

Snowfall Microphysical Observations in the Antarctic Sea Ice Zone

Katherine Leonard^{1,2,3} Ted Maksym⁴ Michael Lehning^{1,3}

Ernesto Trujillo¹ Yvonne Weber¹ Nander Wever^{1,3} Seth White²

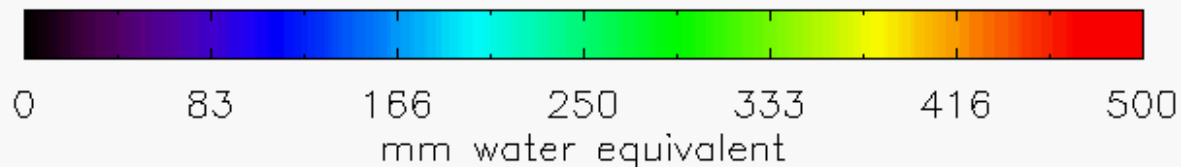
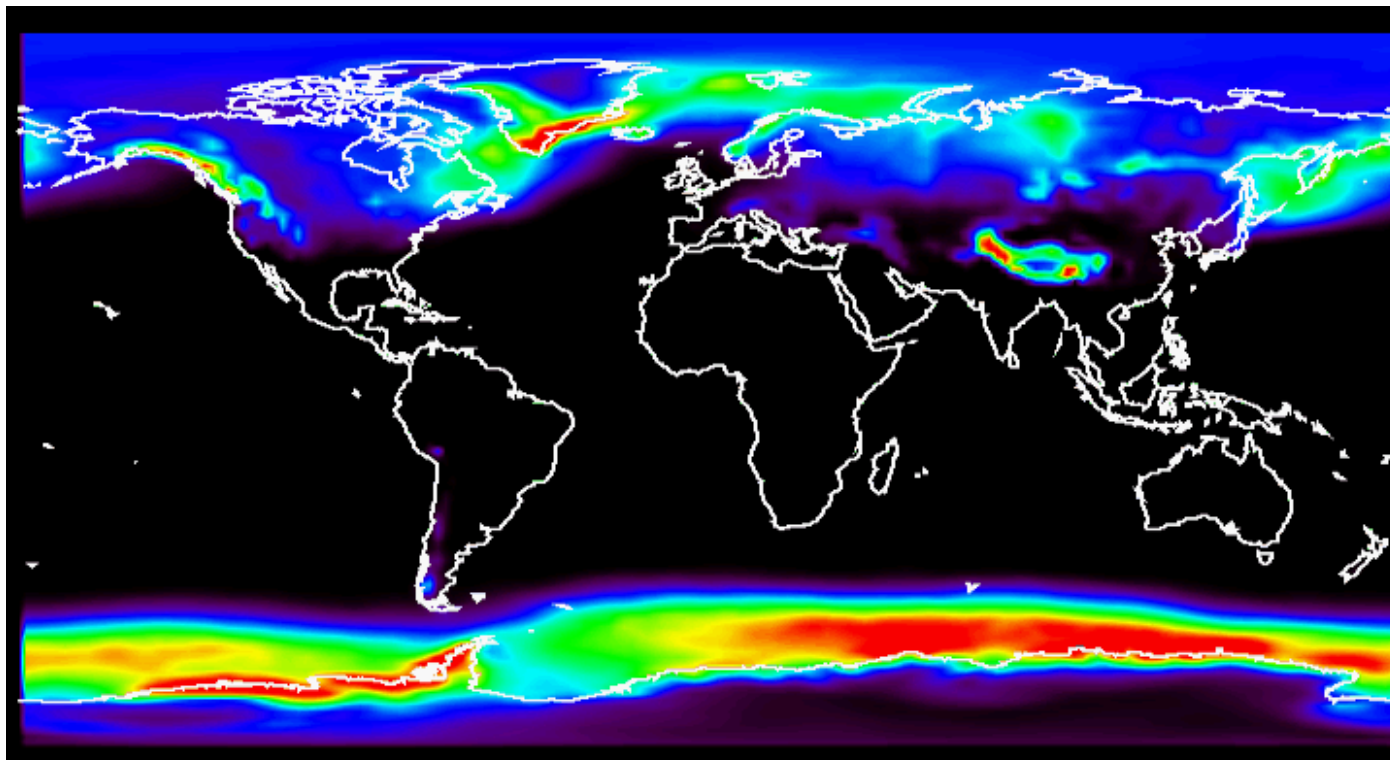
(1) Ecole Polytechnique Federale de Lausanne EPFL, Lausanne Switzerland

(2) Cooperative Institute for Research in Environmental Sciences, University of Colorado Boulder, USA

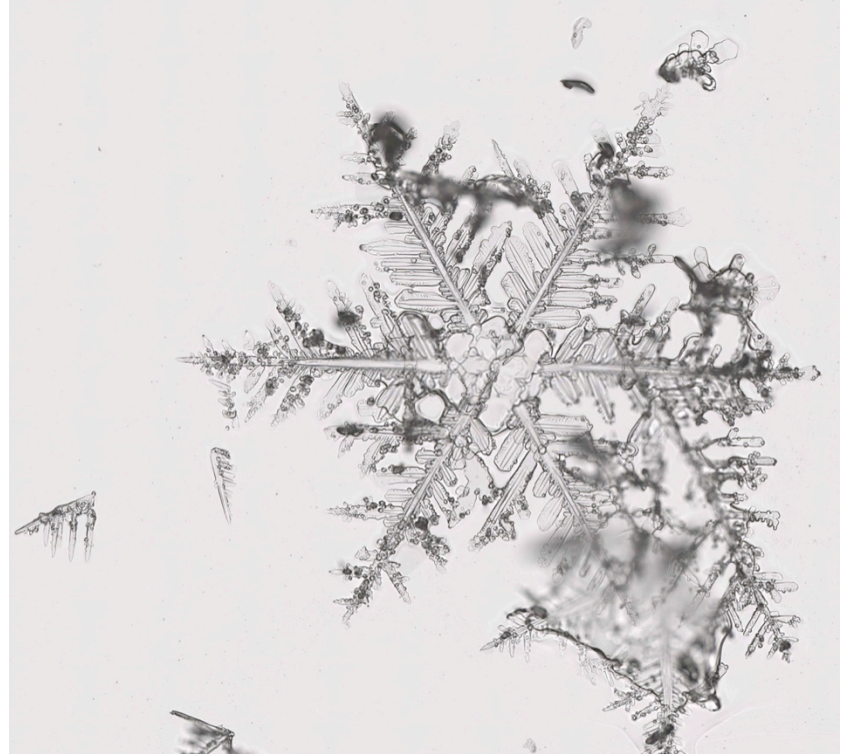
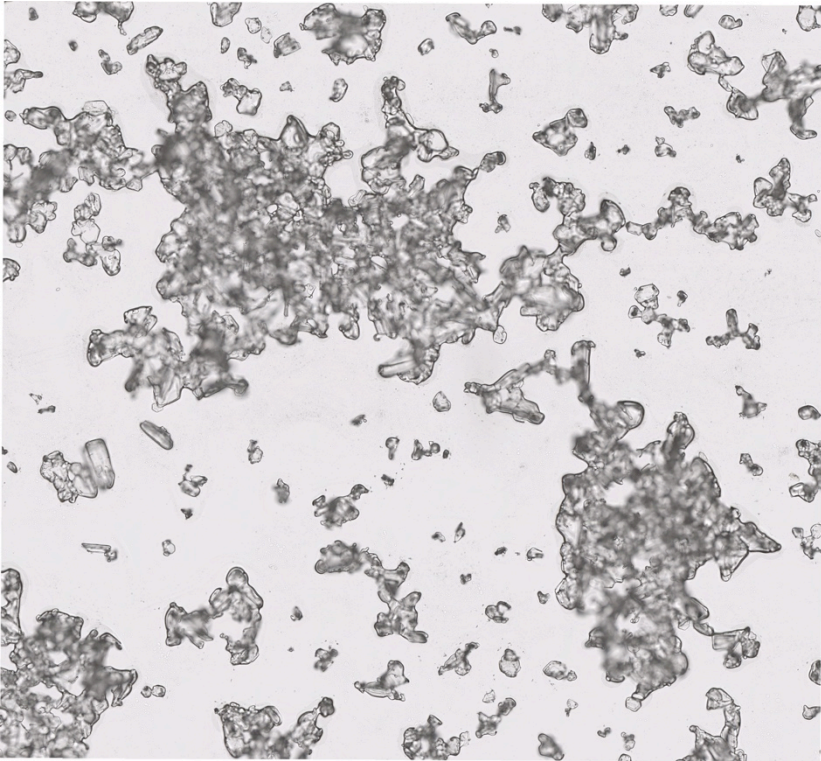
(3) WSL Institute for Snow and Avalanche Research SLF, Davos Switzerland

(4) Woods Hole Oceanographic Institute, Massachusetts, USA

Average Annual Precipitation (ERA-40)

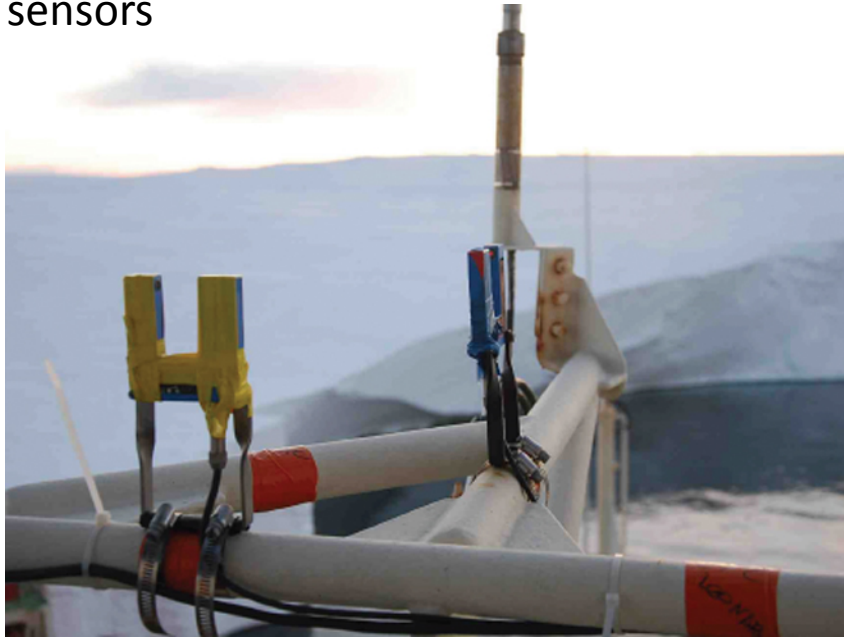


What does Antarctic precipitation look like?



Precipitation measurements

continuous monitoring of precipitation frequency and particle size using photoelectric sensors



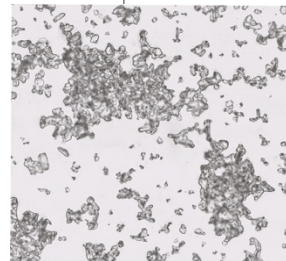
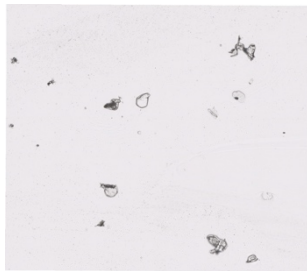
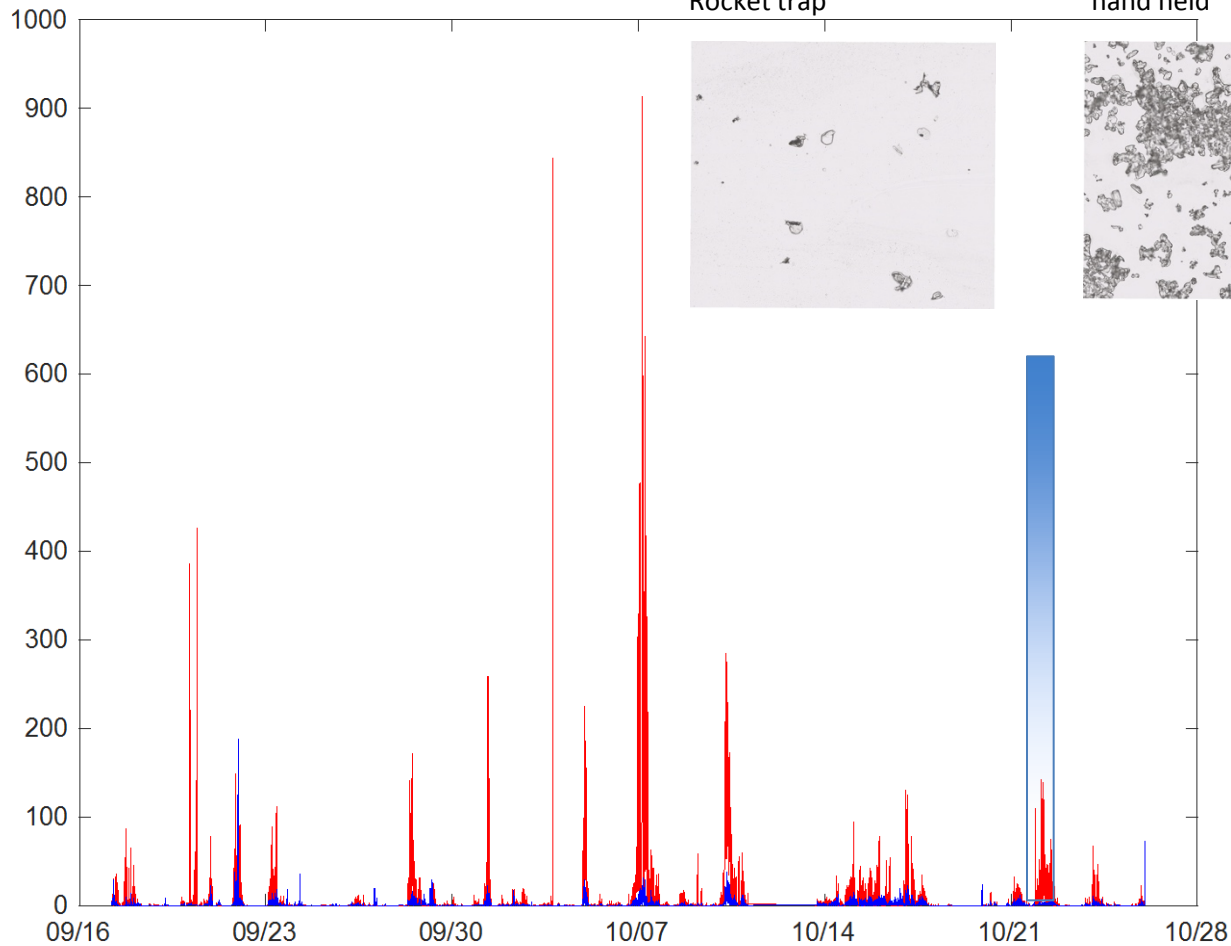
Wenglor



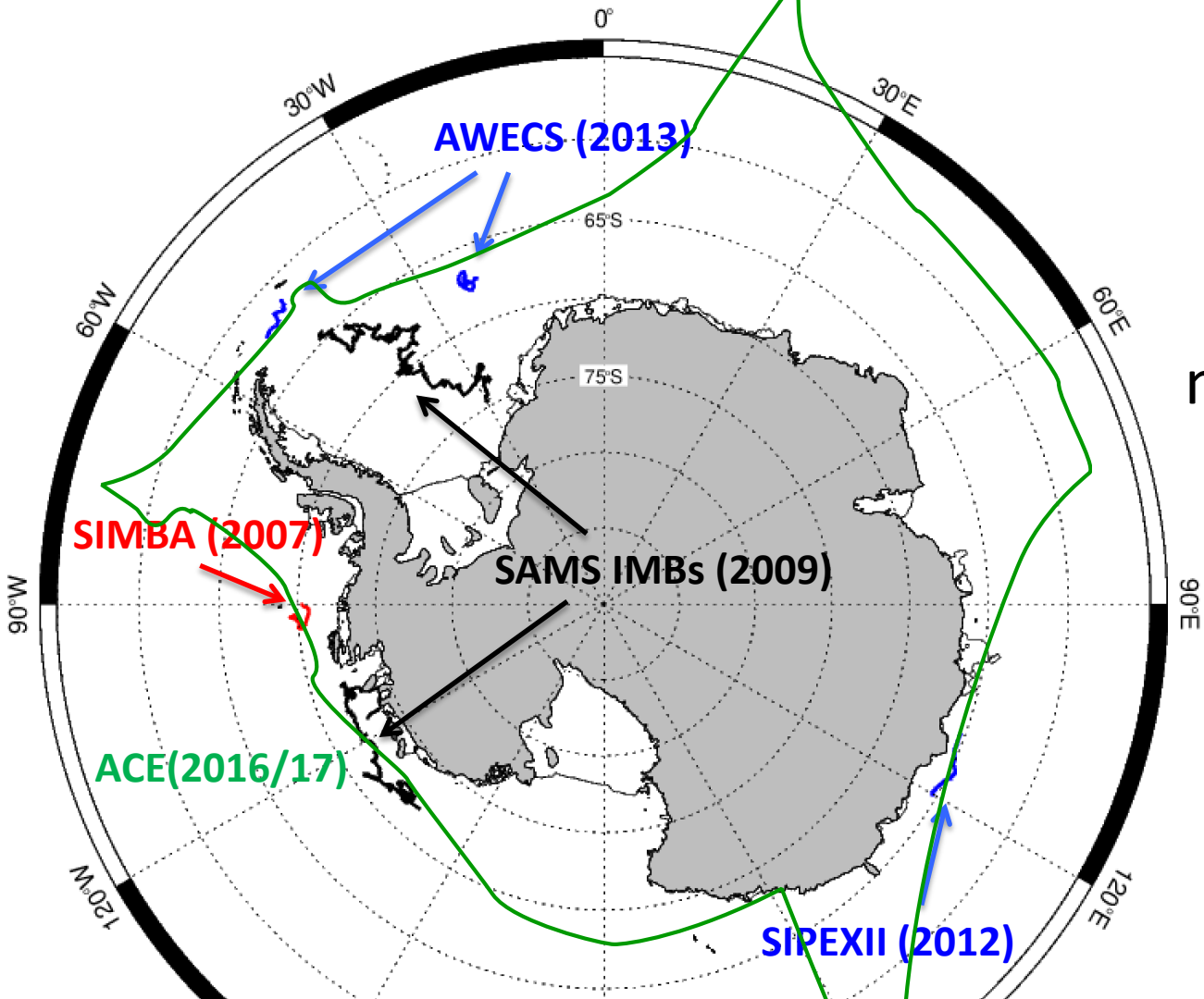
SPC

Formvar replicate scan:
SIPEX-2 / blizzard / 2012-10-22
Rocket trap

Formvar replicate scan:
SIPEX-2 / blizzard / 2012-10-22 /
hand held



Locations of
ship-based
precipitation
measurements

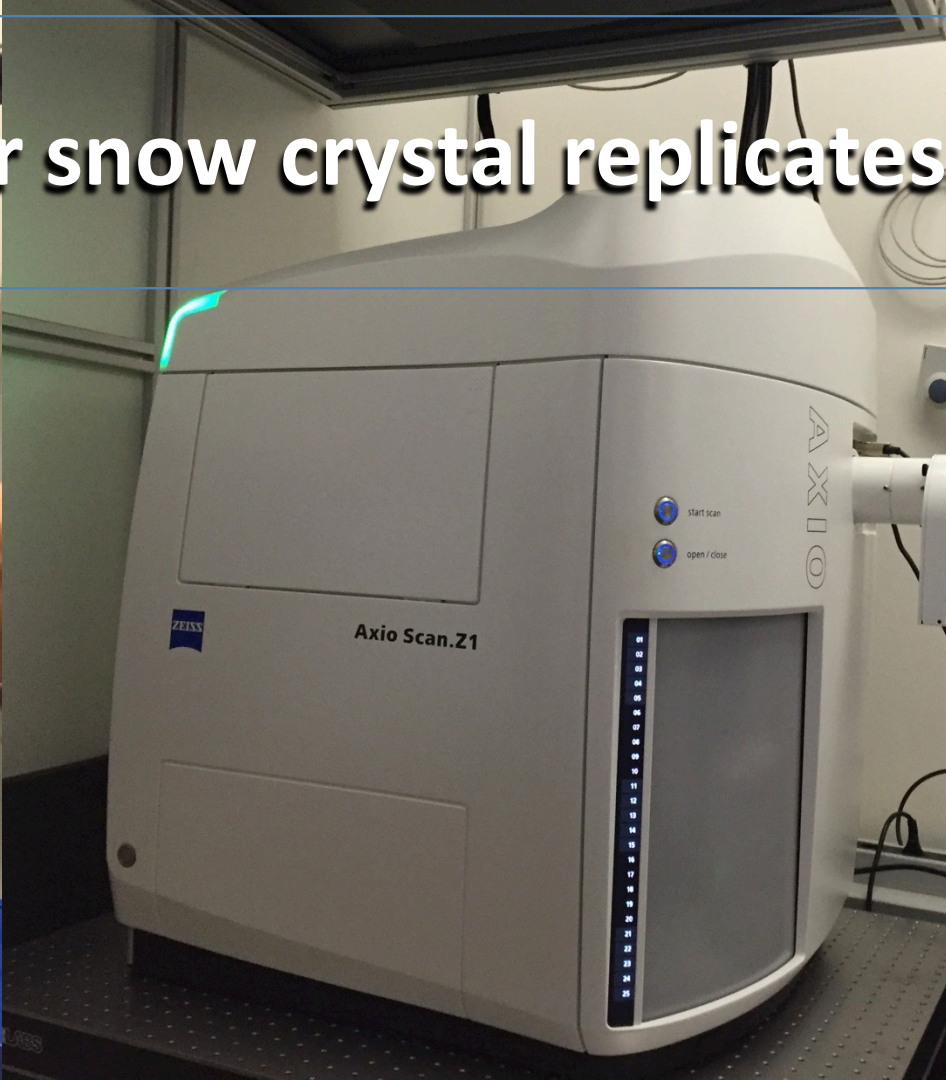
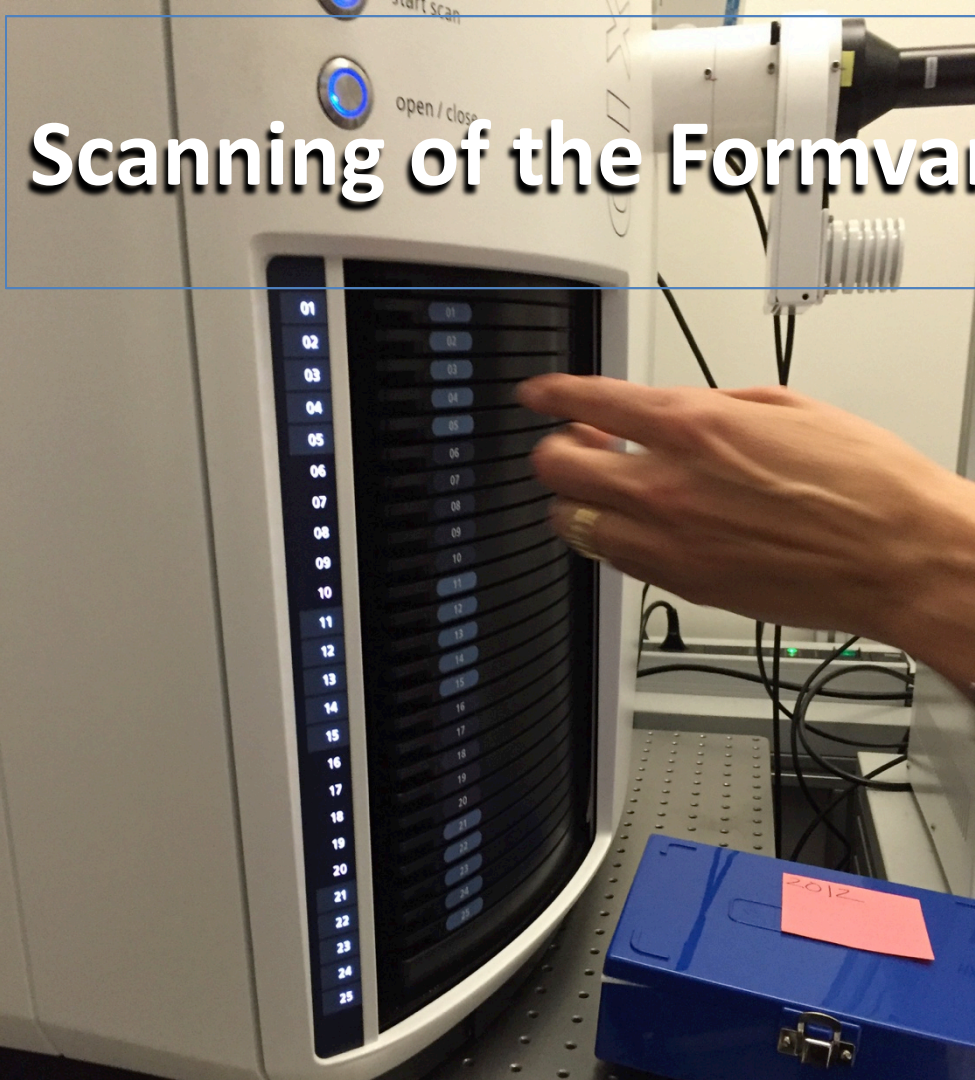


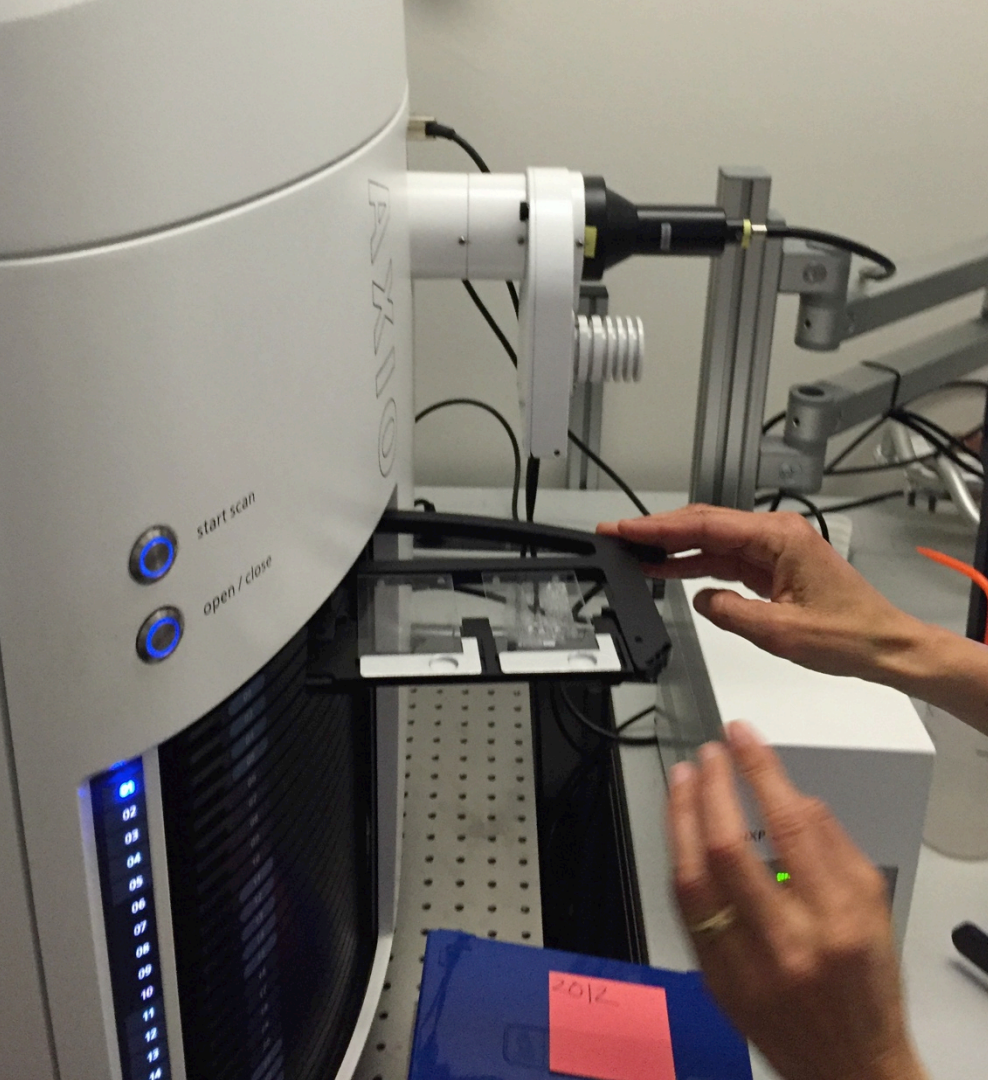
Collecting Formvar replicates of snow Antarctic Circumnavigation Expedition (ACE)



Photos: Irina Gorodetskaya /Maria Tsukernik

Scanning of the Formvar snow crystal replicates





Advanced Scan Profile Wizard - for tray 1, slide 2, profile 17.07.2015_BF_10h.ccspt

- 1 Global Data
- 2 Label Scan Settings
- 3 Preview Scan Settings
- 4 Tissue Detection Settings
- 5 Focus Map Settings
- 6 Scan Settings

Define settings how to scan the specimen (scan region).

- Camera
- Exposure
 - Flash intensity: 286 %
 - Flash duration: 3 μ s
 - Buttons: Measure, Measure and White Balance
- Post Processing
- White Balance
- Objective
- Focus
 - Position: 4227.26 μ m
 - Buttons: Run Auto Focus
- Z-Stack Configuration
 - Z-Stack: 30.00 μ m
 - Range: 31
 - Slices: 5
 - Interval: Interval
 - Keep: Slice
 - EDF active
- Online Processing

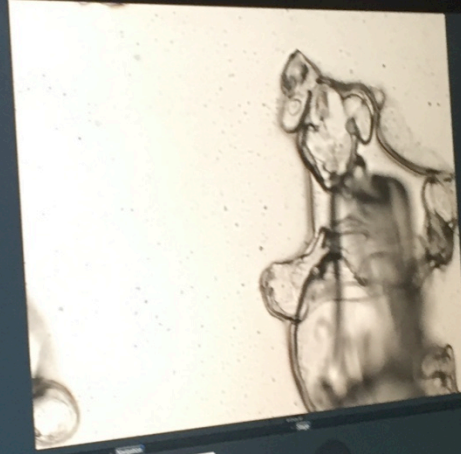
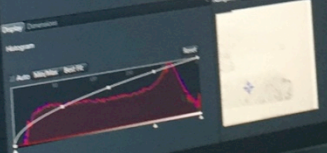
2-Stack Configuration

- # of Z-Stack: 30
- Range: 31
- Interval: 5
- Keep: Slice

EDF active

Online Processing

Buttons: Back, Next, Finish, Cancel

- 4 Tissue Detection Settings
- 5 Focus Map Settings
- 6 Scan Settings

Define settings how to scan the specimen (scan region).


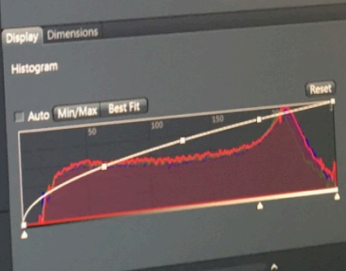
- Camera
- Exposure
 - Flash intensity: 286 %
 - Flash duration: 3 μ s
 - Buttons: Measure, Measure and White Balance
- Post Processing
- White Balance
- Objective
- Focus
 - Position: 4227.26 μ m
 - Buttons: Run Auto Focus
- Z-Stack Configuration
 - Z-Stack: 30.00 μ m
 - Range: 31
 - Slices: 5
 - Interval: Interval
 - Keep: Slice
 - EDF active
- Online Processing

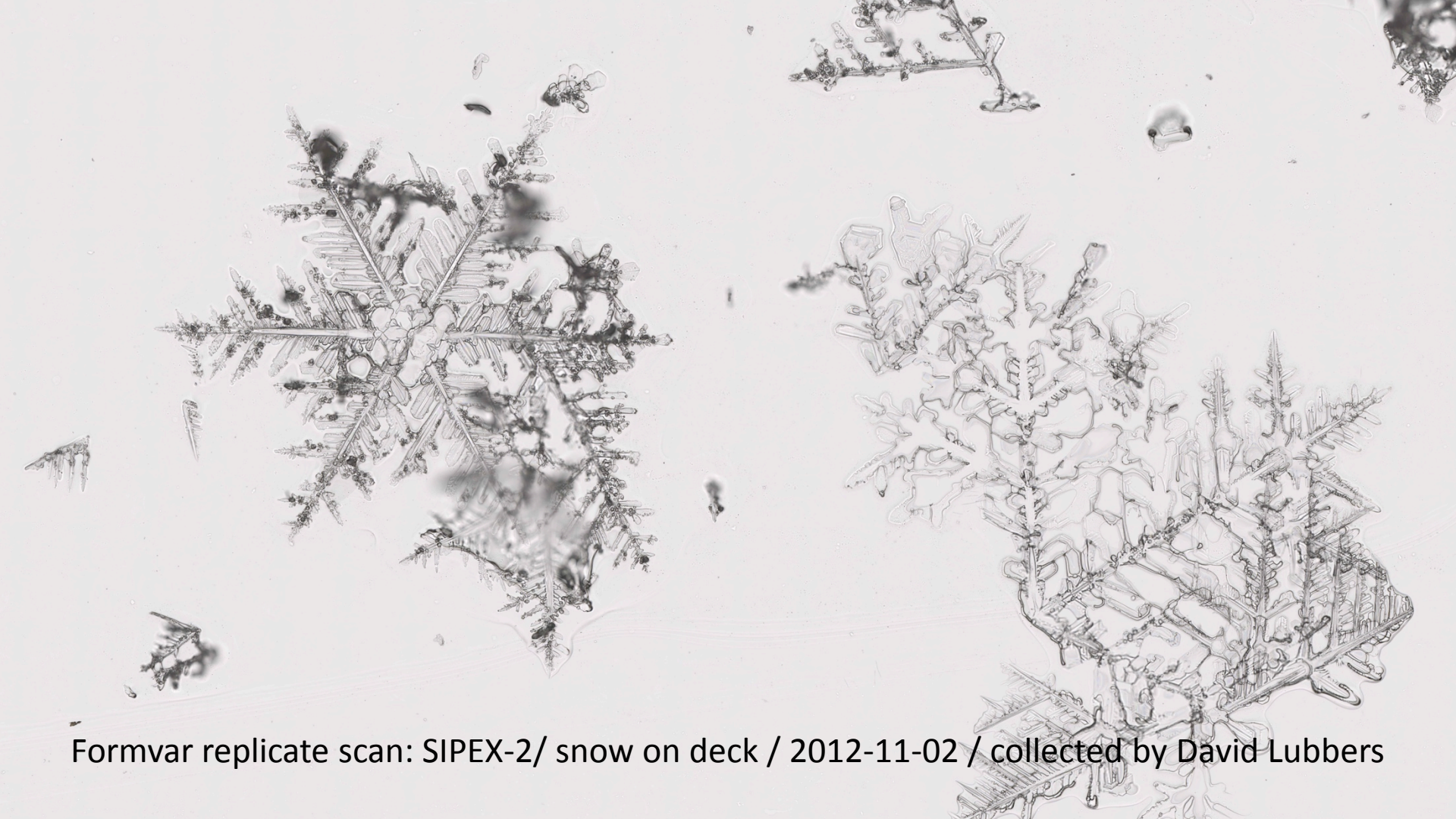
Buttons: Back, Next, Finish, Cancel

Display Dimensions

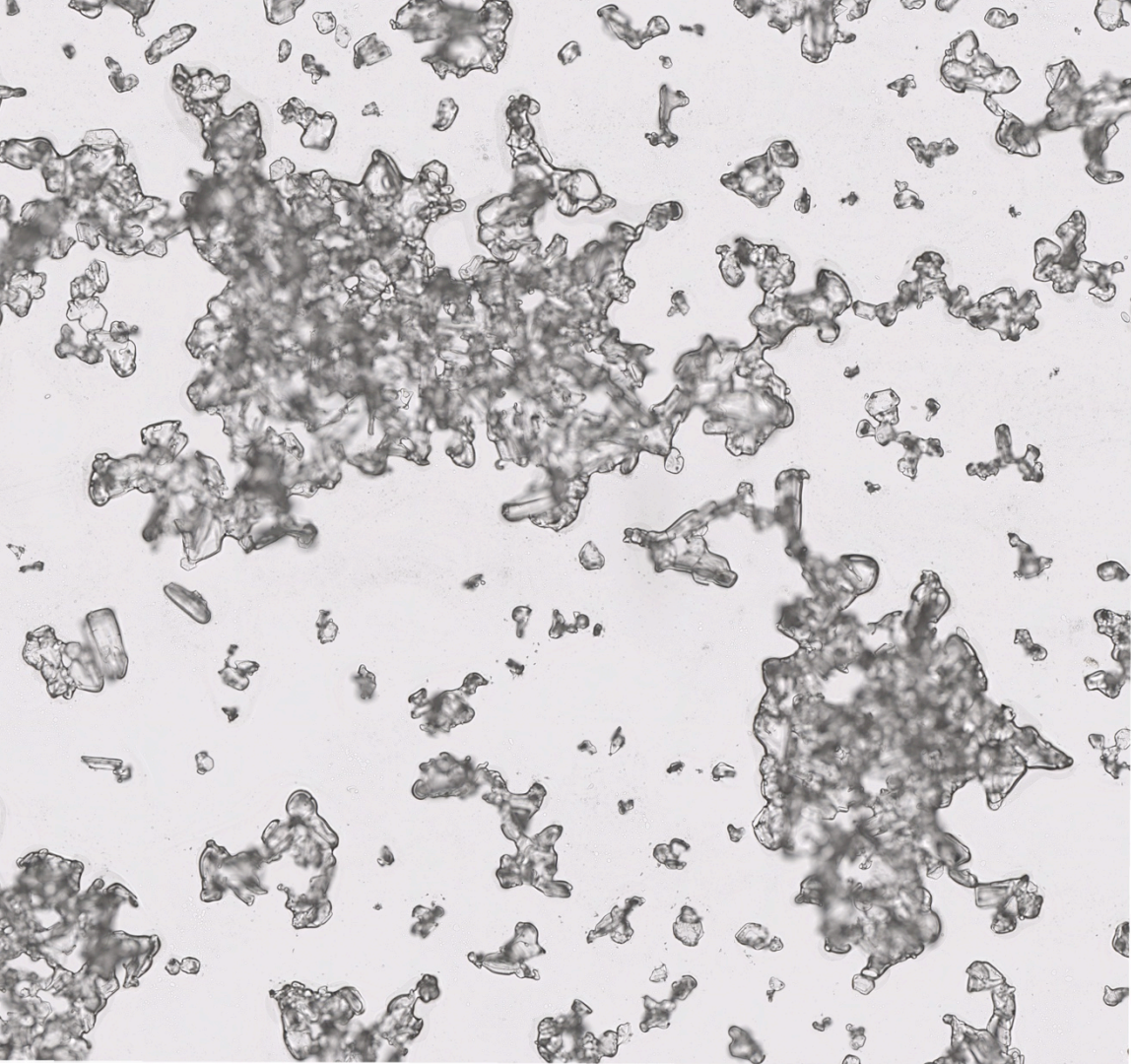
Histogram

Buttons: Auto, Min/Max, Best Fit, Reset

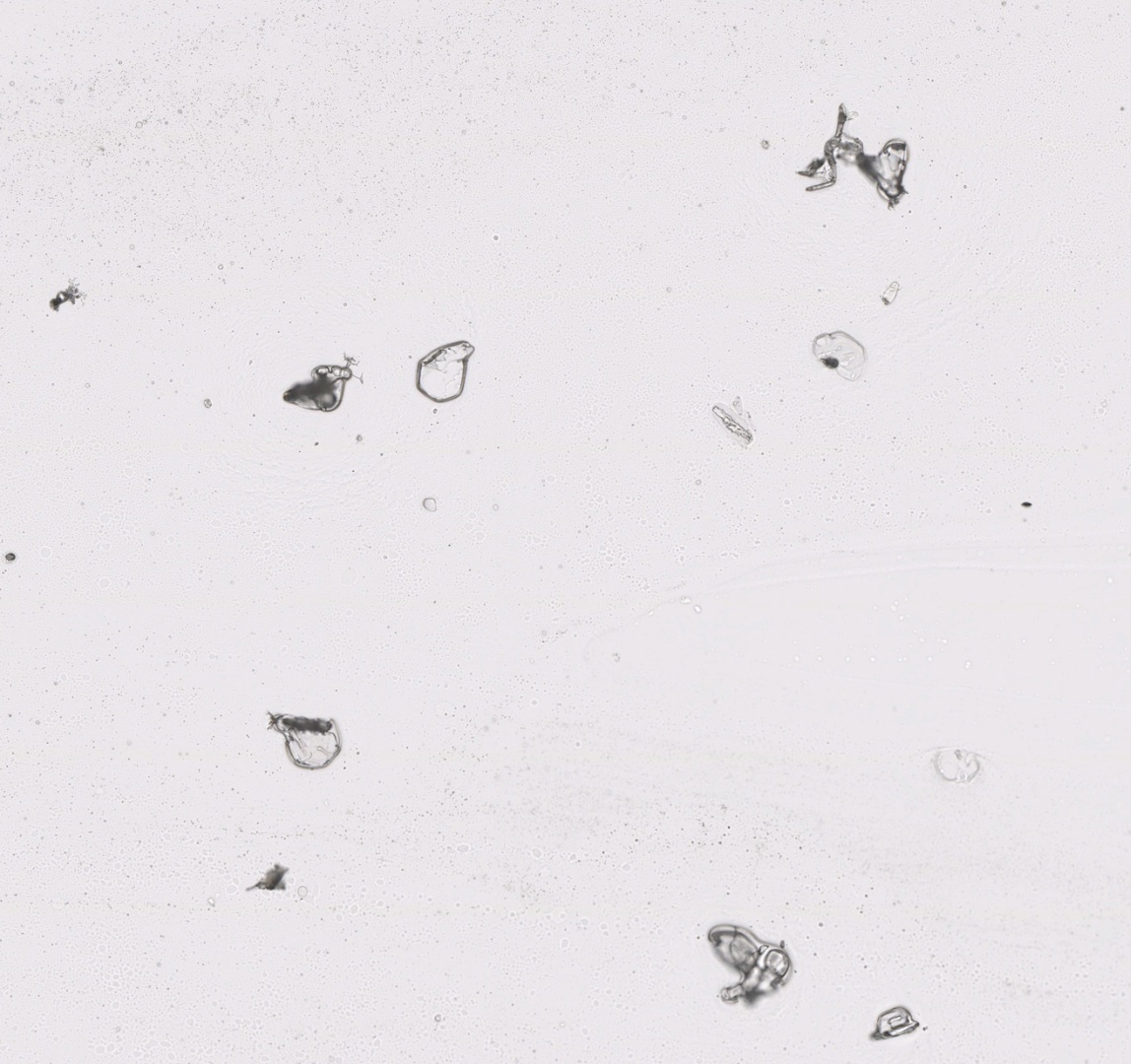





Formvar replicate scan: SIPEX-2/ snow on deck / 2012-11-02 / collected by David Lubbers

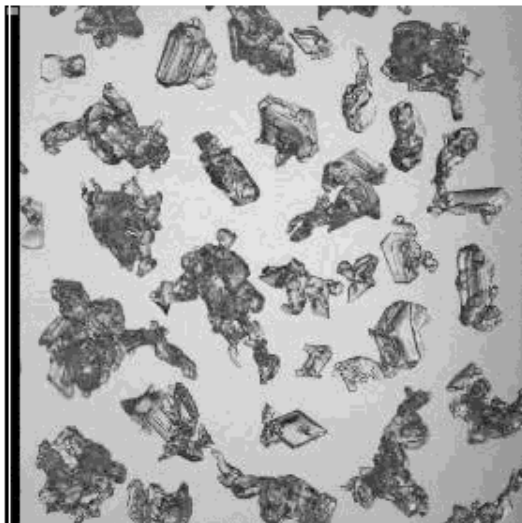


Formvar replicate scan:
SIPEX-2 / blizzard / 2012-10-22 /
hand held



Formvar replicate scan:
SIPEX-2 / blizzard / 2012-10-22 /
rocket trap

Matlab snowflake analysis program from Bartlett et al 2008



Files

- 1996_rounded-depth-hoar-mst6811a.tif - COMF
- 1996_rounded-depth-hoar-mst6811b.tif - COMF
- 1996_surface-hoar-mst6701a.tif - COMPLETED
- 1996_surface-hoar-mst6701b.tif
- 1996_surface-hoar-mst6701c.tif - COMPLETED
- 1996_wet-grains-mst6103a.tif - COMPLETED
- 1996_wet-grains-mst6103b.tif - COMPLETED
- 1997_rounded-depth-hoar-gaud97e09-07a.tif -
- 1997_rounded-depth-hoar-gaud97e09-07b.tif
- 1997_small-rounds-gaud97n06-03a.tif - COMPL
- 1997_small-rounds-gaud97n06-03b.tif - COMPL

Configuration

Calibrate

Outline Editor

Ignore Image

Help

Process outlines

SnowChar2D Picture Loader help:

To calibrate these samples:

1. Click configuration
2. Check settings
3. Click Store
4. Click Calibrate (calibration image shown)

To edit outlines:

Click Outline Editor

To ignore an image:

1. Click the image in the Files listbox,
2. Click Ignore Image.

When finished:

Click the Process Outlines button.

HOME PLOTS APPS

Find Files

New Script

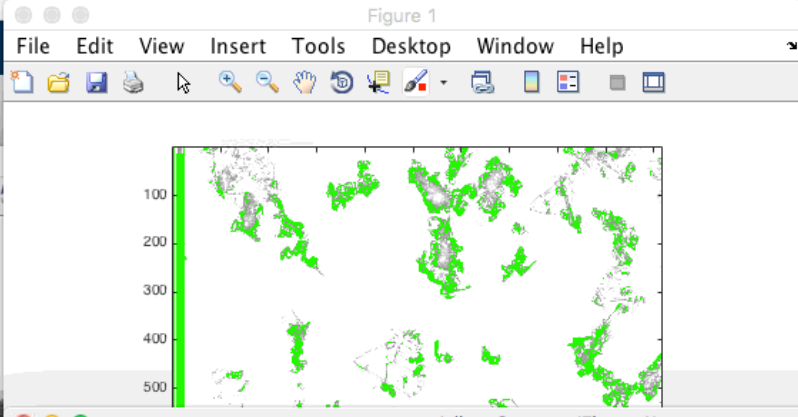
Current Folder

- Name
- matlab
- brice_m
- Brice_m
- figure_p
- matlab
- matlab
- matlab
- matlab
- matlab
- matlab
- size_for

Details

Workspace

Name



Search Documentation

Community

Request Support

SnowChar2D Picture Loader help:

To calibrate these samples:

1. Click configuration
2. Check settings
3. Click Store

Click Calibrate (calibration image shown)

Size	Kind
1.45 GB	Folder
58....GB	Folder
54 KB	PDF D
44 KB	PDF D
5 MB	PDF D
1.77 GB	Folder
119 KB	PDF D
21 KB	Micros
627 KB	PDF D
25 KB	Word
29 KB	Word
9.5...GB	Folder
8.3 MB	Folder
85 KB	PDF D
83 KB	PDF D

Adjust Contrast (Figure 1)

File Edit Window Help

Data Range

Minimum: 0

Maximum: 255

Window

Minimum: 65

Maximum: 188

Width: 123

Center: 127

Scale Display Range

Match Data Range

Eliminate outliers: 2 %

Apply

Adjust the histogram above, or click and drag the mouse over the image.
Click 'Adjust Data' to apply the changes to image data.

Adjust Data

f3 >>

HOME PLOTS APPS

Find Files

Current Folder

- Name
- matlab
- brice_m
- Brice_m
- figure_p
- matlab
- matlab
- matlab
- matlab
- matlab
- matlab
- size_for


Details

Workspace

Name

Figure 1

File Edit View Insert Tools Desktop Window Help



Adjust Contrast (Figure 1)

File Edit Window Help

Data Range

Minimum: 0

Maximum: 255

Window

Minimum: 228

Maximum: 254

Width: 26

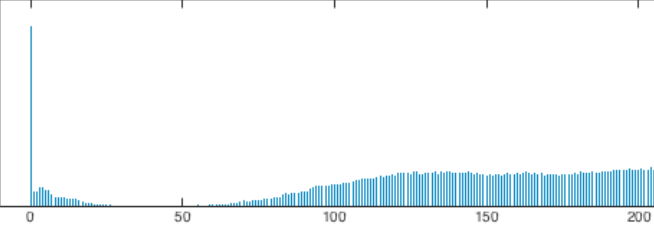
Center: 241

Scale Display Range

Match Data Range

Eliminate outliers: 2 %

Apply



Adjust the histogram above, or click and drag the mouse over the image.
Click 'Adjust Data' to apply the changes to image data.

Adjust Data

Search Documentation

Community

Request Support

SnowChar2D Picture Loader help:

To calibrate these samples:

1. Click configuration
2. Check settings
3. Click Store

Click Calibrate (calibration image shown)

Size	Kind
.45 GB	Folder
58...GB	Folder
54 KB	PDF D
44 KB	PDF D
5 MB	PDF D
.77 GB	Folder
119 KB	PDF D
21 KB	Micros
627 KB	PDF D
25 KB	Word
29 KB	Word
9.5...GB	Folder
8.3 MB	Folder
85 KB	PDF D
83 KB	PDF D

f3 >>

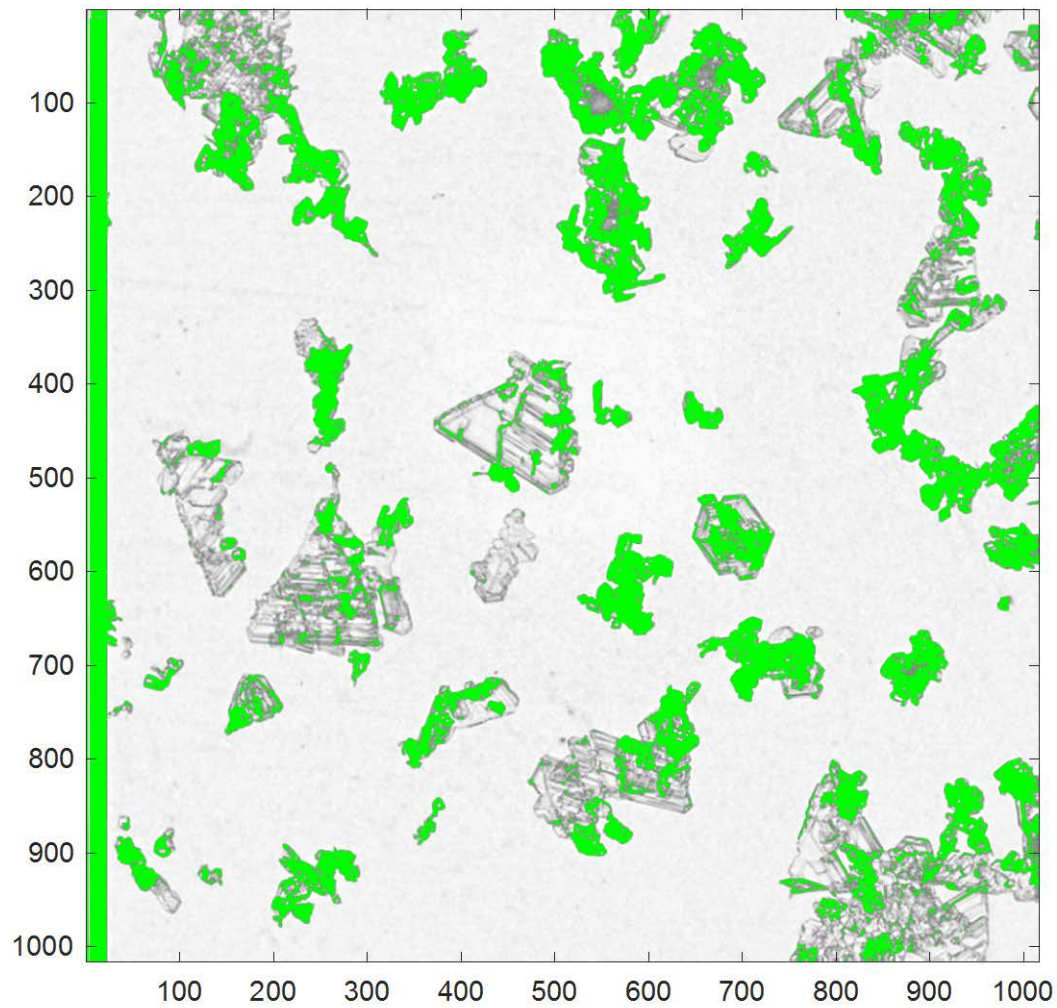
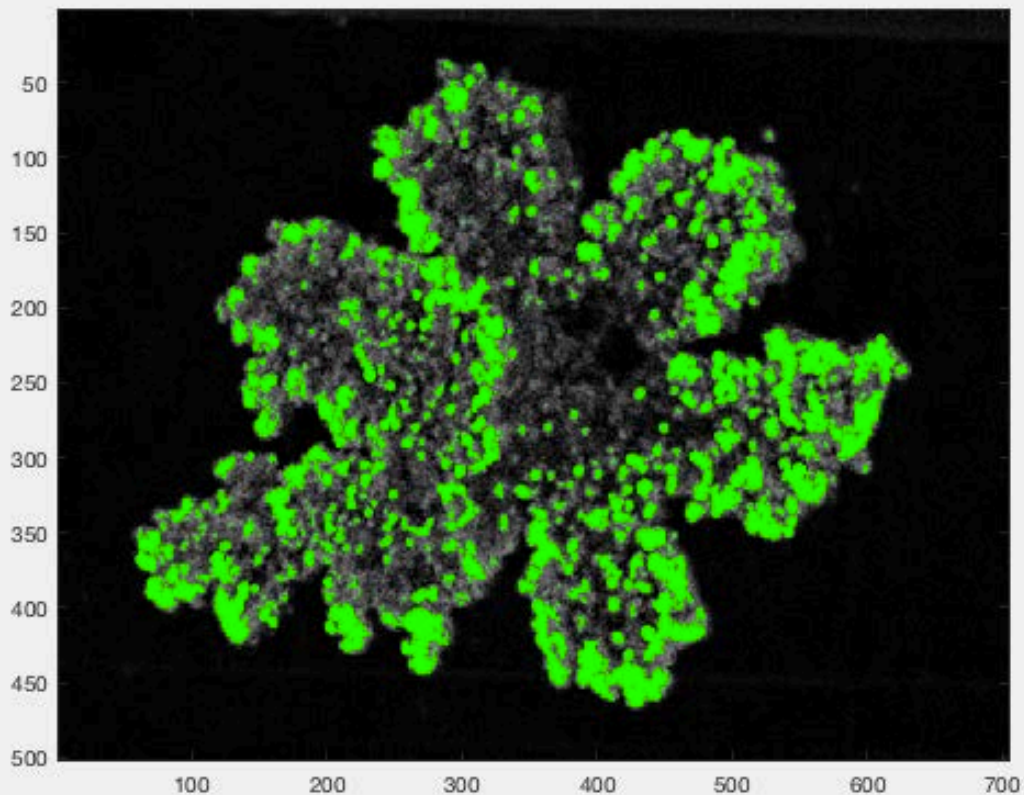
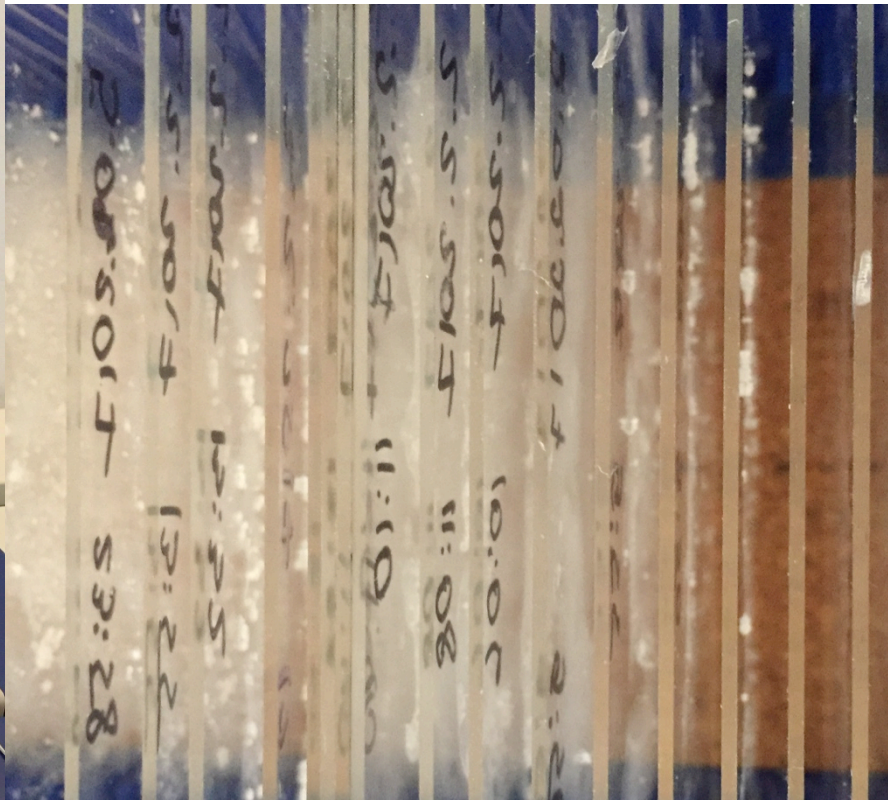


Figure 2

File Edit View Insert Tools Desktop Window Help





Formvar data collection from the Antarctic Circumnavigation Expedition (ACE)

Thanks, and a Brief Update on Swiss Antarctic meteorological field research

Acknowledgements:

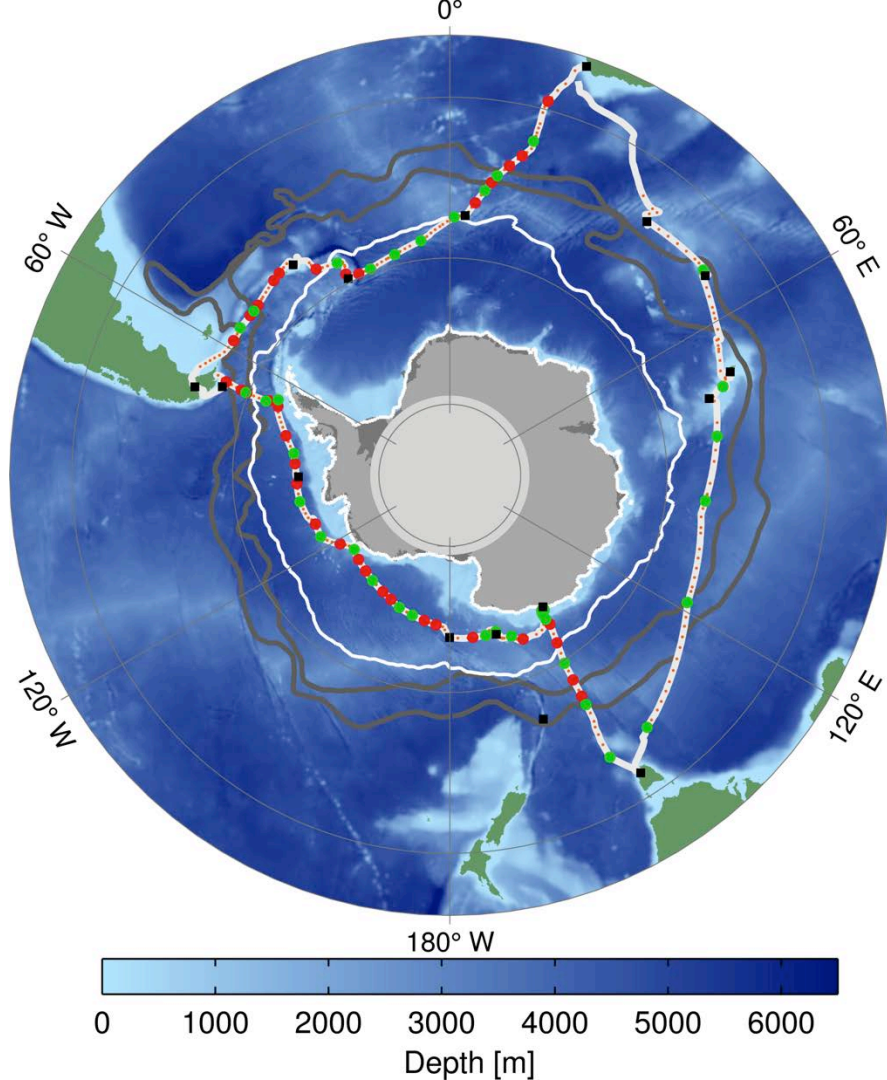
Swiss National Science Foundation, US National Science Foundation, Swiss Polar Institute, Australian Antarctic Division, Alfred Wegener Institute, University of Zurich Microscopy Lab, Swiss Committee on Polar and High Altitude Research

Quantifying precipitation and its contribution to surface freshening in the Southern Ocean



ÉCOLE POLYTECHNIQUE
FÉDÉRALE DE LAUSANNE





sampling locations

- underway
- ctd
- xbt
- planned stops (black squares)
- mean winter sea-ice cover

Locations of ship-based precipitation measurements /
Antarctic Circumnavigation Expedition (ACE) 2016/17

Local surface mass balance in East Antarctica

New Lehning and Berne project at Princess Elisabeth Station:
Ask Katie about the 3 year postdoc opportunities



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FÉDÉRALE DE LAUSANNE

EPFL laboratory of the WSL/SLF - EPFL

artistic output science communication

The fact that someone is travelling all the way to Antarctica, to the most remote and wild place on earth, to catch a snowflake in order to answer one of the most important contemporary questions, namely climate change, is very touching and bears a poetical gesture.

collaboration with swiss artist
Yvonne Weber

