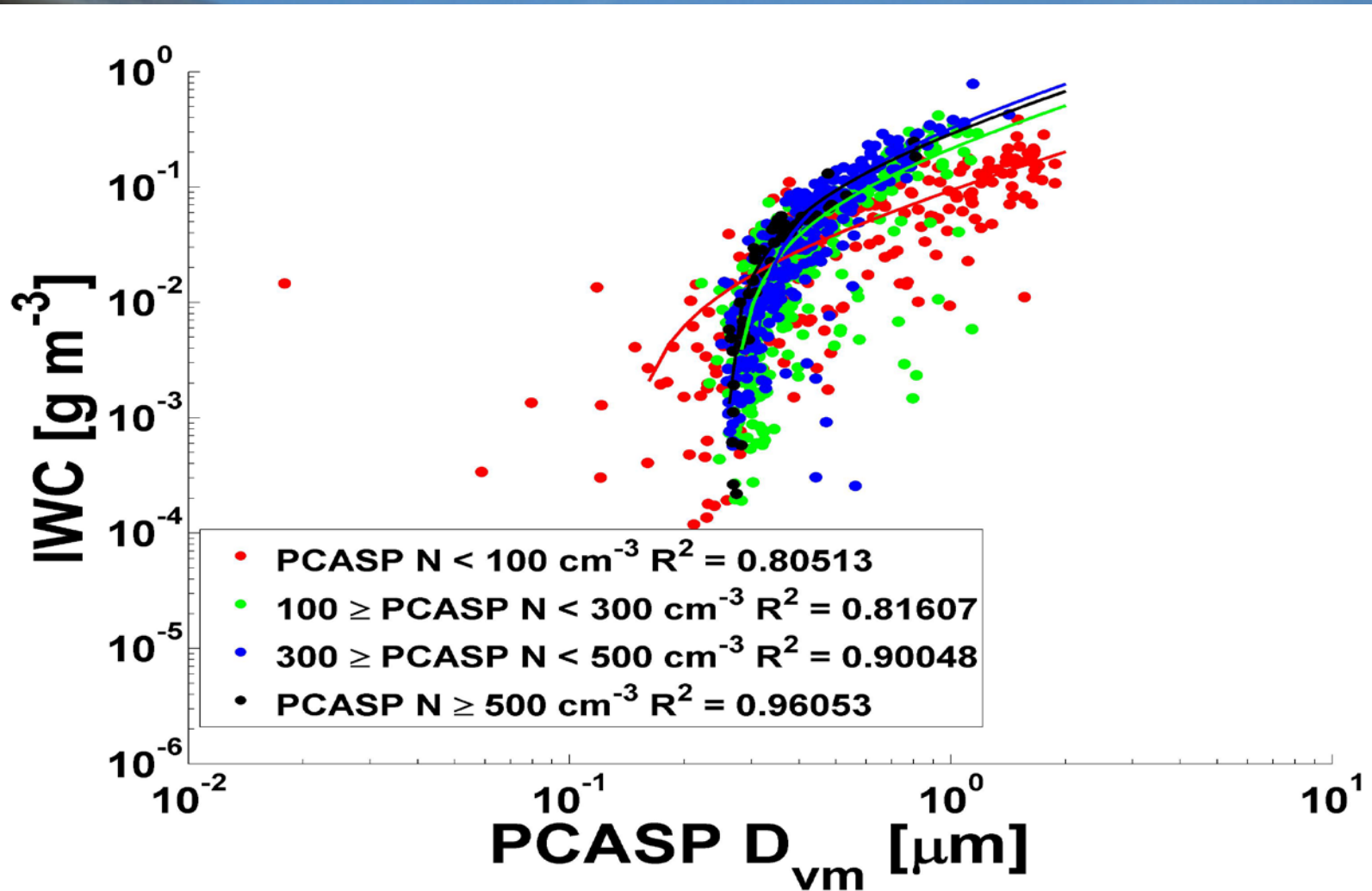
# Other indirect effects?



Some correlation of IWC/ $N_i$  with PCASP below cloud concentration

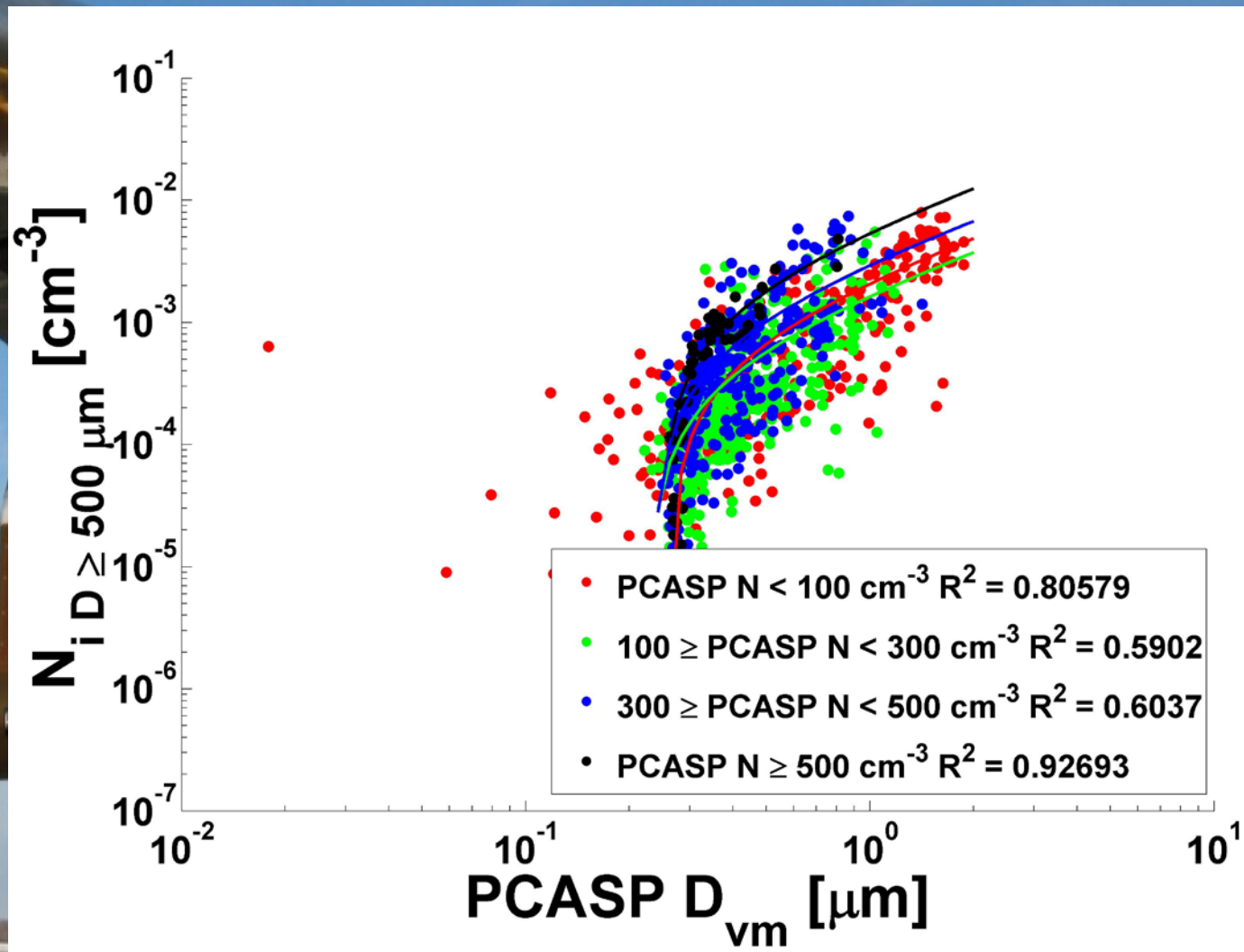


# Other indirect effects?



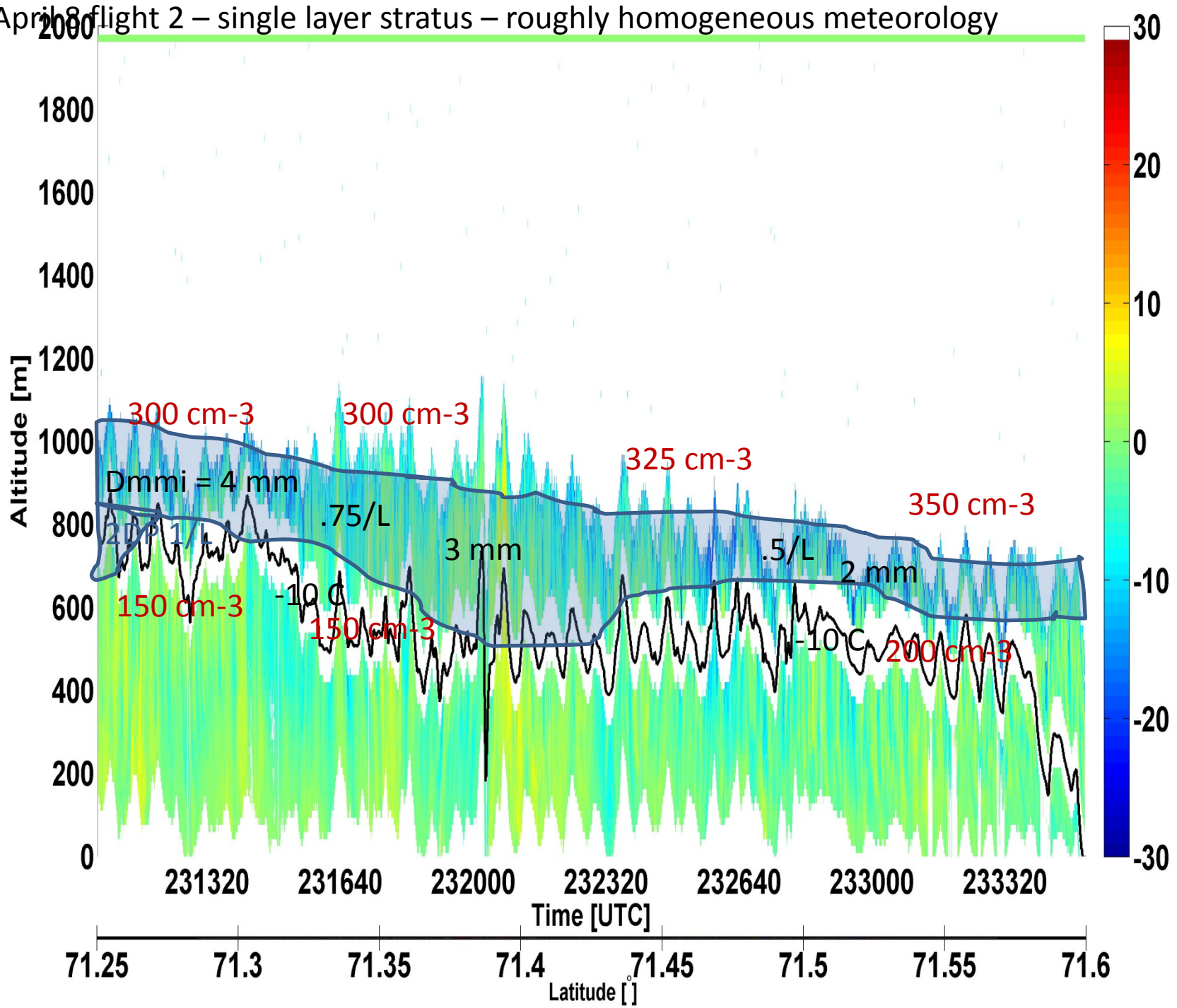
IWC has stronger correlation with PCASP  $D_{vm}$

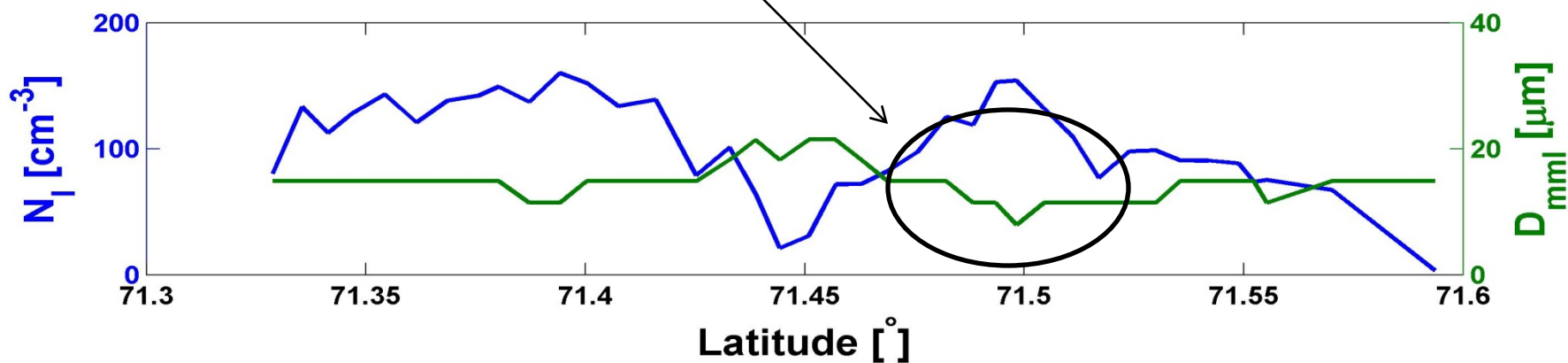
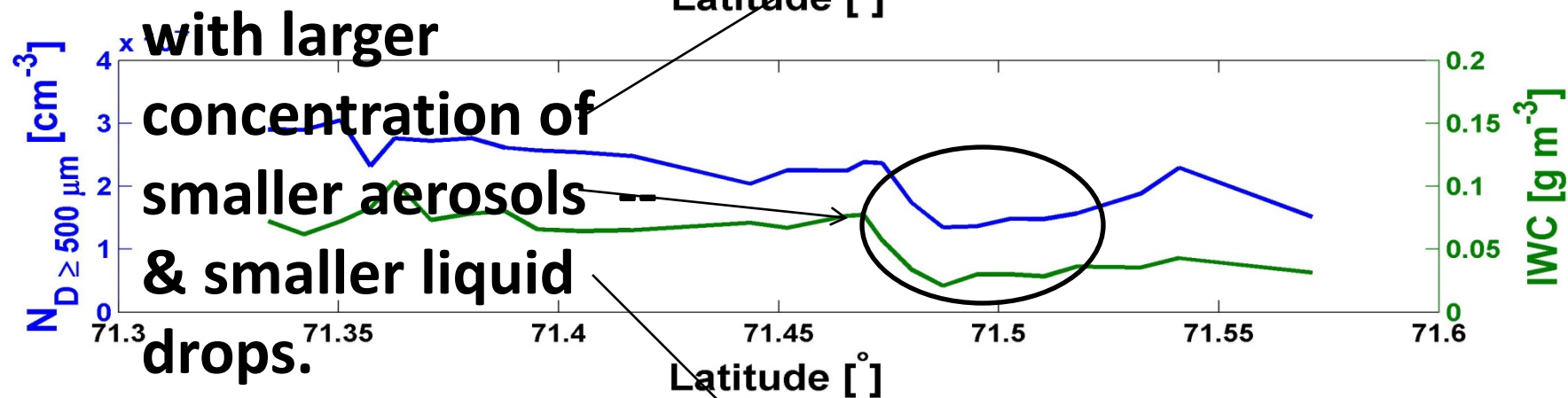
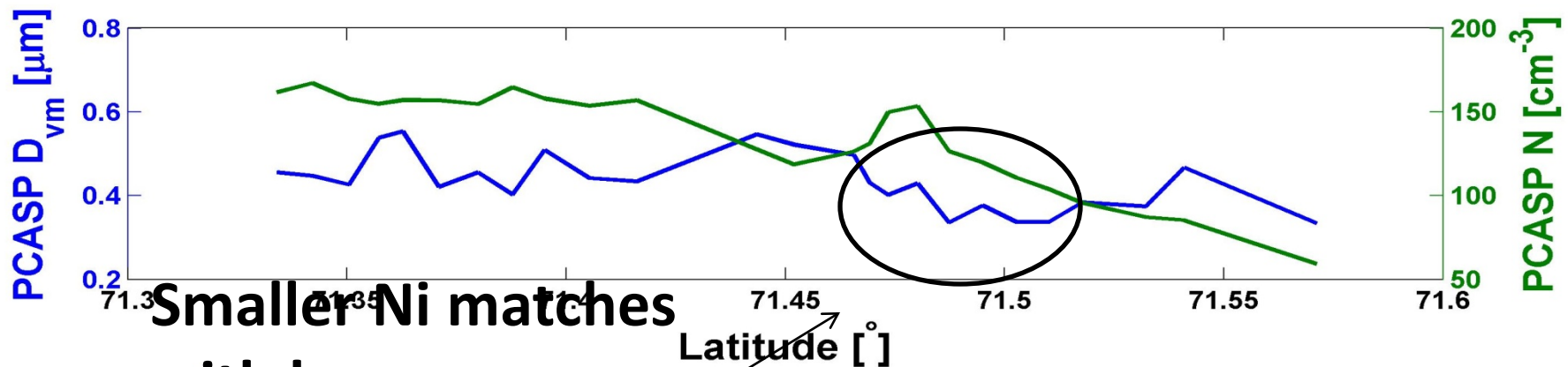
# Cold 2<sup>nd</sup> indirect effect

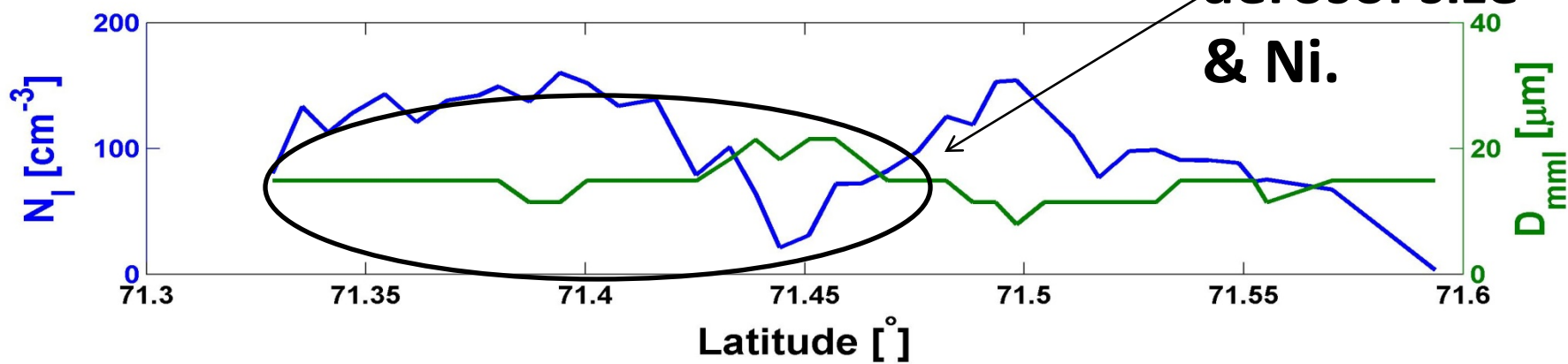
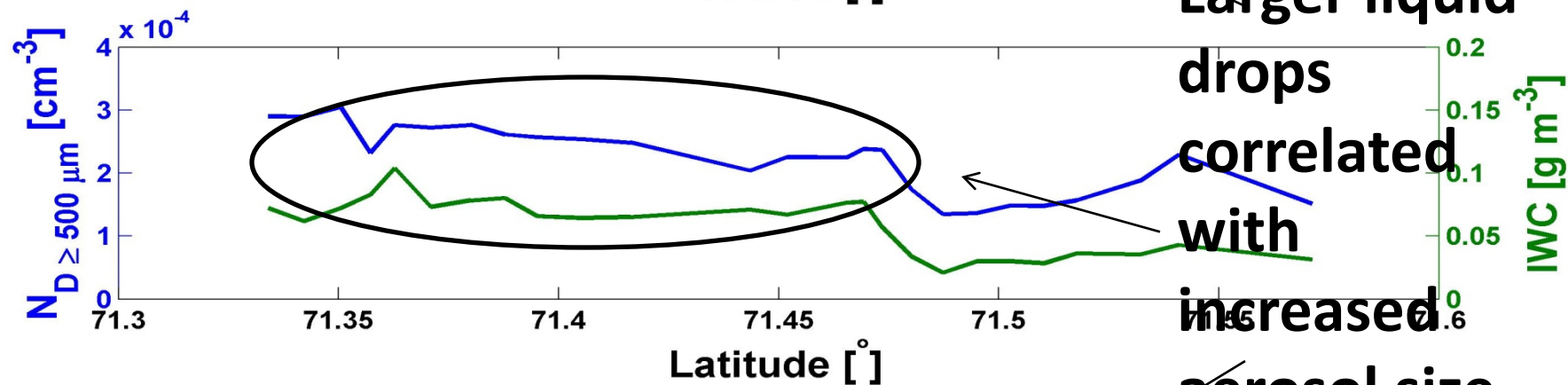
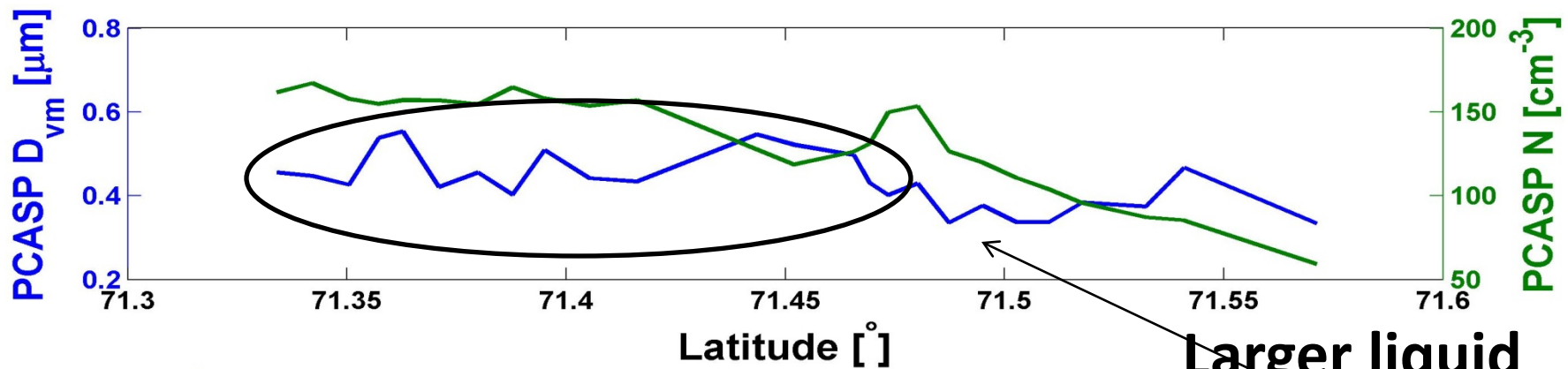


Ni also more strongly correlated with  $D_{vm}$

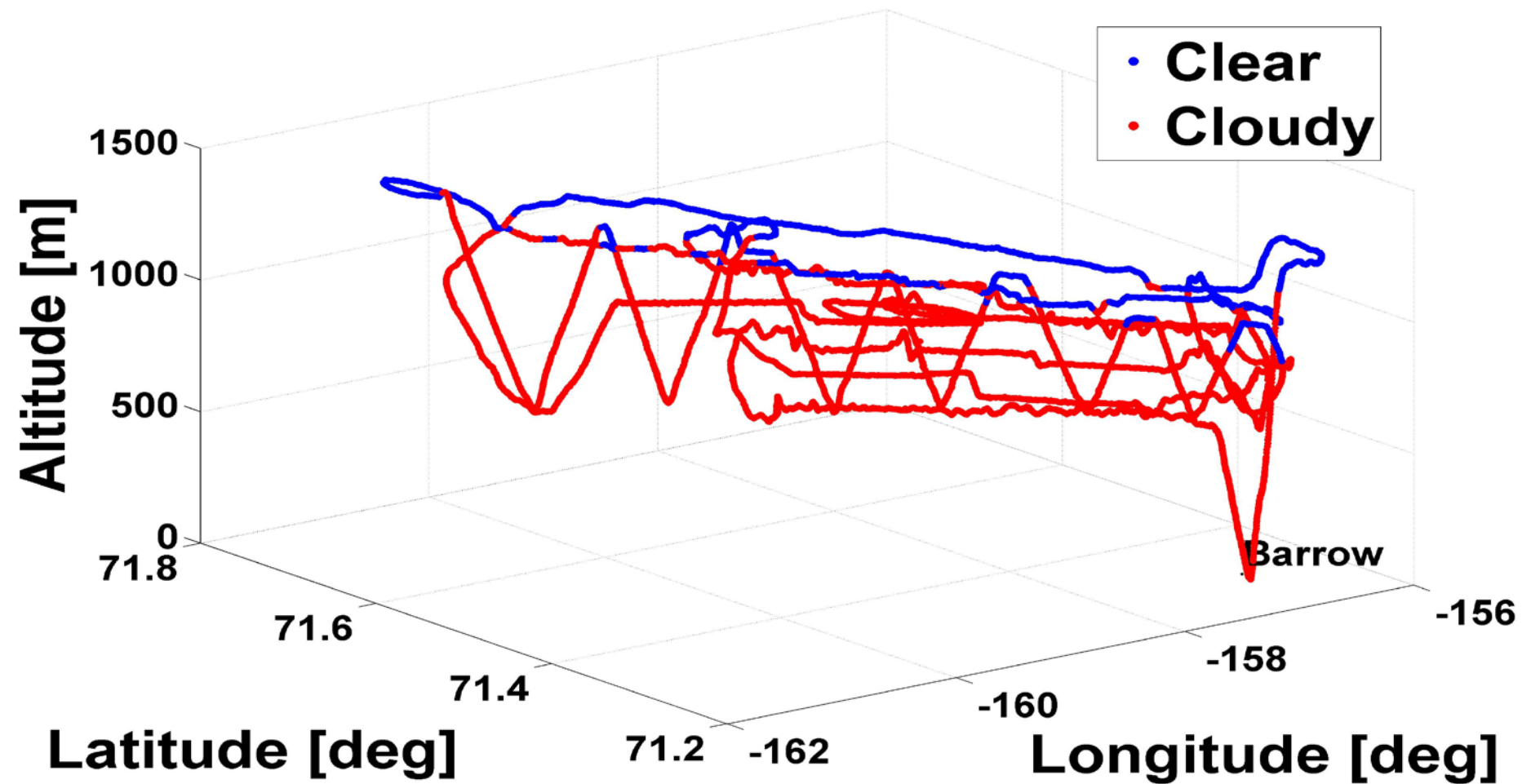
April 8 flight 2 – single layer stratus – roughly homogeneous meteorology







**Larger liquid drops correlated with increased aerosol size & Ni.**



Compare CFDC IN & PCASP aerosol data below liquid cloud with IWC/Ni in cloud and below cloud to assess importance of different effects