• Updates
• South Pole as interdisciplinary observatory
• 2016-17 field season outcomes and BLWG concerns
• Pre-deployment testing
• Winch simulation filters
South Pole – interdisciplinary observatory

- IceCube Gen2
- IceCube
- PINGU
- Radio Array
- SPICEcore
South Pole neutrino detector in radio (200-800 MHz)

Two stations taking data

Planned 80 km² area, >200 holes
150-200 m deep, 5-6”, dry

Investigating switching (back) to RAM

Some concern over Conway et al. GPR conflict in 2016-17

Will use SPICEcore borehole for calibration beacons in 2017-18
• Access point for ARA and IceCube calibration
  Cross-borehole tomography
  Timing pulses, tone bursts, polarization
  Layering and bedrock mapping
  Anisotropy / birefringence
  Complex permittivity vs. depth & T
  UV attenuation in ice
Anisotropy in South Pole ice

Ice flow direction 41° NW

9% less scattering 41° NW

Ice Layer tilt direction 225° SW
Anisotropy in SPICEcore dust log
(preliminary)

...oriented core?

Fluxgate compass
Ice Diver

- Dale Winebrenner / Tim Elam, U. Washington
- 6 kW melter probe
- Lab testing “reversibility” using ethanol antifreeze
Winches (logging lifelines)

Heavy (4 km) logging winches
• **USGS** (formerly) *winch* used for predeployment testing 2016
• **IDDO winch** deployed WAIS Divide 2016-17 for sonic logging
  - leveling issue
  - telemetry problems (!)

• **Intermediate (1500 m) logging winch**
  - deployed as backup (and used) South Pole Ice Core 2016-17
  - deployed to Minna Bluff field test
  - some minor issues

• **Intermediate Depth Drill winch**
  - used for temperature logging South Pole Ice Core 2016-17
  - cable had been partially compromised
  - new tougher cable(s) purchased
Some 2016-17 Logging activity (U.S.)

- **SPICEcore (South Pole Ice Core)**
  - Laser dust logging
    Intermediate Depth Logging Winch (IDLW) < 1600m
    Also logged temperature to bottom using IDD winch
  - Upstream ice/firn dynamics (Conway, Koutnik, Hawley)
    Shallow cores, accumulation, temperature, water isotopes, flow

- **RAID**
  - Field test at Minna bluff
  - Insufficient augers for thick firn \(\rightarrow\) retry 2017-18
  - Optical televiwer firn log
  - Slim-line dust logger built & fielded to test post-drilling optical
  - High potential for borehole logging science
    \(\sim 5\) sites per season, \(\sim 40\) total
    Borehole preservation \(\Leftrightarrow\) logistics
  - BLWG \(\Leftrightarrow\) RAID WG + RAID SCO
  \(\Rightarrow\) Fast logging tools for baselines immediately after drilling
  How many hours do we have?
Some 2016-17 Logging activity (U.S.)

- WAIS Divide logging
  - MHz sonic (borehole deformation) Pettit / Obbard
  - kHz sonic (fabric) Waddington / Anandakrishnan
  - P.I. - IDDO winch “co-piloting”

More telemetry issues…

⇒ Could be specific to WD?  Noisy power? Bad ground?
⇒ Substitute winch used for predeployment testing
⇒ Winch simulation filter LRSP Priority 2
Logging telemetry

- Winches provide transport, power and communication
- Power $P = V^2$ ← cable has voltage limits
  - $R$ ← power is lost over long cables
- Analog communication
- Digital communication
  - Data rates:
    - $\sim 1$ kbyte/sec – temperature probes
    - $\sim 10$ kbyte/sec – optical, sonic loggers, SUBGLACIOR
    - $\sim 100$ kbyte/sec (Mbps) – IceCube, oil & gas

Encoding schemes:
- Amplitude keying (ASK), phase keying (PSK)
- OFDM
Winch simulation filters

Zachary Meulemans (IDDO) + Bay

Example:

Courtesy LBNL