Growing Societal Partnerships for Climate Resilience through Collaborative Storytelling

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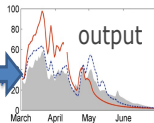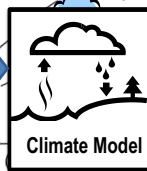
With thanks for Linda Shenk (Dept. of English) & Brandon Fisel (Dept. of Geol. & Atmos. Sci.)

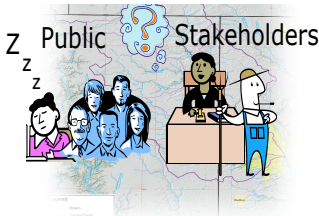# Informing Concerns of Community Partners

➤ **How to use the large volume of data?**

➤ **How to produce information that is relevant, credible and actionable?**

Common Climate Modeling Study

Researchers

Climate Model

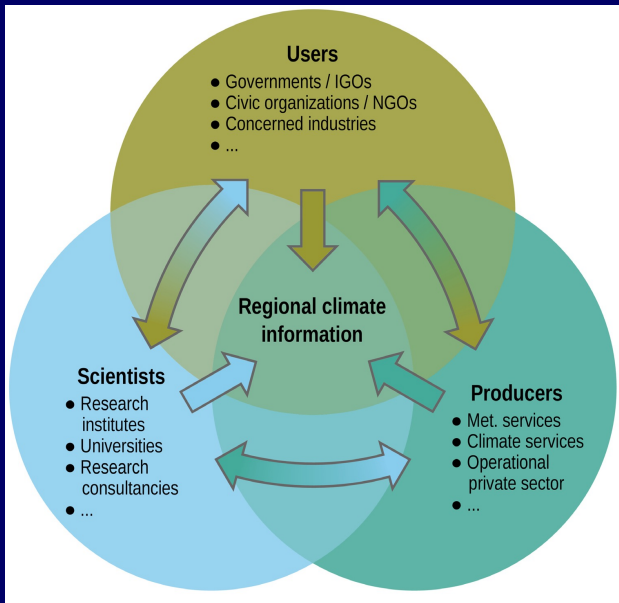output

Results

Users of Climate Information??

Public Stakeholders

Researchers

Co-creating Knowledge: A New Paradigm

Emphasis:
- ➢ relationships
- ➢ equity
- ➢ creativity
- ➢ values

Users
- Governments / IGOs
- Civic organizations / NGOs
- Concerned industries
- ...

Regional climate information

Scientists
- Research institutes
- Universities
- Research consultancies
- ...

Producers
- Met. services
- Climate services
- Operational private sector
- ...

(IPCC AR6 WG1, Ch. 10)

A Co-Creation Pathway: Storytelling

- Allows for diverse ways of knowing
- Connects personal experience and local knowledge with scientific systems
- Fosters creativity, connection, and relationship-building
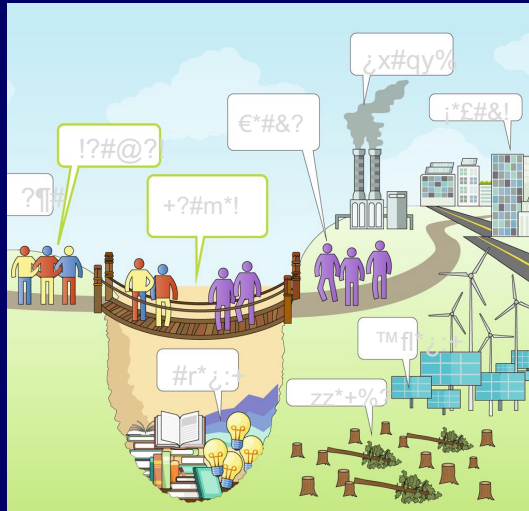
(adapted from Irwin et al., 2018)

A Storytelling Lesson from Shakespeare!

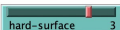☞ **Why are the families feuding so intensely in *Romeo and Juliet* ?**

A Storytelling Assistant: Community Environment Model
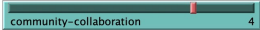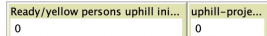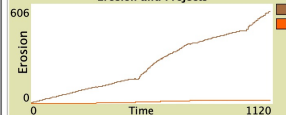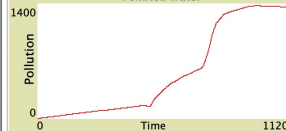
**Contrast with leading-edge climate models:
How can something so simple help??**

A Storytelling Assistant: Community Environment Model

Gaps of
- ➤ **Nonspecificity**
- ➤ **Multiplicity**
- ➤ **Revision**
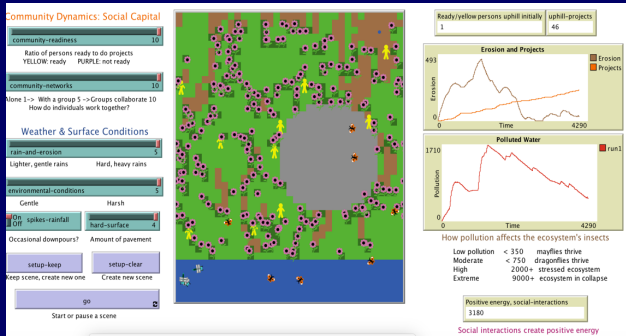
Model's gaps = space for partner's stories
~ An Accessible, Evocative Tool ~

Storytelling with Our Partners

Goals:
- ❖ Fostering relationships, equity, creativity and recognition of values
- ❖ Listening to partners' stories: what was impactful, memorable weather and climate?
- ❖ Recognizing the authority of all participants
- ❖ Going beyond individual narratives to collective understanding among all
- ❖ Filling understanding gaps by "layering diverse knowledges" (Hulme, 2018)
- ❖ Creating a "cognitive ecosystem" among all partners
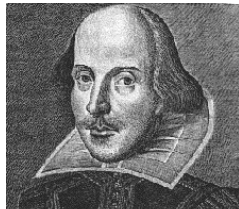
Outcome: Meaningful climate information

Climate Model Stories: Storylines

❖ "Tales of Future Weather" (Hazeleger et al. 2015)

❖ "… a physically self-consistent unfolding of past events, or of plausible future events or pathways." (Shepherd et al., 2018)

Motivations:

1) Societal engagement: **What are memorable/impactful weather or climate events?**

2) How well do models represent these events?
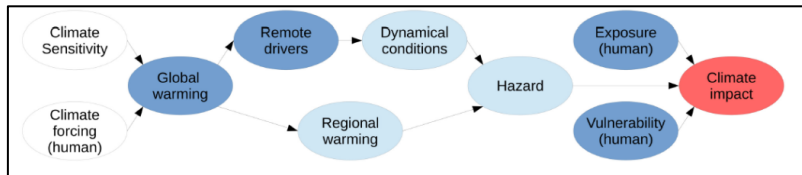
(Adapted from Shepherd, 2019)

Storylines from Tracking Events

Approach: Object-oriented analysis

Tempest Extremes: Software tracking 3-D space-time objects
(Ullrich & Zarzycki, 2017)
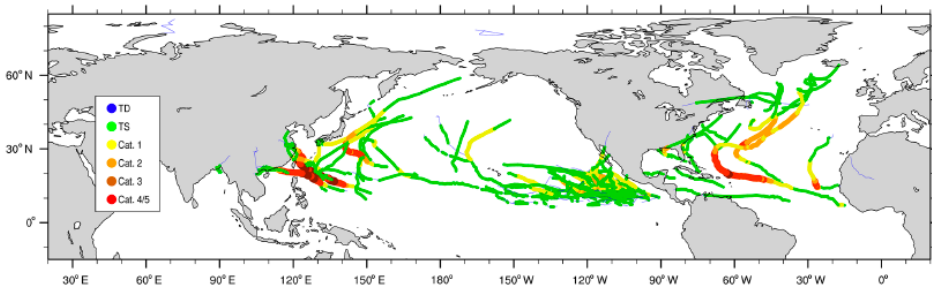
**Here - objects of daily
precipitation :**
➜ Interpreted as events
➜ Yields event storylines

Storylines from Tracking Events

Approach: Objects from Tempest Extremes

Example: Objects of erosion-producing Feb-Mar-Apr precip. events

➡ NOTE:
"Event" = Daily precip ≥ 32 mm (1.25 inches) at locations in a space-time volume

Number of Events over 20 Years
(1981-2000) & (2041-2060)

Sim1: 1981-2000
Sim1: 2041-2060
Sim2: 1981-2000
Sim2: 2041-2060

Number of Events
Month
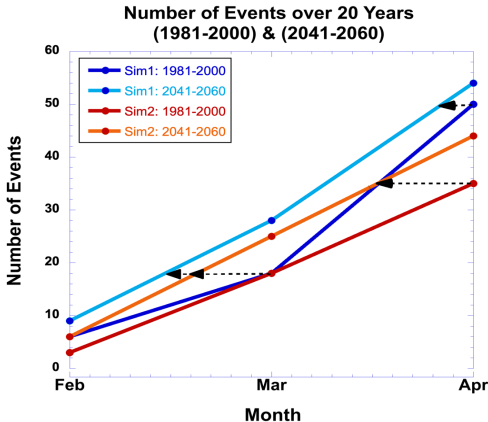
Storyline: Erosion events will occur ~2 weeks earlier, promoting more erosion unless land management changes

Concluding Thoughts

▶ Object-oriented analysis: a natural focus on events, especially community-defined, high-impact events

▶ The events ➔ ➔ decision-relevant storylines motivated by interactions with community partners

▶ Can combine events of different types ➔ compound events

▶ Flexible: can build on experiences, concerns, perspectives, values of all involved

▶ Promotes co-exploration of climate simulations and, thus, co-production of climate knowledge that is relevant, credible and actionable ...

▶ ... which, in turn promotes appropriate responses.

Co-created storylines yield action for climate resilience
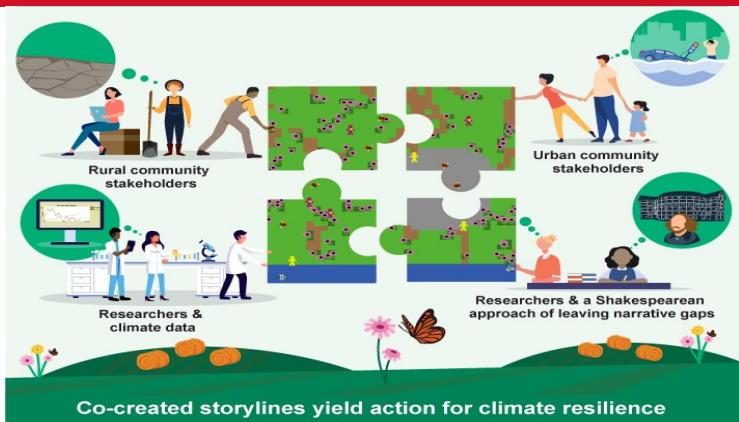
Shenk and Gutowski, 2022: Mind the gaps! Co-producing storylines with stakeholders, using lessons in collaborative storytelling from William Shakespeare. *WIRES Climate Change* [DOI: 10.1002/wcc.783].

Shenk, Franz and Gutowski, 2023: Minding the Gaps to S(t)imulate Collaborative Storytelling: How Humanists, Climate Scientists, and Communities Can Co-Produce Narratives for Action. *Environmental Humanities* (in press).

Extra Slides

Storylines from Tracking Events

Approach: Object-oriented analysis

Tempest Extremes: Software tracking 3-D space-time objects (Ullrich & Zarzycki, 2017)
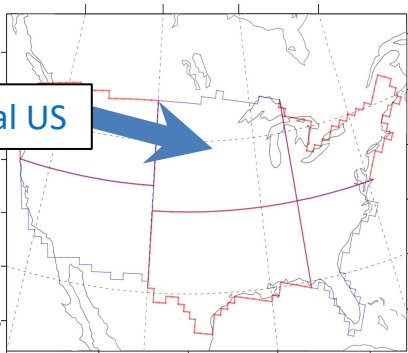
Here - objects of drought and heat stress ➡ Interpreted as events
Yields event storylines

Analysis Region: North Central US

(Modified IPCC SREX analysis regions for contiguous U.S.)

Event Objects: Short-Term Drought

Ag. Motivation: Undermines pollination, promotes high T?

40-Day low-precip events: Cumulative precipitation ≤ 25 mm
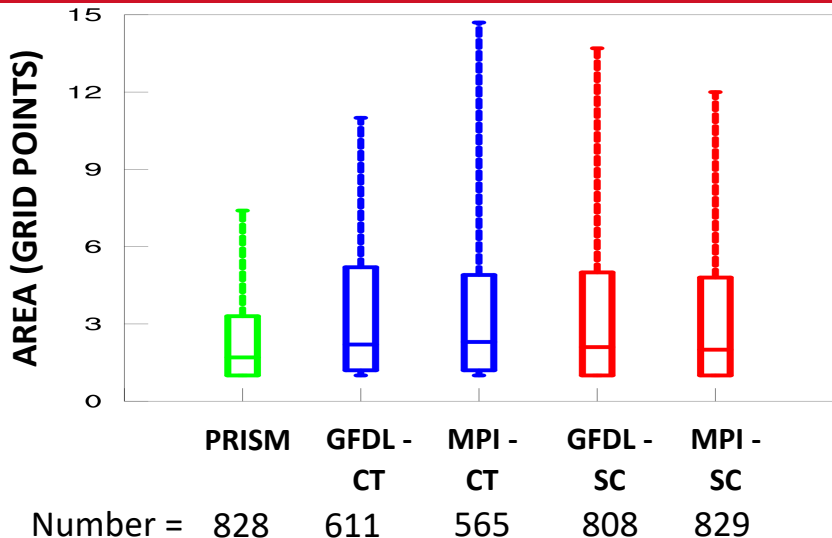
"Season": April-May-June-July

Observations:

► PRISM: Parameter elevation Regression on Independent Slopes Model (4-km → aggregated to 25-km grid)

► Time period: **1981-2000**

Model Simulations:

► RegCM4 (25-km grid spacing)

► Boundary conditions: GFDL & MPI (Contemporary & RCP8.5)

► Time periods: **1981-2000** and **2041-2060**

Short-Term Drought: Object Areas

Event Objects: Heat Stress

Ag. Motivation: Temperatures exceeding optimum

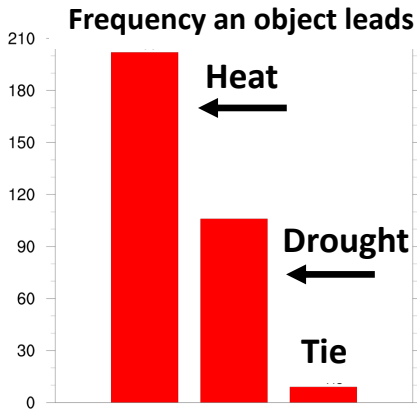**5-D heat-stress events:** Average Tmax $\geq$ 30°C

"Season": April-May-June-July

Same Observations & Simulations

When heat-stress and drought objects overlap, which comes first?
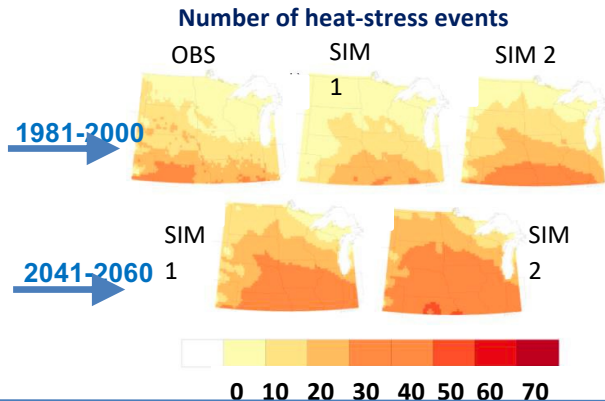
PRISM →

Frequency an object leads

Events: Crop Heat Stress & Short-Term Drought

Ag. Motivations: Inhibited crop development

5-D heat-stress events: Average Tmax $\geq$ 30°C

40-Day low-precip events: Cumulative precipitation $\leq$ 25 mm

"Season": April-May-June-July

Number of heat-stress events

OBS SIM 1 SIM 2

1981-2000

SIM 1 SIM 2

2041-2060

0 10 20 30 40 50 60 70

For both types:
1. Frequency is biggest change.
2. Area & duration change little.
3. Heat stress usually leads drought.
4. Compound events much more extreme

What could be a decision-relevant storyline?

Qualitatively:

☞ **Short-term drought and heat-stress events will become more frequent, but area and duration will not change.**

☞ **Watch for heat stress as a potential precursor, especially ...**

☞ **... because when drought and stress are they will both tend to be more intense.**

Can quantify as needed.

Compound Events: Short-Term Drought & Heat Stress

➤ Climate change: Drought freq. ⬆ & Heat-stress area ⬆

➤ Drought & heat stress: heat stress precedes drought

➤ Drought + heat stress (compound) events tend to be more extreme than individual events.

What could be a decision-relevant storyline?

Qualitatively:

☞ **Short-term drought events will become more frequent, though area and duration will not change.**

☞ **Watch for heat stress as a potential precursor, especially …**

☞ **… because when drought and stress are simultaneous, they will both tend to be more intense.**