A guide to real time weather in computer games

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Intent of this presentation

› Give an overview of weather in games
› Starting point for weather system design
› Highlight what weather can do
Why bother with weather?

› Easier for player to fit in
› More habitable worlds
› Worlds bigger than character
Topics

› Weather systems
› Weather zones
› Designing a weather system
Systems

- Temperature
- Rain-/Snowfall
- Day/Night cycle
- Clouds
- Fog
- Wetness
- Wind
- Vegetation
- Water
- NPCs
Temperature

Reality:

› Heated metals and black body radiators
› Summer sky vs. Winter sky
› Illusion of warm/cold
Temperature

Outcomes:
› Feeling of temperature
› Ambiance
Temperature

Games:

› Warmer/cooler light sources
› Hue change overlay
› Convey humidness for hotness
› Convey windiness for coldness
Minecraft - https://minecraft.gamepedia.com/File:Desert_Hills.png
https://minecraft-seeds.net/seed/1.0.0/wat/
Rain-/Snowfall

Reality:
› Rain clouds → rain (or other)
› Also thunder
Rain-/Snowfall

Outcomes:

› Living world
› Thunder
  › Scary
  › Temporary illumination
› Gameplay changes → less visibility, environment interactions
Rain-/Snowfall

Games:
- Falling droplets
  - What
  - Where
  - Hit something
- Wet camera
- Thunder
Heavy rain - https://www.pressfire.no/nyheter/PS3/6435/Heavy-Rain-komponisten-har-gtt-bort
Wetness

Reality:
  › Lots of water → Dampness → rain → puddles
Wetness

Outcome:

› More humid world $\rightarrow$ feels hotter
› Realistic water buildup
› Gameplay changes
Wetness

Games:
  › Puddle shader
  › Dampness shader
Day/Night cycle

Reality:
› Earth rotates around sun and axis
› Rayleigh Scattering + human color perception
› Moving shadows
› Almost every living thing reacts to this cycle
Day/Night cycle

Outcomes:
- Living world
- Day is peaceful
- Night is scary
- Gameplay changes
Day/Night cycle

Games:
› Directional light angle changes
› Realtime shadows
› Rayleigh Scattering shader
› NPC state change
› Vegetation state changes
Clouds

Reality:
- Part of earth water cycle
- Shape, size controlled by humidity, temperature, wind
Clouds

Outcomes:

› Give a sense of realism
› Make world feel bigger than player
Clouds

Games:
› Skybox
› Floating objects
› Volumetric clouds
Fog

Reality:
  › When given enough air visible light will noticeably scatter
Fog

Outcome:

› Far away objects can be drawn cheaply with only silhouettes in some cases
› Far away objects can seamlessly disappear
› Ambiance
Fog

Games:
  › Depth fog
  › Billboard fog
  › Volumetric fog
Overgrowth - https://store.steampowered.com/app/25000/Overgrowth/
Wind

Reality:
› Air expands/contracts creating wind
› Everything not bolted to the ground moves
› Some living things depend on wind to survive
Wind

Outcome:
› Living world
› Gameplay → interactable objects move
Wind

Games:
Wind zones (noise) →
› Flora bend shader
› Light objects move
› Waves appear on water
› Dust moves
Witcher 3 -
Vegetation

Reality:
› Reacts to temperature, humidity, daylight etc
› Moves with wind
› Goes into a protective state when conditions are bad
› Leaves fall
Vegetation

Outcome:
› Plants and trees that react to weather
› Living world
Vegetation

Games:

- Vegetation made of leveled branches
- Open/closed states for blossoms
- Falling leaf particles
- Seasonal states for flora
Gothic 3 - https://www.neogaf.com/threads/gothic-3-one-of-the-most-underrated-rpgs-ever.1358140/
Water

Reality:
Forces create waves →
Waves splash into objects
Water level changes in some places
Water

Outcome:

› Living world
› Real feeling water
› Good level separator
Water

Games:
- Water shader reacts to wind by creating waves
- Some waves collide with objects
Animals

Reality:
Animals behaviour changes with the weather
NPCs

Outcome:

› Living world
› Lots of gameplay changes
NPCs

Games:
- AI state changes
- AI avoids rain-/snowfall
- AI goes to sleep
- etc
If it starts to rain, they will seek shelter in their homes.
Zones

- Grassland
- Forest
- Beach
- Ocean
- Desert
- Town
- Mountains
Grassland
Beach

Risen - picture taken by me
Ocean
Mountains
Making a weather system

› Does your game need it?
  › Would static weather suffice

› Do you have the resources?
  › Cost varies from cheap to very expensive
What to keep in mind when creating a weather system

› Character should interact with weather
› Gameplay should be effected
› Don’t forget about sound
That's a wrap
Used materials

› Day/Night
  › https://www.reddit.com/r/gamedesign/comments/6actu9/are_daynight_cycles_in_open_world_games_almost/

› Clouds
  › https://sciencing.com/clouds-made-5393253.html
  › https://www.youtube.com/watch?v=LLUUIAKFgWg&t=0s

› Wind
  › https://docs.unity3d.com/Manual/terrain-WindZones.html
  › https://www.youtube.com/watch?v=Lz8wEsvCWMs

› Vegetation
  › https://80.lv/articles/vegetation-creation-techniques-for-video-games/

› Water
  › https://www.pcgamer.com/the-best-water-in-pc-games/

› General
  › http://gamestudies.org/0801/articles/barton
Used materials

› Horizon zero dawn cloud presentation
  › http://advances.realtimerendering.com/s2015/The%20Real-time%20Volumetric%20Cloudscapes%20of%20Horizon%20-%20ARTR.pdf

› Rain
  › https://www.pcgamer.com/how-developers-make-perfect-rain-in-games/

› Scishow humidity → hotness
  › https://www.youtube.com/watch?v=SGHRz8wpj3E

› Fog
  › https://unity3d.com/learn/tutorials/topics/unity-artists/volumetric-fog-fog-volume-3