AIMES/PAGES workshop
Abrupt changes, thresholds, and tipping points in Earth history and future implications
14-16 November 2018; MPI-M, Hamburg, Germany
Agenda
Wednesday 14 November 2018
Day 1: Plenary Talks on Tipping points in the Earth system and social systems. Talks are limited to 15 minutes with 15 minutes for discussion.

Key Questions
(i) How to define, identify, and anticipate tipping points from paleoclimate records and models?
(ii) What are key examples of abrupt changes, thresholds and tipping points in the paleorecord?
(iii) How can the paleo science influence our understanding of the tipping point problem?

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<tr>
<th>Time</th>
<th>Session</th>
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<tr>
<td>12:00 – 13:10</td>
<td>Welcome Coffee</td>
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| 13:10 – 13:30 | Welcome (Victor Brovkin and Ed Brook)  
- Objective of the Workshop  
- Workshop strategy and logistics  
- Address paper structure       |
| 13:30 – 14:00 | Implications of past tipping points for the Anthropocene  
Speaker: Tim Lenton          |
| 14:00 – 14:30 | Past and future tipping points of the Greenland and Antarctic ice sheets  
Speaker: Rob DeConto         |
| 14:30 – 15:00 | Critical transitions in the terrestrial biosphere - atmosphere system  
Speaker: Martin Claussen     |
| 15:00 – 15:30 | Abrupt ocean changes: modeling results and paleoclimate constraints  
Speaker: Andrey Ganopolski  |
| 15:30 – 16:00 | Coffee Break                                                          |
| 16:00 – 16:30 | Rapid changes in atmospheric carbon dioxide and the carbon cycle in the ice core record  
Speaker: Ed Brook             |
| 16:30 – 17:00 | Responses of Terrestrial Ecosystems to Environmental Change: Fast, Slow or Abrupt?  
Speaker: Jack Williams       |
| 17:00 – 17:30 | Tipping points, instability and modes of variability in marine environments as documented from paleo-records of mid-high latitudes of the Northern Hemisphere  
Speaker: Anne de Vernal      |
| 17:30 – 18:00 | Tipping points in early human history, and some lessons we can learn from them  
Speaker: Sander van der Leeuw |
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| 18:00 – 18:30| **Social and climatic tipping dynamics and their interactions in past, present and future**  
Speaker: Jonathan Donges |
| 18:30 – 19:00| Synthesis Discussion  
Chairs/Panel: Tim Lenton and Michel Crucifix |
| **Evening Free** | |
| **Thursday 15 November 2018** | |
| Day 2: Breakout group discussion and synthesis to summarize our state of knowledge and identify future research objectives | |
| 9:00 – 10:30 | Breakout Groups  
- Physical climate system (Leads: David McGee and Andrey Ganopolski)  
- Ecosystems (Leads: Anne de Vernal and Jack Williams)  
- Biogeochemical cycles (Leads: Rachael Rhodes and Thomas Kleinen)  
- Social systems (Lead: Sander van der Leeuw) |
| 10:30 – 11:00| Coffee Break |
| 11:00 – 12:30| Breakout Groups – continuation  
- Physical climate system  
- Ecosystems  
- Biogeochemical cycles  
- Social systems |
| 12:30 – 14:00| Lunch |
| 14:00 – 14:20| Synthesis Discussion/Summary Prep |
| 14:20 – 14:40| Reports from Breakout Groups and discussion  
I. Physical climate system  
II. Ecosystems |
| 14:40 – 15:00| Reports from Breakout Groups and discussion  
III. Biogeochemical cycles  
IV. Social Systems |
| 15:00 – 15:30| Coffee Break |
| 15:30 – 15:50| Reports from Breakout Groups and discussion  
III. Biogeochemical cycles  
IV. Social Systems |
16:10 – 17:00  Synthesis Discussion
- Revisit paper structure outline
- Determine breakout group writing tasks for tomorrow
- Identify writing team and leads for sections

17:00 – 18:00  Questions and Answers
   Chairs: Ayako Abe-Ouchi and Jerry McManus

19:00 – 22:30 Workshop Dinner

Friday 15 November 2018
Day 3: Breakout writing groups; Plenary on future plans and action items and contribution to IPCC AR6.

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<tr>
<td>9:00 – 10:30</td>
<td>Planning and writing session in breakout groups</td>
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<tr>
<td>10:30 – 11:00</td>
<td>Coffee Break – return to plenary room</td>
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<tr>
<td>11:00 – 11:30</td>
<td>Future plans, action items, deadlines</td>
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<td>Leads: Ed Brook and Victor Brovkin</td>
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<td>11:30 – 12:00</td>
<td>Contributions to IPCC AR6</td>
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<td>Speaker: Darrell Kaufman</td>
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<td>12:00 – 13:30</td>
<td>Lunch</td>
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<td>13:30 – 16:00</td>
<td>Writing session for remaining participants</td>
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Goal: Summary report of the breakout groups and synthesis, plan review paper summarizing the state of our knowledge and identifying future research objectives.
Participants

Ayako Abe-Ouchi
University of Tokyo
Japan

Beniamino Abis
Max Planck Institute for Meteorology
Germany

Michael Barton
Arizona State University
United States

Sebastian Bathiany
Wageningen University
Netherlands

Ed Brook
Oregon State University
United States

Victor Brovkin
Max Planck Institute for Meteorology
Germany

Hai Cheng
Xi'an Jiaotong University
China

Martin Claussen
Max Planck Institute for Meteorology
Germany

Michel Crucifix
UC Louvain
Belgium

Rob DeConto
University of Massachusetts, Amherst
United States

Anne de Vernal
Université du Québec à Montréal
Canada

Marie-France Loutre - PAGES
University of Bern
Switzerland

Jochem Marotzke
Max Planck Institute for Meteorology
Germany

David McGee
Massachusetts Institute for Technology
United States

Jerry McManus
Lamont-Doherty Earth Observatory
United States

Thomas Kleinen
Max Planck Institute for Meteorology
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Kira Rehfeld
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Rachael Rhodes
University of Cambridge
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Alistair Seddon
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Sander van der Leeuw
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Fabrice Lambert
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