# Hot Science Cool Talks

UT Environmental Science Institute

# 47

# Come Ice or High Water: How Will Global Warming Affect Antarctic Ice Sheets and Sea Levels?

#### Dr. David Vaughan March 28, 2007

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# Come ice or high water?

#### The future of the West Antarctic Ice Sheet and sea level

David G. Vaughan British Antarctic Survey













# West Antarctic Links to Sea Level Estimation







# Menu

- Overview of Antarctica
- Human fingerprints on the last wilderness
- Archive of Planet Earth
- Climate change in Antarctica
- Sea-level rise life's a beach, why worry?
- Antarctica and sea-level rise
- Getting out there
- Science and policy where next?





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![](_page_7_Figure_0.jpeg)

![](_page_8_Picture_0.jpeg)

British Antarctic Survey

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![](_page_10_Picture_1.jpeg)

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British Antarctic Survey

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NATURAL ENVIRONMENT RESEARCH COUNCIL

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# **Tonight's Menu**

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![](_page_15_Picture_9.jpeg)

#### **Radioactive Fallout**

![](_page_16_Picture_1.jpeg)

CARDINAL Assentations are as a subject to

#### Lead pollution

![](_page_17_Figure_1.jpeg)

![](_page_17_Picture_2.jpeg)

![](_page_17_Picture_3.jpeg)

Source: Wolff and Suttie

#### Ozone Hole

OMI Total Ozone September 24, 2006

150 Ozone (Dobson Units)

420

500>

![](_page_18_Picture_2.jpeg)

NATURALIENVIRONMENT RESEARCH COUNCIL

Source: NASA/BAS

MIVR-FHT-MASA-KNMI

![](_page_19_Picture_0.jpeg)

NATURAL INVIRONMENT RESEARCH COUNCIL

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#### The ice-core record

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![](_page_23_Picture_10.jpeg)

#### Climate change - World perspective

![](_page_24_Figure_1.jpeg)

![](_page_24_Picture_2.jpeg)

Source: IPCCWorking Group I, Summary for Policymakers, 2007

## Climate change - World perspective

#### Trend in annual temperature

#### 1955->2005 Annual Mean

![](_page_25_Figure_3.jpeg)

![](_page_25_Picture_4.jpeg)

Source: Hansen

.59

#### Climate change in Antarctica

Trends in mean annual temperature

![](_page_26_Figure_2.jpeg)

![](_page_26_Picture_3.jpeg)

Source: Vaughan et al., 2004

#### Antarctic Peninsula

#### Trend in annual temperature

Faraday / Vernadsky

![](_page_27_Figure_3.jpeg)

![](_page_27_Picture_4.jpeg)

Source: King et al., BAS

Trends in sea-ice duration around Antarctica and trends in mean annual temperature 1979-2000

![](_page_28_Picture_1.jpeg)

![](_page_28_Picture_2.jpeg)

![](_page_29_Picture_0.jpeg)

1985/86

![](_page_29_Picture_2.jpeg)

1994/95

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![](_page_29_Picture_4.jpeg)

#### Glacier retreat on the Antarctic Peninsula

![](_page_30_Figure_1.jpeg)

![](_page_30_Picture_2.jpeg)

![](_page_30_Picture_3.jpeg)

![](_page_30_Picture_5.jpeg)

Ice shelf retreat on the Antarctic Peninsula

![](_page_31_Picture_1.jpeg)

![](_page_31_Picture_2.jpeg)

![](_page_32_Picture_0.jpeg)

British Antarctic Survey ![](_page_33_Picture_0.jpeg)

![](_page_34_Picture_0.jpeg)

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![](_page_35_Picture_0.jpeg)

IPCC- 2007 "The projections include a contribution due to increased ice flow from Greenland and Antarctica at the rates observed for 1993-2003, but these flow rates could increase or decrease in the future."

![](_page_35_Picture_2.jpeg)

Source: IPCCWorking Group I, Summary for Policymakers, 2007

#### **Asymmetry of Sea Level Change**

![](_page_36_Figure_1.jpeg)

![](_page_36_Picture_2.jpeg)

Source: Bindschadler

![](_page_37_Picture_0.jpeg)

# Impacts of sea level rise

- 10 M people each year suffer from coastal flooding
- 30 M by 2080 with no sea level rise
- But 100 M with 44 cm sea level rise

![](_page_37_Picture_5.jpeg)

#### Sea-level rise – 500 years?

![](_page_38_Figure_1.jpeg)

![](_page_38_Picture_2.jpeg)

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British Antarctic Survey

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![](_page_40_Picture_0.jpeg)

Norfolk coast - UK 1953 300 dead, 24,000 homes flooded

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#### Sea-level rise - Impacts in the developing world

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![](_page_43_Picture_10.jpeg)

#### Antarctica and sea level

**Bed elevation** 

![](_page_44_Picture_2.jpeg)

![](_page_44_Picture_3.jpeg)

![](_page_44_Picture_4.jpeg)

Source: BEDMAP

#### Antarctica and sea level

![](_page_45_Figure_1.jpeg)

Source: Unpublished

#### Surface ice-thickness change 1992-2003

**Intersit** 

Interingenter Stim

![](_page_46_Figure_1.jpeg)

Source: Wingham et al., 2006

#### Antarctica and sea level

- Satellite measurement of elevation change
- Amundsen Sea sector
- 0.043 mm / yr sea level rise (1991-2001)

![](_page_47_Figure_4.jpeg)

![](_page_47_Figure_5.jpeg)

![](_page_47_Picture_6.jpeg)

Source: Shepherd, Wingham and Mansley

![](_page_48_Picture_0.jpeg)

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British Antarctic Survey

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British Antarctic Survey NATURAL ENVIRONMENT RESEARCH COUNCIL

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![](_page_56_Picture_2.jpeg)

![](_page_57_Figure_1.jpeg)

![](_page_57_Picture_2.jpeg)

![](_page_58_Picture_1.jpeg)

![](_page_58_Picture_2.jpeg)

Data pre-2004/05

![](_page_59_Figure_2.jpeg)

![](_page_59_Picture_3.jpeg)

2004/05 data

![](_page_60_Figure_2.jpeg)

![](_page_60_Picture_3.jpeg)

Pre-2004/05 topography

![](_page_61_Figure_2.jpeg)

![](_page_61_Picture_3.jpeg)

New topography

![](_page_62_Figure_2.jpeg)

![](_page_62_Picture_3.jpeg)

![](_page_63_Picture_0.jpeg)

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![](_page_64_Picture_10.jpeg)

#### Antarctic and the media

![](_page_65_Figure_1.jpeg)

![](_page_65_Picture_2.jpeg)

#### Policy-maker

#### Scientist

![](_page_66_Picture_2.jpeg)

![](_page_66_Picture_3.jpeg)

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![](_page_68_Picture_0.jpeg)

![](_page_69_Picture_0.jpeg)

#### "Our most basic common link is that we all inhabit this planet. We all breathe the same air. We all cherish our children's future."

![](_page_69_Picture_2.jpeg)

# **Dr. David Vaugh**

![](_page_70_Picture_1.jpeg)

Dr. Vaughan is the principal investigator for British Antarctic Survey Core Program: Glacial Retreat of Antarctica and Deglaciation of the Earth System (GRADES). The opportunity to define and lead this program was won through open competition. GRADES will employ between12 and 20 staff and focus on aspects of past and future deglaciation as drivers of change in the Earth System.

In 2006 Dr. Vaughan was made Honorary Professor in the School of the Environment and Society, University of Wales, Swansea.

![](_page_70_Picture_4.jpeg)