Climate models have improved in spatial resolution
Climate models have improved in spatial resolution
Climate models have continued to be developed and improved since the AR4. Many models have been extended into ESMs by including biogeochemical cycles.
AR5 assesses three types of model: AOGCMs
AR5 assesses three types of model: ESMs

ESMs: + aerosols, atmospheric chemistry, land carbon, ocean BGC
AR5 assesses three types of model: EMICs

<table>
<thead>
<tr>
<th>Model name</th>
<th>Atmos</th>
<th>Ocean</th>
<th>Land Surface</th>
<th>Sea Ice</th>
<th>Coupling</th>
<th>Biosphere</th>
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Increasing Complexity (light to dark):

- EMBM
- 2-Box
- NST/NSM
- None
- SD
- Q-flux ML
- LST/NSM
- BO
- QG
- FG
- LST/BSM
- BO,BT
- PE
- PE
- LST/CSM
- BO,BT,BV
The ability of climate models to simulate surface temperature has improved in many, though not all, aspects relative to AR4.
The ability of climate models to simulate surface temperature has improved in many, though not all, aspects relative to AR4.
Very high confidence that models reproduce the global-scale annual mean surface temperature increase over the historical period.
The simulation of large-scale precipitation has improved somewhat since the AR4, although models continue to perform less well for precipitation than for surface temperature.
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Not everything is perfect

Clouds, biases in NH storm tracks
Major improvements in some areas

Arctic sea ice, tropical Pacific, capacity to simulate the carbon cycle
There has been substantial progress since the AR4 in the assessment of model simulations of extreme events.
There has been substantial progress since the AR4 in the assessment of model simulations of extreme events.
ArctSIE - Seasonal cycle Arctic sea ice extent
Blocking - Blocking events
CRE - Cloud radiative effects
Monsoon - Global monsoon
NBP - Global land carbon sink
PR - Large scale precipitation
PR-diur - Diurnal cycle precipitation
PR-RS - Regional scale precipitation
SMO - Soil moisture
SNC - Snow cover
SST - Sea surface temperature
TAS - Large scale surface air T
TAS-diur - Diurnal cycle surface air T
TAS-RS - Regional scale surface air T
TrSST - Tropical sea surface T
TrInOcean - Tropical Indian Ocean mean state
TrPacific - Tropical Pacific mean state
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Degradation since CMIP3
No changes since CMIP3
Improvements since CMIP3
No relative assessment CMIP3 vs. CMIP5
AntSIE-t - Antarctic sea ice
ArctSIE-t - Arctic sea ice
fgCO2-t - Global ocean carbon sink
LST-t - Lower stratospheric T
NBP-t - Global land carbon sink
OHC-t - Global ocean heat content
TotalO3-t - Total column ozone
TAS-t - Surface air T
TTT-t - Tropical tropospheric T
ENSO El Niño Southern Oscillation
ENSOtele Tropical ENSO teleconn.
IOD Indian Ocean dipole
IPO Interdecadal Pacific Oscillation
MJO Madden-Julian Oscillation
PDO Pacific Decadal Oscillation
SAM Southern Annular Mode
- PR-ext Global distributions of P extremes
- PR-ext-hr Global distribution of P extremes in high-resolution AGCMs
- PR-ext-t Global trends in P extremes
- TAS-ext Global distributions of T extremes
- TAS-ext-t Global trends in T extremes
- TC Tropical cyclone tracks and intensity
- TC-hr Tropical cyclone tracks and intensity in high-resolution AGCMs
- Droughts Droughts
Summary

Climate models have continued to be developed and improved since the AR4

Temperature, temperature variability, temperature extremes and temperature trends simulated well

Rainfall more challenging – improved since AR4 but remains less reliable than temperature

Climate models have much improved capacity in simulating many extremes