

Glaciology and Global Warming

What is the connection?

Climate Change: Today vs Tomorrow

- **Average temperature today = 15° C**
 - Without the greenhouse effect: **-18°C**
 - Over the past century: A rise of **0.7° C**
- **Predictions (The most catastrophic!)**
 - A rise of up to **6° C**
 - Over the next **100 years**



The Procedure

- **Measurements?**
- **Traces of the ancient atmosphere?**
- **Answer: the world's archives**
- **A huge refrigerator**



Midnight Sun Over Antarctica



Antarctica



EPICA

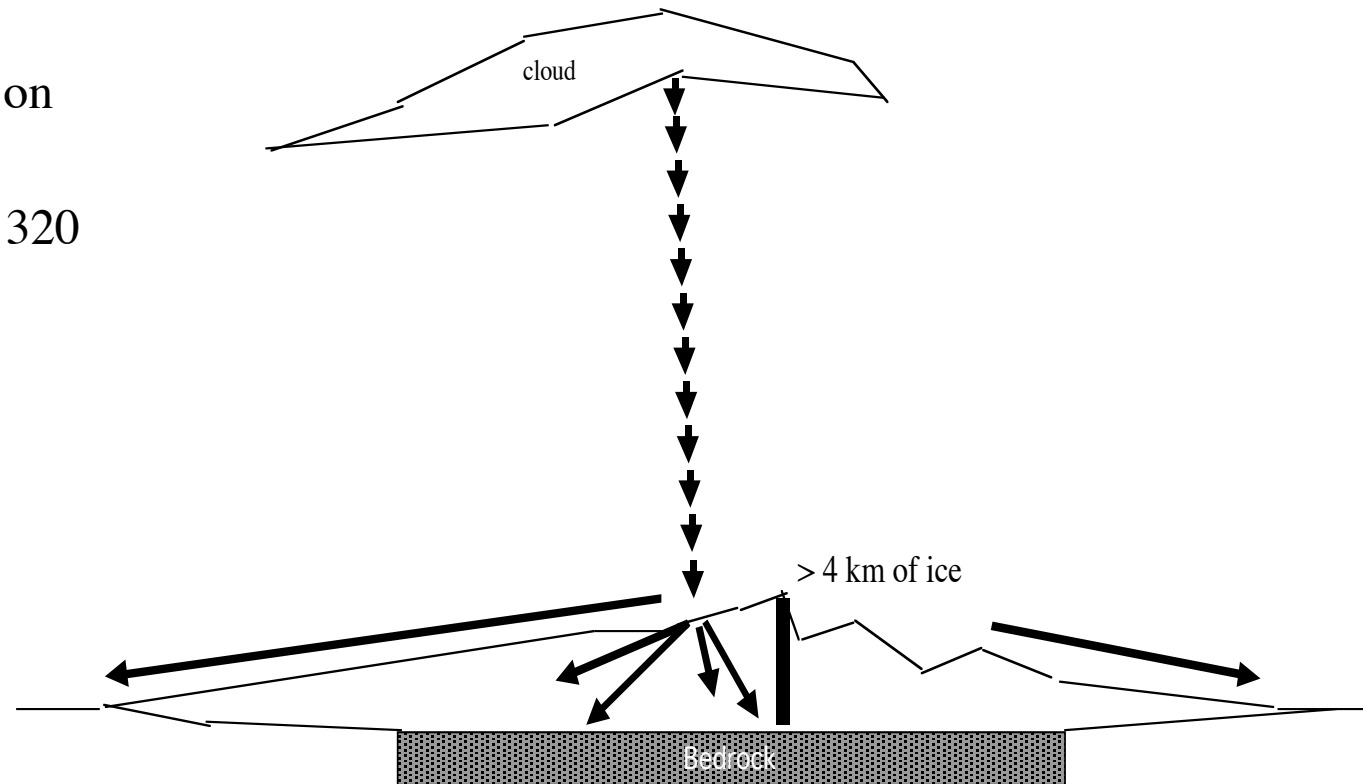
European Project of Ice Coring in Antarctica

Drilling for Ice Samples

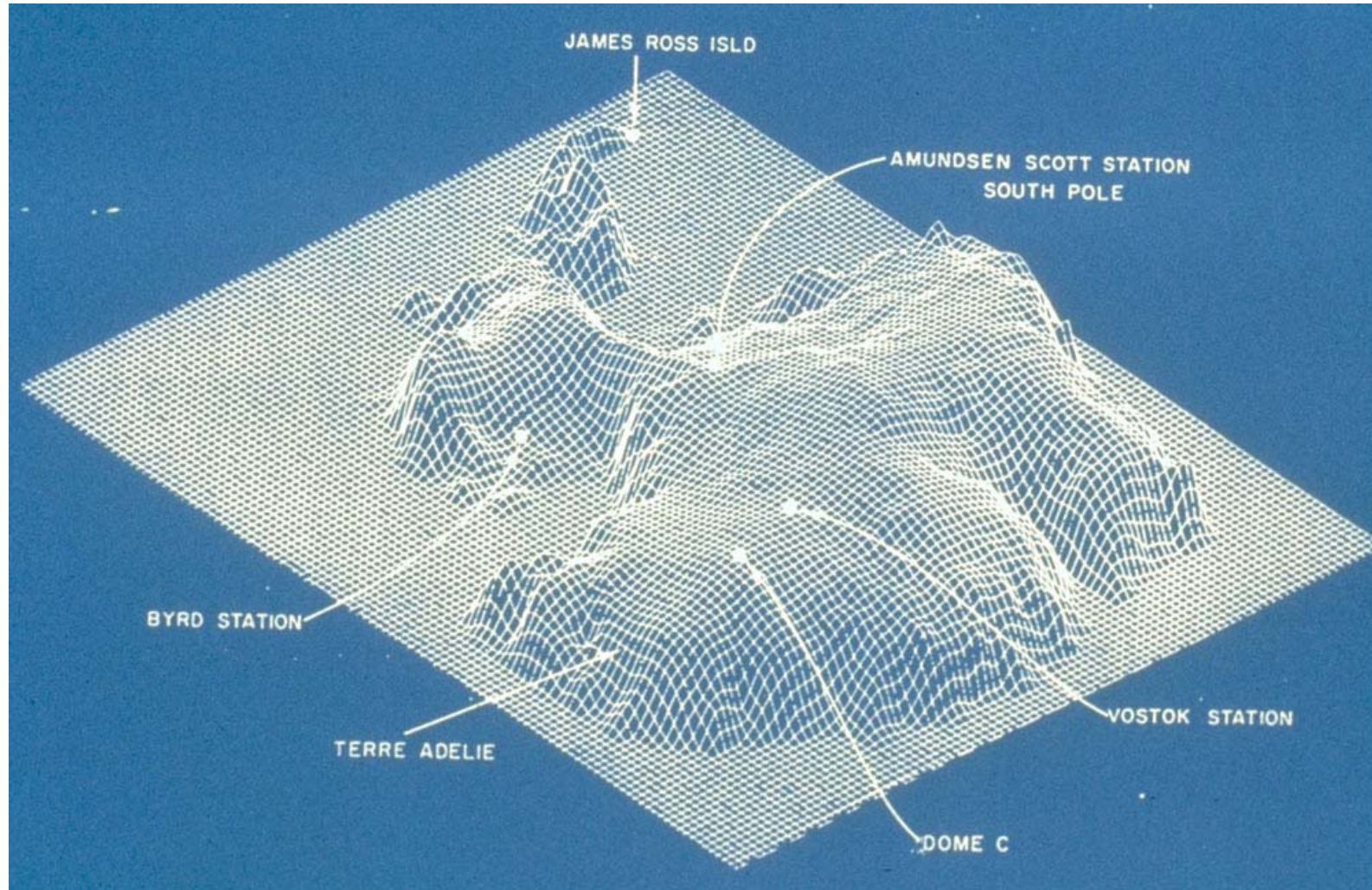


Antarctica

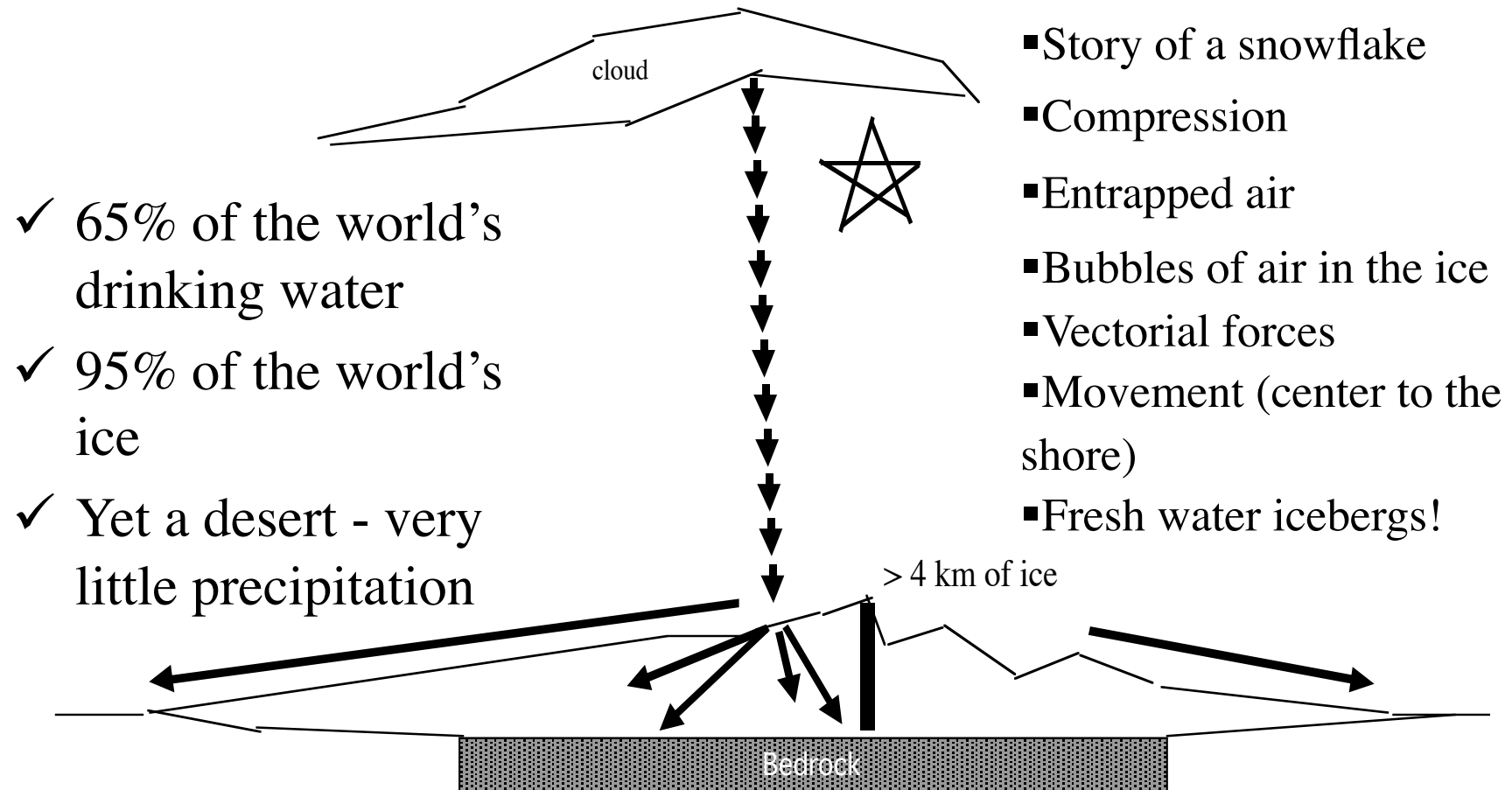
- ✓ Continent
- ✓ Twice size of the USA
- ✓ Driest place on earth
- ✓ Winds up to 320 km/h
- ✓ Among the highest mountains



The Transarctic Mountains



The Long Trip of a Tiny Snowflake

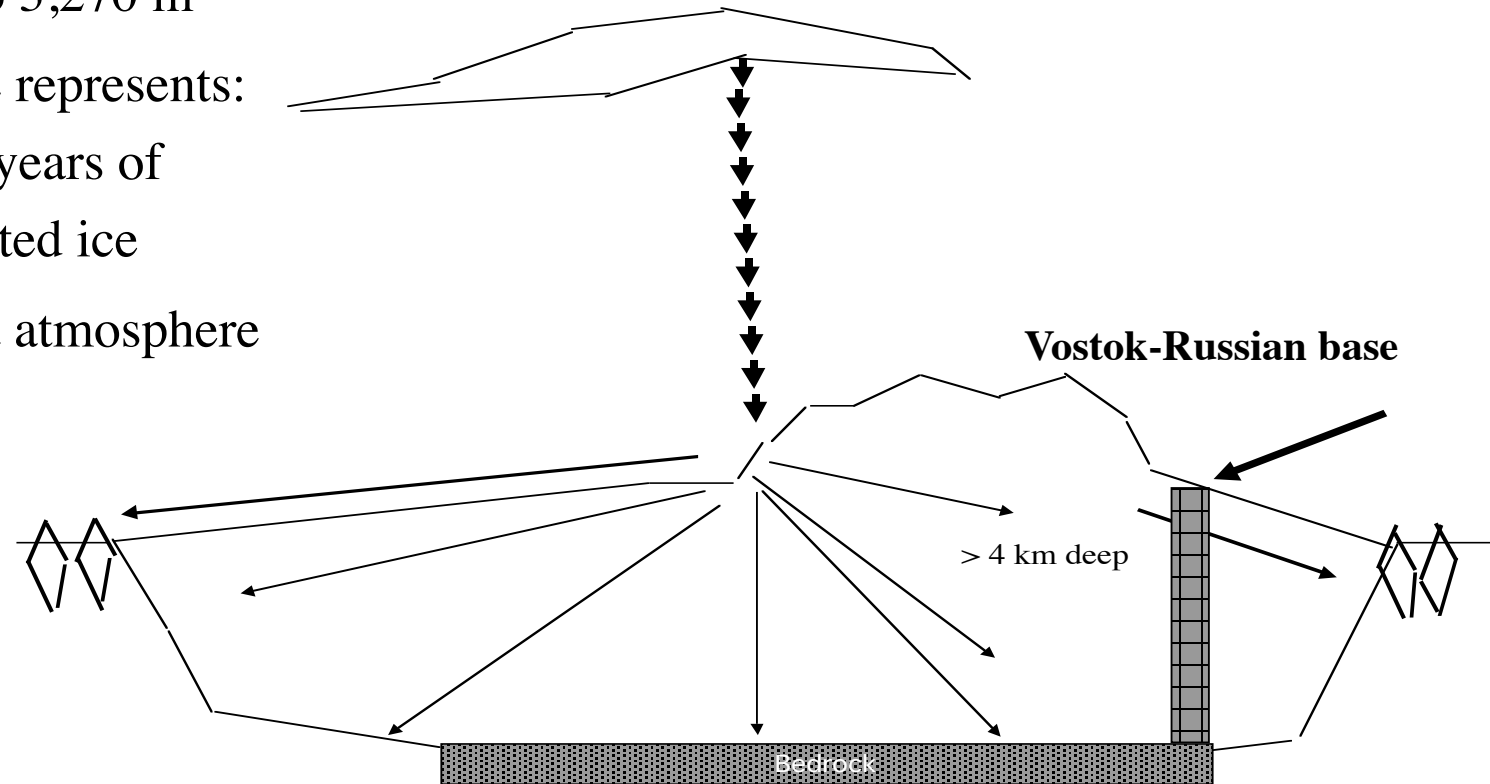


An Iceberg!



The Initial Project: Vostok Station

- Engineers drilled down to 3,270 m
- Ice core represents: 40,000 years of compacted ice
- Ancient atmosphere



Ice Core Samples



Evolution of the Atmosphere Over the Last 400,000 years

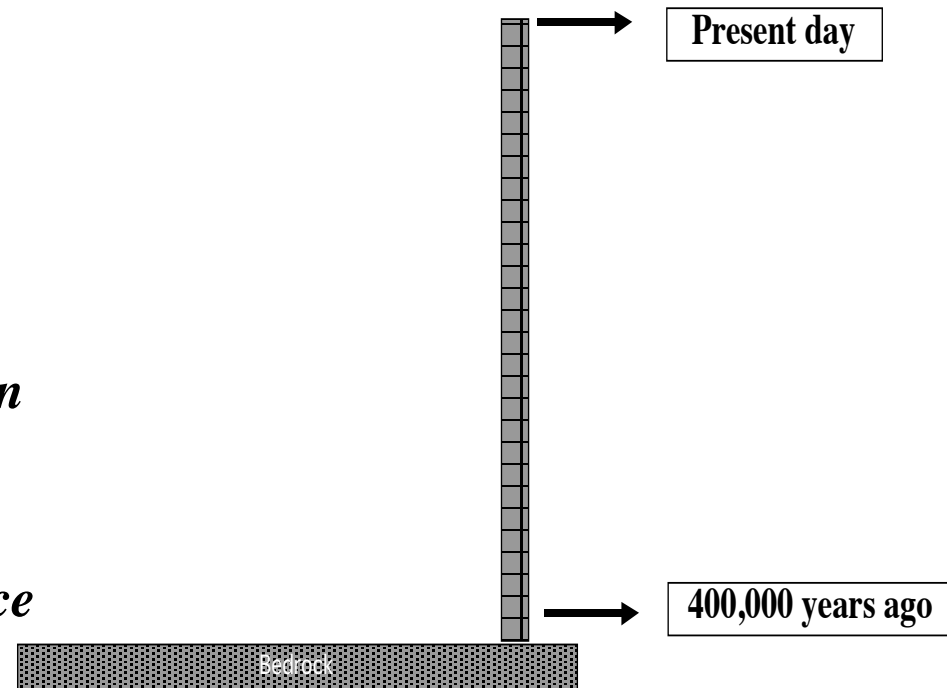
A shaft: roughly 3,200 m in depth

**Taking the “samples back”
... “the easy part”, but
first...**

*They have to ...drill “straight” down
(through moving ice)*

*After that they have to take the
“carrots” of ice up to the surface*

Carrying out an engineering feat!



An Engineering Feat



Research

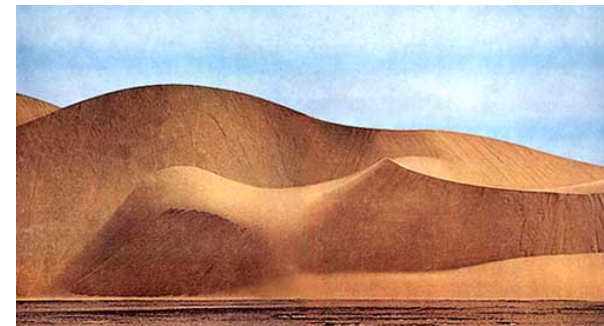
- **Dating of ice**
 - Measurements of **radioactivity**
 - Correlation with **identifiable volcanic eruptions** in the past
 - By means of **marines sediments**
- **Analysis**
 - **Deuterium**
 - **Ratio 18 O** (isotope) to 16 O determines the **temperature at formation**
 - **Greenhouse gases CO₂ and methane** (in bubbles)
 - Variation of gases over the years
 - Correlation between the quantity of these greenhouse gases and the temperature
 - Temperature, thus climate at different periods...
- **And finally...**

Predictions

...over the next 100 years:

The least catastrophic: + **1.5° C**

The most catastrophic: up to + **6° C...!**



Conclusion

- Over the past century **+0.7°C**
- Up to **+21°C** by 3000
- Measures to limit production of harmful greenhouse gases
- Responsibility of both governments and citizens
- Kyoto Protocol of 1997: a first step
- Only way to save our planet for the generations to come!

Acknowledgements

We wish to thank the Laboratoire de
Glaciologie de Grenoble
and its researchers, who participate in

EPICA

European Project of Ice Coring in
Antarctica

Thank you for your attention!