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clear global
clearvars
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%% BEGIN CODE: ORGANIZE ALL CONSTANTS AND VALUES [=] SI units
S = 0.01; % approx. topographic slope [=] m/m derived from QGIS profile tool
g = 9.81; % gravity
Cd = 0.5; % approx. drag coefficient for a rough boulder
k = 0.4; % von karman's constant
rhorock = 2650; % density of granite
rhowater = 1000; % denisty of water
deltarho = rhorock-rhowater; % bouyant density of the boulders
width1 = 80; % channel width approximation [=] meters
width2 = width1; % channel width approximation [=] meters
D84 = 0.75; % 84th percentile of the grain sizes on the bed
Ro = D84/2; % half that for the radius
z_o = 0.1*D84; % bed roughness

%% BOULDER DATA
N1 = 47; % number of boulders measured on terrace 1
N2 = 24; % number of boulders measured on terrace 1
D1 = 3.75; % mean boulder diameter for terrace 1 (statsitical average)
D2 = 6.80; % mean boulder diameter for terrace 2 (statsitical average)
R1 = D1/2; % mean boulder radius for terrace 1
R2 = D2/2; % mean boulder radius for terrace 2
rad1 = asin(Ro/(R1+Ro)); % angle1 in geometry of torque [=] radians
rad2 = asin(Ro/(R2+Ro)); % angle2 in geometry of torque [=] radians
angle1 = rad1*(180/pi);
angle2 = rad2*(180/pi);
cosangle1 = cos(rad1);
cosangle2 = cos(rad2);

%% UNCERTAINTIES IN FLOOD BOULDER DATA
uD1 = 0.24; % uncertainty in D1 --> standard deviation of the mean
uD2 = 0.33; % uncertainty in D2 --> standard deviation of the mean
uR1 = uD1/2; % uncertainty in R1
uR2 = uD2/2; % uncertainty in R2
r1 = (R1*Ro)/(R1+Ro); % gravtitationl torque lever arm 1
r2 = (R2*Ro)/(R2+Ro); % gravtitationl torque lever arm 2

%% FLOODWATERS HEIGHT CALCULATIONS:
height1 = (1/S)*(k^2)*(1/(Cd*1.2))*(Ro/(R1+Ro))*(D1/cosangle1)*(deltarho/rhowater);
height2 = (1/S)*(k^2)*(1/(Cd*1.2))*(Ro/(R2+Ro))*(D2/cosangle2)*(deltarho/rhowater);

%% PALEOLAKE GEOMETRIES DERIVED FROM FIELDWORK, GOOGLE EARTH, AND QGIS:
A1 = 7.4; % area of clear creek lake [=] km^2
h1 = 0.025; % mean depth of paleo clear creek lake [=] km
A2 = 45; % area of Clear Creek lake [=] km^2
h2 = 0.04; % mean depth of the Granite lake [=] km
v1 = A1*h1; % approximate volume of the paleo Clear Creek lake [=] km^3
V1 = v1*10^9; % converting to m^3
v2 = A2*h2; % approximate volume of the Granite lake [=] km^3
V2 = v2*10^9; % converting to m^3

%% FINALIZE
velocity1 = (1/0.4) * (sqrt(9.81*height1*S)) * (log(height1/z_o)-1);
velocity2 = (1/0.4) * (sqrt(9.81*height2*S)) * (log(height2/z_o)-1);
Q1 = width1 * height1 * velocity1; % discharge at ~17 ka
Q2 = width2 * height2 * velocity2; % discharge at ~19 ka
drain_time1 = (V2/Q1)/3600; % in hours
drain_time2 = (V2/Q2)/3600; % in hours

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