A NEURAL NETWORK APPROACH FOR GENERATING SOLAR IRRADIATION ARTIFICIAL SERIES

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OBJECTIVE

GENERATION OF SOLAR IRRADIATION ARTIFICIAL SERIES BY MEANS OF A NEURAL NETWORK APPROACH

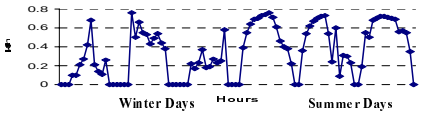
NATURE OF INFORMATION

DATA⟶ ATMOSPHERIC TRANSMITTANCE OR CLARITY INDEX
HOURLY VALUES: 9 YEARS x 365 DAYS x 16 HOURS VALUES

$$k_{th} = G_h / B_{oh}$$

k_{th} = atmospheric transmittance or clarity index during hour h
B_{oh} = extraatmospheric solar irradiation on horizontal surface during hour h
G_h = solar irradiation on the horizontal surface during hour h

Example of Clarity Index evolution in three winter days and in three summer days



PROPOSED GENERATION METHOD

* MAIN FEATURE: ASSOCIATED INFORMATION INCLUDED STEP-BY-STEP

STEP 1
SERIES OF 9x365x16 VALUES CONSIDERED AS ANUMERIC SEQUENCE

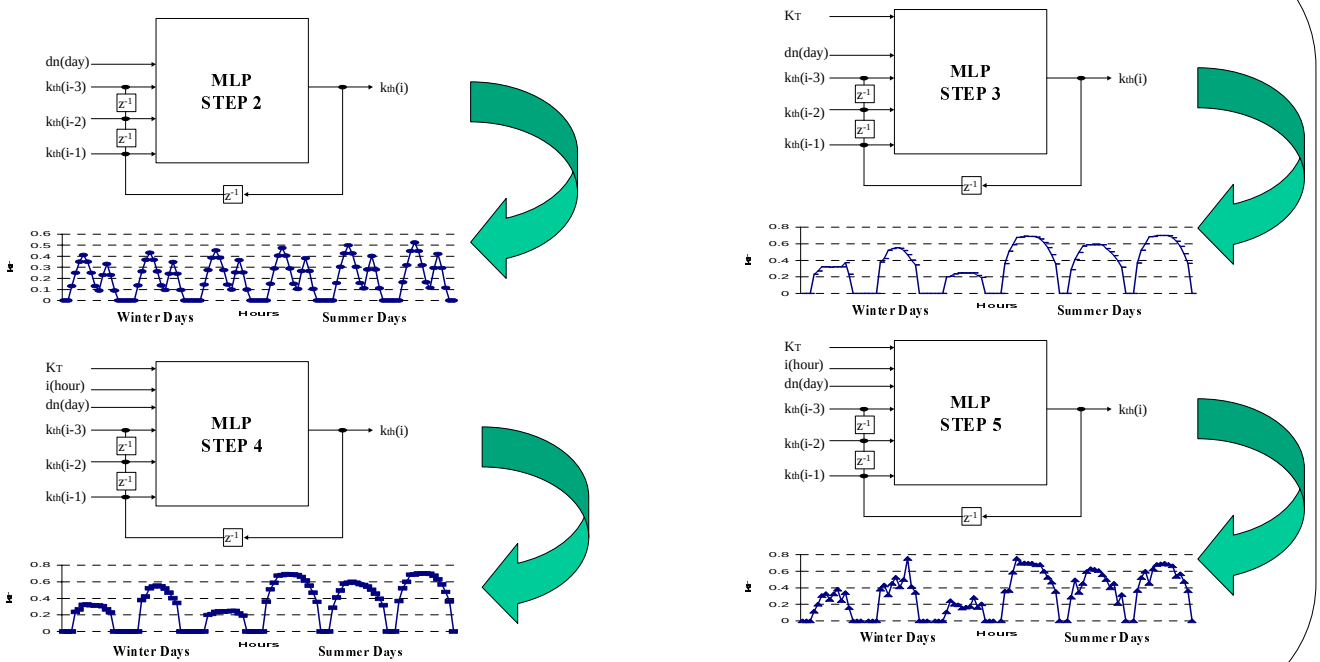
STEP 2
INCLUDING DAILY INFORMATION+THE 3 PREVIOUS k_{th} VALUES
"NORMALIZED DAY **dn**" DEFINED AS: dn = 1 -(Nd -163)/163
Nd = day number within the year

STEP 3
INCLUDING "DAILY CLARITY INDEX **K_T**": DEFINED AS: $K_T = G_d/B_{od}$
B_{od} = extraatmospheric solar irradiation on horizontal surface during day d
G_d = solar irradiation on the horizontal surface during day d

STEP 4
INCLUDING "HOUR ORDER NUMBER": DEFINED AS: $hour_{norm}$ = (hour-p) /(16 - p)
p:prediction window size

STEP 5
INCLUDING "STOCHASTIC RIPPLING".

EVOLUTION OF THE DIFFERENT RESULTS OBTAINED IN SOME OF THE STEPS
(Each Figure Contains Three Winter Days and Three Summer Days)



CONCLUSIONS

* A methodology based on neural networks has been presented for generating solar irradiation time series.
* The generation can be performed with little knowledge of the problem.
* The MLP presents the capability for finding relationships among variables with unknown ***a priori*** relationship.
* The proposed method does not assume any ***a priori*** model as opposed to the standard approximation techniques where polynomial regression techniques are employed.

FUTURE ACTIONS

* Testing the quality of the developed method.
* Improvement of the generation of the stochastic rippling component.
*Comparisons with other methods of generation solar irradiation time series.
*Application of this methodology to other sites where solar irradiation series are available.
* Generation of solar irradiation in other time scales as day scale or minute scale.