UNIVERSIDADE DE ÉVORA

ICT Instituto de Ciências da Terra
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Contribution to the diffuse radiation modelling in Évora, Portugal

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Contents

1. Introduction

- Importance of accurate diffuse radiation data
- Different types of models
- Advantage of using clearness index models

2. Review of diffuse radiation models

- Polynomial functional form:

$$K_d = a + b \cdot K_t + c \cdot K_t^2 + d \cdot K_t^3 + e \cdot K_t^4$$

  - First degree: Gopinathan (1996)
  - Second degree: Barbaro (1981)
  - Third degree: Bortolini (2013)

- Sigmoid functional form:

$$K_d = a - b \cdot (1 - \exp(c - d \cdot K_t))$$

  - Ruiz-Arias (2010)

3. Proposed model

- Combination of two asymptotic limits
  - $K_d = 1$ (overcast sky limit)
  - $f(K_t)$ (clear sky limit)
- General expression

$$K_d = [1 + f(K_t)^{-N}]^{-1/N}$$

3. Proposed model (daily data)

$$K_d = [1 + (1.661 - 2.078 \cdot K_t)^{-5.929}]^{-1/5.929}$$

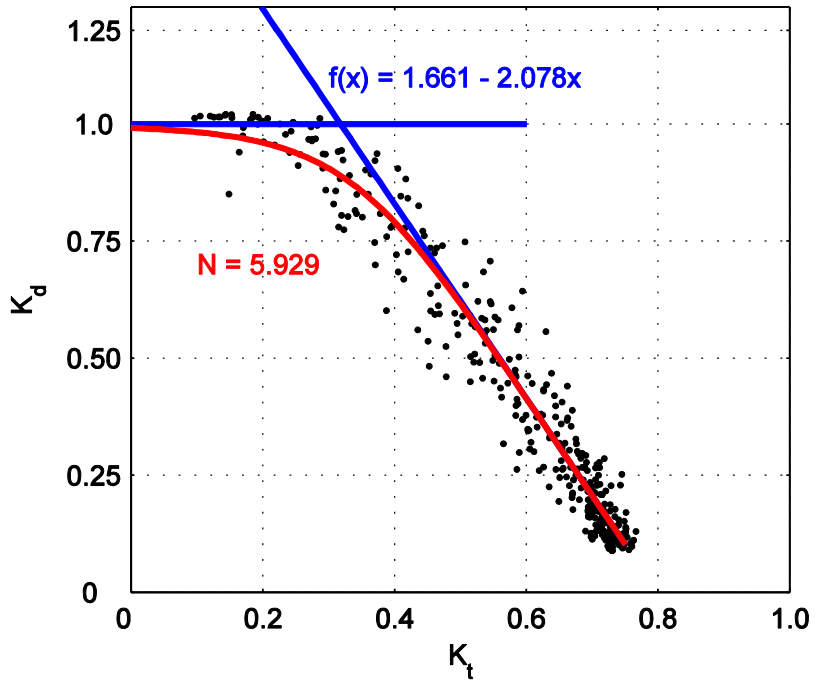

Fig. 1 – Daily correlation for Évora.

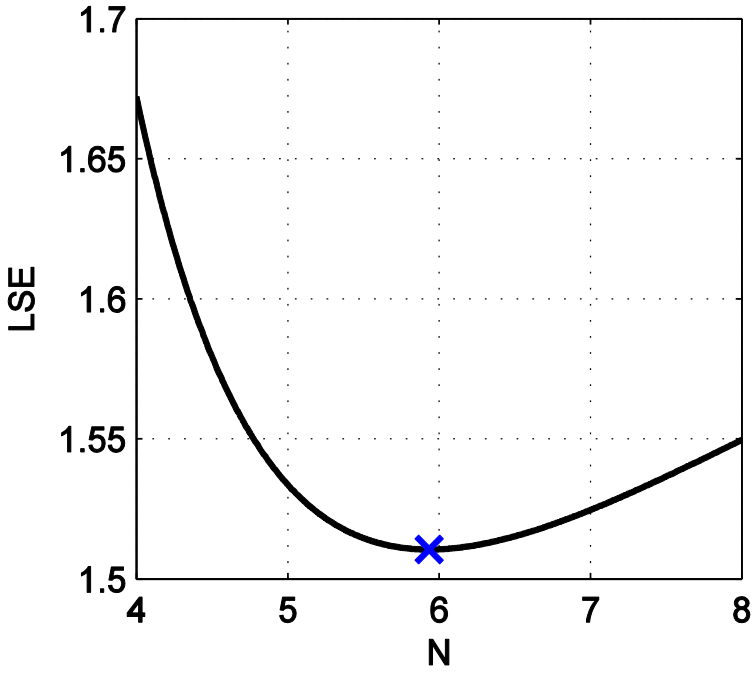

Fig. 2 – Optimization of the fitting parameter *N* for the daily correlation.

3. Proposed model (hourly data)

$$K_d = [1 + (1.502 - 1.820 \cdot K_t)^{-48.589}]^{-1/48.589}$$

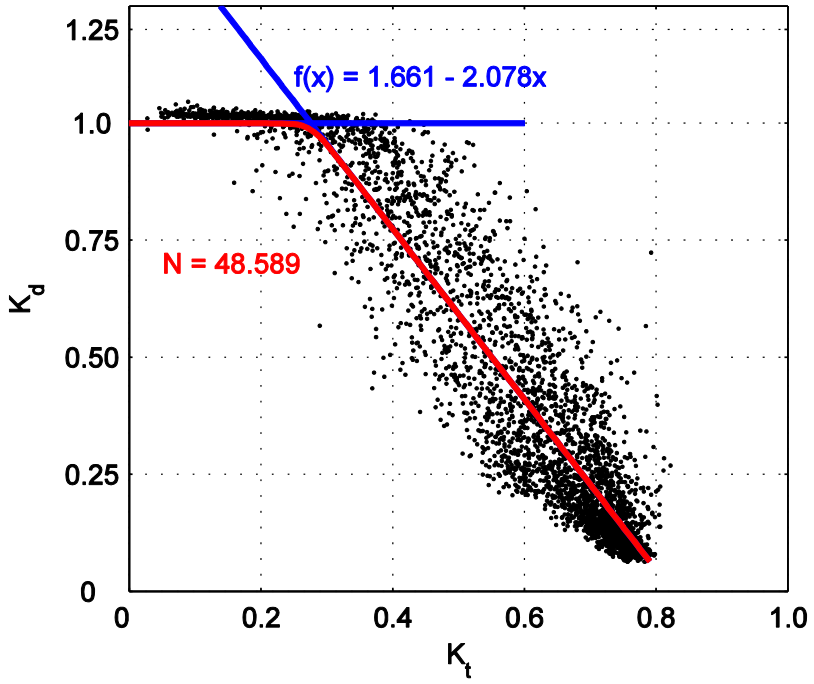

Fig. 3 – Hourly correlation for Évora.

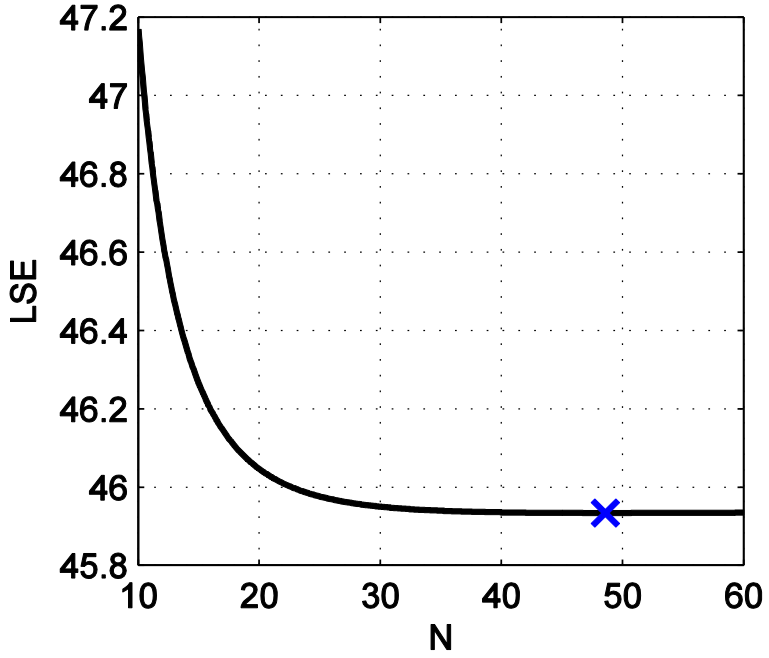

Fig. 4 – Optimization of the fitting parameter *N* for the hourly correlation.

4. Comparison Against Other Models (daily data)

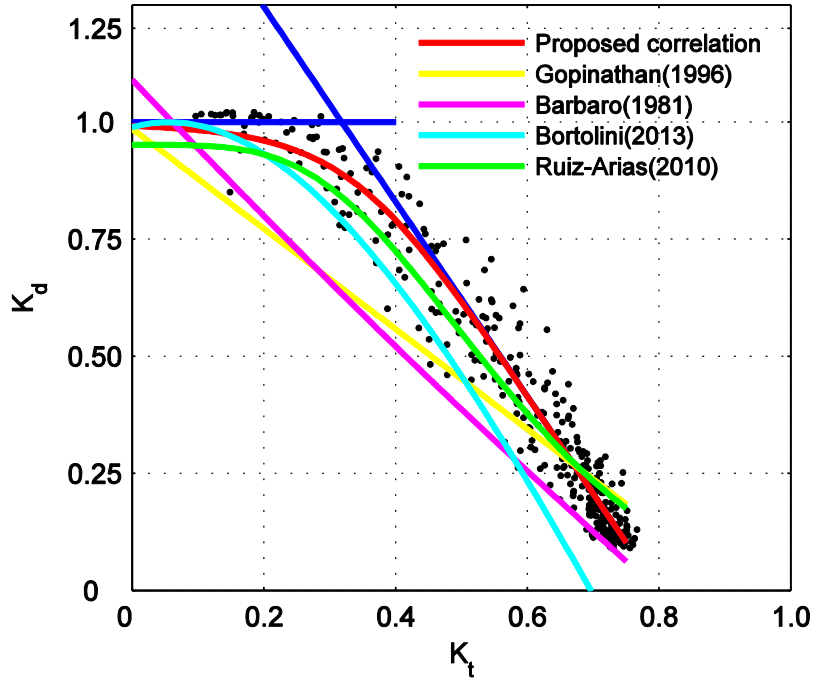

Fig. 5 – Daily correlation for Évora.

Table 1 – LSE and RMSE values for the daily data.

Models	LSE	RMSE
Proposed	1.5100	0.06560
Gopinathan	6.9183	0.14039
Barbaro	9.6900	0.16615
Bortolini	12.982	0.19232
Ruiz-Arias	2.1552	0.07836

4. Comparison Against Other Models (hourly data)

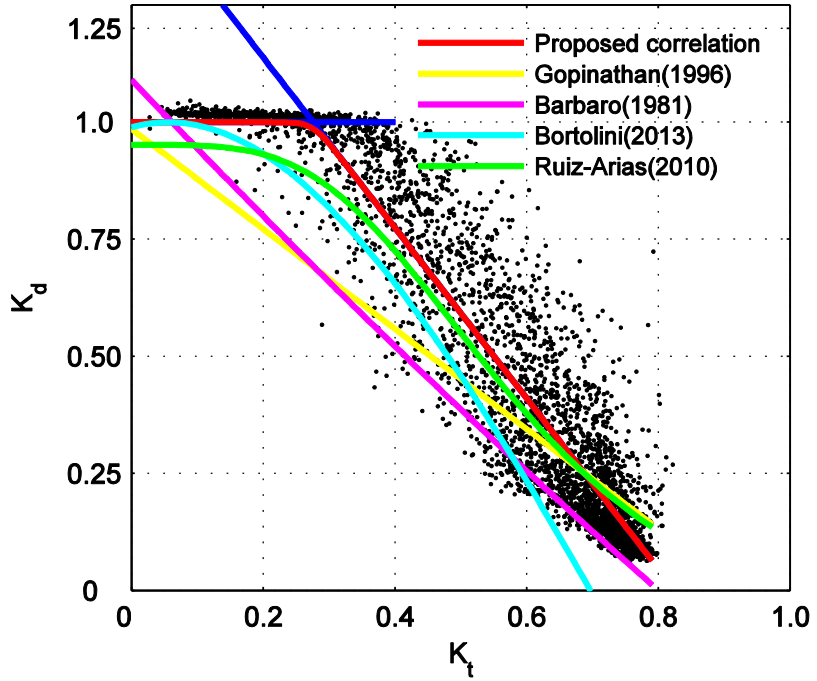

Fig. 6 – Hourly correlation for Évora.

Table 2 – LSE and RMSE values for the hourly data.

Models	LSE	RMSE
Proposed	45.935	0.10639
Gopinathan	131.04	0.17970
Barbaro	168.36	0.20369
Bortolini	215.75	0.23058
Ruiz-Arias	57.156	0.11868

5. Conclusions and Future Work

- New model was proposed to estimate the diffuse fraction
- Only global solar radiation measurements are needed
- The proposed model presents better results when compared against previous models

- More years of measurements should be considered
- Previous models should be fitted to Évora for a more fair comparison
- Different atmospheric conditions should be considered

Acknowledgments

The authors acknowledge the funding provided by the European Union through the European Regional Development Fund, included in the COMPETE 2020 (Operational Program Competitiveness and Internationalization) through the ICT project (UID/GEO/04683/2013) with the reference POCI-01-0145-FEDER-007690 and the project DNI-Alentejo ALT20-03-0145-FEDER-000011.