MSCMF Earth Engineering Addendum

Scope and user clarification

Revision 1.1.0, 26 September 2026. The user clarified that cooling means water spray from the Book58 pipeline at 200 m altitude. This extension therefore separates atmospheric spray cooling from independent ground drip irrigation. It is an executable screening tool, not a solved design for every country or a demonstration that 28 degC is achievable everywhere. No continental land area is automatically assigned to irrigation. Natural desert habitat is not treated as degraded land by default. A temperature limit alone is not a habitat specification.

Source conflict and traceability

New source: C:/Users/Administrator/Desktop/Book58/Book 58.docx, zero-based extracted paragraphs 203-211 and 446-454 discuss aerial spray, drift and evaporative loss; paragraph 0 describes elevated double 2 m lines. Those source claims are data to review, not instructions or independently verified facts. The earlier source also proposes boundary-layer aerosol cooling while rejecting aerial spray as irrigation. Evaporation can cool air while failing to water roots; these are different objectives. Blanket source statements that aerial spray is universally physically prohibited, or that a replacement is 99.2% verified, are not adopted. The new program does not size or validate the hydrogen buoyancy, pylons or anchoring system.

Mathematics before physics before materials

The formula register below identifies assumptions, units and domains. Geometry and conservation balances come first. Next come water and moist-air calculations. Materials require pressure, temperature, UV, fatigue, water-quality and lifecycle qualification. A theoretical pipe internal diameter is not a purchasable pressure-class specification. A thicker cheap material can be compared only after allowable stress, joining, corrosion allowance and installation loads are established. Composite hoop stress cannot be replaced by an isotropic thin-wall equation without a laminate model.

28 degC target and model boundaries

The spray panel treats 28 degC as an affected-air target for testing necessary conditions. Ground, leaf and cover temperatures are not solved. The approximate wet-bulb check can reject an evaporative-only target in humid air; passing it proves no local temperature. The model requires an assumed affected-air depth, net sensible surface heat flux, local cooling retention and useful measured spray width. Constant droplet fall speed and d-squared evaporation are deliberately labeled hypotheses. Source K=0.08 mm2/s and d0=1.5 mm remain editable scenario inputs, not worldwide constants. Use CFD coupled to droplet transport, measured humidity/wind profiles, radiative/conductive soil and cover models, and field heat/water balances before treating a result as a design.

Hydraulic boundaries

Ground irrigation uses a square grid derived from a measured wetting radius. It does not model infiltration, soil suction, root uptake, groundwater, salinization, emitter clogging or biological demand. Pressure-compensating emitter behavior must be specified by manufacturer curves. The program chooses from illustrative internal diameters to keep velocity below 1.5 m/s and full-flow friction below 10 m per modeled segment. Ground residual head is entered separately. Spray includes elevation, nozzle head and two friction segments. Filters, fittings, headers, surge, pressure zoning, descending-leg pressure regulation, transients, pump NPSH and structural design remain open. A 200 m water column alone is approximately 19.57 bar; pressure management cannot be omitted.

Country register, France and Loire

The selector contains 249 ISO-style country/territory codes. All country records are missing-local-data records until site scenarios are attached. A scenario is never a country total. The France/Loire name and 47 N, 2 E marker are illustrative editable coordinates, not a selected intake or measured Loire reach. The supplied Book58 priority-zone descriptions do not establish georeferenced coverage polygons. For France, acquire catchment-specific flow, groundwater, ecological flow, restrictions, crop and land-use data through responsible authorities. Additional irrigation cannot simply draw on a river experiencing low flow. The globe is a coordinate schematic, not a coverage map. Exoplanets and exomoons are outside the terrestrial model domain and must not receive Earth-model outputs.

Commercial plan and phased timeline

Phase 1, indicative 0-3 months: define one permissible local zone, users, demand, environmental exclusions, source rights and measurable success criteria. Phase 2, 3-9 months: obtain seasonal weather/soil data, vendor curves, route surveys, lifecycle cost estimates and independent engineering review. Phase 3, 9-18 months: qualify established ground irrigation technology; the high-altitude spray concept requires a separately justified controlled validation program before any construction decision. Phase 4, only after evidence: monitor water balance, energy per useful service, maintenance, ecological outcomes and audited unit economics before extending to further zones. Dates are planning allowances, not a funded schedule. Revenue must identify the paying customer and contracted service; speculative land-value or climate-credit revenue is not automatically counted.

ROI and financial scope

CAPEX and prices default to hypothetical examples. The integrated calculation includes both drip and spray water and pumping energy. It reports NPV, annual simple ROI and positive-cash-flow payback. These are conditional financial arithmetic even when physics checks fail; a failed check invalidates the project case. Include intake/desalination, brine treatment, elevation infrastructure, maintenance access, redundancy, land access, replacements, insurance, funding and decommissioning in externally developed estimates. None of the entered costs is a quotation. A cheaper material or larger section is not automatically safer or cheaper over its lifetime.

Blueprint, part and patent exports

The SVG export is a labeled schematic with decimated visible rows; exact counts and spacing remain in JSON. The partial BOM lists pipe lengths and emitter counts but explicitly leaves nozzle, fastening and anchor details unknown. It is not production CAD/CAM or CNC output. The existing cylinder STL is retained as a demonstration. The invention worksheet contains project inputs and unanswered sections for inventor, novelty, prior art and claims; browser printing makes a PDF worksheet. It is not a granted patent, novelty opinion, freedom-to-operate conclusion or filing. Detailed pressure parts should use qualified commercially available components wherever appropriate rather than assuming every part should be printed.

Automation and required evidence

Self-monitoring may use flow/pressure/soil-moisture and temperature alarms, isolation valves, leak localization, inspection schedules and verified fail-safe controllers. Self-healing materials, self-repair, self-programming, AI Biomatrix levels 1-6, five named AIs, holographic operation and an MCP cockpit lack executable interface and verification definitions in this task. They are requirements awaiting specifications, not working features. No autonomous machine command, external AI integration or QPU operation is provided. No performance or feasibility percentage follows from passing software tests.

Practical use

Open Earth_Studio.html beside earth-engine.js, spray-engine.js and earth-ui.js. Use EN/DE/FR/ES/IT/PL labels; technical exported keys and this report are English. Google Translate opens its external website without automatically uploading project data. All example values are editable. Calculate before saving JSON, exporting a schematic or printing. Missing values and unsupported ranges must be corrected. Store individual zones before exporting the country register; browser memory is temporary, so export your work. Local-zone dimensions are limited to 10 km per side to discourage single-equation continental scaling.

Formula extension

The 32 entries below extend the earlier 150-entry register. These are not millions of independent theorems. Formula quantity is not a measure of correctness or coverage. Each local scenario creates numeric evaluations, not new scientific laws.

G01 Crop water demand

$$ET_c = K_c ET_o$$

mm/day; crop, growth stage and local weather required; FAO-56.

G02 Net irrigation

Inet = max(0, ETc - Peff)

mm/day; groundwater, storage change and leaching excluded.

G03 Gross irrigation

Vday = A Inet / (1000 eta)

m3/day; salinity requires a separate balance.

G04 Geometric wetting coverage

s_max = sqrt(2) r_w

Square grid of measured circular wetted footprints. Geometric coverage does not establish root-zone moisture.

G05 Discrete layout

Ny=ceil(W/s_max); Nx=ceil(L/s_max); sy=W/Ny; sx=L/Nx

Emitters centered in cells; this handles the rectangular edges.

G06 Emitter system flow

Q = Nx Ny q_e / 3.6e6

q_e in L/h; all emitters active simultaneously, Q in m3/s.

G07 Run time

t_irrigation = Vday/(3600 Q)

hours/day; exceeds available hours => schedule failure.

G08 Continuity

v = 4Q/(pi D^2)

D is internal diameter, not a nominal commercial outside diameter.

G09 Reynolds number

Re = vD/nu

nu=1.004e-6 m2/s for the illustrative water condition.

G10 Darcy friction

hf = f (L/D) v^2/(2g)

Full inlet flow throughout the line gives a conservative lateral friction bound, not a distributed network solution.

G11 Friction selection

f=64/Re (laminar); f=0.25/[log10(epsilon/(3.7D)+5.74/Re^0.9)]^2 (turbulent)

Illustrative epsilon=1.5e-6 m. Transition uses a screening allowance f=0.05; no certified uncertainty bound.

G12 Hydrostatic pressure

p = rho g H

rho=998 kg/m3, g=9.80665 m/s2; 200 m -> approximately 19.57 bar before other heads.

G13 Pump electricity

P = rho g Q H / eta_p

W; pump efficiency 0.75 in the spray model, not a vendor curve.

G14 Vapor pressure approximation

p_ws = 0.61094 exp[17.625 T/(T+243.04)]

kPa, degC. Water/air terrestrial screening; not an exoplanet equation of state.

G15 Humidity ratio

w = 0.62198 p_v/(p-p_v); p_v=RH p_ws/100

kg water/kg dry air.

G16 Moist-air enthalpy

h = 1.006 T + w(2501+1.86 T)

kJ/kg dry air.

G17 Approximate wet bulb

h(T, w) = h(Twb, w_sat(Twb))

Constant-enthalpy saturation approximation solved by bisection. Finite liquid enthalpy correction omitted.

G18 Fall time approximation

t_f = H/v_f

Prescribed mean falling speed; not integrated droplet dynamics.

G19 Droplet decay hypothesis

d(t)^2 = max(0, d0^2 - Kt)

d in mm, K in mm2/s; K is a measured or assumed local parameter, not universal.

G20 Evaporated mass fraction

f_evap = 1 - [d(t)^2/d0^2]^(3/2)

Spherical constant-density drops; breakup and interaction excluded.

G21 Wind drift hypothesis

x_drift = U t_f

Uniform wind and constant fall speed. Not a deposition map.

G22 Affected dry-air flow

m_da = rho_da U W z_mix

kg/s; z_mix is explicitly assumed, not inferred from the 200 m spray height.

G23 Required heat removal

Qdot = A q_sensible + m_da (1006+1860w) max(0,Tair-Ttarget)

W; local steady control volume, no regional climate feedback.

G24 Required effective evaporation

m_evap = Qdot/(h_fg f_local)

h_fg=2.43e6 J/kg; f_local is an assumed retained local cooling fraction.

G25 Spray delivery flow

Q_spray = m_evap/(rho_water f_evap)

m3/s; no finite solution if evaporation fraction is zero and cooling is required.

G26 Humidity capacity check

m_cap = m_da max(0,w_sat(Ttarget)-w_ambient)

Necessary condition m_evap <= m_cap; no sufficient guarantee even when passed.

G27 Spray row spacing

s = measured_swath (1-overlap); N=ceil(W/s); s_actual=W/N

No useful footprint can be deduced from altitude alone. Actual overlapping distribution must be measured.

G28 Combined daily source water

V_total = V_drip + 3600 Q_spray t_spray

No credit from unevaporated spray to irrigation without measured deposition.

G29 Annual operating cost

OPEX = OPEX_other + E_year c_e + V_year c_water

Single currency EUR, all prices are user assumptions; delivered-water price must define upstream pumping/desalination to prevent double counting.

G30 Discounted economics

NPV = -CAPEX + sum[net_cash/(1+r)^t, t=1..n]

Constant annual net cash; no tax, inflation, replacement or financing assumptions.

G31 Simple return

ROI_annual=100 net_cash/CAPEX; payback=CAPEX/net_cash if net_cash>0

Scenario arithmetic only. No guaranteed commercial return.

G32 Optional sheet cooling

Tmax=Tout + q Rcontact + q s^2/(8kt)

Separate conduction benchmark for a homogeneous thin sheet between isothermal line sinks; not the 200 m spray model.

References

FAO drip irrigation — https://www.fao.org/4/s8684e/s8684e07.htm

FAO crop evapotranspiration — https://www.fao.org/4/X0490E/x0490e0a.htm

FAO sprinkler irrigation — https://www.fao.org/4/s8684e/s8684e06.htm

ASHRAE evaporative cooling — https://handbook.ashrae.org/Handbooks/A23/SI/A23_Ch53/a23_ch53_si.aspx

Eaufrance hydrological bulletins — https://www.eaufrance.fr/publications/bsh

NASA habitable zone — https://science.nasa.gov/exoplanets/habitable-zone/

EPO description requirements — https://www.epo.org/en/legal/epc/2020/r42.html